ST. PETERSBURG STATE PEDIATRIC MEDICAL UNIVERSITY

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IMPROVING PREVENTION METHODS IN COMPLEX DENTAL SITUATIONS

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INTRODUCTION

Relevance of the research subject

The search for the most effective prevention techniques of is of great significance for all regions of Russia. The reason is a very high prevalence of dental caries in all age groups within Russia. So, according to E.M. Kuzmina (1999) in persons aged 35–44 years, i.e. in the group of the country main working-age population, this indicator amounts to 98%, the CSE (carious-sealed-extracted) index-based intensity of caries ranging from10.3 (Volgograd region) to 17.3 (Novosibirsk region).

Epidemiological surveys largely perormed in developed countries in the 70s and 80s of the last century confirmed the drinking water fluoridation efficiency resulting in a decline of dental caries intensity in the surveyed regions [Baziyan G.V. et al., 1969; et c.].

Fluoridation of drinking water was recommended as a mass prevention method for areas with fluorine concentrations of less than 0.5 mg/l.

G.V. Baziyan et al. (1969) noted that interruptions in the fluoridation of drinking water, even for one month, nullified the results of a year's water fluoridation.

The WHO data testify that high incidence of herpesvirus infections is one of the pressing problems of todays medicine that determines the future of infectious pathology in the 21st century [Borovsky E.V., Leus P.A., 1979; Vasilyeva T.V., 2006;].

According to WHO up to 90% of the world adult population are carriers of the herpes simplex virus,. Those evidence confirms the fact that herpetic infections are the most common human diseases. Manifestations of the disease are not observed in all patients despite high infection prevalence of herpes simplex virus. The virus remains latent in most carriers.

Stress, injury, hypothermia, smoking, insolation, smoking, immunosuppressive therapy, etc. are those factors adversely affecting immunological status and exacerbating clinical manifestations.

Studying the role of immunosuppressive conditions in relation to chronic herpesvirus infection presents a significant practical interest in difining the scope of medical care.

Considering the fact that secondary immunodeficiency entails the significant change in the sensitivity to other therapy, the issue of the immune response disruption arises with regard to the severity of infection and the degree of immunodeficiency.

Degree of research topic development

The research performed by domestic and foreign authors in the field of preventive activities, prevention programs developement for various age groups and orthodontic treatment in a dental clinic underlies the thesis work [Pakhomov G.N., 1976; Persin L.S., 2007; Alimova M.Ya., Grigorieva O.Sh., 2010; Averyanov S.V., Zubareva A.V., 2016; Vedeshina E.G., 2019; Andriyanov, D.A., 2021; Alekseeva E.O., 2022; Grinenko E.V., 2022; Nikolaev A.V., 2022; Scott C.C., Athanasiou K.A., 2006; Ebner F.H. et al., 2010; Shemesh H. et al., 2011; Domenyuk D.A. et al., 2016]. Those works outline issues of prevention in various dental situations.

The paper explores the basic dental disease prevention issues in children and adolescents basing on the data obtained from city dental clinic that enabled definition of “Ten grades of dental prevention in children” that are included in the National Prevention Program provided for implementation during the childhood decade in Russia.

Currently, effective methods to prevent mucositis are missing. Antioxidants, antimicrobial agents, anti-inflammatory drugs, non-pharmacological therapies, and biological response modifiers are used to prevent oral mucositis. However, one can resolve fast the issues of the pathogenesis of mucositis [Sonis S.T. et al. 2004] and its treatment. However, S.T. Sonis et al. (2004) noted that the prevention of oral mucositis remains insufficiently effective.

Probation of experimental oral mucositis can reveal the pathogenetic effect of damaging factors on laboratory animals systemically and on the oral mucositis locally.

The solution to these issues allows correctly formulating “Personalized preventive programs for dental patients with herpesvirus infection and mucositis.”

Goal of the research

Develop methods and techniques for assessing complex dental condition and their optimization by means of elaborating personalized prevention programs, creating new approaches to various dentistry issues leveraging new patented tools and methods.

Task of the research

1. Assess the clinical approach to prevention methods focusing on different age groups of patients and identify personal hygiene product features to elaborate a set of preventive actions;
2. To study the children’s preventive care details utilizing St. Petersburg Vyborgsky district background;
3. Study the main individual preventive toothpaste properties with regard to their use in preventive programs designed for different age groups;
4. Develop a cleaning teeth appliance and a disposable kit based on it;
5. Develop a method for assessing the quality of prosthetics;
6. Develop orthodontic treatment technique for crowded teeth and orthodontic treatment of distal occlusion;
7. Substantiate a new pathogenetic clinical and experimental approach aimed at improving the herpesviral stomatitis prevention, by studying the course of experimental herpetic stomatitis exposed to herpesviral damaging factors;

8. To study the molixan efficiency on oral microbiocenosis of the test animals exposed to combined effects, and to assess its antimicrobial properties.
9. Within the decade of childhood to define the conditions for the development of the National Program for the Prevention of Dental Diseases and the Personalized Programs underlying it.

Scientific innovation significance

For the first time the work addresses clinical approaches to prevention methods in a dental clinic within different age groups of patients and identifies the personal hygiene product properties aimed at preventive effects.

For the first time the preventive care organization for children have been studied being illustrated by the sampling of Vyborgsky district of St. Petersburg.

For the first tim, the basic individual preventive toothpastes qualities have been studied aimed at their application within the preventive programs designed for different age groups in a dental clinic.

For the first time a cleaning appliance for teeth and a corresponding cleaning appliance-based disposable kit have been developed.

For the first time a method for assessing the quality of prosthetics has been developed.

For the first time methods of orthodontic treatment for crowded teeth and orthodontic treatment of distal occlusion have been developed.

Experimental models of herpesvirus stomatitis in small laboratory animals have been developed that reproduce the clinical symptoms of that disease in humans.

Under conditions of experimental herpes viral stomatitis, oral microbiocenosis lesion 8ationalized8 of laboratory animals have been revealed.

The role of immunodeficiency in the aggravation of chronic herpesvirus infection has been studied when modeling experimental secondary immunodeficiency; the immune suppression largely determines the severity of chronic herpesvirus infection (mice develop a syndrome of chronic herpesvirus infection accompanied by their mass

perish 5-7 days after infection).

The restoration of hematopoietic tissue cells efficacy using drugs of surface cell receptors boosting the sensitivity to regulatory cytokines has been 9ationalized.

In the course of the work the severity of stomatitis caused by the herpes simplex virus HSV-1 has been studied, depending on the herpes virus infection availability in the cells of the oral mucosa.

Provisions for the National Program for the Prevention of Dental Diseases, including Viral Stomatitis, have been developed.

Theoretical and practical significance of the work

A new clinical prevention approach has been developed focusing different age groups of patients and a system of personal hygiene product features aimed at designing preventive programs has been identified.

The details of preventive care organization for children have been studied being illustrated by the sampling of Vyborg district of St. Petersburg

The main preventive properties of individual toothpastes have been studied aimed at their application within preventive programs for various age groups.

A dental cleaning appliance and a cleaning appliance-based disposable kit have been developed.

A method for assessing the quality of prosthetics has been developed.

The methods for orthodontic treatment of crowded teeth and orthodontic treatment for distal occlusion have been developed.

A methodology to prevent identified complications has been developed using drugs resulting from the CHVI pathogenetic link studies as well as the studies of chemically induced herpes viral stomatitis and hemodepression.

The efficacy of molixan in rebuilding microbial balance in the oral mucosa has been established. For the treatment of oral mucositis accompanied by herpesvirus infection, the use of Molixan (Na_2GSSG-inosine) is recommended.

It has been proven that in a qualified, highly specialized dental clinic, the use of

regular dental treatment enables providing high-quality dental care, improving the quality of life and dental health for the the population.

Methodology and research methods

The methods applied within the work are divided into two main groups: clinical and experimental.

To identify clinical properties of oral hygiene products preventive measures were implemented for the child population of the Vyborg district of St. Petersburg and, orthodontic care was provided to them as a part of it. Preventive dental products have been studied to identify preventive properties and efficacy to use them in preventive programs in various age groups. We have studied the anti-caries, remineralizing, hemostatic, desensitizing, whitening (lightening) effect and toothpaste efficacy. Why did we use preventive toothpastes “Protection against caries”, “Comprehensive care”, “Whitening”, children’s toothpastes “Kids Sweet Mint” and “Kids Strawberry”. To meet that purpose those toothpastes were tested on 100 participants who were divided into 5 groups corresponding to the specified toothpastes.

Particular attention was paid to clarify the role of immunodeficiency in the aggravation of chronic herpesvirus infection that presents a significant practical interest primarily in terms of optimizing accompanying therapy in the cytostatic treatment of patients with hemablastosis. The above-mentioned testifies to the the severity (severity) of chronic herpesvirus infection being largely determined by the immune suppression (mice develop a generalization syndrome of CHVI, accompanied by mass death 5-7 days after infection) when modeling experimental secondary immunodeficiency. The course of such herpesvirus injury was even more aggravated with the action of chemically induced immunodeficiency and cytostatic agents.

Up-to-date methods used in the work comply with the principles of evidence-based medicine.

Degree of reliability and result validation

Statistical processing methods, the use of up-to-date highly sensitive and informative techniques in experiments; the degree of obtained data reliability was confirmed by a sufficient number of laboratory animals: 680 white outbred male rats; 520 white outbred male mice and 140 male BALB/c mice.

Reliable results were obtained using the BS 120 biochemical analyzer (Mindray, Germany), the Immulite 2000 analyzer (Siemens Healthcare Diagnostics Inc., USA), and the EVOLIS Twin Plus analyzer (BIO RAD, USA).

The main provisions of the work were presented and discussed at:

- meetings of the Department of Dentistry and interdepartmental meetings of the St. Petersburg State Pediatric Medical University Dentistry Dept in 2006 - 2024;
- “Long-term effects of exposure to ionizing radiation” international scientific and practical conference (Ukraine, 2007);
- III Congress of Pharmacologists of Russia (St. Petersburg, 2007);
- “Experimental and Clinical Pharmacology” international scientific conference (Belarus, 2007);
- Russian scientific conference with international participation “Current problems of toxicology and radiology” (St. Petersburg, 2011);
- Russian scientific conference “Acute problems in the development of anti-radiation agents: conservatism or modernization” (M., 2012);
- Anniversary scientific and practical conference “Medical protection against extreme factors: current situation and future prospects”, dedicated to the 20th anniversary of the Pharmzaschita Scientific and Production Center of the FMBA of Russia (M., 2012);
- II All-Russian Scientific Conference of Young Scientists “Problems of Biomedical Science of the Third Millennium” (St. Petersburg, 2012);
- International scientific conference “Radiobiological principles of radiation therapy of tumors” (M., 2013);
- Russian scientific conference “VI Nevsky Radiological Forum” (St. Petersburg,

2013);

- VII Congress on Radiation Research (M., 2014);
- 1st Congress with international participation “Healthy children - the future of the country” (St. Petersburg, 2017);
- IInd Congress with international participation “Healthy children - the future of the country” (St. Petersburg, 2018);
- International scientific and practical conference “Modern gnathology” (St. Petersburg, 2019);
- III National Congress with international participation “Healthy children are the future of the country” (St. Petersburg, 2019).
- meetings of the specialized pediatric dentistry board of the Ministry of Health of the Russian Federation within the period of 2018 to 2024 inclusive.

Personal contribution of the author in the research

The author has personally analyzed the literature data and collected literature sources, developed and substantiated methodological approaches to experimental models, and took personal part in the development and planning, organization and conduct of research.

The author has personally collected and systematized primary materials, statistically processed data, analyzed and interpreted them, and written the thesis.

Implementation of research results into practice

The obtained results have been introduced into the educational practice of the dentistry, pediatric dentistry and orthodontics chairs of the of St. Petersburg State Pediatric Medical University dentistry dept. Making Molixan a part of the treatment practice for herpes viral stomatitis, in particular, improves the quality of basic cytostatic therapy and one can recommend it for widespread use.

Information about publications on the thesis subject

Nine scientific papers were published in the Higher Attestation Commission peer-reviewed scientific journals on the topic of the thesis, as well as in the journals publishing the main scientific results of thesises for the academic degrees of Doctor and Candidate of Sciences, and 6 patents for inventions were received.

Structure and scope of work

The thesis is availave on 286 pages of typewritten text and consists of an introduction, a literature review, a description of materials and research methodology, three chapters of the results of one's own research, a discussion of the results obtained, conclusions, practical recommendations and a list of references. The thesis contains 38 tables and 58 figures. The list of references contains 290 bibliographic sources, including 194 domestic and 97 foreign publications.

Basic provisions for defense:

1. A clinical age-based prevention approach has been developed to define the range of personal hygiene product properties aimed at the development of a preventive measure set.
2. The certain amount of children preventive care organization issues have been studied basing on the sampling of Vyborgsky district of St. Petersburg.
3. The main characteristivs of individual preventive toothpastes have been studied to design preventive programs for different age groups.
4. A dental cleaning appliance with a corresponding disposable kit have been developed.
5. A technique for assessing the quality of prosthetics has been developed.
6. Orthodontic treatment practices of for crowded teeth and orthodontic treatment of distal occlusion have been developed.

7. The main clinical, microbiological and immunological manifestations of small laboratory animals subjected to combination therapy have been adequately reproduced in the developed experimental models of herpes viral stomatitis.

8. Secondary immunosuppression and the development of inflammatory processes played an important role in the microbiocenosis disruption of the oral mucosa in the pathogenesis of the herpes viral stomatitis.

9. The conditions for the development of the National Prevention Program for of Dental Diseases and have been defined. as well as the Personalized Programs "Ten Grades of Dental Prevention in Children" in the Decade of Childhood incorporated in it.

Basic scientific outcomes

1. Development and implementation of hygienic oral care appliances.

1.1. A utility for cleaning teeth and a corresponding disposable kit [81].

2. Development and implementation of therapeutic materials in dentistry.

2.1. Filling material [82].

3. Development and implementation of diagnostic methods aimed at and studying the condition and size of teeth and jaws in the courses of orthodontic treatment.

3.1. A method to identify the optimal bite height [75, 77, 80].

3.2. Method of orthopedic treatment for crowded teeth [77, 84].

3.3. Method of orthodontic treatment of distal occlusion [77, 85].

3.4. Diagnostic features of dentofacial anomalies with various types of the facial part [77, 79, 86].

3.5. Assessment of the tooth size study results in the people with normodont dolichognathic dental arches [77, 79].

3.6. The impact of dental arche shape reproducing methods on the orthodontic treatment of patients with occlusion anomalies [78, 79].

3.7. Building up a shape reproduction of dental arches. Modern science: current problems of theory and practice [76, 78].

3.8. Morphometric parameters of the maxillofacial area in patients with microdontia [75, 78].

3.9. Treatment details of macrodontia [78, 79, 80].

4. Experimental models of herpetic stomatitis have been developed for isolated (herpetic) and combined (herpesvirus and chemical) lesions of laboratory animals. Preliminary administration of the cytostatic drug cyclophosphamide to experimental animals before herpetic exposure and subsequent infection with herpes simplex virus type 1 strengthened the damaging effect of herpesvirus infection on the oral mucosa of rats and contributed to a growing severity of herpetic stomatitis resulting in a death of about 40% of individuals.

4.1. Prevention and treatment of chemoradiation stomatitis with cancer chemoradiation therapy in the oropharyngeal area [73, 74, 87].

4.2. Prevention and treatment methodology of dangerous neuroviral infections [73, 74, 83].

4.3. Pharmacological correction methodology of post-traumatic immunity disorders and reparative processes in an experiment [73, 74, 87].

4.4. Modeling experimental recurrent herpetic stomatitis methodology [83].

5. The antiviral immunomodulator Molixan reduced (by 2–3 times) the prevalence and clinically manifested severity of oropharyngeal syndrome and helped to preserve the lives of all animals in the experimental group.

5.1. Prevention and treatment methodology of chemoradiation stomatitis in cancer-related chemoradiation therapy in the oropharyngeal area [73,74].

5.2. The role of immunosuppressive conditions in the aggravation of isolated and combined chemoradiation injuries [73, 74].

6. The provisions of the National Program for the Prevention of Oral and Maxillofacial Diseases, Including Viral Stomatitis, have been developed.

6.1. Method for modeling experimental recurrent herpetic stomatitis [83].

CHAPTER 1. LITERATURE REVIEW

The problem of high dental morbidity in children and adolescents posing a real threat to the health of children remains one of the most acute and pressing problems of Russian healthcare [6, 16, 28, 93, 97, 110, 134].

The high prevalence and intensity of damage to the dentofacial system, the simultaneous development of several independent types of pathology: dental caries, inflammatory periodontal diseases, dentofacial anomalies and deformities is currently one of the peculiarities of dental morbidity in children. The chronic progressive course of those pathologies, in turn, results in the formation of chronic odontogenic infection foci often stimulating growth of gastrointestinal tract, cardiovascular system diseases, as well as infectious and allergic conditions [6, 7, 8, 15, 28 , 99, 109].
Today, preserving and strengthening the health of the population is one of the priorities of the national policy of the Russian Federation in promoting a healthy lifestyle.

1.1. Dental morbidity in the country's population

High incidence of dental diseases, such as dental caries and inflammatory periodontal diseases makes maintaining dental health of the population plays an important role. G.N. Pakhomov (1976) claimed that fluoride varnishes were first introduced into practice in Germany in 1964. Clinical studies conducted over more than twenty years have documented the efficacy of fluoride varnishes aimed at caries prevention.

M.A. Todd et al. (1999) emphasized that most scientific studies examining the clinical efficacy of fluoride varnishes demonstrated a reduction in the dental caries intensity by 25–45%.

Clinical studies have shown that the depth of enamel damage that occurs at the attachment points of orthodontic bracket systems fixed with composite material is

reduced in the case of fluoride varnish regular application to adjacent areas of the tooth crown [Todd M.A. et al., 1999].

O. Backer-Dirks (1963) noted that the most effective methods of preventing caries that develops in places of tooth crown natural recesses include the timely use and subsequent monitoring of the safety of sealants (sealants).

Yu.M. Maksimovsky et al. (1989), noted the greatest intensity of caries in the fissure area of molars resulting from the anatomical shape of the fissures, their depth, width, lower level of mineralization compared to another areas of the enamel of the dental crowns, and their poor washing with saliva.

Yu.M. Maksimovsky et al. (1989), O. Backer-Dirks (1963) wrote that local application of fluoride to hard dental tissues using applications, rinses, inclusion in gel, varnish, paste significantly reduces the caries severity.

Recently, preventive closure of intact pits and fissures of teeth with various filling materials called sealants has become widely used.

Up-to-date literature data indicate the importance of direct teeth treatment with anti-caries medicines to ensure their resistance to the action of cariogenic factors [Pakhomov G.N., 1976; Borovsky E.V., Leus P.A., 1979; Kosenko K.N. et al., 1984]. For collective and individual prevention of caries, rinsing with 0.02-0.2% fluoride solutions, applications of 1-2% fluoride solutions and gels (Morozova N.V., 1975; Kolesnik L.G. et al., 1975; Leontyev V.K. et al., 1977; Prokhonchukov A.A., 1977; Chekmezova I.V., 1983], brushing teeth with fluoride-containing pastes [Pakhomov G.N. et al., 1975; Morozova N.V. et al., 1975; et c.], introduction of fluorides using electrophoresis, application of fluoride varnish [Lagutina N.Ya. et al., 1980; Kosenko K.N. et al., 1984; Borovsky E.V. et al., 1979; et c.] are used.

Currently, among the existing means and methods of local dental caries prevention, fluoride-containing dental varnishes have gained wide recognition and distribution, owing to their high anti-caries efficiency [Nikitina T.V., Lagutina N.Ya., 1973; Kosenko K.N. et al., 1984; Schiffman E.L., et al., 2010].

A.V. Alimsky (2007) mentioned that it is more expedient, including cost-effectiveness, to perform individual prevention.

Table 1.1 summarizes the results of the latest epidemiological survey of the child and adolescent population conducted in Russia.

Table 1.1. Incidence Mordidity of dental caries in the country

Researchers	Location of the study	Age groups	Prevalence of dental caries (%)	Intensity of dental caries (CSE index)	Recommendations for reducing morbidity
Akatieva G.G., Admakin O.I., Antipina I.V., Arzhaeva A.M., Akhmedkhanov D.A., Baytrasheva E.V., Balykova I.N., Baranchikova S.V., Bakhturina G.I., Belkind S.D., Benya V.N., Boris N.V., Borovkova L.D., Brezhneva M.A., Brovchenko L.B., Vasina S.A., Vodostoeva A.V., Volokhina E.G., Vorzhevitina Ya L.N., Garvalinskaya B.G., Gorobets T.N., Grigorieva L.F., Grosheva A.A., Gudkova N.L., Danko E.Yu., Dakhkilgov M.U., Dvinyaninova E.V. ., Doroshina V.Yu., Dragan L.P., Dunaeva N.I., Zavyalova T.V., Zimina V.I., Ivanova E.N., Ilyina I.Yu., Isaeva T.N., Kozlova S.V., Kondratov A.I., Kozicheva T.A., Kruse E.M., Krylov S.S., Kuzmina E.M., Kuznetsov P.A., Kuznetsova I.V., Kuzmina I L.N., Lavrentyeva T.B., Lapteva L.I., Lisachenko L.B., Litvintseva M.M., Lomova N.I., Los Kh.G., Martishevskaya V.S., Maslak E.E. ., Mergeneva K.Z., Merkulova O.P., Minaeva A.A., Miroshnichenko T.V., Miryakhina L.G., Mitrofanova M.N., Moisachenko N.G., Mokrousova I.A., Nabatova T.A., Nachin G.K., Nevrotova I.Yu., Nizhnik E.V., Orekhova L.A., Pavlovskaya O.A., Petrina E.S., Pilshchikova N.G., Potapova G. .V., Prostakova T.B., Ravvinskaya A.A., Razumnik I.V., Romadanova O.Yu.,	Republic of Adygea Maykop	6 years /temp	78	4,51	In 6-year-old children, the prevalence of caries in primary teeth amounts to 73%, and the intensity of caries amounts to 4.76, “caries” = 3.47; “seal” - 1.15; “extracted” - 0.14. The intensity of caries in them depends on the fluoride content in drinking water. In those regions where the fluoride content was below 0.5 mg/l, the intensity was higher than 5.2, compared to 4.1 when the fluoride concentration was more than 0.5 mg/l. The results showed that there caries tends to grow in permanent teeth to increase from 22% among 6-year-olds to 100% at 15 years of age. The results of an epidemiological dental survey indicate a high prevalence and intensity of major dental diseases, particularly dental caries in the main age groups of the Russian population. One can argue that the dental care provided does not always meet the needs and residents in Russian Federation It is needed to expand it and improve its quality. Health care priorities need to be changed shifting their focus on prevention. It is
		6 years/reg	11	0,22	
		12 years	79	3,24	
		15 years	83	6,30	
	Arkhangelsk region Kholmogory	6 years/temp	88	6,42	
		6 years/reg	47	0,18	
		12 years	76	2,88	
		15 years	81	5,24	
	Astrakhan region Astrakhan	6 years/temp	96	4,84	
		6 years/reg	56	0,61	
		12 years	74	3,19	
		15 years	88	4,46	
	Republic of Bashkortostan, Ufa	6 years/temp	90	6,19	
		6 years/reg	32	0,37	
		12 years	84	2,60	
		15 years	90	4,88	
	The Republic of Buryatia Ulan-Ude	6 years/temp	88	3,60	
		6 years/reg	12	0,28	
		12 years	76	2,00	
		15 years	92	3,95	
	Volgograd region Volgograd	6 years/temp	94	6,47	
		6 years/reg	16	0,29	
		12 years	82	2,98	
		15 years	88	5,48	
	Voronezh region Voronezh	6 years/temp	98	6,69	
		6 years/reg	34	0,62	
		12 years	90	3,87	
		15 years	88	5,10	
	The Republic of Dagestan Buynaksk	6 years/temp	98	5,04	
		6 years/reg	68	1,38	
		12 years	84	3,49	
		15 years	92	7,18	
	The Republic of Ingushetia G. Nazran	6 years/temp	90	4,56	
		6 years/reg	16	0,34	
		12 years	94	3,58	
		15 years	96	6,00	
	Irkutsk region G. Irkutsk	6 years/temp	88	3,56	
		6 years/reg	5	0,25	
		12 years	82	2,38	
		15 years	94	4,32	
	Republic of Kabardino-Balkaria	6 years/temp	86	4,76	
		6 years/reg	51	0,70	
		12 years	70	3,12	

Selyukova T.F., Silantyeva G.P., Skachkova T.V., Smorodina I.Yu. ., Starikova I.V., Teploukhova N.A., Tolstunova M.N., Tukaev R.R., Khamadeeva A.M., Kholoshina O.A., Chudinova T.A., Shiryaeva L.A., Yushmanova T.N., Yarish I.I., Yarovaya I.V., Olkhovskaya E.B., Belyaev V.V., Eremina N.V. Khaazhyk L.N. Dental morbidity in the Russian population. M., 1999.-228 p.	Nalchik	15 years	84	3,71	applicable to the prevention of dental diseases, at a lower cost (5-6 times) than treatment, it will maintain or improve the dental health of the population.
	Republic of Kalmykia Elista	6 years/temp	92	5,75	
		6 years/reg	2	0,04	
		12 years	66	1,82	
		15 years	74	3,26	
	Kemerovo region. Kemerovo	6 years/temp	90	5,78	
		6 years/reg	4	0,35	
		12 years	86	3,26	
		15 years	92	4,68	
	Krasnodar region Krasnodar city	6 years/temp	90	5,23	
		6 years/reg	20	0,30	
		12 years	90	3,34	
		15 years	100	4,29	
	Krasnoyarsk region Krasnoyarsk	6 years/temp	90	6,92	
		6 years/reg	32	0,44	
		12 years	78	2,52	
		15 years	92	4,30	
	Lipetsk region Lipetsk	6 years/temp	94	7,58	
		6 years/reg	14	0,36	
		12 years	82	3,32	
		15 years	92	4,34	
	Moscow	6 years/temp	80	3,81	
		6 years/reg	56	0,36	
		12 years	82	3,59	
		15 years	89	3,26	
	Murmansk region Murmansk	6 years/temp	76	4,30	
		6 years/reg	8	0,16	
		12 years	76	2,38	
		15 years	72	2,78	
	Nizhny Novgorod region. Nizhny Novgorod	6 years/temp	85	6,19	
		6 years/reg	12	0,24	
		12 years	96	4,43	
		15 years	98	5,34	
	Novosibirsk region Novosibirsk city	6 years/temp	92	5,86	
		6 years/reg	6	0,08	
		12 years	90	3,34	
		15 years	88	5,06	
	Omsk region Omsk	6 years/temp	90	5,68	
		6 years/reg	2	0,02	
		12 years	86	3,10	
		15 years	80	1,98	
	Penza region Penza	6 years/temp	91	4,37	
		6 years/reg	7	0,09	
		12 years	69	2,32	
		15 years	91	4,09	
	Perm region Perm	6 years/temp	96	5,64	
		6 years/reg	12	0,18	
		12 years	72	2,20	
		15 years	86	4,96	
	Primorsky Krai Vladivostok	6 years/temp	96	7,32	
		6 years/reg	85	0,60	
		12 years	91	3,48	
		15 years	96	6,90	
	Samara region Samara	6 years/temp	90	5,30	
		6 years/reg	32	0,50	

		12 years	86	4,20	
		15 years	90	5,43	
	Sakhalin region Yuzhno-Sakhalinsk	6 years/temp	97	7,35	
		6 years/reg	6	0,12	
		12 years	84	3,36	
		15 years	93	5,97	
	Sverdlovsk region. Yekaterinburg	6 years/temp	86	6,18	
		6 years/reg	16	0,32	
		12 years	85	3,42	
		15 years	90	4,57	
	Smolensk region Smolensk	6 years/temp	94	5,96	
		6 years/reg	14	0,28	
		12 years	76	2,06	
		15 years	72	3,18	
	Republic of Tatarstan Kazan	6 years/temp	98	6,46	
		6 years/reg	2	0,02	
		12 years	84	2,68	
		15 years	86	3,48	
	Tver region Tver	6 years/temp	73	3,58	
		6 years/reg	17	0,37	
		12 years	84	2,36	
		15 years	83	3,18	
	Tomsk region Tomsk	6 years/temp	96	5,23	
		6 years/reg	38	0,78	
		12 years	74	1,97	
		15 years	97	6,12	
	Tyumen region Tyumen	6 years/temp	95	6,93	
		6 years/reg	5	0,15	
		12 years	76	2,90	
		15 years	90	4,34	
	Republic of Udmurtia Izhevsk	6 years/temp	95	6,47	
		6 years/reg	9	0,15	
		12 years	86	3,22	
		15 years	93	6,41	
	Khabarovsk region Khabarovsk	6 years/temp	98	6,83	
		6 years/reg	51	0,17	
		12 years	89	4,00	
		15 years	94	6,10	
	Khanty-Mansi Autonomous Okrug Khanty-Mansiysk	6 years/temp	92	5,71	
		6 years/reg	12	0,38	
		12 years	87	3,71	
		15 years	94	5,60	
	Chelyabinsk region Chelyabinsk	6 years/temp	89	4,78	
		6 years/reg	2	0,03	
		12 years	84	2,91	
		15 years	87	4,46	
	Chita region Chita	6 years/temp	90	4,64	
		6 years/reg	6	0,08	
		12 years	70	1,86	
		15 years	84	2,55	
	Yaroslavl region . Yaroslavl	6 years/temp	88	4,72	
		6 years/reg	9	0,01	
		12 years	80	2,37	
		15 years	92	5,49	

From the table 1.1. an epidemiological survey of the children and adolescent population of the Russian Federation conducted in accordance with the requirements of the World Health Organization shows that the children and adolescent population of the country demonstrated a very high prevalence and intensity of dental caries in all regions of the country. Regardless of the region, the prevalence of caries in primary teeth among six-year-old children is very high and ranges 73% to 98%. 73% - the lowest prevalence of caries in primary teeth is found only in the city of Tver; in other regions of the country that rate is much higher. Thus, the prevalence of caries in temporary teeth equal to 98% was detected in Khabarovsk, Kazan, Buinaksk, Voronezh. That high prevalence of caries in primary teeth means that 98 out of 100 children have caries. That situation means that in the future there will also be a high prevalence of caries among permanent teeth, since the microbial environment has already been prepared for the emergence and development of the carious process. Considering the fact that fissures, i.e. The cavities on chewing teeth are affected by caries in the first place, then closing or sealing them allows completely avoiding the development of fissure caries preserving chewing teeth (molars and premolars) not only for the period of childhood, adolescence, but also adulthood that significantly reduces the need for the treatment of complicated forms of caries, tooth extraction as a result of complications associated with the occurrence, development and treatment of complicated forms of caries, and the need for subsequent prosthetics.

The high prevalence of caries in primary teeth confirms the severity of that problem, but also by the equally high prevalence of caries among 12-year-old children and 15-year-old adolescents. Thus, the prevalence of dental caries among 12-year-old children ranges from 66% in Elista (Republic of Kalmykia) to 94% in Nazran (Republic of Ingushetia). Among 15-year-olds, the prevalence of caries in permanent teeth ranges from 72% in Murmansk to 100% in Krasnodar. The situation when caries affects the entire child population is threatening, since the loss of permanent teeth will occur at a much younger age than in regions with a lower prevalence of caries, and, consequently, the need will arise much earlier and in a larger amount. subsequently, after tooth extraction, orthopedic treatment using both

fixed and removable dentures. Considering such a complex situation and previous experience we can conclude that only preventive measures can sanitize this problem and rationally solve it.

With high prevalence of caries, its intensity varies among different age groups. Thus, the fluctuation in CSE index (Caries, Sealed, Extracted) in the group of 6-year-old children in primary teeth ranges from 3.60 in Ulan-Ude (Republic of Buryatia) to 7.58 in Lipetsk. It means that of 20 temporary teeth, almost eight either have carious cavities, fillings, or have been extracted. This indicator shows that on average, 37.9% teeth are damaged or missing in six-year-old children in the city of Lipetsk in temporary dentition.

Among 12-year-old children, the fluctuation of the CSE index was as follows: from 1.82 in Elista to 4.43 in Nizhny Novgorod. This situation is exacerbated: of twelve years all 28 teeth had only erupted and of these, 15.82% of permanent teeth either have carious cavities, or fillings, or have already been removed.

By the age of 15, the situation changes and the fluctuation of the CSE index in the city of Chita amounts to 2.55 and up to 7.18 in the city of Buinaksk. Those indicators testify that in just two years the minimum indicator of the CSE index increased by 1.4 times, and the maximum by 1.62 times, and the number of teeth with caries, fillings or removed already amounted to 25.64% of the number of all available in mouth teeth (28). Thus, we see that by the time a child leaves childhood, more than a quarter of all his teeth are damaged or missing.

Basing on an epidemiological survey A.M. Khamadeev and A.M. Spiridonov (2000) have revealed a high prevalence of dental caries in the children population of the Samara region. Thus, the prevalence of caries in primary teeth in 3-year-old children in the Samara region ranges from 55.2% to 78.7%. The prevalence of caries in primary teeth in 6-year-old children amounted to 92% with an average intensity of 5.5 in Samara. The highest intensity rate according to the CSE index was revealed in the city of Syzran - 6.53. The prevalence of caries in permanent teeth in 12-year-old children in the Samara region ranged from 79.8 to 93.4%, and in 15-year-olds this rate ranged from 82.3 to 95%.

The prevention of dental diseases and thereby maintaining the dental health of the population has always been the main goal of dentistry and it still remains. Up-to-date dental science has never ceased the search of new methods and approaches to solve this problem. The high prevalence of dental diseases worldwide made this problem particularly acute. World Health Organization has achieved some success in reducing the prevalence of major dental diseases in some economically developed countries, however, not all problems have not been solved. Therefore, companies engaged in the production of dental materials, equipment, instruments, and hygiene products are constantly working to develop new means, technologies and prevention programs in order to increase efficiency and adapt their use among different segments of the population in different regions worldwide as well as improve the existing ones.

1.2. Increased tooth abrasion: dentofacial system morphology and functional details

Various experts claim that various nosological forms accompanied by a decreased height of the facial gnathic part amount to 11% to 60% [3, 9, 10, 14, 29 - 32, 152, 155].

Insufficiencies of the face lower part height reduction classification, diagnosis, differences in terminology, all those inconsistencies are interrelated. The authors do not indicate etiological factors and pathogenesis of diseases [1, 4, 13, 37, 55, 56, 57, 58, 113, 194, 216].

The most common pathology of occlusal relationships among the etiological factors of ITA (increased tooth abrasion) is a decreased height of the gnathic part of the face [1, 2, 5, 11, 12, 34, 38, 51, 58, 168, 198].

ITA often occurs in deep bites. A decreased height of the gnathic part of the face, with a characteristic symptom complex of facial signs, is also characteristic of distal occlusion ranging from 24.5% to 37.3% of the number of patients with dentofacial anomalies. The ratio of the teeth of the maxilla and mandibles in the mesio-distal direction, the shape of the curve of Spee, the interincisal angle, the shape of the teeth, the inclination of the anterior teeth of the maxilla and mandibles affect

the degree of incisal overlap. An increase in the vertical dimensions and downward displacement of the upper anterior teeth or an increase in the vertical dimensions and an upward displacement of the lower anterior teeth result in a deep bite. In this case, the upper and lower alveolar parts have increased vertical dimensions in the anterior section and reduced ones in the lateral section. Distal occlusion is the most common anomaly of the maxillofacial area in adults. The causes include heredity, bad habits, pathology of pregnancy and childbirth. The clinical picture is aggravated by tooth loss, increased tooth wear and the occurrence of deformities with a decrease in the height of the gnathic part of the face in adults. Acute and chronic diseases of internal organs such as tuberculosis, skeletal ossification disorders, sinus bronchopathies, etc. can also be causes of distal occlusion. Many experts have tried to identify and differentiate various forms of distal occlusion. F.Ya. Khoroshilkina (2005) distinguishes dentoalveolar and gnathic forms of distal occlusion [128]. The dentoalveolar form is characterized by a discrepancy between the length of the dental arch and its apical base on one or both jaws. The gnathic form is characterized by abnormalities of the maxilla and mandible. The gnathic form includes the options in which the distal bite is formed from a decrease in the angle of the mandible, and the backward curvature of the articular processe necks, shortening the branches of the mandible with normal dimensions of the jaw body. Combined forms of dentoalveolar and gnathic varieties of distal occlusion have also been identified [10, 17, 18, 19, 23, 40, 42, 43, 44, 59, 67, 117, 178, 209].

Patients with mesial occlusion make up a significant proportion of patients with ITA. They have impaired chewing function and complaints about aesthetics, difficulties with prosthetics resulting from tooth loss. Patients with mesial occlusion require complex orthodontic, prosthetic and surgical treatment involving a speech therapist, otolaryngologist and psychotherapist. Such patients have facial disharmony in the form of a protruding chin and lower lip, a wrong correlation of the maxilla and mandible anterior teeth that one can notice clearly when talking and smiling [20, 22, 24, 30, 46, 49, 55, 119].

Numerous publications address the mesial occlusion etiology, pathogenesis, diagnosis and treatment-related issues [23, 30, 40, 50, 51, 53, 59, 122, 177, 191, 196]. The clinical picture of ITA in combination with mesial occlusion is more symptomatic in adults than in children and adolescents. It is explained by the fact that adult patients are in greater need of sanitation measures. They often suffer not only from ITA, but also tooth loss, complicated by a decreased height of the face gnathic, functional overload of the periodontium, and the diseases of the temporomandibular joint [25, 31, 40, 46, 52, 54, 55, 58, 59, 70, 75, 176, 178].

Most researchers identify forms of mesial occlusion associated, firstly, with excessive development of the mandible and, secondly, with underdevelopment of the maxilla. However, one should note that many experts write primarily about the results of children examinations in their publications. At the same time, it is obvious that while the facial skeleton is growing the symptoms can grow or decrease, in particular, appearance can change, as well as complications can arise associated with the loss of lateral teeth and a decrease in the height of the lower part of the face - gnathic height [26, 35, 45, 53, 60, 61, 82, 85, 96, 99, 100, 119, 136, 160, 181].

To draw a conclusion the authors use various data on excessive development, underdevelopment, anterior or posterior position of the jaws. In most cases those are the angles SNA and SNB, as well as the linear distances ANS-PNS, ME-GO according to the method of calculating profile teleroentgenograms according to A.M. Schwarz an absolute increase in linear distances is also possible in large patients with enlarged head sizes, and may depend on the individual structure of the anterior nasal spine [27, 46, 66, 87, 90, 100, 101, 112, 120, 131, 132, 151, 202].

A decrease in interalveolar height, muscular-articular dysfunction, changes in the shape and size of the alveolar processes and alveolar parts of the jaws, damage to periodontal tissues are the causes of decompensated increased wear of teeth, which leads to a decrease in the height of the gnathic part of the face and is accompanied by a number of morphological, aesthetic and functional disorders [17, 62, 64, 65, 101, 104, 123, 130, 181, 184, 185, 201, 203].

Not only anomalies of occlusion in various directions affect the decreased height of the gnathic part of the face, but also by the changes in the maxillofacial area that occur with increased abrasion of hard dental tissues, loss of antagonists and other pathological conditions. With various forms of ITA, no clear distinction is revealed between the forms of reduction in the height of the gnathic part of the face; changes occurring in the maxillofacial area and in the temporomandibular joints are not noted.

Parafunctions, manifested in the form of bruxism (night grinding of teeth), clenching of the dentition, foodless or involuntary chewing, lead to increased wear of teeth and, hence, to a decrease in the gnathic part of the face. Thus, a vicious circle arises - disrupted occlusal relationships stimulate deformities and are an etiological factor in muscle parafunctions. [18, 29, 35, 66, 68, 97, 109, 114, 138, 146, 158, 214].

A complex process and numerous nerve formations located at different levels of the central nervous system ensure maintaining normal muscle tone and redistribution of tone during various motor reactions of the body [23, 38, 69, 72, 129, 141, 206].

Dentition compression (66.07%), foodless chewing, teeth grinding - bruxism, hypertonicity or increased tone of the masticatory muscles are the main clinical forms of parafunctions of the masticatory muscles [57, 67, 71, 91, 108, 121, 173].

Functional overload of the periodontium and TMJ (temporomandibular joint), unusual in terms of the action duration, is observed when the reflex activity of the masticatory muscles is disrupted, when in some patients the phase of functional rest of the mandible falls out, and instead of dissociation, the dentitions are closed with a significant contraction force of the masticatory muscles. This occurs with parafunctions of the masticatory muscles [18, 23, 63, 72, 107, 124, 192].

Involuntary functions automatically regulated by the subcortical centers of the brain that lead to self-destruction of both hard dental tissues and periodontal tissues function regardless of the nature of the parafunction (mental, endogenous, compensatory, professional or stress) [28, 64, 88, 108, 111, 155, 186].

Hypertonicity of the masticatory muscles can cause damage to TMJ, masticatory muscles, pulp tissue, disruption of the processes of formation and growth of the masticatory-speech apparatus [72, 92, 95, 98, 100, 102, 130, 156].

Various dysfunctional conditions of the TMJ occur without organic damage to the elements of the articulation. Some authors claim that morphological changes in the bone structure of the anterior part of the condylar process can arise with increased load on the joint [23, 28, 105, 107, 124, 136].

Domestic and foreign experts express the opinion that hearing loss and tinnitus arise as a result of the pressure exerted by the head of the mandible on the nerve trunk when it is displaced back, [110, 122, 142, 216].

L.V. Muzurova (2006) found a strict correlation between a decrease in occlusal height and displacement of the mandible heads [88].

Disorders of the masticatory apparatus activity resulting from the violated integrity of the dentition are an important point in the occurrence of TMJ diseases [23, 107, 124, 127].

Some experts share the opinion that TMJ dysfunction can develop with parafunctions of the masticatory muscles [23, 107, 124].

When treating patients with reduced interalveolar height the causes were revealed to be associated with various changes in the joint with occlusion pathology [28, 117, 125, 128].

A number of authors believe that in arthritis, arthrosis, dysfunction, Costen's syndrome occurs and, in most cases, it is not associated with a decrease in interalveolar height [10, 12, 15, 16, 40, 42, 45, 55, 59, 67, 207, 209].

Occlusion disorders may serve as a predisposing factor for functional disorders of the temporomandibular joint [9].

Thus, in the occurrence of TMJ functional disorders, various occlusal disorders are an important pathogenetic link, leading to distal movement of the head of the mandible in the articular fossae. Polyetiology underlies the today's understanding of maxillofacial area diseases. At the same time with various forms of ITA there is insufficient information about the state of the TMJ.

1.3. Prevalence and etiopathogenesis of dental crowding

According to various sources the prevalence of dental anomalies in the adult population ranges from 30 to 50%. Those DAAs (dental alveolar anomalies) often result in occlusal anomalies, combined with missing individual teeth, and the functional and aesthetic disorders. The variants of these defects vary quite widely [54, 105, 129, 135, 157, 194].

The following anomalies in the shape of the dentition are distinguished:

1. V - shaped, observed when the dentition narrows in the lateral sections, while the central or lateral incisors are rotated along the longitudinal axis with a protruding anterior section;
2. trapezoidal - with narrowing of the dentition in the lateral sections, while the anterior section is flattened;
3. generally narrowed dentition - the front and lateral teeth are located closer to the median plane compared to the normal position of the teeth;
4. saddle-shaped: when the narrowing is most distinct in the area of the first molars, as well as the second premolars;
5. asymmetrical, in which the location of the lateral teeth on both sides is different [11, 66, 75, 134, 136, 137, 156, 159].

There are unilateral or bilateral narrowings of the dentition, symmetrical and asymmetrical, on one or both jaws. Narrowing of the dentition with protrusion of the anterior teeth, with a crowded position, rotation of some teeth along the longitudinal axis, with partial or complete retention of individual teeth are revealed as well [37, 108, 115, 135, 138].

One-sided end defects of the dentition are common; their share in the structure of the dental-jaw anomalies ranges from 18 to 36% cases [2, 161, 164].

Crowded teeth are one of the most common DAA variations. The incidence of crowded teeth amounts on average 33.7%, while the incidence of malocclusion in combination with CTP (crowded teeth position) exceeds 70% [111, 112, 136, 139, 144, 162].

A insufficient space in the dental arch and various variants of incorrect positioning of teeth characterize manifestations of CTP. In this case, one finds a decrease in the longitudinal (longitudinal) length of the dental arch relative to the sum of the mesiodistal size of the tooth crowns that form it [27, 29, 113, 140, 163, 165]. Incisor crowding is one of the most common Angle Class I anomalies, and it is prevalent among DAA in general.

The causes of the above dentition anomalies include, as a rule, insufficient development of the alveolar processes or basal jaw parts, in some cases those resulting from to the relatively large size of the teeth that interfere with the correct position of other teeth [77, 93, 111, 114, 130, 131, 132, 142, 143, 171]. Early tooth extraction resulting from caries-related complications often contributes to the development and aggravation of DAA [125].

In most cases, there is multiple incorrect position of the teeth revealed. Those anomalies are belived to be genetic that determines the inheritance of pathological characteristics - the number, shape, size of teeth, as well as the parameters of the jaws and bones of the facial skull [38, 48, 144, 173]. In early mixed dentition a crowded position of the incisors is often formed, while in the period of late dentition, dystopia of the canines and crowded position of the lateral teeth are more typical [81, 95, 145, 147, 179]. Some reports detect DAA during the eruption of wisdom teeth [154, 178, 180, 181].

The following factors are considered to be etiological for narrowing the dentition:

1. Nasal breathing difficulty with predominanating mouth breathing.
2. Sucking one or more thumbs in childhood, as well as foreign objects.
3. Swallowing and speech disorders.
4. Parafunction of the facial and chewing muscles and muscles of the tongue.
5. Short frenulum of the tongue.
6. Slow chewing of food, with one-sided chewing not stimulating jaw growth.

7. Premature loss of primary teeth - the loss of molars results in a significant decrease in chewing pressure that is a main factor stimulating the physiological and proportional development of the jaws causing their narrowing.
8. Somatic diseases facilitating metabolic disorders and body weakness, including rickets, dyspepsia, infectious and other diseases [3, 9, 192].

A number of authors include the following factors contributing to CTP: hereditary predisposition, disproportions in the size of the jaws, jaw underdevelopment, a decreased dentition width, as well as the eruption of wisdom teeth [76, 102, 137, 140, 184]. Other researchers believe that factors in the pathogenesis of CTP may include:
- increased tooth size;
- triangular shape of the anterior teeth (narrow neck and wide cutting edge);
- horizontal position of the lower third molars and retention [37, 113, 146, 186].

One should mention that the etiological role of environmental factors in the formation of STP and changes in the size of dental arches has not been fully identified. There are certain suggestions on the role of soft food intake and the predominance of mouth breathing in those disorders, but a clear correlation between STP and those factors has not yeat been revealed. The changes in the nutritional structure of the population in recent decades are believed to have entailed a significant change in the functional jaw characteristics that in turn has increased the observed trend towards a decrease in the size of these bones.

Considering the age-related aspects of CTP the eruption of the incisors, both dentitions become denser. In most cases in the upper dentition the amount of space is sufficient for all four incisors, but in the lower dentition during this period a space deficit may be detected, the average value of which is 1.6 mm [78]. It facilitates mandibular crowding of the incisors.

In cases of distinct CTP from the very beginning, it can persist even after the formation of a permanent dentition [37, 190, 193, 194].

As mentioned above the development of late CTP in some cases coincides with the eruption of third molars. Occlusal forces exert the determining impact on the

position of teeth [12]. Difficult eruption of third molars can significantly increase the magnitude of those forces that deform the dental arch of the mandible with occlusal interference of the canines in the area of the incisors [4, 139].

Some experts believe that the pressure occurring during the eruption of those teeth promotes to the emergence of late crowding of the incisors. However, one has to detect this pathology in patients with a completely missing third molars. According to A.V. Sevastianov (2015), pressure cannot be the main cause of crowding.

Crowding of the anterior teeth complicates the dentoalveolar, gnathic and cranial forms of occlusion pathology, accompanied by morphological, functional and aesthetic disorders of the maxillofacial area [14]. If all above factors, unfavorable conditions for the formation of the dental arch are created that cause malocclusion, as well as prerequisites for aesthetic disorders [19].

CPT contributes to the occurrence of functional overload of some teeth along with a decrease in the load on others, as well as deterioration of oral hygiene. In the case of incorrect positioning of teeth, the periodontium is believed to perceive an occlusal load, the direction of which changes; it results in periodontal overload development that is classified as functional and traumatic, leading to circulatory disorders of the dentofacial system tissues [15, 24, 25, 198]. A conclusion has been made that CPT significantly predetermines the approximal caries and of periodontal diseases that in turn complicates and reduces the opportunity of using orthodontic treatment methods [55].

It has also been found that CPT is accompanied by various psycho-emotional disorders in patients [60, 151].

Morphofunctional shifts observed in unilateral terminal defects of the dentition particularly in the mandible in young people are adaptive in nature but if the etiological factors persist they can lead to the pathology of the temporomandibular joint [152, 200].

With a constant chewing load a process of unilateral chewing is formed, while the mandible is displaced to provide forced occlusion that correspondingly alters the

anatomical and topographic characteristics of the TMJ on both sides [47, 59, 193, 201, 202, 204].

Thus, it has been found that CPT is a polyetiological nosological form with a complex pathogenesis.

1.4. Up-to-date comprehensive prevention techniques in patients with

The works of domestic and foreign researchers demonstrate the results of patient treatment with extraction of permanent teeth [135, 157, 162, 206, 207, 266] and without it.

As a rule, orthodontic treatment of patients is aimed at creating physiological or optimal functional occlusion, achieving a morphological, functional and aesthetic optimum condition in the maxillofacial area. One can consider achieving an optimal balance between morphology, function and aesthetics to be a satisfactory treatment result. The shape of dental arch has a particular importance in treatment that will correspond to the individual morphometric parameters of the patient's maxillofacial area and will not cause relapse of pathology [97, 129, 132, 209].

Most authors demonstrate up-to-date methods of orthodontic treatment of a dentofacial arche anomalies and deformations aimed at normalizing their morphometric parameters [191, 251, 256, 264, 266].

The choice of the shape of metal orthodontic arches, according to experts, is important when treating patients with the edgewise technique. The work specifies a discrete general Lloyd's algorithm-based solution for selecting arcs. The thesis presents the methods for using the double arc technique and preforming metal arcs [277].

Since the underlying pathology is often combined with tooth and dentition defects, currently the treatment of individuals with anomalies and deformities is associated with significant difficulties [220, 221, 226, 256]. The researchers claim, it is quite difficult or even impossible to perform orthopedic treatment with up-to-date structures for anomalies of occlusion [84, 239, 240].

The relevance of the problem is determined by the issue of individual morphometric characteristics of the maxillofacial area and is important for dentists [227, 274, 275, 276, 280].

The used literature sources devoted to the issues of achieving functional occlusion in patients after treatment of anomalies of the dentofacial arches confirm the relevance of studies dealing with the issue [277, 278, 280].

Clinical and functional disorders in the dentoalveolar area with this pathology remain insufficiently studied. Not all researchers share the consensus on the indications for extraction and non-extraction methods of treatment. There are different statements regarding the timing and methods of orthodontic treatment of people with anomalies in the shape and size of the dentofacial arches [279, 282, 285, 289].

Considering individual parameters of the craniofacial complex solutions are supposed to enhance complex treatment efficiency within the first stage of adulthood when anomalies in the shape and size of the dentofacial arches [290] take place.

1.5. Development of complications of oral mucosa chemoradiation lesions

In general one of the most important radiobiology and medical radiology issues is the search for medicines that help to prevent and treat successfully herpetic stomatitis caused by secondary immunosuppression

To date, the basic patterns of the typical acute radiation sickness clinical course, caused by general irradiation of the human body that is relatively uniform have been studied quite thorougly [Avetisov G.M. et al., 2003]. Meanwhile, the analysis of the people exposure conditions during emergency situations demonstrates that in most cases there was an uneven distribution of absorbed doses throughout the body that in turn determined the injury clinical picture details [Butomo N.V. et al., 2004].

Clinical manifestations of OPS (oropharyngeal syndrome) in people exposed to uneven irradiation depend on a number of factors that largely determines their

severity and the period of development. One can obtain complete understanding of the OPS clinical course under the conditions of combined radiation-chemical exposure by studying syndrome-like conditions in patients with head and neck cancer undergoing chemoradiotherapy.

The ideas that currently exist reflect the concept that herpetic infection plays a decisive role in the development of chemoradiation lesion complications of the oral mucosa (oropharyngeal area) [Murrah V.A., 1995]. Herpes simplex is a serious medical and social issue. It is one of the human viral infections with high prevalence: about 90% world's population is infected with the herpes simplex virus and approximately 10–20% of those infected have some clinical manifestations of herpes infection [Stewart M.W., 2013; Villa A., Treister N.S., 2013].

In most cases simultaneous chemoradiotherapy is considered to be the main therapeutic approach in antitumor therapy of malignant neoplasms [Langendijk J.A. et al., 2004]. The most common and early toxic complication of chemoradiation treatment limiting its efficiency is a grade III–IV severe stomatitis, the incidence of which amounts to 70% or more [Kanaev S.V., Gershanovich M.L., 2004; Trotti A. et al., 2003]. To achieve success in a search for the prevention medicines and treatment of chemoradiotherapy complications an urgent need arises to clarify the possible role of herpesvirus infection in the occurrence and the course of experimental herpetic stomatitis aggravated by additional load of herpesvirus infection.

Local radiation damage to the skin and mucous membranes [Butomo N.V. et al., 2004] is one of the most frequent and dangerous manifestations of radiation pathology that occurs within radiation accidents and disasters. They may acquire particular relevance during acts of nuclear or radiological terrorism, in particular, when using radioactive materials to make a "dirty bomb" that can cause great damage due to radiation contamination of an area in a densely populated area with subsequent contact damage to the skin and mucous membranes of people living there [Onishenko G.G., et al., 2003; Sheppard B. et al., 2006].

Non-keratinizing epithelium of the soft palate and palatine arches is the most radiosensitive among the mucous membranes; being damaged it develops so-called.

“radiation oropharyngeal syndrome” that manifests itself as hyperemia, edema, focal and confluent epitheliitis, salivary disorders (xerostomia), pain when swallowing and passing food through the esophagus, in severe cases - laryngitis [Butomo N.V. et al., 2004]. The morphofunctional basis of radiation oropharyngeal syndrome is oral mucositis (stomatitis) that dentists often encounter in everyday life when treating patients [Naidu M.N. et al., 2004; Hancock P.J., Epstein J.B., Sadler G.R., 2003].

Basing on actual ideas one can claim that oral dysbiosis plays a decisive role in the development of oral mucositis, while particular importance is given to fungal microflora in the pathogenesis of that complication [Maslenikova A.V., 2008; Xu L., Zhang H., Liu J.X., 2013; Sonis S.T., 2004]. Thus, antiseptics, antibiotics and antifungal drugs are used to prevent oral mucositis, but their efficacys in treating this pathology is very ambiguous. For example, the use of chlorhexidine solution makes no effect on the severity of oral mucositis [Nicolatou-Galitis O. et al., 2001; Nicolatou-Galitis O, Athanassiadou P, Kouloulias V. et al., 2006]. On the other hand a complex medicinal effect (rinsing the mouth with chlorhexidine and iodopolyvidone while taking nystatin) enables reducing significantly the incidence of candidiasis of the oral mucosa and severe mucositis [Prokhvatilov G.I., et al., 2007; Trotti A. et al., 2003].

Using immunoregulatory peptides in the treatment of chemoradiation stomatitis is of particular interest at present, the wide range of its biological activity, regulate all stages of the inflammatory process [Reference Vidal., 2012; Nicolatou-Galitis O. et al., 2001]. The need to study antimicrobial action on microorganisms that determine the development of the inflammatory process in the oral mucosa is one of the main issues within a pathogenetic rationale for the use of medicines, including the immunoregulatory peptide Molixan. [Grinevich V.B. et al., 2004; Rezvani M., Ross G.A., 2004].

1.6. World Health Organization Preventive Goals

WHO global goals planned to be achieved in the 21st century:

- by 2000, to reduce the incidence of caries in permanent teeth in children of the "key" group aged 12 years to a KPU not exceeding 3.0;
- by 2020, minimize the impact of dental diseases on general health and psychosocial development, popularize dental health among the population;
- by 2030, ensure universal coverage of oral hygiene services for all people and communities, achieve the best possible dental health.

Those global goals have proved to be partially useful and they have been implemented or even surpassed in many countries. However, for a significant part of the world's population they remain only a distant prospect.

WHO global goals – conditions planned to be achieved in the 21st century:

- by 2000, develop and implement national programs of dental caries primary prevention;
- by 2020, develop dental health programs to improve overall health;
- by 2030, develop dental care systems based on the primary prevention of dental diseases.

CHAPTER 2. MATERIALS AND METHODS OF RESEARCH

The work has been performed in the St. Petersburg State Pediatric Medical University and Dental Clinic No. 4 a clinical base of St. Petersburg State Pediatric Medical University dental department serving the child population of the Vyborg District.

As of January 2024, 102,345 children were assigned to the clinic.

The orthodontic department employs: 6 orthodontists, of which 5 are doctors of the highest qualification category, 1 is a doctor of the first qualification category; 5 dental technicians.

Children are admitted by personal application. A clinical visit includes the following:

- reception of patients undergoing instrumentation treatment;
- reception of primary patients;
- examination of patients registered at the dispensary and undergoing non-equipment treatment.

At the initial visit, the following diagnostic methods are used to make a diagnosis and plan orthodontic treatment:

1. collection of anamnesis (mother's health condition during pregnancy, type of feeding, type of breathing, previous diseases (rickets, dyspepsia, etc.) and their severity, timing of milk and permanent teeth eruption, bad habits (thumb sucking, tongue sucking, biting pencils, nails, etc.) I clarify the reasons for the early loss of milk and permanent teeth, whether orthodontic treatment has been performed, whether there have been injuries.
2. When interviewing a child (in the form of a non-forced conversation) I pay attention to the purity of pronunciation, breathing method, and articulation of the tongue. If necessary I refer the child to consultation with a speech therapist, otolaryngologist, surgeon, pediatrician, endocrinologist and other experts.

3. When examining the patient's appearance, attention is paid to the symmetry of the face, the severity of the nasolabial and chin folds, and I study the profile of the face.

4. When examining the mouth, I check the color and condition of the oral mucosa, the condition of the teeth, dentition, I evaluate the frenulum of the tongue and lips, the functions of the orbicularis oris muscle and tongue, tongue, etc.

5. Study the type of mandible movements.

6. The condition of the temporomandibular joints is studied.

7. The functions of chewing, swallowing, breathing, and speech are examined.

To clarify the diagnosis, use:

Biometric method for studying control models.

1. X-ray method (sighted images of individual teeth, orthopantomogram, CT, lateral and direct teleroentgenograms, tomograms of the temporomandibular joints).

2. Use erythrosine or Schiller-Pisarev solution to assess the hygiene index and periodontal condition.

3. The diagnosis is performed using Angle's classification and ICD 7. After the diagnosis, make up a treatment plan. Specify the amount of required interventions, orthodontic or combined treatment option, approximate timing, design and type of orthodontic apparatus.

In case of early primary teeth loss, considering deformations of the dentition, make either a prosthesis or an orthodontic apparatus for the patient, or register the patient in a dispensary. Most dispensary patients are preschoolers. This group undergoes the following:

1. sanitation of the mouth;

2. referral to a hygienist to develop hygiene skills;

3. identifying bad habits and combating them;

4. grinding of the cusps of primary teeth with premature contacts that form improper closure of the dentition;

5. selection of a myogymnastics complex;

6. referral to doctors of other specialties for the treatment of somatic diseases.

Another group of patients consists of children who require apparatus-based treatment. To eliminate various types of malocclusion, equipment of mechanical, functional, combined action is used. Bimaxillary devices (Andresen-Goipl, Frenkel, open Klammt activator, Clark apparatus) are widely used. Mechanically operating equipment includes base plates with a retraction arc, pushers, screws, spring processes, and half-arches. Combined-action devices include bite plates with a retraction arc, screw, etc.

At the time of device application, the child and parents are instructed in maintaining oral hygiene, and the skills of device care. If necessary, before orthodontic treatment and during it, the patient is sent to attend oral sanitation and hygiene classes.

To rebuild the functional value of permanent molars and premolars, metal and combined crowns are manufactured. To eliminate a cosmetic defect in the frontal area, plastic crowns and pin teeth are made.

Up-to-date non-removable technology, the braces system, is applied widely in practice to correct defects in the dentition and bite. In their practice, orthodontists use systems such as mini ROTH and Alexander that today account for less than 2% of the equipment used. Damon Q and Q2 is the main system in today's arsenal. Absolute support – miniscrews – are also actively used. Damon Clear braces are installed for cosmetic purposes at the request of some patients. Braces are fixed by means direct and indirect methods. Fixed retainers are used as retention devices; rarely, thermoplastic aligners are used for transversal anomalies. For sagittal anomalies, intermaxillary removable retainers are used in addition to fixed ones.

2.1. Clinical research methods aimed at identification of oral hygiene product clinical properties

In the clinic "Protection against caries", "Comprehensive Care" preventive toothpastes, "Whitening", children's toothpastes "Kids Sweet Mint" and "Kids Strawberry" were tested in order to identify their therapeutic and preventive

properties: anti-inflammatory effect and efficacy, anti-caries effect, remineralizing action and efficacy, whitening effect and efficacy.

The testing involved 100 people who were divided into 5 groups depending on the oral hygiene products they used:

in group 1 –"Protection against caries" preventive toothpaste was used;

in group 2 – "Comprehensive Care" preventive toothpaste was used;

in group 3 – "Whitening" preventive toothpaste was used;

in group 4 – "Kid's Sweet Mint" children's toothpaste was used;

in group 5 – "Kid's Strawberry" children's toothpaste was used.

The subjects independently applied toothpastes 2 times a day (morning and evening) in duration of 30 days. Subsequently, repeated examinations were performed once a week for 4 weeks.

During the research process, they conducted a questionnaire-based survey.

The distribution of respondents by age is shown in the figure 2.1, distribution by gender in the figure 2.2.

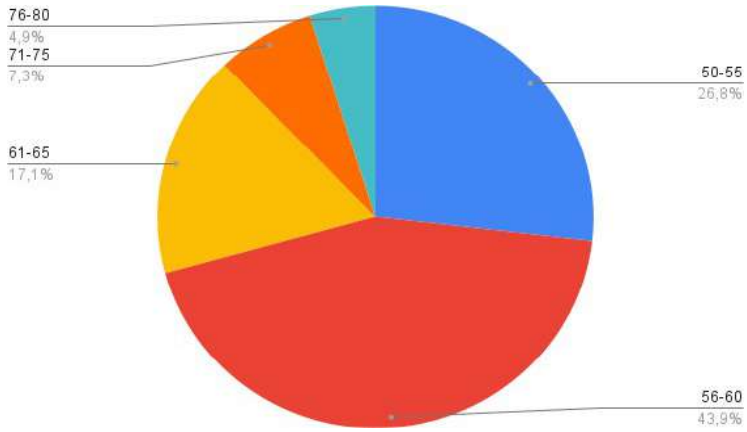

Figure 2.1. Distribution of respondents by age.

The interviewed patients were distributed by age as follows: 43.9% are patients aged 56-60 years, 26.8% - 50-55 years old, 17.1% - 61-65 years old, 7.3% - 71-75 years old , 4.9% - 76-80 years old.

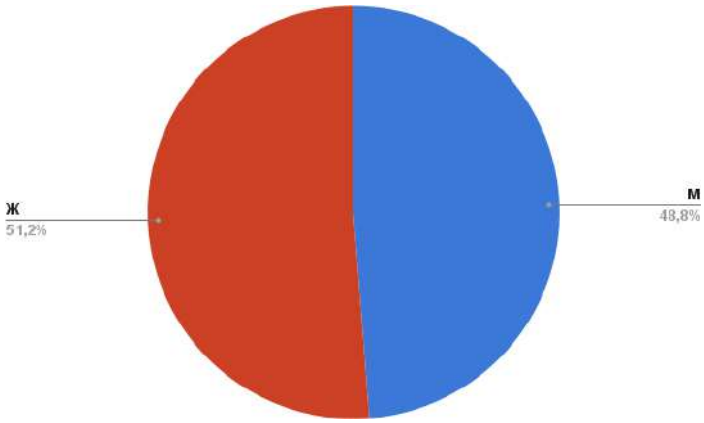

Figure. 2.2. Distribution of respondents by gender.

Respondents by gender were distributed as follows: 51.2% - women, 48.8% - men.

2.1.1.Identification of of anti-caries effect (enamel electrical conductivity) and anti-caries efficacy (enamel resistance)

Anti-caries effect was tested in the participants by means of the electrical conductivity method in hard dental tissues. One defines the electrical conductivity of hard dental tissues (enamel) and by its change concludes whether “strengthening” of the enamel takes place or not. If the electrical conductivity time grows, it indicates a rise in the stability of the enamel. If the conduction time of the electrical impulse decreases, it means that the enamel stability is reduced.

Based on the obtained data on the electrical conductivity of enamel, the anti-caries efficiency was calculated.

2.1.2.Assessmnent of remineralizing action and efficacy

The remineralizing effect and efficacy were assessment using the ERT (enamel resistance test) according to Okushko (1984). One drop of 1 N hydrochloric acid with a diameter of 2 mm was applied to the vestibular surface of the central upper incisor, washed with water and dried. After 5 s the acid was washed off with water, and the tooth surface was dried. The depth of enamel etching was assessed by the intensity of its staining with a 1% solution of methylene blue. The remaining dye was removed

from the tooth surface with a swab. The etching area turned out to be colored blue. The color intensity depended on the depth of enamel damage; it was assessed using a standard ten-field blue scale, in which each strip corresponds to 10% (fig. 2.3.).

Fig. 2.3. Scale of different blue color tones

The intensity of enamel staining up to 30% characterized normal acid resistance of teeth. Indicators amounting to 40% and above indicated a decrease in enamel stability. Based on the ERT test indicators, the remineralizing efficiency was calculated.

2.1.3.Assesment of hemostatic effect and its efficiency

The Muchlemann and Son bleeding index was used to assess the condition of periodontal tissues. Based on the results of the bleeding index, hemostatic efficacy was assessed that indicated the nature of the change in the periodontium inflammatory process.

Hemostatic efficiency was determined using the formula:

$$\text{Hemostatic efficiency (\%)} = [100 \times (IK_0 - IK_n)] / IK_0 \qquad (2.1)$$

, where

IK_0 –index value in the beginning;

IK_n - index value at the last examination.

2.1.4.Assessment of desensitizing action and efficiency

To attain this purpose, the L.Yu. Orekhova - S.B. Ulitovskiy Tooth Sensitivity Index was used (© 2008) that allows tracing changes in teeth under the effect of desensitizing agents used, its components include 11 parameters, each of them is assessed on a 5-point scale. Use the formula to calculate it:

$$\text{L.Yu. Orekhova - S.B. Ulitovskiy Index} = \frac{\sum(a_1 + \ldots + a_n)}{5n} \text{ x } 100, \qquad (2.2)$$

where $\sum$ - sum of criteria assessment values;

a_1 - qty of units on the first criterion;

a_n - qty of units on the n-criterion;

n - qty of criteria;

5 – number of parameters to be assessed within each criterion.

In our case, the qty of criteria and parameters is stable and corresponds to 11 and 55, respectively. So the formula would look like:

$$\text{L.Yu.Orekhova - S.B.Ulitovskiy Index (\%)} = \frac{\sum(a_1 + \ldots + a_{11})}{55} \text{ x } 100 \qquad (2.3)$$

limits amount to: $20 \leq$ L.Yu.Orekhova - S.B.Ulitovskiy Index ≤ 100

Criteria for assessing conditions: * 81 – 100% – very severe; * 61 – 80% – severe; * within 41 - 60% – this is relatively compensated tooth sensitivity; * if the indicator is 21 – 40% – compensated; * when assessed at 20% – the tooth(s) are healthy with normal sensitivity to external stimuli.

To study the evolution of changes in tooth sensitivity we used the formula for calculating the Efficiency of Teeth Sensitivity (Efficiency of Teeth):

TS efficiency (%) = $[(I_I - I_n) \text{ x } 100] / I_I$ (4)

, where

I_I – L.Yu.Orekhova - S.B.Ulitovsky Index value at the first visit;

I_n – L.Yu.Orekhova - S.B.Ulitovsky Index at the n-visit.

Table 2.1. contains data on Teeth Sensitivity index.

Table 2.1. Assessment of the sensitivity using the Orekhova-Ulitovskiy Teeth Sensitivity Index

Assessment paramenters (%)	**Efficiency by Orekhova-Ulitovskiy Teeth Sensitivity Index**
20,0 %	Very low efficiency
20,1 – 40,0 %	Low efficiency
40,1 – 60,0 %	Moderate efficiency
60,1 – 80,0 %	High efficiency
80,1 – 100,0 %	Very high efficiency

2.1.5 Assessment of brightening effect and its efficiency

Using using the VITAPAN scale the brightening effect was assessed at the beginning of the reserach and each subsequent week of toothpaste use. Calculate the brightening efficiency using that data.

2.2. Molixan-based methodology for the prevention of experimental herpetic stomatitis in laboratory rats

In experimental studies, we used 150 white outbred male rats weighing 180-220 g, obtained from the Rappolovo nursery of the Russian Academy of Sciences (Leningrad Region) that were kept in quarantine for 14 days before the start of the experiment. The animals were kept in a vivarium under standard conditions being fed ad libitum in the first half of the day. The studies were perormed in compliance with the requirements of experimental work regulatory documents on the laboratory animal procedure.

The combined chemovirus effect was modeled by injecting animals with the cytostatic alkylating agent cyclophosphamide, followed 24 hours later by infecting rats with herpes virus HSV-1 at a dose of 1LD50. Cyclophosphamide "Baxter Oncology" (Germany) was administered intraperitoneally once at a dose of 100.0 mg/kg that is a maximum tolerated dose for this animal species.

Primary and secondary prevention of experimental herpetic stomatitis was performed using a pharmacopoeial immunomodulator with a distinct antiviral

activity, Molixan that was administered to rats intraperitoneally at a dose of 30 mg/kg immediately after infection and then every other day for 15 days, i.e. on days 1, 3, 5, 7, 9, 11, 13 and 15 of observation.

The animals were divided into five groups, each containing 30 rats: group 1 included intact animals that were not exposed to infection and/or chemical exposure; in group 2 there were animals that were infected with HSV-1 at a dose of 2LD50; in group 3 there were animals infected with HSV-1 at a dose of 1LD50, followed by treatment with Molixan following the specified regimen; in group 4, animals were subjected to combined chemovirus treatment; 24 hours before infection, cyclophosphamide was administered at a dose of 100.0 mg/kg; in group 5, animals were subjected to combined chemovirus treatment followed by secondary prevention: 24 hours before infection, cyclophosphamide was administered at a dose of 100.0 mg/kg + HSV-1 1 LD50 + treatment with molixan according to the regimen. Within the period of 21 days after injection the animals were observed: their general condition was assessed per day, including motor activity, food excitability, changes in body weight and the clinical picture of mucositis - stomatitis of the oral mucosa.

Material for microbiological studies was obtained using sterile swabs; a smear was taken directly from the surface of the oral mucosa - the tongue and gums. Then the tampon was placed in a test tube with 1 ml of sterile physiological solution, from which dilutions of 1:10, 1:100, 1:1000 were prepared. The contents of the tubes from each dilution were sown on nutrient media: Endo medium, Ploskirev medium, Sabouraud medium, enterococcal agar, 5% blood agar, anaerobic blood agar, agar for lactobacilli, agar for bifidobacteria, Wilson-Blair medium, Kligler medium, meat-peptone agar, yolk-salt agar, Gause agar medium No. 2, sterility control medium, sterility control medium enriched with 10% medium 199. For the cultivation of anaerobic microorganisms, “Anaerobic plus system” microanaerostats (Oxoid, UK) were used. In the form of oxygen-free gas, a three-component gas mixture was used, containing 80% nitrogen, 10% hydrogen and 10% carbon dioxide, with an admixture of molecular oxygen of no more than 0.01%. The gas mixture was certified in a specialized laboratory of the Special Design Bureau for Analytical Instrumentation of

the Russian Academy of Sciences (St. Petersburg). The material for research was selected before herpesvirus or chemovirus exposure and on the 15th day after. The results of microbiological studies were expressed in colony-forming units (CFU), namely in the decimal logarithm taken from the number of CFU.

Evolution of α-defensin HNP 1-3 antimicrobial peptide level in the blood plasma of laboratory animals is used to assess innate immunity. The content of antimicrobial peptides was determined by enzyme-linked immunosorbent assay using diagnostic kits (HycultByotechnology, the Netherlands).

A classical method of serial dilutions in a liquid nutrient medium against three microorganisms of different types: gram-positive cocci (Staphylococcus aureus) and rod-shaped gram-negative bacteria (Escherichia coli and Salmonella typhymurium) is used to study in vitro the Molixan antimicrobial activity. Molixan was prepared in concentrations: 1000 – 800 – 400 – 200 – 100 – 50 – 25 – 12.5 μg/ml.

The causative agents of staphylococcal infection (Staphylococcus aureus) and generalized salmonella infection (Salmonella typhymurium), E. coli (Escherichia coli) were grown in meat-peptone broth at 37^0C for 24 hours. An inoculated suspension of microorganisms was used at a concentration of 106 microbial cells/ml. Before the study, 0.1 ml of each dilution of the drug and 0.1 ml of the corresponding pathogen inoculum suspension were added to bacteriological test tubes and placed in a thermostat at 37^0C for 24 hours. After that incubation time the results were visually recorded depending on growth/missing growth in the test tubes. three experts witnessed the visualization of microorganism growth.

2.3. Methodology for studying the cyclophosphamide effect on laboratory mice

White outbred male mice were obtained from the Rappolovo nursery of the Russian Academy of Sciences. Before the experiments, the animals were kept in quarantine for 10-12 days. Immunosuppression was performed using a cytostatic - cyclophosphamide that was administered intraperitoneally in doses 20 mg/kg, 60 mg/kg and 120 mg/kg.

The combined radiochemical exposure was modeled by subcutaneous injection of the alkylating cytostatic drug cyclophosphamide (Teva, Israel) into experimental animals at a dose of 70.0 mg/kg maximum tolerated by rats, followed 24 hours later by infection with the herpes simplex virus type 1. An additional damaging factor was a herpes virus infection caused by herpes simplex virus (HSV-1) type 1, pathogenic strain US, the initial titer of the virus was 10^2-10^3 LD_{50}/ml. Modeling was performed by means of intraperitoneal injection of a HSV-1 suspension into animals in a volume of 0.5 ml 5 days before irradiation. A period of 5 days was chosen because the incubation period for the experimental generalized viral infection under the conditions of our experiment amounted to 5–7 days.

An additional damaging factor was a viral infection caused by herpes simplex virus type 1 (HSV-1), pathogenic strain US, initial virus titer 10^2-10^3 LD_{50}/ml. Intraperitoneal injection of a 0.5 ml HSV-1 suspension into animals 5 days after the administration of the cytostatic cyclophosphamide was used to perform modeling. The duration of the incubation period for experimental generalized herpesvirus infection in small laboratory animals (mice, rats) amounting to 5–7 days [9] determined the choice of timing for HSV-1 administration.

The pharmacopoeial Molixan an immunomodulator with distinct antiviral activity was used as a pharmacological probe to identify the role of herpesvirus infection in the severity of herpetic stomatitis chemoradiation syndrome. The drug was administered to rats intraperitoneally at a dose of 30 mg/kg immediately after infection with HSV-1, 24, 48 and 72 hours after infection, immediately after infection and then, starting from the first day after infection, every other day for 15 days: on 1, 3, 5, 7, 9, 11, 13 and 15 days of observation.

The animals were divided into five experimental groups of 20 rats each: group 1 was irradiated dosed 4.5 g; in group 2, cyclophosphamide was administered at a dose of 100.0 mg/kg; in group 3, cyclophosphamide was administered dosed 100.0 mg/kg + HSV-1 infection dosed 1 LD50; in group 4, infection with HSV-1 2LD50 + administration of cyclophosphamide at a dose of 100.0 mg/kg + irradiation dosed 4.5 Gy was performed; in group 5 they were infected with HSV-1 + administration of

cyclophosphamide dosed 100.0 mg/kg + irradiation dosed 4.5 Gy + treatment with the Molixan drug. The animals were observed for 30 days after infection, their general condition per day assessed: motor activity, food excitability, changes in body weight and the clinical picture of mucositis - stomatitis of the oral mucosa.

2.4. Modeling conditions for studying the molixan effect on the oral microbiocenosis in laboratory animals after combined exposure

Chemoradiation oral mucositis was modeled by administering the cytostatic drug cisplatin to experimental animals, followed 24 hours later by cranio-caudal gamma irradiation of rats dosed 10 Gy. The drug cisplatin (Teva, Israel) was administered once subcutaneously at a dose of 7.0 mg/kg, which is the maximum tolerated dose for this animal species. Irradiation was performed using the IGUR-1 research installation with a source of ^{137}Cs gamma rays with a dose rate of 21.07 Gy/min.

Secondary prevention of experimental mucositis was performed with Molixan a pharmacopoeial immunomodulator with distinct antiviral activity. Molixan (ZAO PHARMA VAM, Russia) was administered intraperitoneally to rats dosed 30 mg/kg immediately after irradiation and then every other day for 15 days: on days 1, 3, 5, 7, 9, 11, 13 and 15 of observation .

The animals were divided into 3 experimental groups of 20 rats each:

- in group 1 there were intact animals that were not exposed to chemoradiotherapy;
- in group 2 there were animals exposed to combined chemoradiotherapy: 24 hours before irradiation, cisplatin was administered dosed 7.0 mg/kg + irradiation dosed of 10 Gy;
- in group 3 there were animals that underwent combined chemoradiotherapy and subsequent treatment with molixan: 24 hours before irradiation, cisplatin was administered dosed 7.0 mg/kg + irradiation dosed 10 Gy + treatment with molixan according to the regimen.

The animals were observed for 30 days after irradiation, assessing their general condition per day: motor activity, food excitability, changes in body weight and the clinical picture of mucositis - stomatitis.

Collection was performed with sterile swabs before chemoradiotherapy and on the 15th day after irradiation. A swab was taken directly from the oral mucosa: tongue, soft palate and gums. Then the swab was placed in a test tube with sterile saline solution (1 ml), from which dilutions of 1:10, 1:100, 1:1000 were prepared. The contents of the tubes were sown on nutrient media: Endo medium, Ploskirev medium, Sabouraud medium, enterococcal agar, 5% blood agar, anaerobic blood agar, agar for lactobacilli, agar for bifidobacteria, Wilson-Blair medium, Kligler medium, meat-peptone agar, yolk-salt agar, agarized Gause medium No. 2, medium for sterility control, enriched with 10% medium 199. “Anaerobic plus system” microanaerostats (Oxoid, UK) were used to cultivate anaerobic microorganisms. A three-component gas mixture was used as an oxygen-free gas: 80% nitrogen, 10% hydrogen and 10% carbon dioxide, with an admixture of molecular oxygen of no more than 0.01%. The composition of the mixture was certified by a specialized laboratory of the Russian Academy of Sciences.

Serial dilutions in a liquid nutrient medium against three microorganisms of different types: gram-positive cocci (Staphylococcus aureus) and gram-negative rod-shaped bacteria (Escherichia coli and Salmonella typhymurium) were used in vitro to realize the antimicrobial activity of Molixan drug. Molixan was prepared in concentrations: 1000 – 800 – 400 – 200 – 100 – 50 – 25 – 12.5 μg/ml.

The causative agents of staphylococcal infection (Staphylococcus aureus) and generalized salmonella infection (Salmonella typhymurium), E. coli (Escherichia coli) were grown in meat-peptone broth at 37°C for 24 hours. An inoculated suspension of microorganisms was used at a concentration of 106 microbial cells/ml. Before the study 0.1 ml of each dilution of the drug and 0.1 ml of the corresponding pathogen inoculum suspension were added to bacteriological test tubes and placed in a thermostat at 37°C for 24 hours. After the incubation time, the results were visually

recorded to reveal growth/missing growth in test tubes. Three experts witnessed the visualization of microorganism growth.

2.5. Questioning of respondents who used orthopedic structures and orthodontic devices

Figure 2.4 demonstrates the questionnaire used to survey children undergoing orthodontic treatment using removable appliances.

Questionnaire used to survey children undergoing orthodontic treatment using removable appliances
1. How old are you:_____
2. Gender:
● male;
● female.
3. How long have you been using removable orthodontic appliances??
● less than 3 months;
● from 3 months to 6 months;
● from 6 monrgs to 1 year;
● more than 1 year.
4. Has the doctor told you about proper care of the removable structure?
● yes;
● no.
5. How often do you clean removable orthodontic appliances?
● 2 times per day;
● 1 time per day;
● 1 time in 3 days;
● 1 time weekly;
● after each meal;
● other: _____.
6. Do you use special brushes and pastes for cleansing removable design?
● tes;
● no.
7. Do you clean the removable structure yourself??
● yes, myself;
● no, with the help o an adult person.
8. Do you use special products for staining plaque on teeth to control the quality of oral hygiene??
Yes No
9. Where do you store your device when you're not wearing it??
- in a special container
- in a cup

- in a cloth
- on a table
10. Is it comfortable for you to wear a removable design? (rate by scale below)

Figure 2.4. Questionnaire for children undergoing treatment on removable devices.

Figure 2.5. shows a questionnaire for adult patients who used removable orthopedic structures.

Questionnaire for adult patients using removable orthopedic structures or orthodontic devices.

1. How old are you:_____

Gender:

●male;

●female.

2. What removable structure are you using?

●partial removable denture;

●complete removable denture;

●orthodontic removable structure.

3. How long have you been using removable orthopedic/orthodontic appliances?

● less than 6 months;

● from 6 months to 1 year;

● less than 1 year.

4. Have you used removable appliances before?

● yes;

● no.

5. Have you noticed an unpleasant odor from your mouth while using the removable appliance?

● yes;

● no.

6. During the period of using the removable appliance, did your mucous membrane in contact with the prosthetic bed become inflamed?

● yes;

● no

7. When installing a removable structure, did the doctor advise you on proper care of the prosthesis?

● yes;

● no.

8. What oral hygiene products and items did your doctor recommend if you have removable appliances?

● special brushes for cleaning the removable structure;

● special pastes for cleaning removable appliances;

● special antiseptic solutions;

● gels/liquids for cleaning removable appliances;

● tablets for cleaning the removable appliance;

● ultrasonic baths for cleaning removable appliances.

9. Has your doctor recommended the use of various fixatives?

● yes, fixing cream;

● yes, fixing powder;

● yes, fixing gaskets;

● no, I do not recommend it.

10. How often do you clean removable orthopedic/orthodontic appliances?
● 2 times a day;
● 1 time per day;
● 1 time every 3 days;
● 1 time per week;
● after each meal;
● other: _____.
11. What products do you use to clean the removable appliance?
● special brushes for cleaning the removable appliance;
● special pastes for cleaning removable appliances;
● special antiseptic solutions;
● gels/liquids for cleaning removable appliances;
● tablets for cleaning the removable appliance;
● ultrasonic baths for cleaning removable appliances.
12. What brand of products do you use most often?
● Protefix;
● Corega;
● Protodent;
● Lacalut;
● Evofix.
13. How much are you ready to spend per month on hygiene products to care for a removable appliance?
● less than 300 rubles;
● from 300 to 500 rubles;
● from 500 to 1000 rubles;
● more than 1000 rubles.
14. How often do you go to the dentist for a consultation after _____you have a removable dental appliance installed?
● 1 time every 3 months;
● 1 time every 6 months;
● 1 time per year;
15. Do you remove the removable appliance at night?
● yes;
● no.
16. Where do you store the removable structure when you remove it?
in a glass of water;
in a glass with a special solution for storing removable appliances;
in a cloth;
in a container for storing removable appliances;
other: _____.
17. How do you clean the removable structure?
above the sink;
sitting at the table;
over a terry towel;
other: _____._

Figure 2.5. Questionnaire for adult patients who used removable orthopedic devices.

2.6. Mathematical data processing

The obtained data were processed by generally accepted methods of variation statistics using the application package Statistica for Windows vers. 6.0 (StatSoft Inc., USA). The mean value and error of the mean ($M \pm m_x$) were calculated. The significance of differences in mean values was assessed using Student's t-test. Differences in the compared indicators were considered statistically significant at $p \leq 0.05$ [21, 42].

CHAPTER 3. IMPROVEMENT ISSUES IN DENTAL PREVENTIVE CARE TO THE POPULATION

3.1. Organization of preventive care in a dental clinic

St. Petersburg State Budgetary Healthcare Institution “Dental Clinic No. 4” as a clinical base of the St. Petersburg State Pediatric Medical University dental department provides dental care to the adults and children of the Vyborgsky district of St. Petersburg within the state budgetary medical care guarantees. It consists of two outpatient departments: the first department provides dental care of all profiles to the adult population; the second provides outpatient dental care of all sorts to children and adults. The clinic is the clinical practice site for the dental dept of the St. Petersburg State Pediatric Medical University of the Ministry of Health of the Russian Federation.

Work performed in accordance with the job function

General work management includes:

1. Organization of primary specialized health care in compliance with the current rules for medical care provision.
2. Work control and direct supervision of structural department heads and doctors:

- compliance with the current procedures of medical care addressing its individual types, profiles, clinical recommendations performed by subordinate medical specialists.
- providing employees with assessment criteria for the quality of medical care approved by the authorized federal executive body.
- quality and safety control performed in outpatient departments.
- control of the information reporting procedures to the authorized official aimed at monitoring the safety compliance of medicines and medical devices performed by subordinate medical workers using approved procedures in the Polyclinic.

The polyclinic providing care to adults includes the following structural divisions:

- registration; central sterilization department; office of medical statistics;
- 3 departments of dental therapistry with 6 treatment rooms for 54 workplaces of dental therapists;
- department of surgical dentistry with 10 workplaces;
- department of orthopedic dentistry for 16 workplaces of orthopedic dentists. The department meets the highest level standards in dental prosthetics. A high level is ensured by: dentists-orthopedists of the first and highest qualification categories with practical experience of 10 years or more. The department has a dental laboratory equipped with high-precision modern equipment for the production of a wide range of dentures.
- diagnostic and treatment department, including:

- duty and examination room for 6 workplaces of dentists and therapists;
- physiotherapy room;
- room for x-ray examinations and diagnostics;
- Chargeable assistance office with registration;

3 treatment rooms for 8 workplaces for dental therapists, orthopedic dentists and an orthodontist

Outpatient department № 2

Children's outpatient department No. 2, located in a 2-story non-residential brick building.

Children's outpatient department No. 2 structure includes:

Figure 3.1 shows the structure of the attached population and headcount evolution.

- registration dept; central sterilization department;
- 2 children’s dental departments for 22 workplaces for children’s dentists, 2 workplaces for dental surgeons and a hygiene room;
- orthodontic department for 6 workplaces of orthodontists;

- paid assistance office for 2 workplaces of a pediatric dentist.

Figure 3.1. demonstrates the structure of the assigned population evolution.

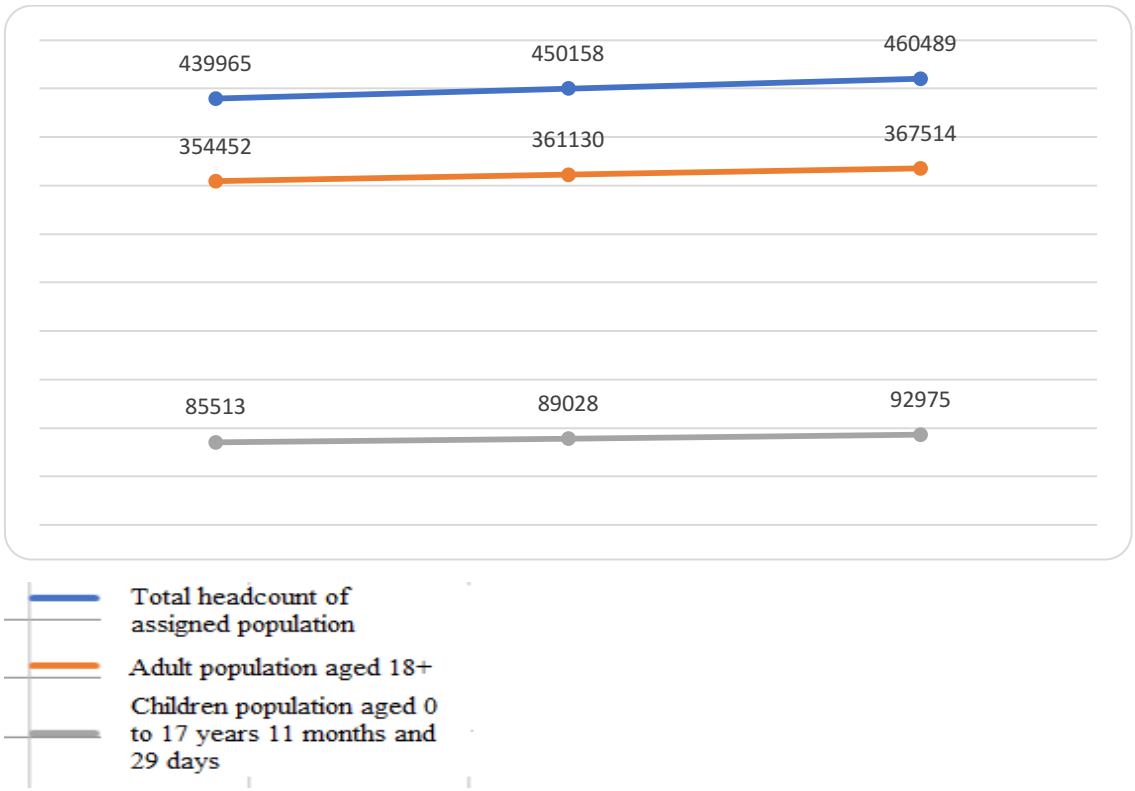

Figure 3.1. Evolution of the population assigned to the clinic.

The availability of dental care for the population depends on: its organization, the availability of dentists/dentists, etc.

Personnel composition:

The clinic has a staff of 275 employees, including:

1. 119 medical experts (22 men and 97 women), including: 115 dentists (7 orthodontists, 64 dental therapists, 14 dental surgeons, 12 orthopedic dentists, 17 pediatric dentists, 1 general dentist), 1 radiologist and 1 physiotherapist;
2. 94 employees from among the emergency services;
3. 7 EMP people;
4. 55 people other personnel.

Table 3.1. provides information on the staffing of the clinic.

Table 3.1. Clinic staffing indicators

Personnel	Number of salary rates according to staffing table			Positions occupied			Individuals		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
Doctors	160,25	154,25	149,50	145,50	141,50	140,50	120	118	118
Paramedical staff	174,00	161,75	160,00	144,25	145,00	143,00	101	111	105
Emergency medical personnel	70,75	68,50	70,00	59,75	52,50	53,25	24	26	28
Other	57,00	61,50	60,50	55,00	57,00	56,00	37	38	39
TOTALLY:	**462,00**	**445,00**	**440,00**	**405,00**	**396,00**	**392,75**	**282**	**293**	**290**

Analysis of clinic staff part-time work allows concluding that there is a growth trend in part-time work among all clinic staff from 1.37 in 2016 to 1.46 in 2018, including:

Doctors 2016. - 1,1 2017 – 1,2 2018 - 1,2

EMP 2016. - 1,4 2017 – 1,5 2018 - 1,5

and an increase in staffing in 2018 among the paramedical staff of the clinic: for emergency medical personnel from 0.86 in 2016 to 0.91 in 2018.

Figure 3.2 provides information on part-time positions and staffing with medical personnel.

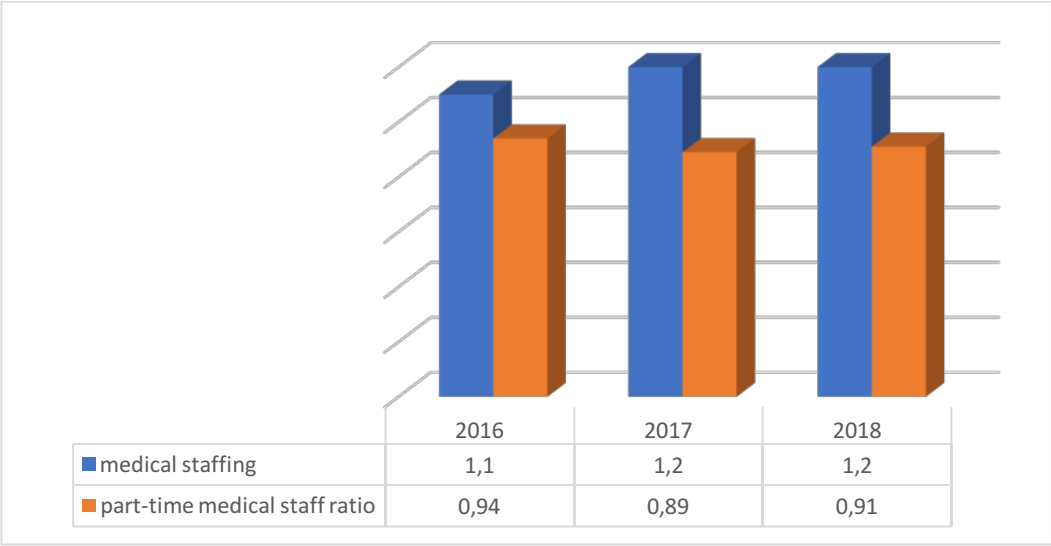

Figure 3.2. Part-time and medical staffing.

From Figure 3.2 one can understand that the coefficient/rate of part-time work for doctors amounted to: 2016 - 1.1 2017 - 1.2 2018 1.2; and the number of medical personnel: 2016 - 0.94 2017 - 0.89 2018 - 0.91.

Figure 3.3 shows the percentage of young specialists within the overall structure.

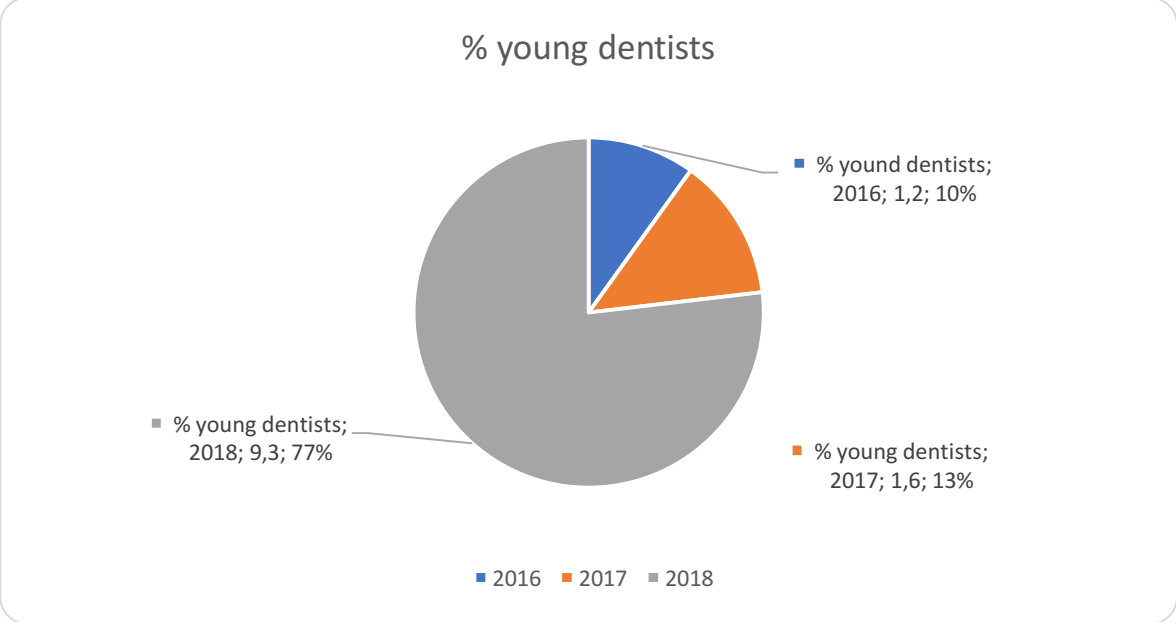

Figure 3.3. Percentage of young specialists among dentists.

Figure 3.4 provides information about dentists of retirement age.

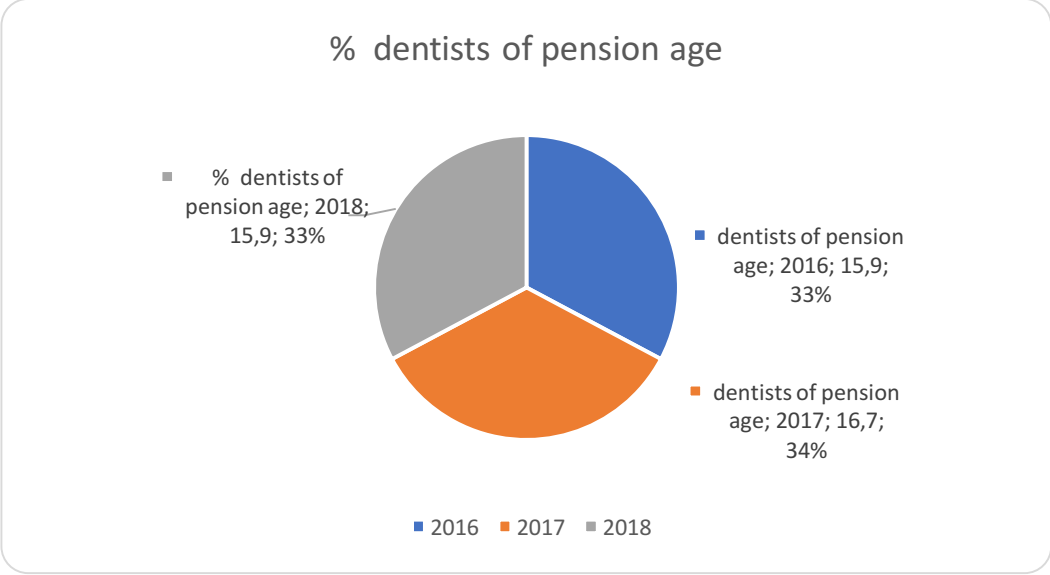

Figure 3.4. percentage of dentists of retirement age.

In the clinic, among the medical and nursing staff: 70.2% dentists and 56.3% nursing staff are qualified experts, while 65.0% dentists and 62.2% nursing staff posess the

highest qualification categories. It employs 2 experts with a degree of doctors of medical sciences and 3 – of candidates of medical sciences. All dentists take part in specialized certification seminars held by leading Russian and foreign specialists.

Management control over compliance with sanitary norms and rules and implementation of sanitary and anti-epidemic (preventive) actions

Particular attention is paid to infection safety. Patients are protected from health care-associated infections (HAIs).

In SanPiN (Sanitary rules and standards) 3.3686-21 “Sanitary and epidemiological requirements for the prevention of infectious diseases”, SanPiN 2.1.3684-21 “Hygienic and epidemiological requirements for the territories of urban and rural settlements, for water bodies, drinking water and drinking water supply, atmospheric air, soils, residential premises, operation of industrial and public premises, organization and implementation of sanitary and anti-epidemic (preventive) measures”, SanPiN 1.2.3685-21 “Hygienic standards and requirements to ensure safety and (or) harmlessness of environmental factors to humans”, SP 2.1. 3678-20 “Hygienic and epidemiological requirements for the operation of premises, buildings, structures, equipment and transport, as well as the operating conditions of business trade entities selling goods, performing work or providing services” sets out the following definition of HAI (Health Care-Associated Infections): “Any infection with clinical manifestations that affects the patient after he is admitted to the hospital or any other medical organization, regardless of its legal status to get healthcare, as well as the disease of an employee resulting from performing his work duties in this organization.”

Ensuring infectious safety of visitors and staff in a clinical facility is a high priority being an important socio-economic issue that has a straight impact on the quality of medical care. A set of measures strictly implementing current rules, legal acts regulating the sanitary standards of the population, disinfection and sterilization

measures, including preventive ongoing disinfection, cleaning of the premises of treatment and diagnostic rooms ensure the safety of visitors and medical staff.

ISO standards serve as guidelines for the treatment and diagnostic activities performed in a clinical facility in compliance with all valid standards and rules of septic systems, asepsis and sterilization.

The clinic has developed a program of compliance control over sanitary standards and rules, and the implementation of sanitary and anti-epidemic (preventive) measures that are realized in providing legally admitted primary, pre-hospital, medical and specialized health care to ensure sanitary and epidemiological protection of the population, environment and nature management control.

The clinic exercises compliance monitoring of the following objects:

1. workplaces for specialists to provide medical care;
2. premises for visitors awaiting reception;
3. equipment, apparatus, technologies;
4. clinic territory;
5. waste of various hazard classes generated by medical activities;
6. staff and visitors.

Visual compliance monitoring.

When conducting visual compliance monitoring, clinic officials pay particular attention to:

1. timely maintenance of work documentation (accounting and reporting forms);
2. sanitary and technical condition of working premises;
3. the sanitary condition of the clinic territory;
4. the condition of utilities, ventilation and air conditioning systems;
5. serviceability of technological equipment;
6. the availability of a minimum supply of personal protective equipment and its mandatory use;

7. compliance with the sanitary and anti-epidemic (preventive) standards, occupational and personal hygiene rules and the sanitary legislation of the Russian Federation:

1. individual storage in specially equipped rooms in individual closets for personal and special sanitary clothing, spare shoes;
2. timely compliance with changing and sanitizing work clothes;
3. mandatory use of personal protective equipment (disposable gloves, protective masks, screens, glasses, caps, etc.);
4. availability of individual towels for staff;
5. compliance with the hand washing and disinfection rules for medical personnel before and after examination of each patient;
6. compliance with general cleaning routine of working premises;\
7. timely registration of step-by-step and general cleaning routine of working premises in the “Technology maps”;
8. compliance with the requirements for labeling, storage, disinfection and intended use of cleaning equipment;
9. maintaining the refrigerators temperature mode;
10. accounting for the operation of bactericidal irradiators and refrigerators;
11. compliance with the conditions and terms of storage, shelfe time of medicines, additional products (instrumentation), medical supplies, disinfection, pest control, deratization agents licencsed and legally approved for use in Russian Federation in medical organizations;
12. temporary storage of fixer in the x-ray room of the diagnostic and treatment department in a tight container by x-ray technicians;
13. temporary storage of biological waste (extracted teeth) in tight containers;
14. collection of medical waste of class “B” in structural units;
15. transportation of medical waste of class “B” from places of generation in structural divisions to the site for handling waste of class “B”;
16. sanitary condition of the class “B” waste handling site accounting for the operation of class “B” waste disposal units;

17. daily maintenance of technological logs of medical waste handling.

Objective methods of compliancen control

Laboratory and instrumental control are included to ensure production compliance control. They are performed by accredited laboratory centers under contracts.

The following control routines are conducted at the clinic:

1. Testing washing off surfaces, at least once a quarter;
2. Air testing, at least once a quarter;
3. Examination of medical device sterility, at least once a month;
4. Control of sterilization with chemical indicators, daily;
5. Bacteriological control of sterilization and disinfection equipment, bactericidal irradiators;
6. Testing disinfectants and the quality of pre-sterilization cleaning of medical devices with azopyram and phenolphthalein tests, daily;
7. Control of sterilizing equipment, 2 times a year
8. Control of microclimate parameters (temperature, humidity);
9. Metering natural and artificial light;
10. Measurements of noise and vibration;
11. Testing the quality of drinking water and water treatment (distilled, purified, pyrogen-free water);
12. Testing the quality of drinking water and air conditioning systems for legionella, at least once a year;
13. Assessing ionizing and non-ionizing radiation from equipment.

In recent years the responsibility of clinical medical staff and the systematic replacement of disinfectants resulted in missing positive seeding inputs.

Organization of healthcare for the population in a clinic

In the Russian Federation, dental morbidity ranks second in the structure of population visits to medical institutions and third in the structure of general morbidity.

An important condition for the normal general physical condition of the human body is oral health. A close correlation between lesions of the oral organs and almost all non-infectious diseases has already been proven.

Clinicians consider linking occurrence of various types of somatic pathology and dental diseases.

The ongoing focal chronic oral infection increases the frequency of somatic diseases by 2-4 times, and in case of a revealed unsatisfactory oral hygiene index - by more than 5 times. Elimination of dental pathology is directly related to the task of protecting public health.

Chronic diseases of the gastrointestinal tract accompanied by a lack of vitamins, minerals, proteins, and carbohydrates in the body result in oral mucosa functional and organic disorders, the development of inflammatory and dystrophic changes in the mouth tissues, and dysfunction of the masticatory apparatus. The severity of the pathology of the oral organs is aggravated by the development of combined lesions of the gastrointestinal tract.

The most important tasks of dental care are

1. dispensary measures for prevention (revealing, treatment, monitoring);
2. qualified primary pre-medical, medical and specialized health care.

To implement the main tasks in the clinic, the following measures are required:

1. Preventive activities - including preventive medical examinations of patients in compliance with the schedules approved by the leading executives of somatic clinics in Vyborgsky district, the principals of Vyborgsky district state secondary educational institutions of secondary educational institutions with the implementation of planned mouth and teeth preventive examination and sanitation for all those in

need: the children population in preschool, school and other organized groups, patirnts with occupational hazards, pregnant women and other populations, aimed at oreventing dental caries and other common dental diseases.

2. Preventive mouth examinations of pre-conscription and conscription contingents.

3. Timely provision of qualified, highly specialized dental care to those visiting the clinic.

4. Implementation of timely emergency and planned hospitalization of those in need of treatment in specialized maxillofacial surgery clinics of compulsory medical insurance hospitals in the city.

5. Providing emergency medical care for “acute” oral cavity, salivary glands and maxillofacial area diseases,.

6. Temporary work disability examination, issuance, extension and termination of disability certificates.

7. Dispensary observation of patients with severe dental diseases.

8. Analysis of morbidity, development of action plan aimed at reducing and eliminating the causes of diseases and their complications.

9. Performing pathology rehabilitation treatment of the maxillofacial area, dental prosthetics, orthodontic and physiotherapeutic treatment.

10. Interaction and compliance with the succession principles during diagnostic and treatment procedures.

11. Ensuring medical prevention, health education, hygienic training and education, as well as building up a healthy lifestyle image among all groups of the population by performing:

1. consultations, lectures, promotional debates both individual and group among the people of various age groups on prevention issues;

2. promotional awareness-raising events (lectures, debates, demonstrations of thematic movies, open public meetings, thematic exhibitions, events dedicated to the celebration of international days, etc.);

3. use of material and technical equipment (visual aids, videos, video clips, etc.), printed materials ("Home Doctor" newspaper, magazines, information brochures, posters, health bulletins, etc.);

4. Activities to improve the qualifications of doctors and nursing staff.

12. Participation in training programs on the prevention of dental pathology

Preventive focus

Preventive focus in the clinic is implemented through dispensary observation. Medical examination based on the prevention and early diagnosis of diseases, effective treatment and dynamic monitoring including activities aimed at promotion of a healthy lifestyle is a high priority type of activity in the clinic. The dispensary method is used in working with children, pregnant women, the elderly, etc. During the dispensary examination, dentists examine patients to reveal diseases at early stage, and, if necessary, register them, take steps to improve their health, restore their ability to work, and extend the period of active life.

Primary health care at the clinic is provided:

1. in the form of free healthcare to insured patients in the compulsory health insurance system, assigned to a clinic, under the current compulsory medical insurance policy within the Territorial program of state guarantees of free healthcare to citizens in St. Petersburg (hereinafter referred to as the Territorial compulsory medical insurance program), established by the decision of the Commission on development of the Territorial Compulsory Health Insurance Program of St. Petersburg, approved by the Decree of the St. Petersburg Government;

2. with public and corporate (as chargeable medical care) funding.

Polyclinic healthcare structure: routine and practices.

1. Patient pre-registration, consultation, examination appointment with medical specialists is performed as planned:

1. by direct contact in person to the clinic's reception desk;

2. by telephone at the reception;

3. by means of software intake channel: the software package (PC) “WEB Polyclinic” Self-registration.

2. The patient selects the date and time for the initial appointment from the available free coupons within the valid schedule offered by the medical registrar and/or from those available on the Internet and/or infomat.

3. When booking a proper medical service in a standard form, there may be a waiting period.

4. The maximum waiting period for an appointment with doctors and for diagnostic, instrumental and laboratory tests does not exceed 10 working days from the date of application.

5. A repeated appointment for the patient is scheduled on the day and time prescribed by the attending physician of the clinic.

6. In case of “acute” course of disease regarding oral organs, salivary glands and maxillofacial area, the patient is provided with medical care by the dentists in the duty examination room on the day of application, regardless of the place of residence. Emergency medical care is provided at night, on Sundays and holidays. The maximum waiting period for medical assistance does not exceed 2 hours after a visit to the clinic.

7. If a patient’s health condition requires emergency medical care, in case of sudden acute diseases, conditions, exacerbation of chronic diseases that pose a threat to the patient’s life, the examination and treatment is performed immediately by the doctor of the clinic to whom he turned.

8. The clinic has developed Internal Regulations for patients and visitors posted for public viewing in a place accessible to visitors on:

1. permanent information module (stand);

2. in information folders of registries;

3. on the official website of the clinic;

9. A necessary precondition for treatment, including that chargeable, is confirmation of the informed voluntary consent of the patient or his legal

representative for medical intervention in compliance with the Federal Law No. 323-FZ requirements “On the fundamentals of public health protection ".

Primary specialized healthcare in pediatric dentistry

Dentists at children's clinics treat children of various age groups displaying sensitivity and patience. The children's outpatient department employs dental hygienists, pediatric dentists, and orthodontists.

Dentists of the children's outpatient department provide preventive care, treatment and diagnostic services aimed at the optimal development of the bones of the facial skeleton as well as reducing the prevalence of dental diseases and their growth. It is important since childhood not to frighten a child by visiting the dentist, therefore, all of our medical staff at the children's outpatient department undergoes special psychological training in working with children, including children with special psychosomatic health conditions.

Dentists of the children's outpatient department provide the entire range of dental services:

1. Preventive activities:

1.1. hygiene promoting classes;

1.2. instructing in oral hygiene;

1.3. instructing in preventive toothpastes;

1.4. implementation of individual selection of additional oral hygiene products in compliance with the “General recommendations for the hygiene product selection”, considering the child dental status, including:

- condition of dental hard tissues, periodontium and oral mucosa;
- revealing dental anomalies, including anomalies of free-standing teeth and bite;
- availability of orthodontic devices and/or structures;

1.5. conducting supervised tooth brushing to refresh and sharpen children’s oral hygiene skills;

1.6. holding preventive medical examinations of minors;

1.7. instructing on newborn oral care;

1.8. deep fluoridation of hard dental tissues (coating teeth with fluoride-containing varnishes, gels);

1.9. sealing the fissures of permanent dentition teeth with sealant;

1.10. silvering teeth in temporary occlusion.

2. Calculating oral hygiene indices, an indicator of the intensity of caries in compliance with CSE index.

3. Providing emergency medical care for the oral cavity, salivary glands and maxillofacial area diseases at “acute” stage.

4. Treatment of tooth tissue non-carious lesions.

5. Treatment of carious processes in teeth of temporary and permanent bite.

6. Planned sanitation of the mouth in children of different age groups.

7. Professional oral hygiene, cleaning the tooth surface from plaque.

8. Treatment of periodontal diseases and oral mucosa.

Surgery:

1. removal of temporary and permanent occlusion teeth of any complexity, incl. impacted teeth;

2. tooth extraction on orthodontic indications;

3. exposure of the crown of a dystopic tooth;

4. frenuloplasty;

5. deepening of the mouth vestibule.

6. timely referral of children in need of inpatient treatment to specialized children's maxillofacial surgery clinics in compulsory medical insurance hospitals in the city using a prescribed application;

7. holding an examination of temporary disability, issuing, extending and closing certificates of disability to care for a sick family member.

Orthodontic treatment of children and adolescents:

1. prevention of malocclusion and abnormal growth of teeth;

2. registration of children requiring orthodontic treatment;

3. complex orthodontic correction in children with dentoalveolar anomalies: making temporary dentures, orthodontic appliances and structures (removable

appliances, mouth guards, bracket systems, myobraces, trainers, etc.) single-jaw and double-jaw appliances, orthodontic correction with removable orthodontic appliances.

Dispensary observation of children with dental system pathology, including:

1. multiple dental caries;
2. active forms of dental caries;
3. dental fluorosis;
4. periodontal diseases and oral mucosa;
5. chronic diseases of salivary glands;
6. abnormal development and deformation of the jaws;
7. conditions after surgical interventions for benign neoplasms of the maxillofacial area, congenital defects of the face and jaws;
8. specific inflammatory processes of the maxillofacial area.

Primary specialized healthcare in dental therapistry

Dental therapistry is the most important branch of dentistry, dealing with the prevention, detection, and treatment of carious lesions.

Highly qualified dental therapists, working with up-to-date equipment and using a competent approach to treatment in their work, provide the entire range of dental therapistry services:

1. Preventive actions:

- instructing in individual oral hygiene;
- instructing in preventive toothpastes;
- individual selection of additional oral hygiene products in compliance with the “General recommendations for the selection of hygiene products”, dental status, including:
- diseases of hard dental tissues of teeth, periodontium and oral mucosa;
- dental anomalies, including malocclusions;
- availability of removable and fixed dentures, orthodontic devices and/or structures;

- conducting supervised brushing of teeth in order to refresh and sharpen oral hygiene skills;
- deep fluoridation of hard dental tissues (coating teeth with fluoride-containing varnishes, gels);
- sealing dental fissures with sealant;
- holding preventive medical examinations among certain privileged categories of patients within the Territorial Compulsory Medical Insurance program, such as pregnant women, disabled workers, disabled people and participants of the Great Patriotic War and Special Military Operation, somatic patients under dispensary supervision by a general practitioner of a somatic territorial clinic aimed at the early and timely detection of pathology, diseases of the maxillofacial area and their causes, as well as assessing dental health condition, oral cavity evolution monitoring, sanitizing oral cavity and providing recommendations.

2. Calculation of oral hygiene indices, periodontal indices.
3. Providing emergency medical care for the oral cavity, salivary gland and maxillofacial area diseases in “acute” phase.
4. Treatment of non-carious lesions of tooth tissue.
5. Treatment of dental caries and complicated forms of caries.
6. Professional oral hygiene, cleaning the tooth surface from plaque using the Velapex Aquacut water-abrasive system; removal of supragingival and subgingival dental plaque manually and using the PIEZ0N-MASTER-400 system and the Vector Paro Pro 2031-51 ultrasonic periodontal center.
7. Treatment of periodontal diseases and oral mucosa, restoration of fresh breath, splinting tooth mobility.
8. Holding examination of temporary disability with periodontal diseases and oral mucosa, issuance, extension and closure of certificates of disability.
9. Ultrasonic treatment of periodontal pockets.
10. Aesthetic tooth restoration – restoration of tooth aesthetics even with 80% destruction of the coronal part of the tooth.
11. Therapeutic preparation of teeth before dentures.

12. Clinical patient observation:

12.1.1. with multiple dental caries;

12.1.2. with dental caries that actively occurs;

12.1.3. with dental fluorosis;

12.1.4. with increased tooth wear;

12.1.5. with glossodynia;

12.1.6. with diseases of periodontium and oral mucosa.

13. Professional photo depicting teeth whitening with cold light using the halogen professional multifunctional system “Beyond polus”, which is an absolutely safe whitening method:

Figure 3.5. shows an analysis of the workload of on-duty therapeutic appointments per working day per dental therapist.

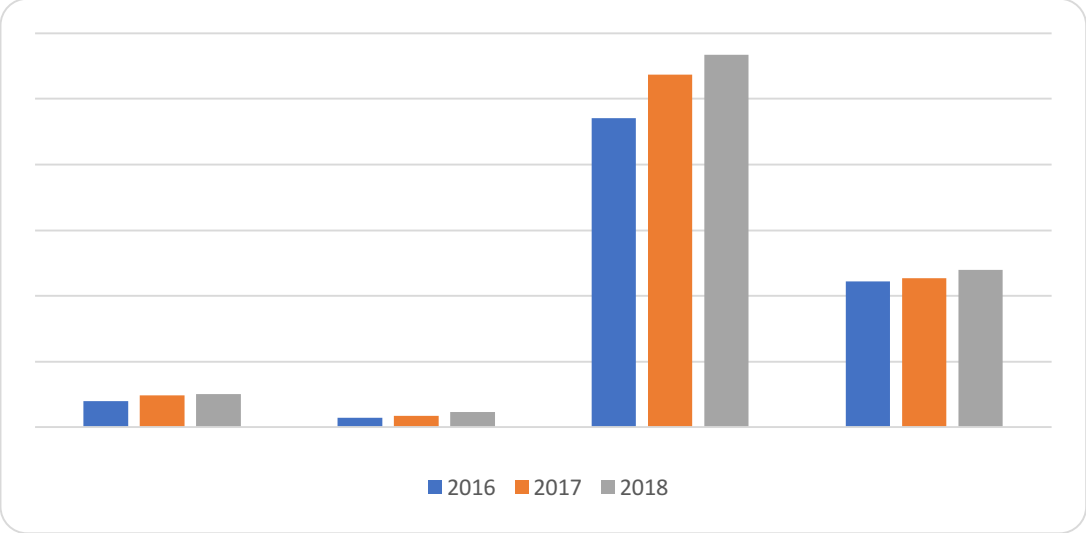

Figure 3.5. Comparative analysis of the workload on a duty therapeutic appointment for 1 working day per 1 dental therapist of the diagnostic and therapeutic department as part of the implementation.

Territorial compulsory medical insurance program

Figure 3.6. presents information on the percentage of admitted primary patients from the total number of those admitted.

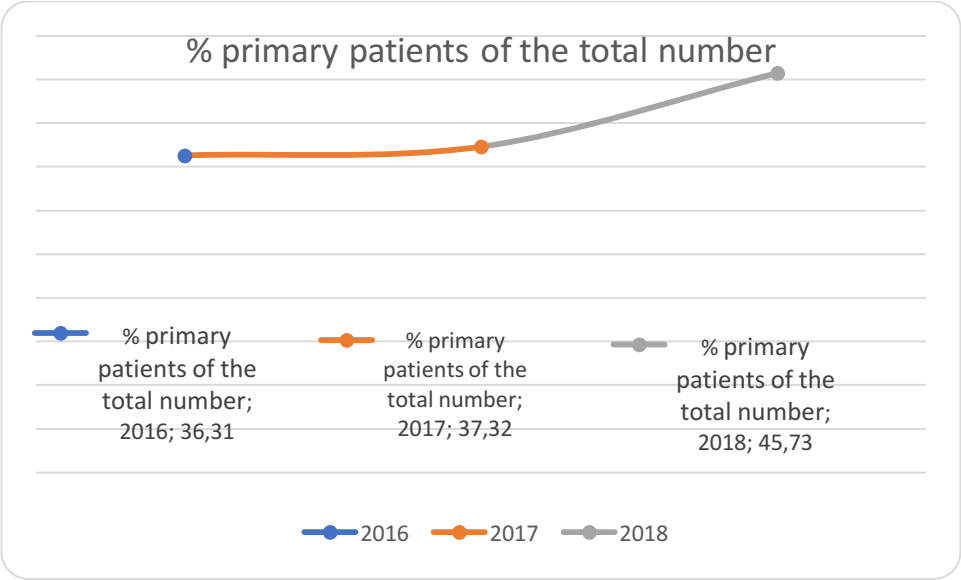

Figure 3.6. percentage of received primary patients.

Figure 3.7 presents a comparative analysis of the workload per working day when providing home medical care.

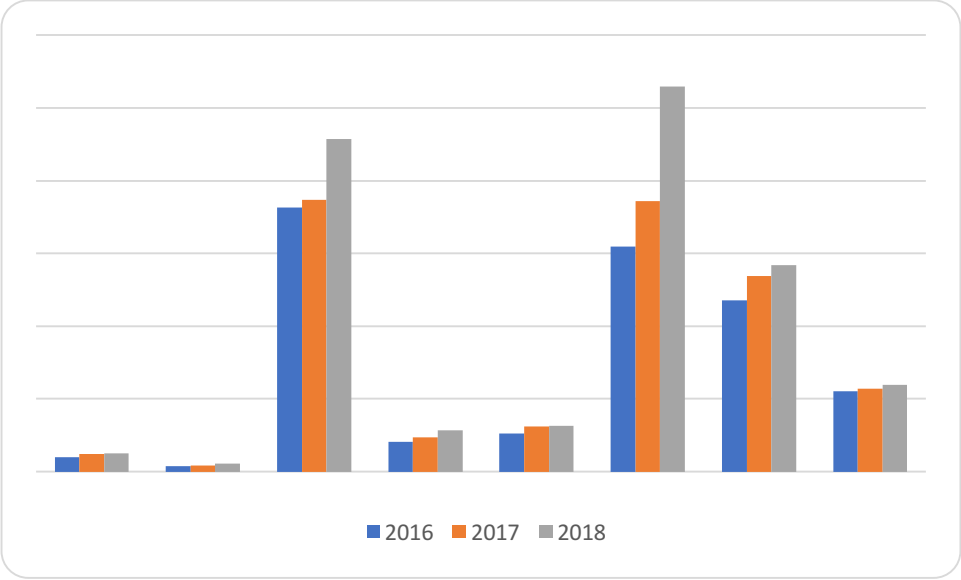

Figure 3.7.Comparative workload analysis per 1 working day when providing home medical care per 1 dental therapist of the medical-diagnostic department within compulsory medical insurance.

Table 3.2 Comparative workload analysis per 1 working day when providing home medical care per 1 dental therapist.

Table 3.2. Comparative workload analysis per 1 working day when providing home medical care per 1 dental therapist of the medical-diagnostic department within Territorial compulsory medical insurance.

Average and quality indicators per 1 working day when providing home medical care per 1 dental therapist of the medical-diagnostic department within territorial compulsory medical insurance	Year		
	2016	2017	2018
Appointments per day	1,97	2,42	2,5
Primary patients per day	0,73	0,88	1,14
% primary patients of the totally admitted	36,31	37,32	45,73
Teeth filled per day	4,11	4,7	5,67
Teeth restored with fillings per one working day	5,23	6,21	6,26
The ratio of "Tooth caries" to its complications	30,95	37,2	52,9
CULI (conventional unit of labor intensity) completed per day	23,52	26,86	28,36
CULI (conventional unit of labor intensity) completed per visit	11,08	11,36	11,96

Comparative workload analysis per 1 working day in case of a therapeutic appointment per 1 dental therapist of the medical-diagnostic department within regional compulsory medical insurance

A comparative analysis of the workload of dental therapists allows concluding that in 2018 a positive trend was detected in all performance indicators. Figure 3.8 shows the distribution of appointments per day by year.

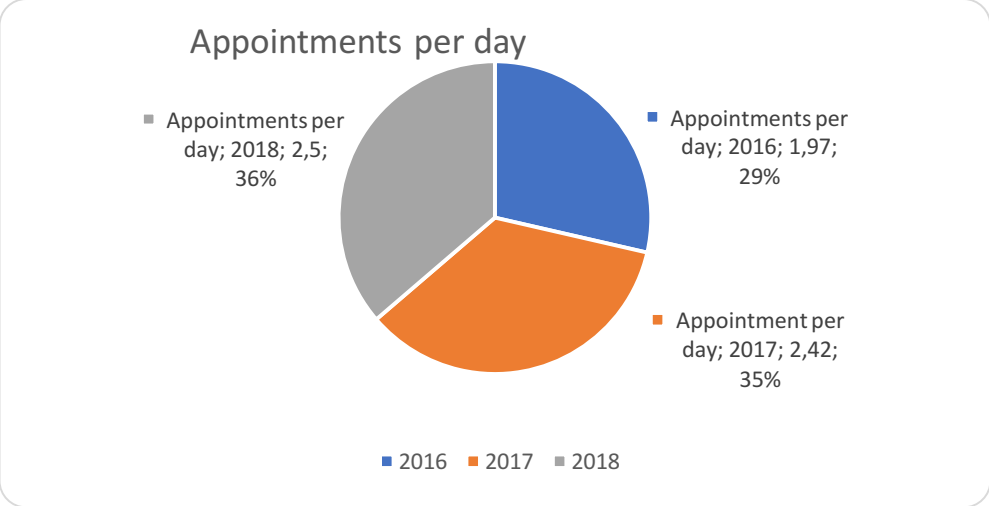

Figure 3.8. Number of appointments per day.

Figure 3.9 shows the distribution of primary appointments per day by year.

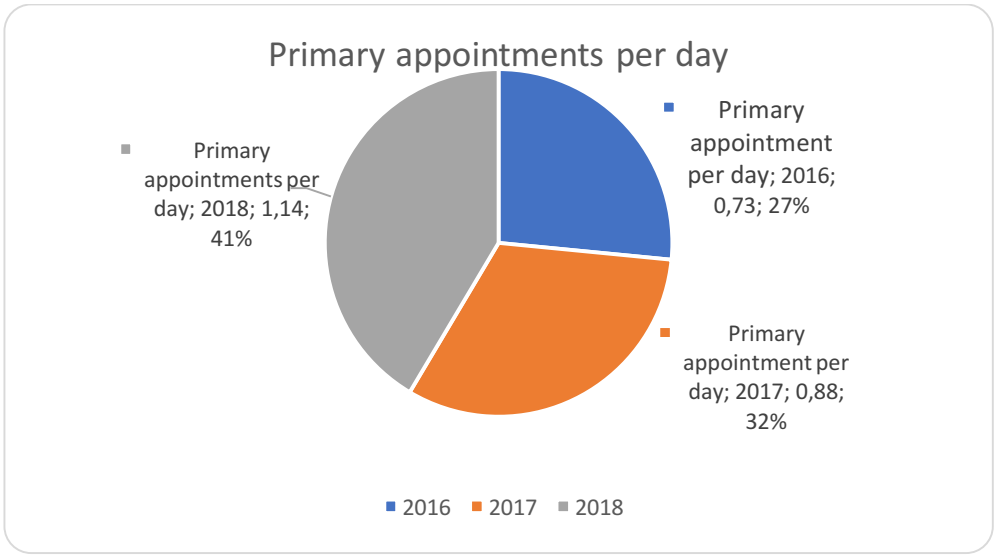

Figure 3.9. Number of primary appointments per day.

Figure 3.10 the percentage of primary appointments of the total number of admitted patients per year.

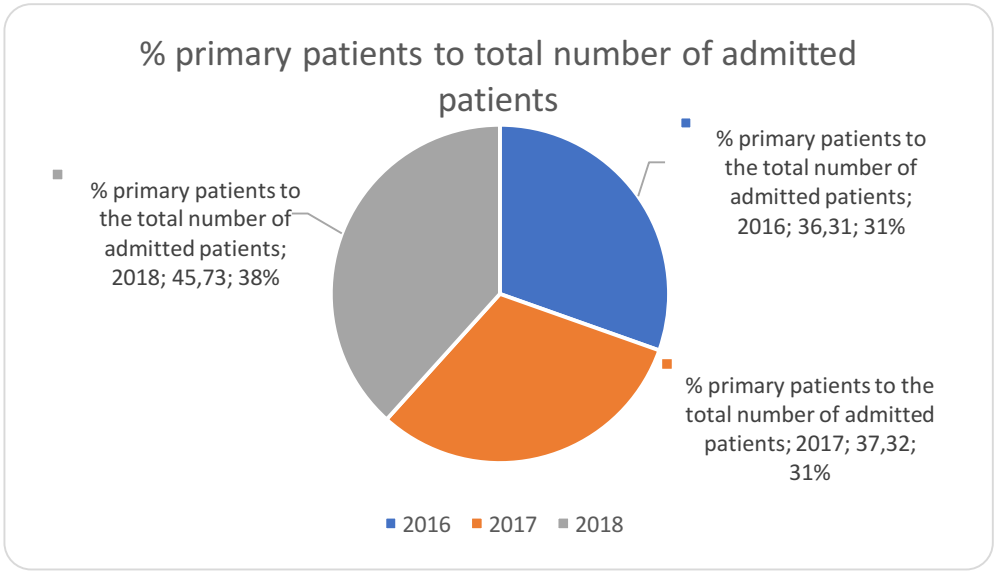

Figure 3.10. the percentage of primary appointments of the total number of admitted patients.

Figure 3.11 shows the distribution of generated CULI per appointment daily

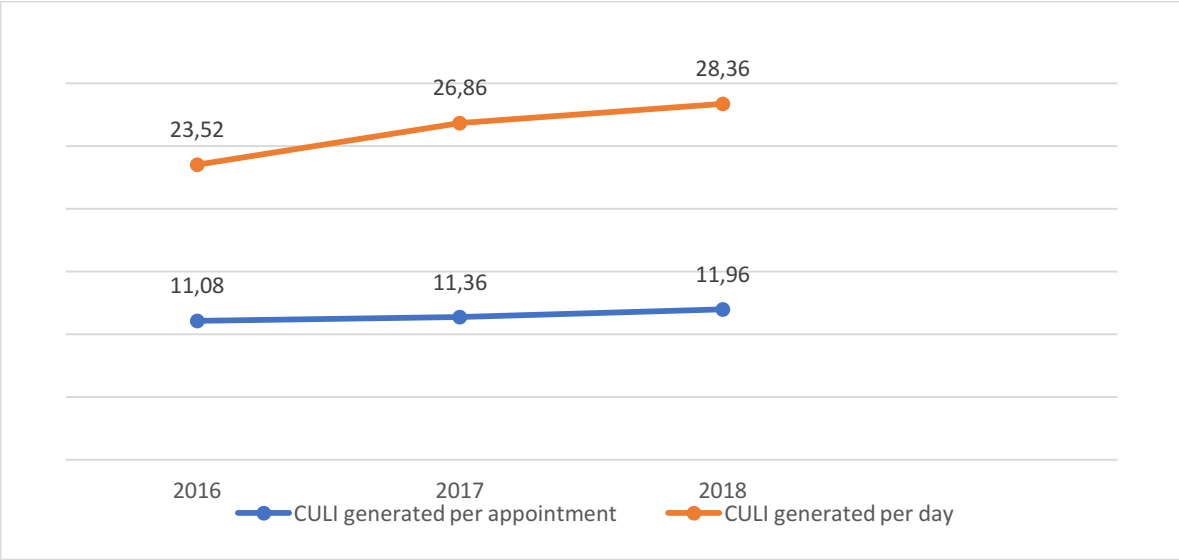

Figure 3.11. Amount of CULI generated per day and per appointment.

Figure 3.12 shows the number of teeth filled per day.

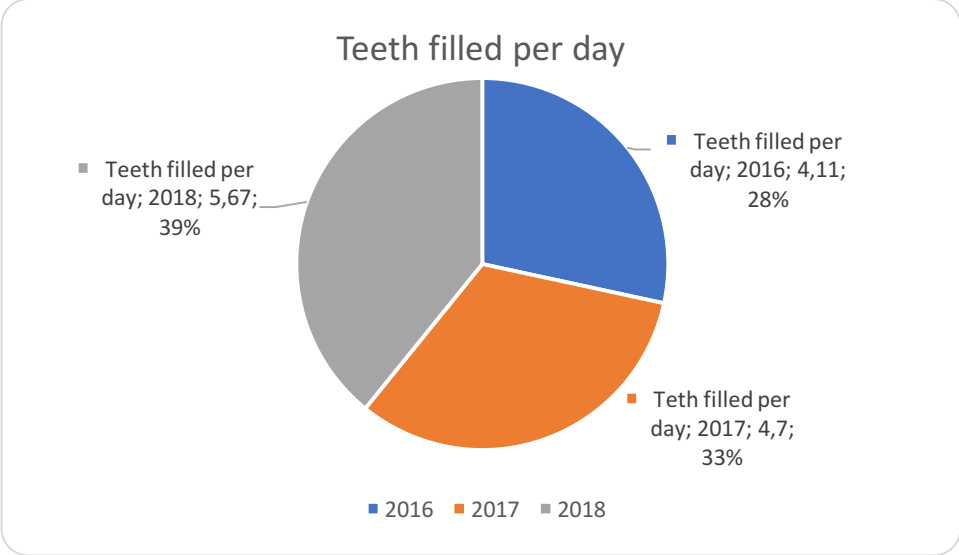

Figure 3.12. Number of teeth filled per day.

Figure 3.13 shows the number of teeth restored by means of fillings per a working day.

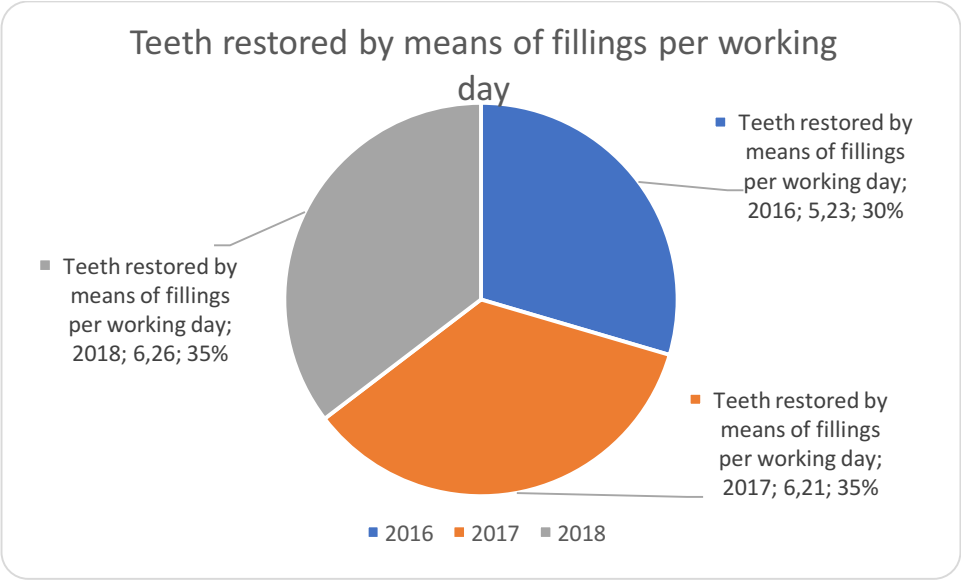

Figure 3.13. Number of teeth restored by means of fillings per working day.

Figure 3.14 shows the ratio tooth caries to its complicated forms.

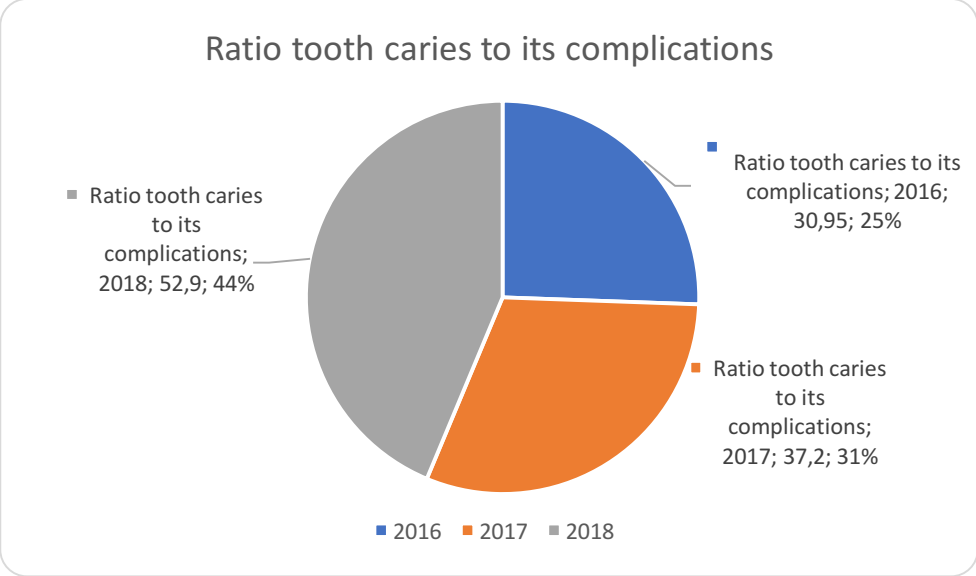

Figure 3.14. The ratio dental caries to complicated forms of caries.

Table 3.3 comprises data on the average workload of dental therapists per working day.

Table 3.3. Average workload indicators per 1 working day per 1 dental therapist

Average and quality indicators per 1 working day per 1 dental therapist of the medical-diagnostic department within regional compulsory medical insurance	Year		
	2016	2017	2018
Appointments per day	8,1	8,9	9,8
Primary patients per day	1,9	2,8	2,8
% primary patients of the totally admitted	23,26	31,3	28,5
Teeth filled per day	6,7	7,3	8,7
Teeth restored with fillings per one working day	7,4	8,1	9,1
The ratio of “Tooth caries” to its complications	3,5	2,8	2,6
CULI (conventional unit of labor intensity) completed per day	0,7	0,7	0,6
CULI (conventional unit of labor intensity) completed per visit	53,73	66,1	74,7
Appointments per day	6,56	7,36	7,55

Figure 3.15 the doctors output indicators while fulfilling the state target assignment

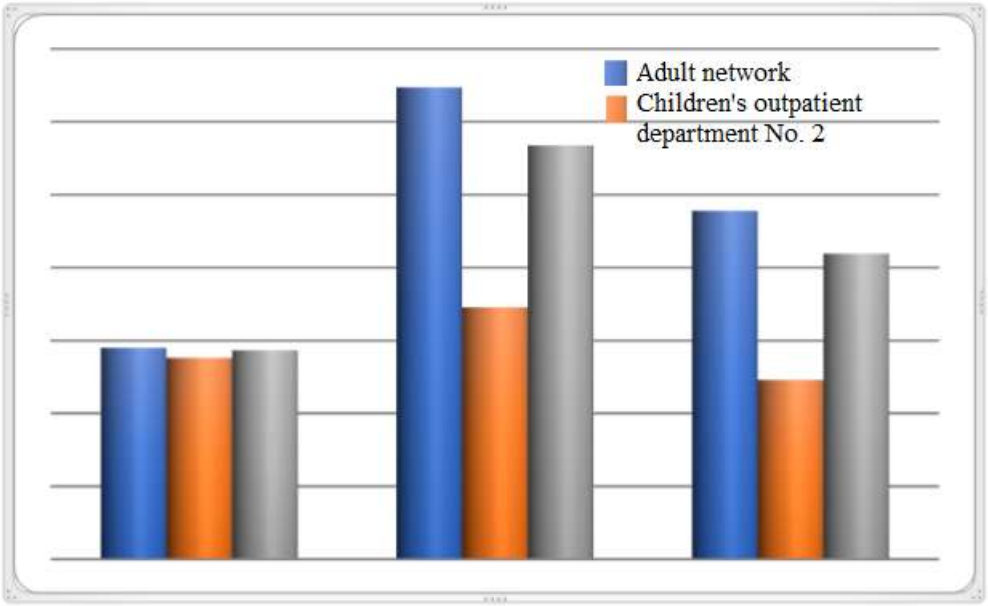

Figure 3.15. Indicators of state target assignment completed by medical personnel.

Orthopedic dentistry: primary specialized health care

Orthopedic care is provided at the final stage of dental treatment after oral sanitation is completed.

The department keeps its own registry, an orthopedic dentist’s office, and a dental laboratory. A patient in need of prosthetics contacts the reception desk of the orthopedic dentistry department.

The department's dentists and orthopedists use an individual, comprehensive approach to each patient together with other specialist doctors at the clinic that leads to a better, more beautiful and long-lasting result of dental prosthetics.

An orthopedic dentist examines a patient with missing teeth partial or complete, after r the patient’s informed voluntary consent to orthopedic treatment is documented, draws up a denture implementation plan. If necessary, he sends the patient for oral sanitation, and issues an order for the manufacture of dentures. The production of dentures begins in the dental laboratory.

The department also provides consultating on dental prosthetics and, if necessary, repairs broken dentures both fully partially removable ones.

Our orthopedic dentists and dental technicians in the dental laboratory are proficient in all up-to-date methods and technologies of dental prosthetics, from the manufacture of a single crown to fully removable dentures for completely edentulous people using various high-tech denture materials.

The practical experience of dental technicians allows manufacturing the most complex structures of both removable and fixed prosthetics. Dental technicians regularly attend congresses and symposia, as well as master classes that allow manufacturing state-of-the-art dental structures. All types of work are performed in articulators and undergo a double check of the fitting accuracy.

Types of dental work and denture services:

1. Aesthetic dental restoration.
2. Microdental prosthetics.
3. Implant-based dental prosthetics.
4. Removable dentures of any degree of complexity - partial and full, using state-of-the-art thermoplastic materials:

1. nylon dentures
2. acry free dentures

3. acrylic dentures
4. acetal dentures
5. Fixed prosthetics - inlays, veneers, single crowns, bridges made of materials:
    1. CCA (Cobalt-chromium alloy);
    2. metal ceramics;
    3. metal-free ceramics on zirconium dioxide, E-max.
6. Repair of partial and fully removable dentures.

The department utilises state-of-the-art digital technologies, including a CAD/CAM system to produce zirconium dioxide prostheses, as well as the metal-free “E-MAX” structures, advanced thermoplastic masses for the production of partial and complete removable dentures:

The department provides both free dental prosthetics (at the expense and within the limits of the budget of St. Petersburg) and chargeable dental prosthetic services at the expense of civil personal funds.

Budget-funded (free of charge) dentures

Budget-funded denture services - the manufacture and repair of dentures is performed in the department of orthopedic dentistry following the referrals for free dentures from the district administration welfare and social protection department.

Within the agreement concluded with the Committee on Social Policy and the "City Information and Computer Center" free dental prosthetic service is provided in compliance with the dental service funding limits and standards for free dental prosthetics approved in the current calendar by the Committee on Economic Policy and Strategic Planning of the Government of St. St. Petersburg.

Adhesive bridges (AB)

The state-of-the-art method of AB manufacturing utilizes replacing a missing tooth by means of composite material reinforced with fiber tape, ensuring support for the teeth adjacent to the defected one. The method capabilities ensure the creation of minimally invasive permanent, temporary or conditionally temporary adhesive bridge

structures. The structures manufactured by a direct method help to completely eliminate or temporarily delay traditional invasive prosthetic methods.

Indications for the production of fiber-reinforced ABs

Included defect of the dentition of small extent in the following clinical cases:

1. one or both supporting teeth are intact;
2. 20+ degrees divergence of the supporting teeth;
3. missing one or more teeth resulting from the periodontitis with simultaneous splinting;
4. the need for urgent aesthetic replacement of a missing tooth;
5. in case of denial of classical methods of prosthetics following the patient's desire to preserve the vitality of the pulp of the supporting teeth.
6. allergic reaction to metals in the mouth.

Fiberglass-based direct method of microprosthetics

Compared to the indirect method the direct method of manufacturing directly in the mouth has an advantage of an immediate production and its lower cost. To construct such microprostheses use glass fiber from the Japanese company Tokuyama Dental - EverStick a unique patented structure of the interpenetrating polymer network "IPN" that significantly distinguishes it from its analogues.

The IPN technology provides EverStick glass fiber with high bending strength and resistance to cyclic loads, and reliable fixation of microprosthetic structures. The latest data testify that glass fibers filled with a composite resin industrially have the greatest strength up to 1500 MPa owing to complete homogeneity after polymerization and chemical bonding with the EverStick composite.

When planning prosthetics on implants, a patient rehabilitation scheme with stages and terms of treatment is developed.

The patient is prepared following the scheme:

1. Primary counselling with an orthopedist and/or surgeon - computed tomography.

2. repeated counseling session - if necessary, an extended advising may be required (surgeon, orthodontist, therapist who treats periodontal diseases, otolaryngologist).

3. The stage of implantation preparation includes mouth sanitation, laboratory tests, production of temporary structures, etc.

4. The surgical stage may include bone grafting, sinus lifting – following clinical indications - installing implants - setting gum shaping braces.

5. orthopedic stage - patient monitoring.

Depending on the indications orthopedic treatment begins after completion of osseointegration (engraftment) of the implants (in the maxilla, usually after 4-6 months, in the mandible - after 2-3 months) or immediately after the installation.

Orthopedic treatment includes the following stages:

1. taking an impression - trying on abutments and superstructure;

2. fitting and fixation of the superstructure to the installed abutment.

After treatment, the patient is given the necessary recommendations, including those on oral hygiene. It is simply recommended to contact a dental hygienist or dental therapist twice a year for professional teeth cleaning.

Quality control of dental care.

The clinic has establised a Quality Service for Medical Care, a multi-level system of healthcare internal control and safety has been developed that is functioning now:

The objects of internal control of in a clinic or medical facility are:

1. setting up primary health care comprises maintaining and/or restoring the patient health, including the provision of medical services, in order to achieve specific results and patient satisfaction with the medical care provided;

2. legally significant primary medical documentation for long-term health monitoring, containing information about the patient's health status, the process of providing medical care aimed at solving problems of the medical examination.

Target values for accessibility and quality of medical care:

A comprehensive assessment of the degree and evolution of target values for the availability and quality of medical care is performed on meeting:

1. Patient satisfaction with healthcare comfirmed by the sociological survey and the data obtained from the "Social monitoring and assessment questionnaire on medical care availability and quality received in the clinic (percentage of the respondent number).
2. Providing sufficinet medical personnel staffing per 10 thousand people.
3. The assessment of clinical performance based on an medical position function performance as well as indicators meeting targeted spenditure of budgetary and extra-budgetary funds (%).
4. Assessment of emergency outpatient medical spenditure share within the total structure for the Territorial Compulsory Medical Insurance Program (%).
5. Children preventive medical examination coverage assessment (percentage of the total number of children subject to preventive examinations).
6. The number of people within working age group recognized as disabled for the first time.
7. The maximum waiting period in certain types of emergency primary healthcare does not exceed 2 hours from the moment of contacting the clinic.
8. In case of providing primary specialized healthcare the target maximum waiting period for an appointment with dentists including diagnostic, instrumental and laboratory tests should not exceed 10 working days from the date of application.
9. Hospitalization rate of the population attached to the clinic providing primary health care (per 1000 people).
10. The rate of emergency hospitalizations in the total amount of hospitalized patients assigned to the clinic providing primary health care.

11. Justified complaints, including refusal to render medical care services provided under the Territorial Compulsory Medical Insurance Program (percentage of the number of registered complaints).

The clinic runs a system of economic incentives for employees; on a quarterly basis, the 1st level Commission and the reward commission for the distribution of incentive payments to the clinic's employees assesses the criteria and performance indicators of each employee.

3.2. Vyborgsky district of St. Petersburg practice as an example of dental care improvement for the children's population of a metropolis

The Government of the Russian Federation considers the health of the population to be one of the top priorities, a strategic potential; understanding the importance of adopting preventive approaches that was declared in "On the concept of preserving the health of people" decree adopted by the Board of the Ministry of Health of the Russian Federation on June 25, 2002. Subsequently, the idea of preventive medicine was further developed. In accordance with the Healthcare system development concept in Russian Federation till 2030, a state federal program for the primary prevention of dental diseases the population of Russia is being developed based on WHO recommendations for the prevention of dental diseases and accumulated experience of preventive activities in Russia and actual economic opportunities [7, 9, 28, 36].

The program should cover the entire population, and meet the intended goals and their practical implementation through a set of prevention methods including oral hygiene, use of fluoride, rational nutrition; they are performed taking into account the characteristics of different age groups: newborns and young children 0 - 2 years; preschool children 3 – 5/6 years old; school age children 6/7 – 14/17; young people 15/18 - 25 years old; adult population 26+.

Reasonable oral care is a basic method of prevention that can be etiological in nature, i.e. aimed at eliminating the causes of oral diseases in organs and tissues

(microorganisms of dental plaque). Fundamental knowledge of disease causes and development is a necessary premise for the development of their primary prevention. The most efficient methods of prevention are those that attack the cause of the disease. Family and parents are the primary source of information for the child on dental health issues. One of the ways to improve a child's dental knowledge and habits is to provide up-to-date, accurate instruction to parents. Primary school has an influence on the formation of healthy lifestyle habits in children. A child spends a significant amount of time in school starting at the age when habits are formed and formed. Teachers with a positive oral health attitude who have undergone sufficient training have to conduct health education programs.

The group of school children aged 6-14 years is the most representative group for the implementation of mass preventive measures by pediatric dentists.

Numerous scientific studies as well as recommendations of WHO and the Ministry of Health of the Russian Federation distinguish the main areas included in preventive programs for this age:

1. Systematic dental instruction of parents, teachers, children on the importance of oral hygiene, the dangers of sweet foods for teeth, the need for dental treatment in the early stages of the disease

It is advisable to start motivating parents by explaining to them the opportunities and importance of preventing dental diseases, talking about the rules and basics of brushing teeth and a balanced diet. According to I.A. Khoshchevskaya [43], only 8% of St. Petersburg parents of six-year-old children believe that poor oral hygiene is the cause of caries. The diet of younger schoolchildren is regulated by their parents, while older students follow the diet on their own: eating no more than 5-6 times a day, including snacks. Those recommendations should also come from teachers in health classes.

Motivating children is an important step. One should strictly differentiate classes with them depending on age: if the younger ones need to conduct classes in the form of a game, then the older ones required the same format as adults.

2. Individual training in cleaning techniques.

Children perform hygiene actions in the mouth independently at home in the morning after meals and in the evening before bed using a prophylactic toothbrush with soft bristles and fluoride-containing toothpaste. Both the dentist or a dental hygienist and parents are supposed to monitor the quality of teeth cleaning during regular preventive examinations or when students independently visit a dentist (at a school dental office, dental clinic).

3. Sealing fissures of permanent molars.

It is performed during the first year after tooth eruption in a dental office by a dentist (for children) or a dental hygienist.

4. Local use of remineralizing drugs, including those containing fluoride compounds.

Start at the age of 6 years. One judges the remineralizing efficacy by the white spots on the enamel by being stable or fading away or decreasing the incidence of caries. Local fluoride prevention is performed by brushing teeth with fluoride-containing toothpaste. Toothpastes containing 1000 – 1500 ppm (0.1 – 0.15%) fluoride ion are recommended.

5. Endogenous use of fluoride-containing drugs (according to indications).

6. Professional hygiene and mouth.

7. Providing information materials to school dental offices.

8. Limiting cariogenic foods in school meals for children.

9. Oral sanitation using state-of-the-art filling materials (glass ionomer cements, composite materials, etc.).

10. Prevention of dentoalveolar anomalies: timing monitoring, pairing and symmetry of permanent teeth eruption, by the indications - plastic surgery of the labial frenulum, small vestibule of the oral cavity, elimination of bad habits, if necessary - selective grinding of temporary teeth, preventive prosthetics

The main activities that enable implementation of prevention activities in those areas constitute a set of the following sequential and interrelated actions:

1. Education courses for dentists, pediatric dentists, dental doctors and dental hygienists involved in the program, to update their knowledge and enhance competencies in preventive dentistry;

2. Lectures for school teachers:

1. methods and means of preventing major dental diseases in schoolchildren and their application within the school curriculum by instilling the need to maintain healthy habits;

2. the correlation between spiritual and moral qualities of the individual and health.

3. Instruction for schoolchildren at school and at an appointment with a dentist and/or dental hygienist

1. rules for brushing teeth,

2. the importance of fluoride and calcium for dental health,

3. principles of rational nutrition;

4. Training for parents of schoolchildren at school and at an appointment with a dentist and/or dental hygienist:

1. rules of oral hygiene, the benefits of fluoride-containing toothpastes and fissure sealants, rational nutrition;

2. instilling in children the need to maintain healthy habits;

5. Individual preventive procedures for schoolchildren at an appointment with a dentist and/or dental hygienist:

1. controlled teeth brushing;

2. professional oral hygiene (removal of plaque and tartar);

3. application of fluoride solution, coating of teeth with fluoride varnishes/fluorogels;

4. sealing of fissures in accordance with age indications [70, 109, 110, 134, 136, 141, 183].

3.3. Providing orthodontic care to children in the Vyborgsky district

In orthodontic practice, it is most often necessary to treat patients with dentoalveolar anomaly of class II according to Engle. The number of such patients is 69.5% of the total number of patients with orthodontic anomalies. The etiology and morphological manifestations are different. By age category you can present a typical treatment plan:

1. Primary occlusion up to 6 years - identifying bad habits and combating them, myotherapy, use of orthodontic appliances - vestibular plate, Mühlemann propulsor.
2. Replaceable occlusion - Frenkel function regulator type I, open Klammpt activator, functional Andresen-Goipl apparatus, Clark apparatus.
3. Permanent occlusion - braces system.

For mesial occlusion (3.5% of the number of anomalies), treatment is performed in compliance with the following plan:

4. Primary occlusion - identifying and combating bad habits, selective grinding of the incisor and canine cusp cutting edges before setting incisors in marginal closure. Myotherapy, hardware treatment with the Bruckle apparatus and the use of a cap with a chin sling and extraoral traction.
5. Replaceable occlusion - vestibular plates, Brückle apparatus, monoblock, Frenkel type III, Andresen-Goipl apparatus, etc.
6. Permanent occlusion - when treating adolescents with a dentoalveolar form, the same mechanically acting and functionally guiding appliances are used during the period of mixed occlusion, but preference is given to the edgewise technique. Sometimes I combine orthodontic treatment with the removal of teeth in the mandible and the use of extraoral traction. More often, in case of gnathic anomaly, I send the patient for combined treatment.

Treatment of crossbite (3.2% of anomalies) also depends on its type, causes of development and age of the patient.

7. Primary occlusion - elimination of the cause (bad habits, mouth breathing, unworn cusps of primary molars and canines), myotherapy, and in case of early loss of

primary teeth - prosthetics.

8. Replaceble occlusion - base plates with screws, pushers, occlusal overlays, double-jaw appliances.

9. Permanent occlusion - mechanically operating devices, combining their use with intermaxillary traction, removal of individual teeth for orthodontic indications.

During the periods of milk teeth eruption, first permanent molars, change of incisors, eruption of second permanent molars, the treatment for deep bite is the most efficient accounting for 18.2% of anomalies. To eliminate the causes that impede dento-alveolar elongation in the area of the lateral teeth, to separate them, to correct the shape of the dental arches, to normalize the position of the mandible and jaw growth are the main objectives of treatment.

Open occlusion refers to vertical malocclusion and it has a vertical gap between the teeth when the dentitions are closed; it occurs in 5.6% cases. In this case one has to deal with significant functional impairments. Treatment of open bite depends on its type, severity and period of formation.

10. Primary occlusion - eliminating bad habits, setting the proper position of the tongue, ensuring nasal breathing, closing lips, proper swallowing, classes with a speech therapist, myotherapy, the use of vestibular plates with a barrier for the tongue.

11. Replaceable occlusion - to the above, you can add mechanically operating devices with a tongue barrier, a screw, etc. The use of a cap with a chin sling and a vertical extraoral traction is mandatory.

Permanent bite - expansion plates with a screw and tongue rest, bracket system with intermaxillary traction. The use of absolute support - Vector Tas miniscrews. In rare cases, removal of individual teeth in compliance with the indications.

81,894 children from Vyborgsky and surrounding areas attended the orthodontic department. 24,621 consultations were given. 9,753 people were admitted for orthodontic treatment, 7,521 removable single-jaw orthodontic appliances were manufactured, 3,801 double-jaw appliances were manufactured, 4,080 brace systems were fixed. 9183 patients completed orthodontic treatment.

3.4. Preventive activities provided to children in a district dental clinic

Statistical data for 2020-2022 report the number of children in Vyborgsky district of St. Petersburg, who have undergone preventive dental examinations, amounts to 237,662, 419,217 and 332,879 people aged 0 to 18 years, respectively.
The children's dental service in Vyborgsky district of St. Petersburg is available in dental clinic No. 4.

According to the annual reports, the main preventive activities of the public sector pediatric dental service are:

- preventive examinations;
- coating of teeth with fluoride varnish;
- fissure sealing;
-professional oral hygiene;
- oral hygiene training.

In the dental clinic in the children's department, schoolchildren and preschoolers are examined annually. Examinations are performed at the clinic or in the educational institution itself, and are also performed in a passive mode when the patient turns for help independently. Often a dental examination is combined with a medical examination performed by pediatricians and takes place in a somatic clinic.

Table 3.4. shows the results of preventive examinations in different age groups of children.

Table 3.4. Preventive examinations of the organized children in the Vyborgsky district of St. Petersburg in 2020 - 2022.

Examined	Number of children subject to examinations			Total number of the examined with preventive purposes		
	2020	2021	2022		2021	2022
totally	735431	697328	932583	237662	419217	332879
3 years	41700	38278	34981	12913	13873	16060
6 years	50695	48553	48608	27741	34747	37657

12 years	65519	56000	42137	14619	20320	23778
15 years	64867	51644	40951	15866	21390	27240

Table 3.4. shows a gradual growth of examined children number with preventive purposes in recent years.

Table 3.5 presents the distribution of examined and sanitized children depending on their need for treatment.

Table 3.5. Number of children sanitized and those in need of dental treatment in the Vyborgsky district of Saint-Petersburg

Event	Timing / of the total number of the examined		
	2020	2021	2022
Intact	75393	98369	110094
Sanitized earlier	71072	81353	99339
Those needed medical treatment	91197	110006	128623

Table 3.5 demonstrates a growing number of children with an intact mouth from 75,393 to 110,094 in the period from 2020 to 2022. The same situation is applicable to the number of children previously sanitized where the growth was from 71,072 to 99,339. In parallel with those data the number of children in need of dental treatment has grown from 91,197 to 128623.

Table 3.6 summarizes data on preventive measures involving fluoride varnish.

Table 3.6. Preventive activities performed for children in the period 2020-2022.

Event	Period of survey		
	2020	2021	2022
Professional oral hygiene	98653	112881	140351
Teeth coating with fluoride (number of children)	100663	111466	158404
Coating of teeth with remineralizing preparations (number of children)	20324	60823	60275

Table 3.6 shows the growing amount of professional oral hygiene services from 98,653 to 140,351 considering the actual need for dental care among the children. The number of children using dental fluoride coatings has grown from 100,663 to 158,404. Remineralizing preparations for application to the crowns of teeth were used in 20,324 children in 2020 year and their number has tripled to 60,275 children in 2022.

At the same time, one should keep in mind the reason for the rather high need for dental care in children:

1. low sanitary culture of people resulting in a reluctance of a large number of parents to turn for dental procedures before the onset of an obvious disease. A very common opinion shared by the patients and their parents is that toothache is the only reason to turn to a dentist;
2. the low dentist activity result from a large medical workload owing to a large number of preventive measures. The need for treatment of caries that already exist often exceeds the patient's need for preventive measures and becomes a priority in the daily visit of the pediatric dentist;
3. experts aimed at preventive work in dentistry (dental hygienists) are missing in most public clinics owing to low wage rates and work in commercial clinics as dental assistants. The basic salary rate of a hygienist, an experts with secondary medical education working 38.5-hours weekly does not exceed 10 thousand rubles per month;
4. the lack of preventive procedure cost efficiency does not stimulate the administration of dental clinics to increase the share of that type of within the overall workload structure. Thus, the actual CULI-based work rate payment system for dental services does not even cover the direct costs of examination, sealing, and fluoridation. Such a position as "preventive examination" is generally missing in the dental care pay rate structure, and used in most cases with prof. examination, the pay rate for "repeated dentist appointment" amounts to 45 rubles. for a unit.

Table 3.7 shows the amount of sealing primary and permanent teeth.

Table 3.7. Fissure sealing in children in different years

Event	Fissure sealing period		
	2020	2021	2022
Number of children	10053	11392	16389
Sealed teeth (milk)	277	648	4276
Sealed teeth (permanent)	20843	24911	31589

Table 3.7 shows that every year the number of fissure sealings grows, both temporary and permanent teeth in children who have undergone fissure closure from 10,053 to 16,389. The number of sealed permanent teeth has grown from 20,843 to 31,589.

Thus, the current situation in St. Petersburg, similar to that in Vyborgsky district, necessitates work on:

1. intensifying preventive dental work to reduce childhood dental morbidity rates;
2. creating unified approaches (algorithms) to record and assess the efficiency of basic preventive procedures;
3. creating a motivation system for doctors and managers of dental institutions, increasing the share of preventive work in children’s population;
4. increasing dental and hygienic literacy of the population.

Realizing the significance of those issues in the Vyborgsky district and taking Dental clinic No. 4 as a practice facility some actions are being taken to carry preventive examinations, fluoridation of teeth and sealing of fissures in children of decreed ages, as well as the development of preventive work methodological recommendations and setting medical and economic standards for dental preventive procedures. The assigned tasks within the implemented activities included in the work of the children's department of the clinic require a clear approach to the organization of preventive work in a medical institution, and the funding allocated for those activities allows its efficient realization.

3.5. Educational work among children to prevent dental morbidity

Material and technical activity support in dental clinic No. 4 of Vyborgsky district of St. Petersburg includes:

1. preparation of teaching aids for dentists and dental hygienists;
2. publication of lectures for dentists and dental hygienists;
3. introduction of lectures for school teachers;
4. preparation of a series of posters for schoolchildren;
5. publication of leaflets for parents of primary schoolchildren;
6. publication of memos for students in grades 4-8;
7. publication of memos for students in grades 9-11;
8. use of samples of hygiene products and models of jaws to teach children, their parents and school teachers the basics of oral hygiene and the prevention of dental diseases.

Table 3.8 provides information on teaching children on the basic rules of oral hygiene conducted by dentists at Dental clinic No. 4 of the Vyborgsky district of St. Petersburg

Table 3.8. Instructing children in the rules of oral hygiene

Event	Period of survey		
	2020	2021	2022
Oral hygiene training (number of children)	244900	327108	331802

Table 3.8 shows that the number of children living in the Vyborgsky district and who have received oral hygiene training amounted to 244,900 n 2020 and increased to 331,802 in 2022.

3.6. Clinical trials of toothpastes to define their therapeutic and preventive properties

Clinical studies of toothpastes were conducted to define their therapeutic and prophylactic properties for targeted use among various population groups to improve the quality of their dental health [70].

3.6.1. Data from studying changes in anti-caries effect and efficacy

Table 3.9 provides info on the electrical conductivity indicator-based anti-caries effect evolution

Table 3.9. Changes in enamel electrical conductivity indicators

Distribution by groups	Indicators of electrical conductivity of enamel				
	Survey period				
	Beginning	1 week	2 week	3 week	4 week
1 group	3,71 ± 0,33	3,28 ± 0,36	2,85 ± 0,31	2,61 ± 0,24	2,42 ± 0,22
2 group	3,68 ± 0,42	3,29 ± 0,30	2,82 ± 0,25	2,63 ± 0,32	2,49 ± 0,30
3 group	3,94 ± 0,36	3,49 ± 0,42	3,02 ± 0,27	2,79 ± 0,31	2,59 ± 0,23
4 group	3,00 ± 0,27	2,82 ± 0,31	2,50 ± 0,23	2,27 ± 0,20	2,10 ± 0,19
5 group	3,05 ± 0,34	2,79 ± 0,25	2,61 ± 0,24	2,33 ± 0,21	2,16 ± 0,24

Table 3.9 shows, the electrical conductivity of the enamel evolves from 3.71 ± 0.33 to 2.42 ± 0.22 in group 1. Whereas in group 4 this rate evolves 3.00 ± 0.27 to 2.10 ± 0.19 and in group 5 from 3.05 ± 0.34 to 2.16 ± 0.24.

Table 3.10 shows the results to identify anti-caries efficiency.

Table 3.10. Evolution of enamel electrical conductivity

Distribution by groups	Enamel electrical conductivity rates (%)			
	Survey period			
	1 week	2 week	3 week	4 week
1 group	11,58 ± 1,03	23,17 ± 2,76	29,64 ± 2,68	34,76 ± 3,12
2 group	10,61 ± 0,94	23,38 ± 2,56	28,52 ± 2,57	32,35 ± 3,89
3 group	11,43 ± 1,02	23,36 ± 2,81	29,18 ± 2,61	34,27 ± 3,07
4 group	6,01 ± 0,53	16,68 ± 1,83	24,32 ± 2,91	30,01 ± 2,71
5 group	8,52 ± 0,77	14,43 ± 1,30	23,61 ± 2,13	29,18 ± 2,63

Table 3.10 shows that using pastes enhances anti-caries efficiency in one month in group 1 from 11.59 ± 1.04% to 34.77 ± 3.13%, in group 4 from 9.33 ± 0.54% to 30.00 ± 2.70% and in group 5 from 8.52 ± 0.77 to 29.18 ± 2.63%. Thus, the anti-caries efficiency rate in terms of enamel electrical conductivity increased 3 times in group 1; in group 4 by 3.21 times, and in group 5 by 3.42 times.

3.6.2. Remineralizing action evolution and efficiency

Table 3.11 shows the results of Okushko TER-test to identify the remineralizing effect in groups 1, 3, 4 and 5.

Table 3.11. TER-test indicator evolution

Distribution by groups	TER-test indicators				
	Survey period				
	Beginning	1 week	2 week	3 week	4 week
1 group	45,33 ± 4,99	41,18 ± 3,71	38,86 ± 4,28	35,24 ± 3,17	31,27 ± 3,44
3 group	50,82 ± 5,59	46,91 ± 5,16	42,00 ± 3,78	40,21 ± 3,62	37,25 ± 3,35
4 group	30,05 ± 2,71	27,24 ± 3,00	25,11 ± 2,26	20,58 ± 1,85	18,90 ± 2,08
5 group	30,83 ± 2,76	28,05 ± 2,53	24,46 ± 2,69	21,33 ± 1,92	19,48 ± 2,14

Table 3.11 shows ERT test-based survey has revealed the following remineralizing effect rate evolution in group 1 it decreased from 45.33 ± 4.99 to 31.27 ± 3.44; in group 3 from 50.82 ± 5.59 to 37.25 ± 3.35; in group 4 from 30.05 ± 2.71 to 18.90 ± 2.08 and in group 5 from 30.83 ± 2.76 to 19.48 ± 2.14

Table 3.12 shows TER-test - based remineralizing effect rate evolution.

Table 3.12. TER-test - based remineralizing effect rate evolution

Distribution by groups	ERT test efficiency indicators (%)			
	Survey period			
	1 week	2 week	3 week	4 week
1 group	9,15 ± 1,01	14,26 ± 1,27	22,25 ± 2,01	31,01 ± 3,42
3 group	7,68 ± 0,67	17,35 ± 1,92	20,87 ± 1,86	26,71 ± 2,94
4 group	9,34 ± 0,82	16,43 ± 1,47	31,52 ± 2,83	37,11 ± 3,32
5 group	9,02 ± 0,93	20,14 ± 1,81	30,36 ± 2,73	36,40 ± 3,28

One can see remineralizing efficiency rate evolution from the indicators shown in Table 3.12., it indicates the toothpaste anti-caries effect used in groups 1, 3, 4 and 5. The remineralizing efficiency rate within a month when toothpastes were used amounted to 31.02 ± 3.41% in group 1; in group to 3 26.70 ± 2.95%; in group to 4 37.10 ± 3.33% and in group 5 to 36.40 ± 3.28%. During the specified period, remineralizing efficiency in group 1 increased by 3.39 times; in group 3 by 3.47 times; in group 4 by 3.97 times and in group 5 by 4.03 times.

3.6.3. Indicatros of hemostatic action evolution and its efficiency effectiveness

Table 3.13 shows digital indicators of hemostatic effect evolution based on the Mühlemann and Son bleeding index in group 2.

Table 3.13. Mühlemann and Son bleeding index rate evolution

Distribution by groups	Mühlemann and Son bleeding index rate (%)				
	Survey period				
	Beginning	1 week	2 week	3 week	4 week
1 group	12,78 ± 1,14	10,25 ± 1,12	9,85 ± 0,90	8,92 ± 1,08	6,79 ± 0,62
2 group	11,45 ± 1,03	9,22 ± 1,10	7,62 ± 0,69	6,23 ± 0,75	5,99 ± 0,54
3 group	12,93 ± 1,16	11,28 ± 1,02	10,35 ± 1,24	9,39 ± 0,85	9,05 ± 1,00
4 group	3,82 ± 0,34	3,27 ± 0,36	2,76 ± 0,25	2,49 ± 0,30	2,05 ± 0,19
5 group	3,37 ± 0,30	3,05 ± 0,33	2,63 ± 0,29	2,30 ± 0,25	1,96 ± 0,18

Table 3.13 shows a decrease in the Mühlemann and Son bleeding index from 11.45 ± 1.03% to 5.99 ± 0.54% in group 2.

Table 3.14 shows Mühlemann and Son bleeding index efficiency evolution in 2 group**.**

Table 3.14. Mühlemann and Son bleeding index efficiency evolution

Distribution by groups	Mühlemann and Son index-based gum bleeding effect evolution (%)			
	Survey period			
	1 week	2 week	3 week	4 week
1 group	19,60 ± 1,76	22,94 ± 2,47	30,23 ± 2,72	46,75 ± 4,21
2 group	19,48 ± 2,14	33,45 ± 3,01	44,80 ± 4,03	47,69 ± 4,30
3 group	12,76 ± 1,15	19,95 ± 1,80	27,38 ± 3,05	30,01 ± 3,33
4 group	14,40 ± 1,30	27,75 ± 2,51	34,82 ± 3,13	46,34 ± 4,17
5 group	9,50 ± 0,86	21,96 ± 1,76	31,75 ± 2,86	41,84 ± 4,61

Table 3.14 shows hemostatic efficiency growth in group 2 from 19.48 ± 2.14% to 47.69 ± 4.30% which reduction of bleeding increases by 2.45 times assessed by the Mühlemann and Son bleeding index.

3.6.4. Desensitivity evolution and efficiency data

Table 3.15 shows indicators of decreased sensitivity assessed by the Orekhova-Ulitovsky tooth sensitivity index.

Table 3.15. Orekhova-Ulitovsky tooth sensitivity index evolution

Distribution by groups	OUTSI evolution (%)				
	Survey period				
	Beginning	1 week	2 week	3 week	4 week
1 group	27,64 ± 2,29	22,05 ± 2,43	15,91 ± 1,72	12,84 ± 1,62	10,12 ± 0,93
2 group	27,00 ± 2,97	21,25 ± 2,34	16,88 ± 1,52	13,26 ± 1,46	10,54 ± 0,95
3 group	28,16 ± 3,10	21,52 ± 2,36	15,39 ± 1,85	11,17 ± 1,00	9,44 ± 1,04
4 group	26,70 ± 2,94	20,11 ± 1,81	14,63 ± 1,61	8,44 ± 0,93	7,65 ± 0,84
5 group	26,47 ± 2,38	20,43 ± 2,25	14,54 ± 1,31	9,12 ± 1,00	7,83 ± 0,86

Table 3.15 shows a reduction in tooth sensitivity from 27.00 ± 2.97% to 10.54 ± 0.95% in group 2.

Table 3.16. shows the results of desensitivity efficiency evolution.

Table 3.16. Desensitivity efficiency evolution

Distribution by groups	OUTSI efficiency evolution (%)			
	Survey period			
	1 week	2 week	3 week	4 week
1 group	20,22 ± 1,59	42,44 ± 2,23	53,55 ± 4,63	63,39 ± 5,37
2 group	21,30 ± 2,34	37,48 ± 3,37	50,89 ± 5,60	60,96 ± 6,71
3 group	23,58 ± 2,60	45,35 ± 4,08	60,33 ± 5,43	66,48 ± 5,98
4 group	24,68 ± 2,72	45,21 ± 4,07	68,39 ± 7,52	71,35 ± 6,42
5 group	22,82 ± 2,51	45,07 ± 4,06	65,55 ± 5,90	70,42 ± 6,34

Table 3.16 shows the desensitizing efficiency has grown from 21.30 ± 2.34% to 60.96 ± 6.71% and increased by 2.86 times in group 2.

3.6.5.Bleaching (lightening) effect and efficiency evolution data

Table 3.17 shows the teeth color(lightening) evolution under the impact of pastes

Table 3.17. Bleaching (lightening) effect evolution

Distribution by groups	Survey period				
	Beginning	1 week	2 week	3 week	4 week
1 group	A3	A3	A3	A2	A2
2 group	A3	A3	A3	A3	A2
3 group	A3,5	A3	A2	A2	A2
4 group	A3	A3	A3	A3	A2
5 group	A3	A3	A3	A3	A2

Table 3.17 demonstrates a color change on the Vita scale from A3.5 to A2 in group 3.

Table 3.18 demonstrates the paste clarification efficiency of the used pastes.

Table 3.18. Evolution of whitening efficiency

Distribution by groups	Survey period			
	1 week	2 week	3 week	4 week
1 group	-----	-----	33,33%	33,33%
2 group	-----	-----	-----	33,33%
3 group	14,29%	42,86%	42,86%	42,86%
4 group	-----	-----	-----	33,33%
5 group	-----	-----	-----	33,33%

Table 3.18 shows, that lightening rate of teeth color in group 3 in 1 week amounted to 14.29%, and by the end of the study it reached 42.86%, that is 1.5 tones. Thus, it was found that the toothpastes under analysis have the following properties that determined their selection and use depending on the dental and hygienic status, and the direction of action of the oral hygiene products themselves and the degree of their efficiency:

* Anti-caries efficiency with use of the pastes has grown up in group 1 (Preventive toothpaste “Protection against caries”) from 11.59% to 34.77%, in group 4 (Children’s toothpaste “Kid’s Sweet Mint”) from 9.33 % to 30.00% and in group 5 (Kid's Strawberry children's toothpaste) from 8.52% to 29.18%. Thus, the anti-caries efficiency in terms of enamel electrical conductivity has grown up 3 times in group 1; in group 4 by 3.21 times, and in group 5 by 3.42 times within one month.

* The evolution of remineralizing efficiency, indicating an anti-caries effect of the toothpastes used in groups 1, 3, 4 and 5 amounted to 31.02%; 26.70%; 37.10% and 36.40% respectively. During the specified period, the remineralizing efficiency in group 1 (Preventive toothpaste “Protection against caries”) has grown by 3.39 times; in group 3 (Preventative toothpaste “Whitening”) by 3.47 times; in group 4 (Kid's Sweet Mint children's toothpaste) by 3.97 times and in group 5 (Kid's Strawberry children's toothpaste) by 4.03 times.

* Hemostatic effectiveness growth assessed by Mühlemann and Son bleeding index has grown (Complex Care Preventive toothpaste) from 19.48% to 47.69% that makes a 2.45-fold bleeding reduction in group 2.

* Desensitivity effectiveness in group 2 (Preventive toothpaste “Comprehensive Care”) has grown from 21.30% to 60.96% by 2.86 times.

* Teeth whitening in group 3 (Preventative toothpaste “Whitening”) within 1 week amounted to 14.29%, and by the end of the survey it reached 42.86% in terms of whitening efficiency.

Within the research it has been revealed that toothpastes have therapeutic and preventive properties that manifest themselves as hemostatic, desensitizing, remineralizing, brightening and anticaries effect that is evidenced by their desensitizing, hemostatic, brightening and anticaries effectiveness. The tests have revaled a growing anti-caries and remineralizing effects, a decline in bleeding in the soft periodontal tissues under the impact of those toothpastes ensuring healthy gums and protecting the mouth from caries, thus, ensuring the dental health of users. The key factor is to correctly find the correlation between the patient’s dental status and the characteristics of oral hygiene products that build up a preventive effect for their users and ensures a quality improvement of dental health.

3.7. Basic provisions for the development and implementation of a national dental disease prevention program

T.V. Vasilyeva (2006) pointed out that the two-component fluoride varnish demonstrates high efficiency in the comprehensive prevention of dental caries among workers employed in the confectionery industry.

Fluoride varnishes

Taking fluoride varnishes as those affecting only the hard tissues of teeth, it excludes the opportunity to increase the amount of fluoride entering the body with water, milk, salt, pastes, rinses and other products, and it is limited exclusively locally that eliminates the opportunity to increase the dose consumed orally and

acting systemically on the entire body [Todd M.A., Staley R.N., Kanellis M.J., et al., 1999].

Colorless varnish with sodium and calcium fluorides intended for professional prevention with individual action.

Indications for use:

1. treatment of tooth neck hyperesthesia (when it is exposed, particularly in periodontal diseases);
2. local deep fluoridation ensured by two fluorine compounds in the fluoride varnish;
3. remineralization of tooth enamel. It is a very important matter, as it balances demineralization process that regularly affects teeth and it is a main cause of hard dental tissue destruction;
4. prevention of dental caries.

It is a fluorine-containing varnish containing 6% NaF and 6% CaF_2. As numerous studies as well as the practical use of Bifluorid 12 evidence, one can use it in the following dental situations:

1. in the general prevention of major dental diseases;
2. during orthodontic treatment and upon its completion;
3. in the process of orthopedic treatment;
4. in conservative dentistry;
5. in the treatment of hypersensitivity;
6. defective enamel.

Advantages:

1. reduces tooth sensitivity of various etiologies;
2. builds up deposits of calcium and fluoride for intensive and long-term fluoridation of teeth;
3. transparent – does not alter the color of teeth;
4. a special varnish base enhances the duration of deep hard dental tissue fluoridation effect;

5. cost-effective and easy to use expanding the scope of its application in dentistry;

6. low cost combined with high efficiency;

7. ease of use, coupled with rapid application;

8. An important distinguishing feature is the rapid drying of fluoride varnish on the tooth surface.

A classic medicine for deep fluoridation and for the treatment of dental hypersensitivity, and the prevention of major dental diseases. One can explain this situation by the availability of the following properties:

1. One drug – multiple applications. A special transparent varnish is applied to treat cervical hypersensitivity that is associated with exposure of the cervical area resulting from gum disease, tartar removal, and periodontal manipulation. Considering that issue one should should always use that varnish to cover surfaces that have been subject to instrumental trauma during manipulations including periodontal manipulations; defects in the occlusal surfaces; treatment of tooth surfaces that have a regular contact with individual parts of removable orthopedic structures and orthodontic devices; to reduce discomfort and unpleasant sensations in the teeth after treatment (or preparation). Transparent varnish that does not alter teeth color. There is an indication to accelerate the hard tissue remineralization and prevent dental caries. This medicine also has a preventive effect against secondary caries on teeth with restorations, particularly for the areas that have been etched, as well as for teeth prepared as abutments for fixing bridges, artificial crowns or inlays (including individual inlays and bridges, fixed on tabs). Using that medicine in a dental clinic one can protect the areas of teeth with a high risk of caries occurrence and development, as well as the areas with increased risk of enamel damage.

2. Exceptionally long-term preservation of properties. When the varnish is used correctly and professionally and the patient follows medical recommendations, the varnish remains on the surfaces of the treated teeth for quite a long while. Under appropriate conditions, the varnish is retained for a long while inside the tooth cavities and fissures. The combined effect of both fluorides results in the formation of

a calcium fluoride depot promoting the conversion of hydroxyapatite into fluorapatite and/or hydroxyfluorapatite.

3. High efficiency and immediate protection of teeth from thermal stress (Hellwig E., University of Freiburg, Germany). The combination of sodium fluoride and calcium fluoride provides a high fluoridation effect. Owing to that effect, a very good and long-lasting therapeutic effect is achieved. Comparative tests of a varnish with two fluoride components and a varnish containing only sodium fluoride demonstrated greater effectiveness of the one with two fluoride components. After treatment including that varnish, dentin contains 3.5 times more fluoride than before treatment. And the amount of fluoride during treatment is 2 times higher than when using a simple varnish based only on sodium fluoride.

4. More than 90% success rate in the treatment of cervical hypersensitivity. A study of the hypersensitivity treatment efficiency compared to the degree of initial discomfort displayed in many cases, after the first application, there was a significant discomfort reduction in or complete disappearance of pain. 92% of patients reported significant or complete health improvement.

5. Cost-effectiveness. The varnish dries very quickly, therefore, in order to obtain long-term adhesion to the enamel, it should be applied in a thin layer, preferably using a ball.

6. Guaranteed elimination of caries. The efficiencys of two-component fluoride varnish in reducing caries was studied by V. Ramirez-Amador et al. (1997) for 2 years in a double-blind manner in children 12-14 years of age. Two groups of 90 children each received that fluoride varnish as treatment twice a year and quarterly, another group received a placebo varnish twice a year. Tests for caries were performed by independent dental experts at the beginning and at the end of the experiment.

V. Ramirez-Amador et al. (1997) has found that a two-component fluoride varnish, and when used quarterly at the approximal surfaces of permanent teeth in children aged 12-14 years effectively protects them from carious lesions, carious processes are eliminated in a more intense and efficient way than when using it once

in six months. The two-component fluoride varnish demonstrated on average 30% greater efficiency in eliminating caries than placebo. Even more significant inhibition, up to 36-40%, was observed in the proximal area that is most often affected by caries in children aged 12-14 years.

S.S. Woo et al. (2003) have conducted a double blind, randomized survey aimed at identifying the cariesstatic effect while using a two-component fluoride varnish and another fluoride-containing varnish that unlike a two-component varnish, contains only 5% sodium fluoride, and the control group consisted of people who used a placebo varnish. The survey involved 400 schoolchildren aged 12 to 14 years. All participants in the experiment were divided into three main test groups and one placebo group of 100 people each. After two years of experiment, a significant progress in suppression of the dental caries growth and development was revealed in all test groups compared to the control group. The percentage of dental caries reduction ranged from 25 to 30%. The greatest effect from their use was achieved on proximal surfaces.

Prof. Hellwig and Dr. Attin (1994) studied the depth of fluoridation of teeth using a two-component fluoride varnish. The combined use of sodium fluoride and calcium fluoride in the ratio used in Galenic formulas is a particular of that drug. The peculiarity of this combination is a lightning-fast effect of that sodium fluoride, while calcium fluoride has a delayed effect. CaF_2 closes the exposed entrance holes of the dentinal tubules penetrating into them, therefore, even after removing the varnish, a long-lasting remineralizing and fluoridating effect is maintained. When using a two-component fluoride varnish, in comparison with other compounds, such as 12% NaF, 6% CaF_2, 6% NaF applied in the form of varnish on the bare surfaces of tooth roots, in a layer 30 mm thick, dentin saturation with fluoride was twice as high as with conventional sodium fluoride.

Unlike most medicines that are used to reduce tooth sensitivity two-component fluoride varnish does not contain methacrylate, and its desensitizing effect is much higher.

Compared to other fluorine-containing varnishes, two-component fluorine varnish is more economical, as it is applied in a thin layer and dries quickly.

Beginning in February 1997, for three months, eleven dentists participated in clinical trials of the drug on patients suffering from dental hypersensitivity to various external stimuli and varying degrees of intensity. A total of 245 participants took part in this research, of which 77% highlighted the onset of relief after a single application, 14% mentioned a decline in sensitivity and the onset of relief after the second application during the second visit to the doctor [Crum W.R., Hartkens T., Hill D.L. R., 2004] . In addition to the practical use of the varnish itself, dentists filled out a questionnaire specially designed to allow assessing the quality of the drug during a professional appointment and indicate the shortcomings that impaired its use. At the end of the experiment, all dentists who took part in the experiment stressed the good results achieved via drug application: 94.3% of patients admitted the improvement in their condition. Other professional comments concerned exclusively the features of the application procedure itself, its convenience, the quality of the applicator, etc., i.e. those properties that were necessary for the manufacturer to evaluate the quality of additional equipment.

Thus, it is clear that two-component fluoride varnish is a state-of-the-art product that one can effectively use professionally in various age groups with different types of dental pathology, both as a medicinal product and as a prophylactic agent to effectively prevent the development of dental caries.

The application background of two-component fluoride varnish has the following indicators:

1. rapid relief of hypersensitivity and its successful treatment of cervical area hypersensitivity of the cervical region in 94%;
2. improved structure of the calcium fluoride depot determines very intense fluoridation which effect stays on for a long time;
3. its transparency prevents teeth from staining;
4. maintains its effect for a lasting period owing to deeper penetration;
5. quick-drying, easy to use and cost-effective product.

Sealants

This group includes products intended for sealing fissures on the masticatory tooth surfaces. They are designed to isolate the recesses on the occlusal teeth surfaces that acid-producing microorganisms causing enamel demineralization and the development of dental caries should not penetrate, accumulate, or multiply in them. Therefore this method is easy and simple to implement, and at the same time a very effective way to prevent individual dental caries. At the beginning when probated it was viewed as an effective way to prevent caries of molars in children immediately after the eruption of molars and premolars. Nowadays, the indications for using this method have expanded, and it is applicable at any age, the main point is that the condition of the teeth fissures meets two requirements:

1. the sealed fissure should not lead to a higher occlusion, i.e. teeth closure lines;
2. the fissure itself is supposed to be clean, i.e. so after its closure, secondary caries should not develop from anaerobic microflora.

Table 3.19 presents the main means of preventing dental diseases with indications and methods of application.

Table 3.19. Means of prevention and methods of their application

№ пп	Types of drugs	Indications for use	Methods of application	Complement
1.	Sealant for fissures	- Sealing/filling dimples and fissures, as well as small cavities. - Sealing/veneering damaged enamel surfaces. - Securing orthodontic appliances and covering areas with an increased risk of developing caries during orthodontic treatment. - Sealing fillings made of plastic or cement (protective layer against moisture). - Sealing carious lesions to stop their development. - Restoration of small defects in plastic or amalgam fillings. - Sealing milk teeth.	- Seal fissures as early as possible, as soon as the masticatory surface has completely erupted and it can be dried. - After drying, thoroughly clean the surfaces to be sealed (using a rotating brush and fluoride-free cleaning paste). - Afterwards you need to rinse and dry the surface. - In case of initial caries or unclear diagnosis, expand the fissures using a thin instrument.	Light curing: Polymerization with a halogen lamp for 20-30 seconds. On one surface, controlling sealing. Remove excess material (eg with a diamond finish), polish the surface if necessary (with a rubber finish). Then apply fluoride varnish to the treated and adjacent teeth.

2.	Fluoride varnish	- Prevention of dental caries in children and adolescents in regions with low or normal fluoride content in water. - Prevention of dental caries in children, adolescents and adults during orthodontic treatment. - Prevention of secondary caries when placing fillings and inlays using the enamel etching technique. - Treatment of hyperesthesia of hard dental tissues.	1.Clean teeth from plaque, dry with a stream of air and isolate from saliva. 2.Shake repeatedly varnish before use until a homogeneous, easily flowing suspension is formed, 3.Using a brush Apply a thin layer of varnish to the surface, leave for 10-20 seconds. 4.Then dry it with a stream of air.	Avoid brushing your teeth and eating solid foods for 24 hours. For particularly sensitive patients, it is recommended that the procedure be performed in two visits and not on an empty stomach. Apply 2-3 times a year, with high caries activity - 3-4 times a year. Observe storage terms and conditions.
3.	Tooth sensitivity reducer	- Treatment of dentin hypersensitivity. - Treatment of sensitivity in the cervical area, with exposure of the tooth necks and rootsh in the initial stages of periodontal disease.	1.Preparation. Clean the teeth to be treated with a fluoride-free paste or polish them with an eraser or a rotating brush. 2.Application. Make sure there is a hole at the end of the pipette (dispenser) when tilting the bottle. Add and distribute on the surface, mixing well first. 3.Use. Apply the product with a brush and distribute evenly over the entire surface of the dentin to be treated for 20 seconds, then distribute the product using a weak air stream and then light-cure with a halogen lamp for 10 seconds. Apply a second layer of product, distribute it with a weak stream of air and polymerize for 10 seconds. 4.Removing the protective layer. Remove the oxygen barrier layer (soft surface) with a cotton ball or cotton cylinder. Check the gum margins and remove any remaining material if necessary.	Avoid contact with saliva. In case of contact with eyes, rinse immediately with plenty of water and consult an ophthalmologist.
4.	Fluoride Gel	- Prevention of dental caries in children and adolescents in	Used after brushing teeth and applied by means of	Used at least once a week - by a doctor

		the regions with low or normal fluoride content in water. - Prevention of dental caries in children, adolescents and adults during orthodontic treatment.	applicator or toothbrush.	or patient, for 5-10 minutes. Observe storage periods and conditions
5.	Fluoride rinse aid	- Prevention of dental caries in children and adolescents in regions with low or normal fluoride content in water. - Prevention of dental caries in children, adolescents and adults in case of orthodontic treatment.	Pour 1 tablespoon (10 ml) of mouthrinse into your mouth after brushing teeth and rinse mouth with this solution for 1 minute. Then spit and do not rinse mouth for 15-30 minutes.	Use in children aged over 6 years, at least 3 times a week.
6.	Paste for cleaning dental surfaces before applying fluoride varnish/gel	Before applying sealants and other preventative agents to clean tooth surfaces	The paste is applied to a standard polishing disc (rubber polisher). To avoid heat build-up, always apply a sufficient amount of paste to the polisher. During the procedure, saliva is removed with a saliva ejector to prevent the paste from becoming too thin. After applying the paste, all surfaces have to be washed and then air dried.	To complete the procedure use fluoride varnishes (to prevent caries; to treat hypersensitivity of the tooth necks; fix orthodontic appliances on intact teeth.

Unfortunately, hygienic oral care can not prevent fissure caries. Morphological structure of tooth contact surfaces, cracks and depressions does not allow complete mechanical cleaning with a toothbrush necessitating the need to search for new preventive methods and means for such problem areas.

Sealing fissures and cracks was a main effective solution to the problem in due time and it is still the most significant way to combat bacteria penetrating and spreading that cause dental caries onset and development. One such fissure sealing system is given in Table 3.20.

Table 3.20. System for dental disease prevention

№ пп.	**Main characteristics of the product**	**Main focus of action**
1.	Fluoride varnish with a color indicator for monitoring caries prevention.	Anti-caries activity, sealing of dentinal tubules in case of hypersensitivity.
2.	Balls 4 sizes.	For direct and cost-effective application of solutions.
3.	Cleaning paste.	For removing plaque, does not contain fluoride.

4.	Light-curing composite.	Fissure sealing.
5.	Light-curing composite. White, contains fluorine.	Fissure sealing.
6.	Light-curing composite. Contains a high concentration of fluorides.	Fissure sealing.
7.	Fluorine-containing varnish, which contains sodium and calcium fluorides.	For intensive fluoridation, relief of hypersensitivity and prevention of secondary caries. Fluoride varnish penetrates deeply into pores and acts for a long time. Provides quick pain relief and long-term protection against pain and secondary caries.
8.	Nouth rinse.	Due to the content of sodium fluoride and xylitol, it has an anti-caries effect. Recommended for daily use.

There is a variety of methods and materials to prevent dental diseases. The task of professionals is to learn how to use them following the indications and considering the treatment plan and preventive measures made up for a particular patient, i.e. depending on the “National Program for the Dental Disease Prevention with an Individual Approach” and move from stage to stage, in compliance with the chosen plan. This approach will allow the patient to preserve his teeth for life, subject to systematic monitoring by the attending dentist.

3.8. Program for the prevention of dental diseases in children and adolescents with an individual approach

3.8.1. Identifying Dental Problems

There are a lot of and mouth-associated problems and diseases. Most bodily diseases have to some extent mouth manifestation. The mouth and the organs it houses reflect not only those developments that take place in the stomach and intestines. The mouth is a kind of health barometer; it can underlie judgements on the condition of the lungs, heart, blood vessels, liver and kidneys, pancreas and gall bladder, i.e. about almost all organs and systems of our body.

WHO recommends to implement problem-oriented programs aimed at protecting, maintaining and restoring the health of the country's population. Dental caries still remains to be problem number 1, both in the World and in the Russian Federation. However, the preventive program implementation background

accumulated in the countries such as Finland, Sweden, Switzerland, and the USA, shows the opportunity to find the most suitable practices for each country to combat those ailments, and their experience has shown that public (national scope) individual action programs come first. That formula is particularly suitable for Russia, where different regions have different living conditions, ecology, medical care, and, consequently, the intensity of dental caries, according to the WHO classification, varies from mild to very severe. That feature makes individual national preventive programs unique, capable of solving the dental problems of every person participating in such a program.

Today, the prevalence of dental caries and periodontal diseases in most parts of the country ranges from 98.0 to 100.0%. A lack of dental preventive programs over the past 30 years entails the situation that affected negatively dental health of the country's population.

3.8.2. Setting up a program for the prevention of dental diseases

The goal of this program is to improve the dental health of the population through the implementation of the “National Program for the Dental Disease Prevention with an Individual Approach,” that will primarily reduce the intensity of dental caries among children, adolescents, young people and middle-aged people, i.e. the most able-bodied part of the population. Solving just this problem will improve their oral health, and, consequently, their overall general health since today the the general somatic health of the population and individual dental health have been correlated.

To achieve this goal, the following tasks to prevent dental caries are supposed to be fulfilled and implemented nationwide and obtain results within the next five years:

1. reduce the prevalence of dental caries in children aged 6 years to 40%;
2. reduce the intensity of dental caries in children aged 12 years by 30%;
3. reduce the number of extracted teeth in the population aged 18 years to no more than 0.2 on average per person (in 1983 this figure was 0.7);

4. ensure the national preventive program coverage over entire child and adolescent population of the country.

3.8.3. Methods and means of prevention

That program uses scientific and methodological approaches adopted by WHO.

The main etiological factors of dental caries identified during the data analysis underlie the prevention program comprising the following methods with regard to the age of the program participants and the timing of teething:

1. applications with fluorine-containing varnish;
2. clogging teeth fissures using sealants.

Fluoride varnish is available in disposable and reusable type of package. It is easy to apply and is absolutely safe when used in the oral cavity that allows it being prescribed to young children who cannot tolerate the application of fluoride preparations in mouthguards and are not able to rinse with fluoride-containing products.

Before using the varnish, dry the teeth with a gauze pad or a stream of air. Then the varnish is applied, treating all surfaces with a disposable brush. After the drug comes into contact with saliva, a yellow film forms on the teeth. This evening, children are advised to refrain from brushing their teeth, but the next morning they must carry out the usual hygiene procedure in the oral cavity.

R.J. Simonsen (2002) stressed the efficiency of fissure sealing method in preventing caries on the masticatory surfaces of molars.

R.J. Simonsen (2002) noted that one of the core principles to properly apply sealants, ensuring their long-term safety on the tooth surface, is careful isolation of the enamel after etching the tissues with a phosphoric acid solution done to prevent contamination.

To carry out high-quality and qualified sealing of fissures, the following rules have be observed:

1. Before etching, the tooth has to be cleaned with a dry brush, pumice stone or treated using an Air-Flow device;

2. Etching of the enamel takes 15 seconds a 35% solution of orthophosphoric acid is used;

3. the effectiveness of fluorine-containing sealants is comparable to conventional ones, while the degree of glass ionomer retention to dental tissues is significantly lower than that of composite materials;

4. the use of an intermediate bonding layer generates conditions for better retention of sealants [Simonsen R.J., 2002].

K.N. Kosenko et al. (1984) highlighted a significantly lower incidence of dental caries ($P < 0.001$) compared to the control group obtained by comparing the absolute values of indicators of the dental caries damage intensity (CSEp index) as a result of repeated examinations after 2 years from the start of fluoride varnish application. In all cities where children's teeth were treated with fluoride varnish 2 times a year, the the caries intensity fell by 35.60 - 45.12% (% reduction in dental caries based on the growing CSEp index).

3.9. Questioning of users of removable orthopedic structures and orthodontic devices

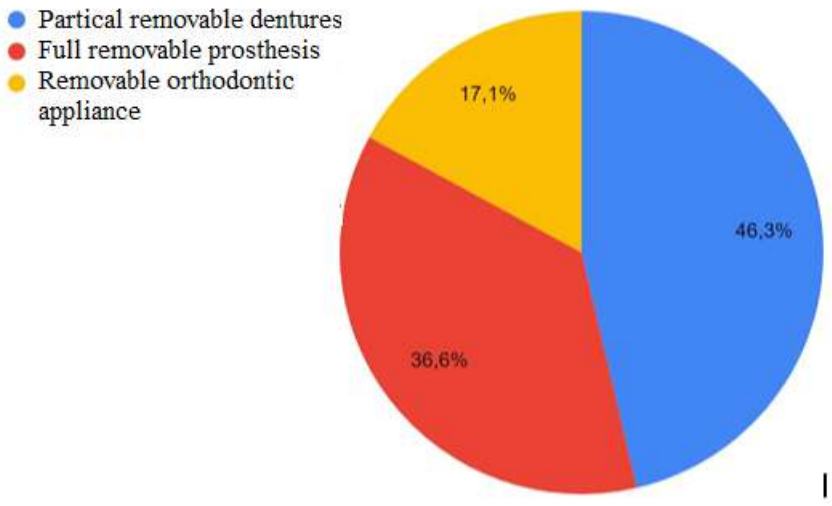

Figure 3.16. Answer to the question: “What removable appliances or devices do you use?»

The following answers were received from respondents to the question indicated in Figure 3.16: - 46.3% of respondents answered that they use partial removable dentures; 36.6% - indicated that they had fully removable dentures; and the remaining 17.1% use orthodontic removable appliances

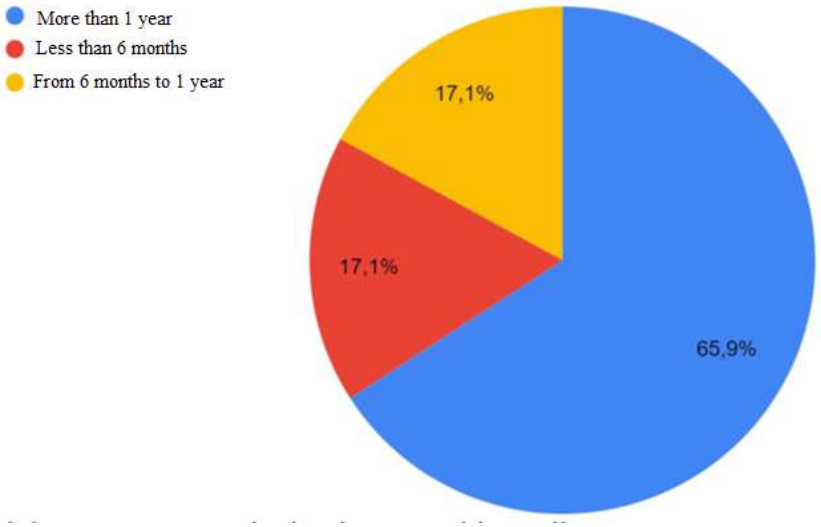

Figure 3.17. Answer to the question: “How long have you been using removable orthopedic structures or orthodontic appliances?”

To the question indicated in Figure 3.17, respondents indicated that 65.9% have been using it for more than 1 year; 17.1% from 6 months to 1 year; the remaining respondents 17.1% - less than 6 months. 65.9% surveyed patients wear removable orthopedic structures for more than a year.

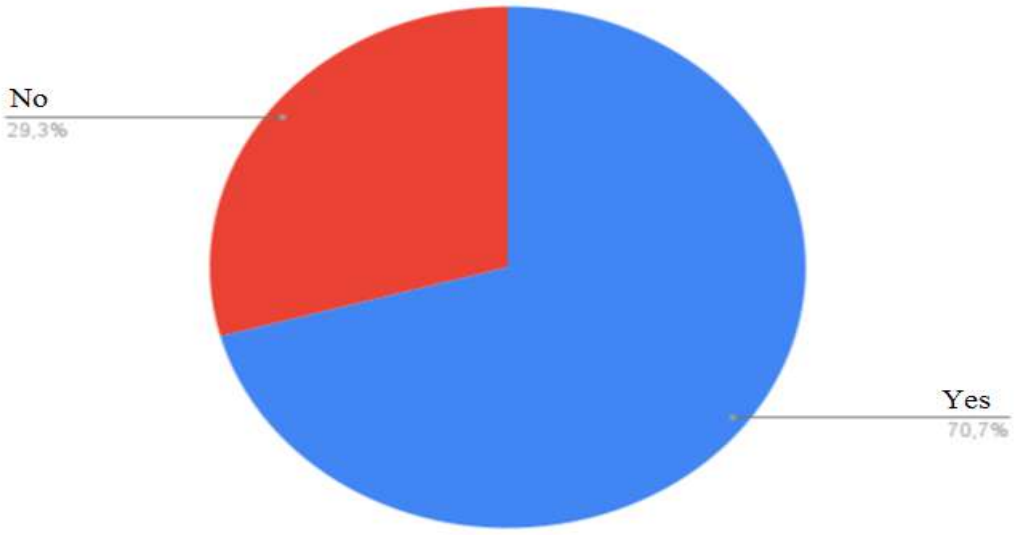

Figure 3.18. Answer to the question: “Have you used removable appliances before?”

The survey results shown in Figure 3.18 have revealed that 70.7% respondents wore an orthopedic device repeatedly, and 29.3% wore the appliance for the first time.

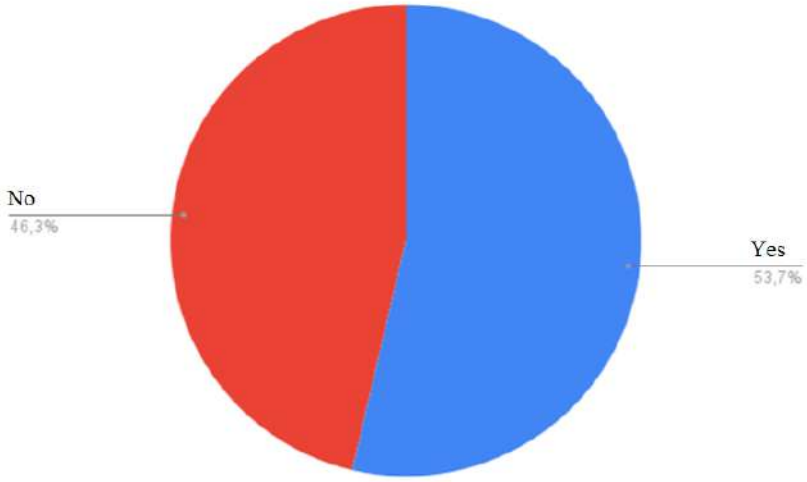

Figure 3.19. Answer to the question: “Have you noticed bad breath while using the removable appliance?”

To the question indicated in Figure 3.19 “Have you noticed bad breath while using the removable appliance?” 53.7% respondents reported bad breath; 46.3% did not sense any unpleasant odor. More than half of patients (53.7%) do not take proper care of their mouth that results in halitosis.

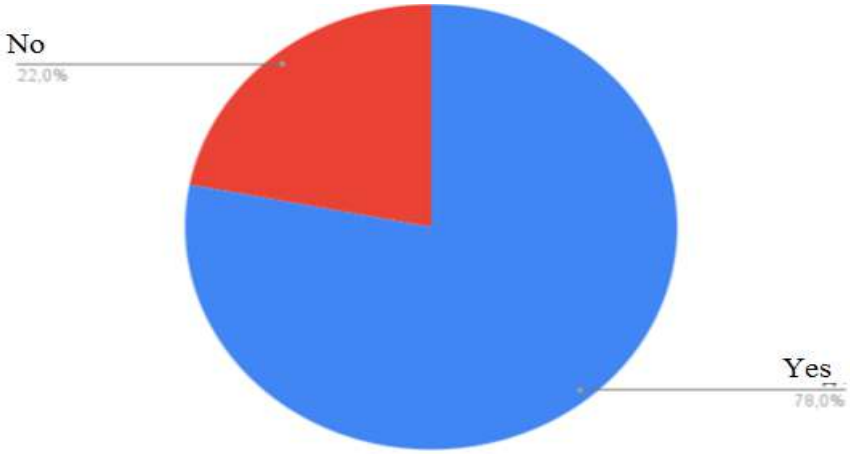

Figure 3.20. Answer to the question: “While using a removable structure, did your oral mucosa in the area of the prosthetic bed become inflamed?”

The results of the survey have revealed that 78% patients using the removable structure complained of oral mucosa inflammation in the area of the prosthetic bed, and 22% did not experience discomfort in the mouth when wearing dentures.

Basing on the data shown in Figure 3.21, one can assume that, patients wearing prostheses experience discomfort in the adaptation to removable appliances, allergic reactions, insufficient hygiene of prostheses, as well as the mechanical effect of the prosthesis on the mucosa of the prosthetic bed.

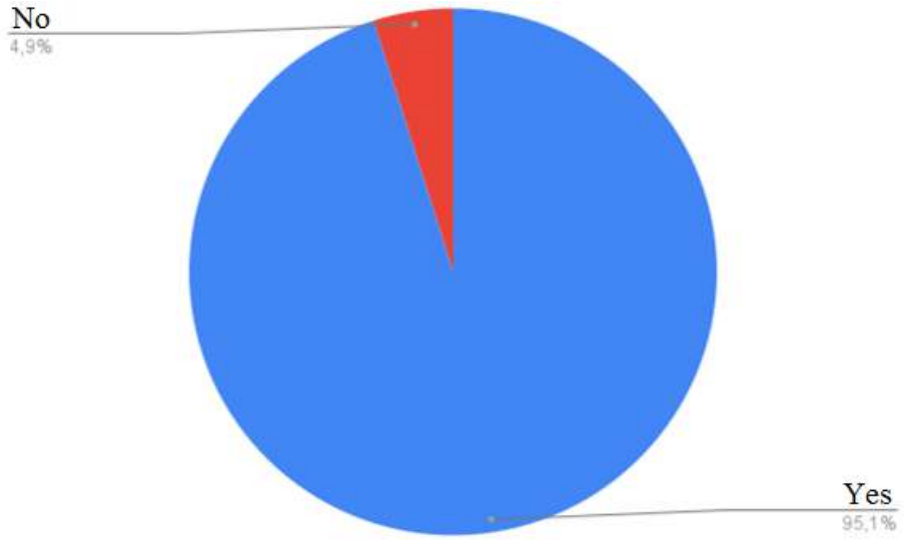

Figure 3.21. Answer to the question: “When setting a removable structure, did the doctor advise you on proper care of the prosthesis?”

The survey results presented on Figure 3.21, testify that 95.1% respondents received detailed instructions on prosthesis care, and 4.9% respondents did not receive recommendations. The obtained data enable concluding that almost all patients (96% surveyed patients) received recommendations on prostheses care from the doctor when the structure was handed over.

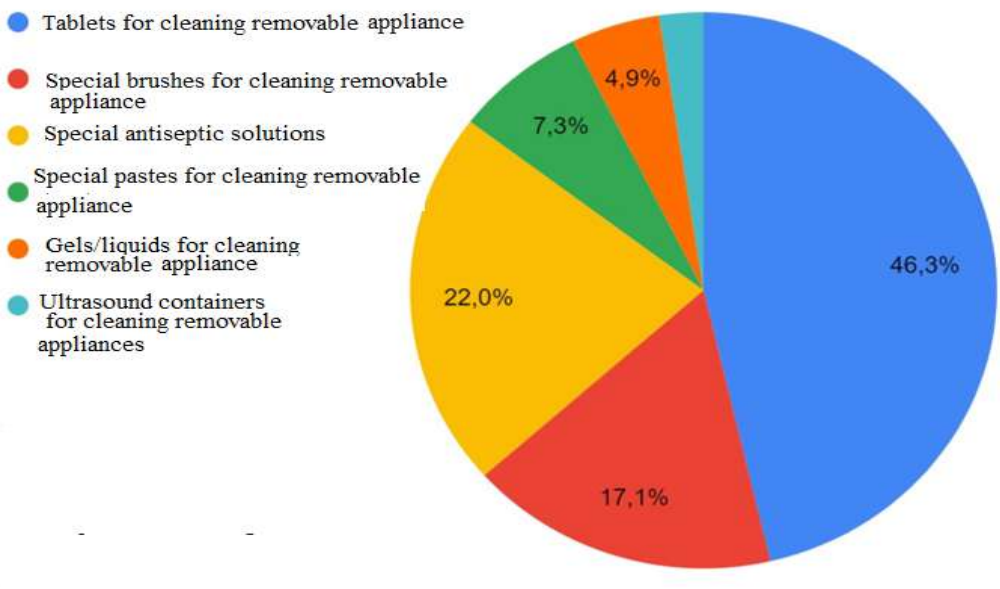

Figure 3.22. Answer to the question: "What oral hygiene products and items did the doctor recommend to you if you have removable appliances?"

To the question on Figure 3.22 - 46.3% respondents answered that the doctor had recommended "tablets for cleaning removable appliances", 22% - "special antiseptic solutions", 17.1% -"special brushes for cleaning removable appliances", 7 .3% - "special pastes for cleaning removable appliances", 4.9% - "gels/liquids for cleaning removable appliances", 2.4% - "Ultrasonic baths for cleaning removable appliances."

Of all hygiene products for removable denture care 46.3% respondents recommended tablets, 22% respondents recommended special brushes for cleaning removable dentures.

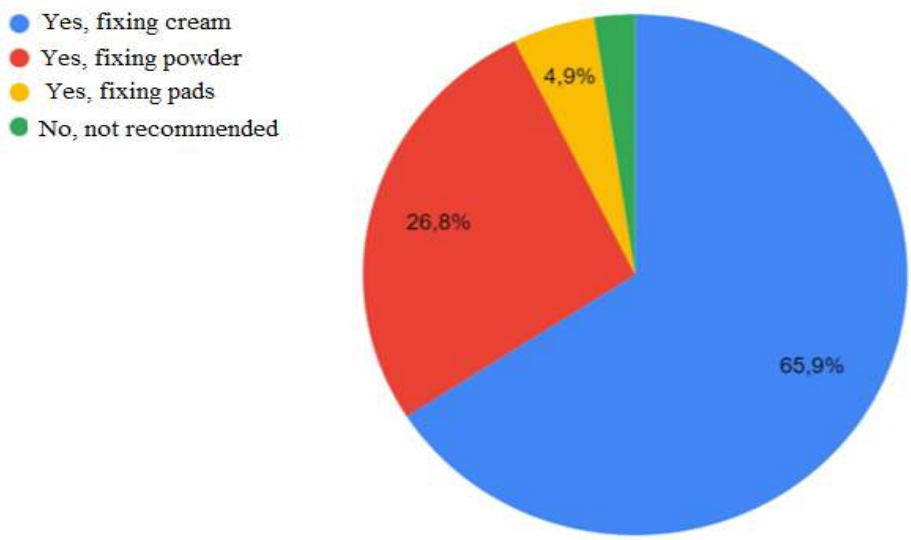

Figure 3.23. Answer to the question: “Did your doctor recommend you use any fixatives?”

The survey results on Figure 3.23 testify that a fixing cream was recommended to use for 65.9% respondents, a fixing powder for 26.8% respondents, fixing pads for 4.9% respondents was recommended, and for 2.4% respondents the doctor did not recommend additional fixing agents. Doctors consider fixing creams to be the most common means for fixing dentures; one can point out that almost all patients received recommendations and remember this. The survey results testify that fixing powder was recommended for 26.8% surveyed patients that suggests that some patients experience hypersalivation.

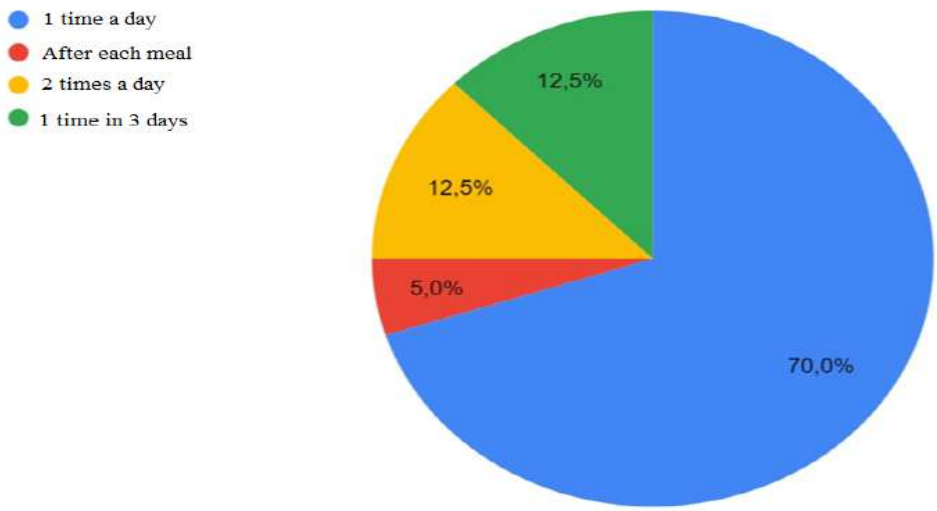

Figure 3.24. Answer to the question: “How often do you clean your removable orthopedic appliance or orthodontic appliance?”

The survey results on Figure 3.24, testify that 70% respondents clean removable orthopedic structures or orthodontic appliances once a day, 12.5% - once every 3 days, 12.5% - 2 times a day, 5% - after each meal. From the obtained data one can conclude that not all patients, but only 7.3% respondents observe the correct frequency of hygienic care procedures for removable appliances, that is, they clean it after every meal. One can guess that such poor hygiene can lead to the development of oral mucosa inflammation.

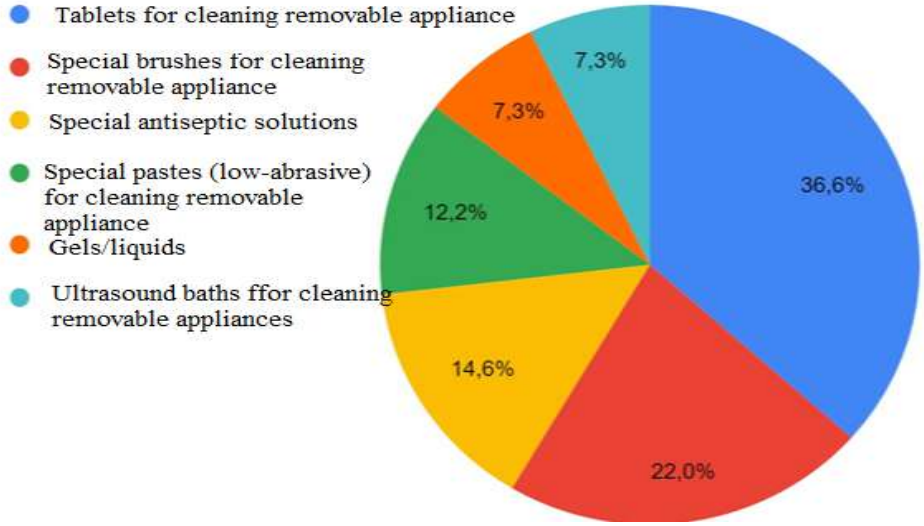

Figure 3.25. Answer to the question: “What products do you use to clean the removable appliance?”

To the question on Figure 3.25 - 36.6% respondents answered - “tablets for cleaning removable appliances”, 22% - “special brushes for cleaning removable appliances”, 14.6% - “special antiseptic solutions”, 12.2% - “special pastes (low abrasive) for cleaning removable appliances”, 7.3% - “gels/liquids for cleaning removable appliances”, 7.3% - “ultrasonic containers for cleaning removable appliances”.

The obtained data allowed concluding that the most common and popular removable appliance care products among patients include cleansing tablets and special brushes.

As patients used the prosthesis, the preferences of patients changed; doctors recommended tablets for cleaning the structure to 46.3% of patients, but only 36.6% of respondents use them; also, ultrasonic containers became common practice for patients using removable appliances; 7.3% purchased them.

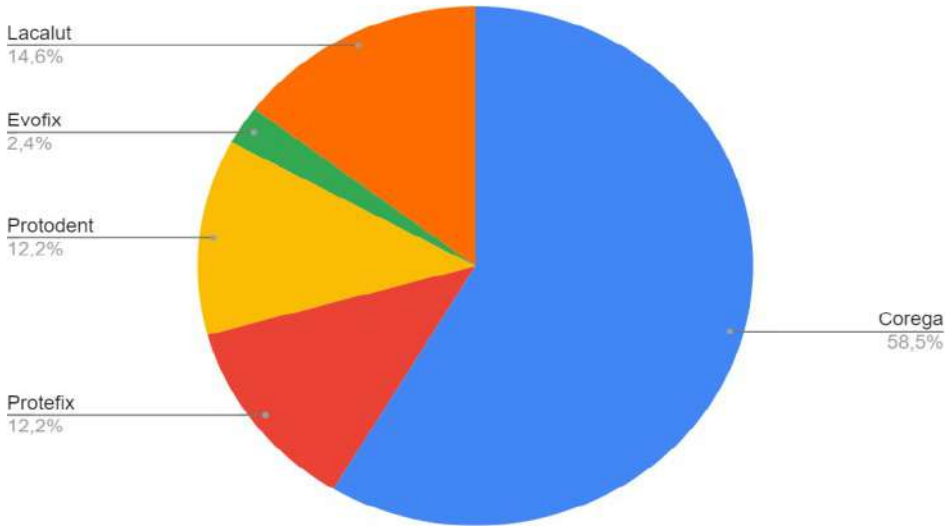

Figure 3.26. The answer to the question: “Which company’s products do you use most often?”.

On Figure 3.27 the obtained data give the following picture: “Corega” (58.5%), as well as “Protefix” (12.2%) and “Protodent” (12.2%) that patients purchase from pharmacies.

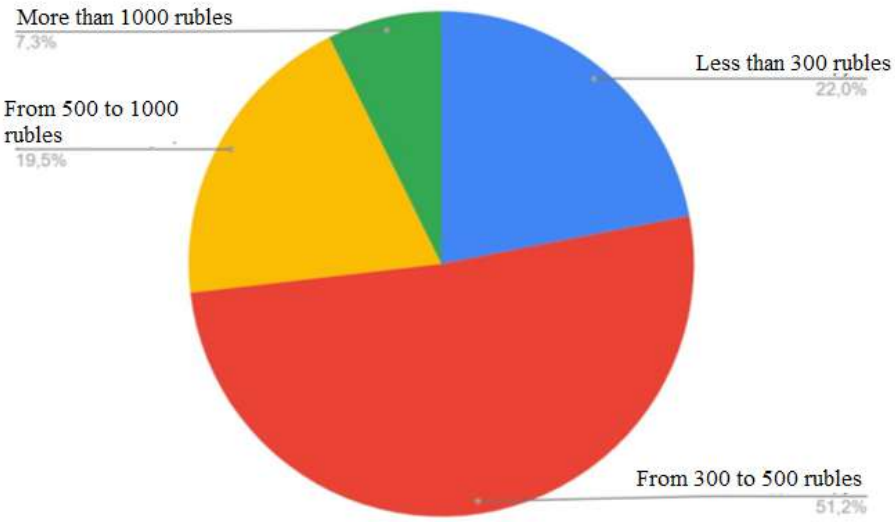

Figure 3.27. Answer to the question: “How much are you ready to spend per month on hygiene products to care for removable appliances?”

The survey results on Figure 3.27 testify that 51.2% respondents are ready to spend from 300 to 500 rubles per month on removable structure hygiene care products, 22% - less than 300 rubles, 19.5% - from 500 to 1000 rubles, 7.3% - more than 1000 rub.

The obtained data allow concluding that most respondents are ready to spend from 300 to 1000 rubles on removable structure hygiene care products from their budget.

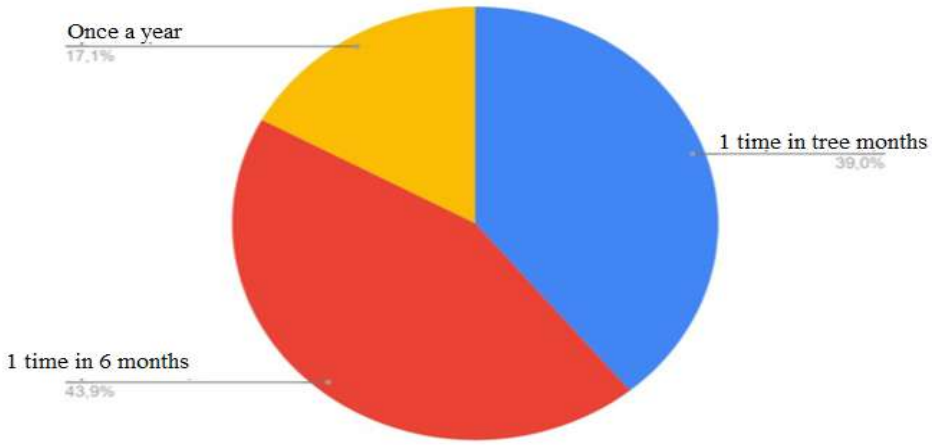

Figure 3.28. Answer to the question: “How often do you go to consult with the dentist after you have had a removable dental appliance installed?”

The survey results on Figure 3.28 testify that 43.9% respondents go to consult with a dentist once every 6 months, 39% - once every 3 months, the remaining 17.1% - once a year. Orthopedic dentists recommend that patients should come for an appointment 2 times a year to examine the condition of the oral mucosa and the condition of the orthopedic structure. Less than half (43.9%) of the surveyed patients follow the recommendations of the orthopedic dentist.

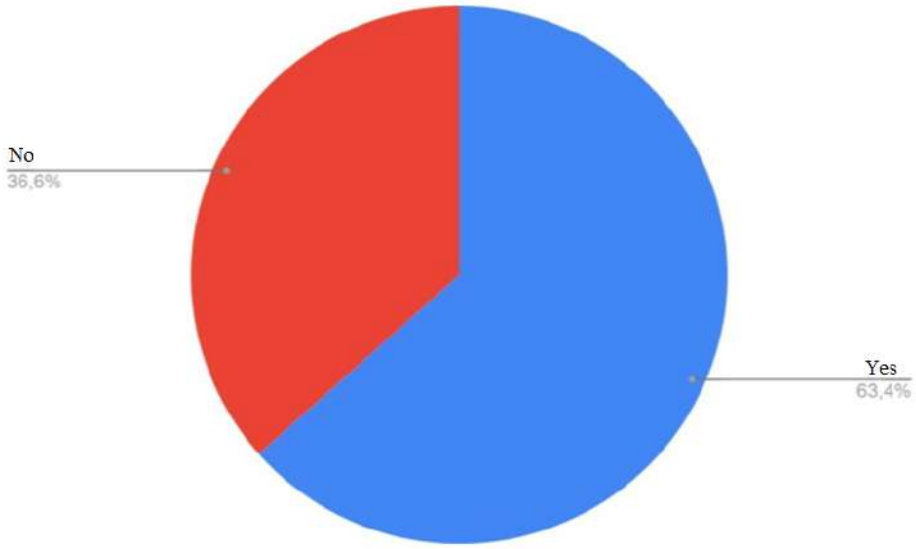

Figure 3.29. Answer to the question: “Do you take off the removable appliance at night?”

From the Figure 3.29, one can see that 63.4% of patients gave “Yes” answer, and 36.6% - “No”. The survey testifies that most patients sleep at night without an appliance.

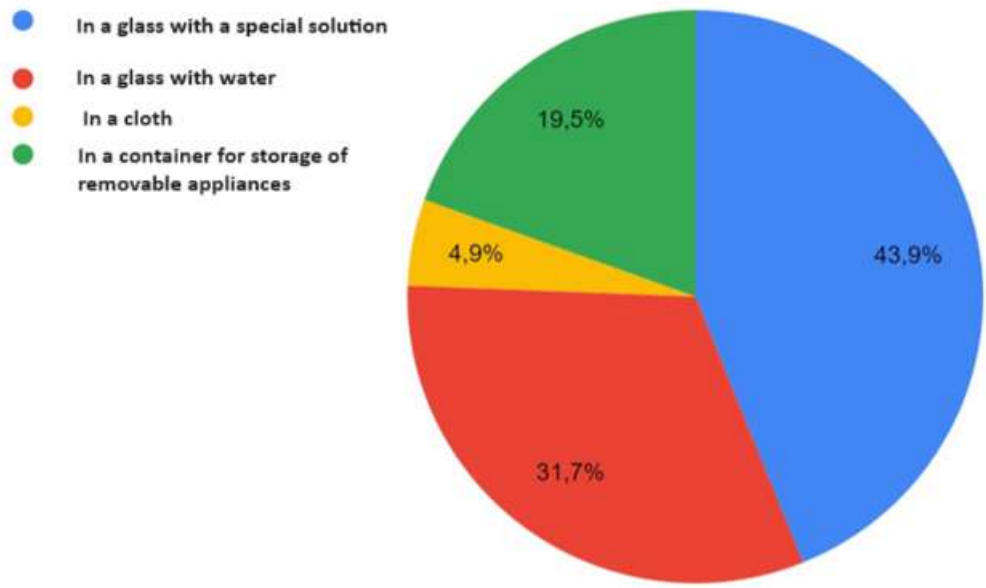

Figure 3.30. Answer to the question: “Where do you store the removable appliance when you remove it?”

To the question on Figure 3.30 - 43.9% respondents gave the answer - “in a glass with a special solution for storing removable appliances”, 31.7% - “in a glass of water”, 19.5% - “in a container for storage of removable designs”, and 4.9% store their appliances in a cloth. The obtained data allowed concluding that the majority of patients (60%) comply with the storage conditions for removable appliances.

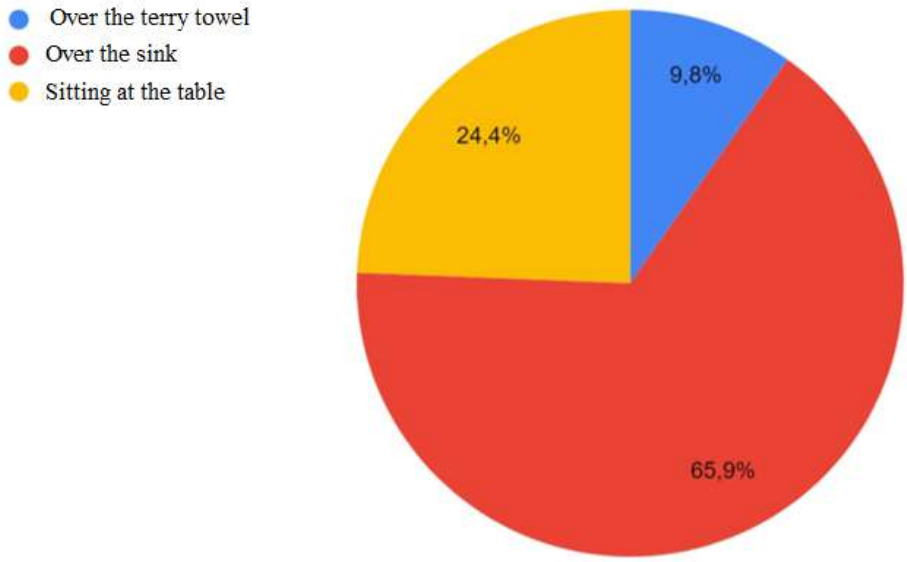

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Figure 3.31. Answer to the question: “How do you clean a removable appliance?”

The survey results on Figure 3.31 testify that 65.9% respondents clean the removable appliance over the sink, 24.4% - while sitting at the table, and the remaining 9.8% - over a terry towel. The obtained data allowed concluding that 66% patients clean their dentures over the sink owing to the average age of patients ranging 50-60 years, who are able to work. Thus, it is not difficult for them to practice hygienic procedures in the bathroom.

Questioning children

The survey on children using removable orthodontic appliances is given in the figures below (Figures 3.32. – 3.38.).

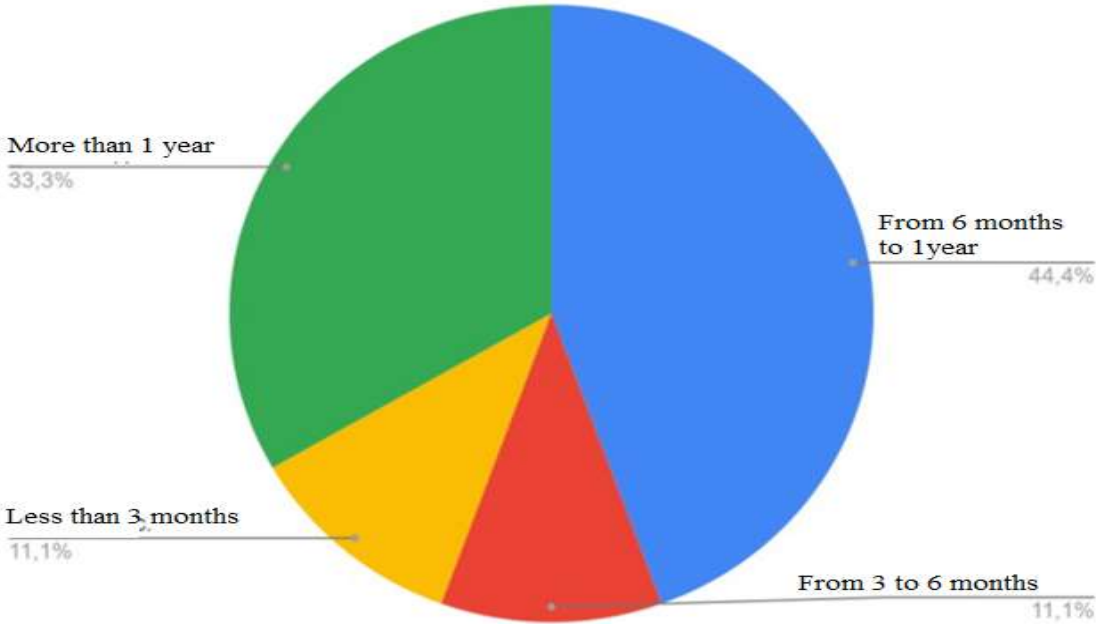

Figure 3.32. Answer to the question: “How long have you been using removable orthodontic appliances?”

The answers given to the question shown in Figure 3.32 testify that 33.3% respondents gave the answer “more than 1 year”, 44.4% - “from 6 months to 1 year”, 11.1% - “less than 3 months”, 11. 1% - “from 3 months to 6 months.”

Children who wear dentures for more than a year have extensive daily experience in the hygiene of removable appliances.

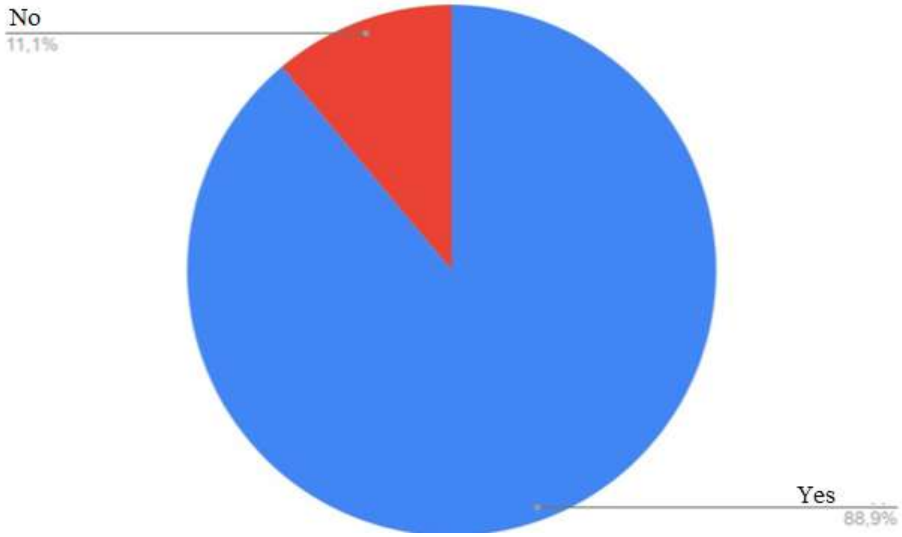

Figure 3.33. Answer to the question: “When installing a removable appliance, did the doctor advise you on proper denture care?”

The survey results on Figure 3.33 based on the answers of 88.9% respondents who were consulted by a doctor on the proper care of the denture, testify that 11.1% of respondents did not receive consultation. The reveived data indicate that most patients had received recommendations for removable equipment care from a doctor.

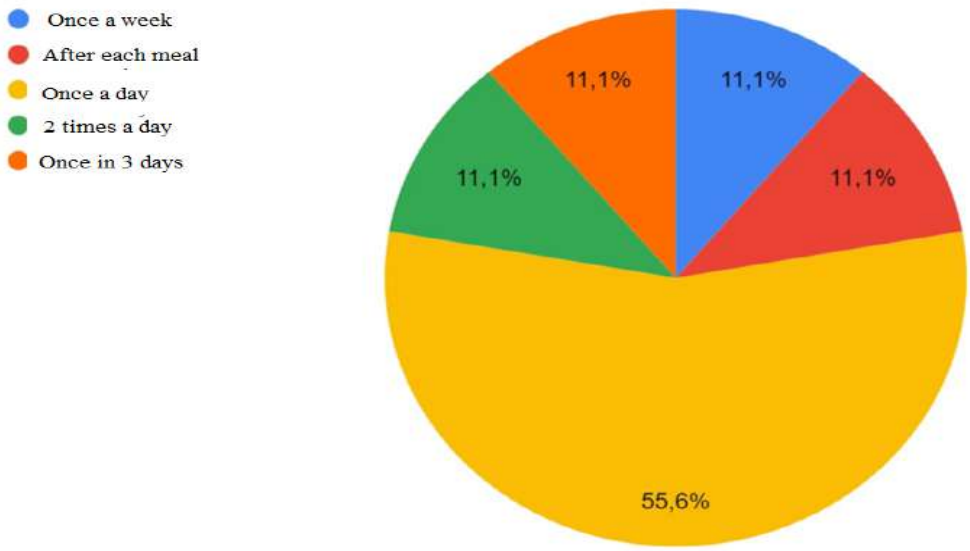

Figure 3.34. Answer to the question: “How often do you clean your removable orthodontic appliance?”

The anwers on Figure 3.34 show that 55.6% respondents gave the answer “once a day”, 11.1% - “2 times a day”, 11.1% - “once every 3 days”, 11.1% - “after each meal”, and 11.1% - “once a week”. Only 11.1% clean the orthodontic appliance after each meal, the most of them clean it once a day, one can explain it with the child behavior, while at school the child feels embarrassed to take off the appliance, and children also forget about the need to perform hygiene care for the removable appliance after each meal.

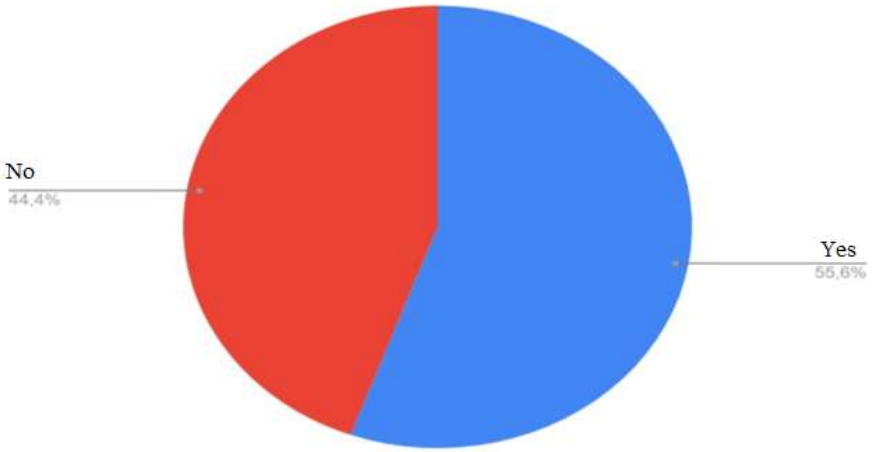

Figure 3.35. Answer to the question: “Do you use special brushes and pastes to clean removable equipment?”

The results of the survey on Figure 3.35 indicate that 55.6% respondents use special brushes and pastes to clean the removable appliance, and 44.4% do not. The obtained data allows concluding that the most patients follow the removable appliances care recommendations, however, the percentage of those who do not use any cleaning products is high as well as long as parents parents are not ready to allocate a large amount of money for removable orthodontic appliance hygiene products.

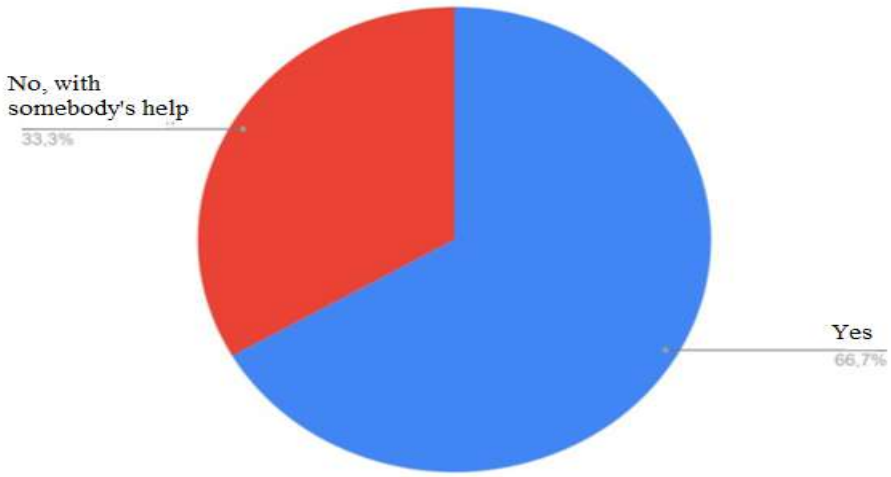

Figure 3.36. Answer to the question: “Do you clean the removable structure yourself?”

The answers on Figure 3.36 indicate that 33.3% respondents gave the answer “no, with the help of an adult”, 66.7% - “yes”. The obtained data allowed concluding that most patients are able to clean the dentures on their own that is why it is important to explain the cleaning rules to children in detail for a removable appliance, and adults to control the routine.

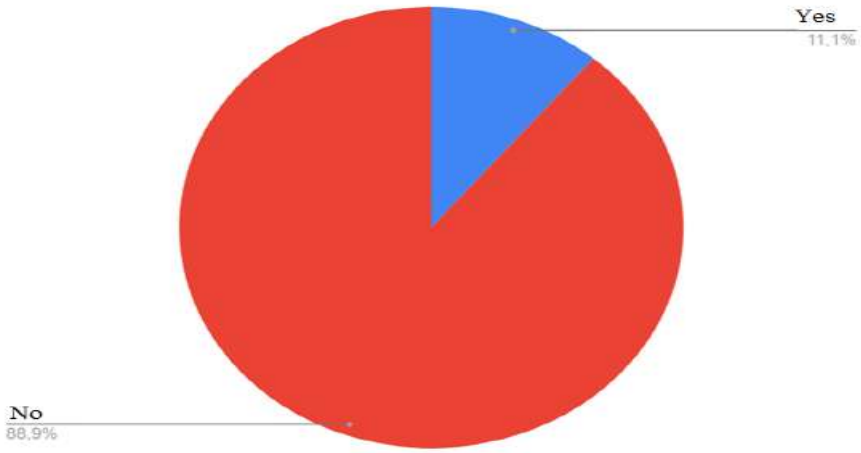

Figure 3.37. Answer to the question: “Do you use special products to stain plaque on your teeth to control the quality of your oral hygiene?”

The answers on Figure 3.37 indicate that 88.9% respondents gave the answer “no”, 11.1% - “yes” that implies that the orthodontist did not stress the importance of using means to indicate plaque, insufficient educating children and their parents on

the individual hygiene importance and its procedure, as well as the need to monitor hygiene.

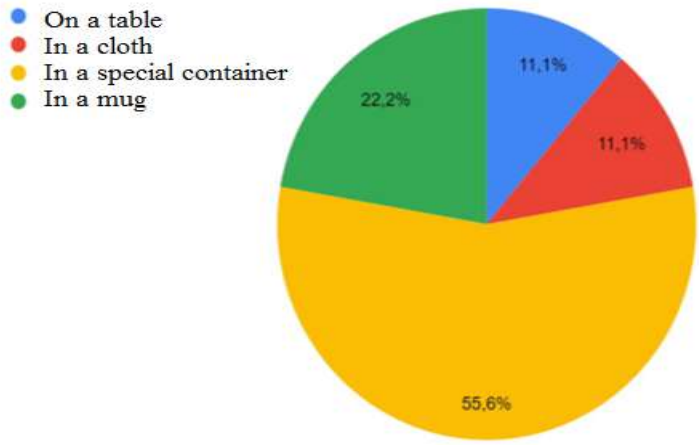

Figure 3.38. Answer to the question: “Where do you store the appliance when you’re not wearing it?”

The answers on Figure 3.38 indicates that 55.6% respondents gave the answer “in a special container”, 22.2% - “in a mug”, 11.1% -“on a table”, and 11.1% - “ in a cloth." Based on the data obtained, we can conclude that most patients comply with the storage conditions for removable structures.

When asked to evaluate the comfort of wearing the results were distributed as follows (Table 3.21).

Table 3.21. Comfort of wear

Criterion						
Percentage	10	12	43	21	2	12

The data in Table 3.21 testify that 43% patients are negative about wearing a removable orthodontic appliance, 21% demonstrate a satisfactory attitude, 2% are positive and 12% very positive. While 12% mentioned their negative attitude to using the device and 10% - very negative.

CHAPTER 4. RESULTS OF OWN RESEARCH ON SOLVING ISSUES IN COMPLEX DENTAL SITUATIONS

To solve problems associated with various complex dental situations, the following appliances were developed: (1) a device for cleaning teeth that was particularly convenient for use when the opening space of the mouth is restricted, with a small mouth, when access to deeper and hard-to-reach places is limited; (2) crowding of teeth is a complex situation that is accompanied by various dental situations, for which an orthodontic treatment method was developed; (3) distal occlusion is an equally complex dental condition that is reflected in malocclusion, chewing, breathing, and biting and chewing of food. To cope with that problem an orthodontic treatment method has been developed; (4) as teeth wear down and fillings are ground down, there is a decrease or increase in the bite height inevitably affecting the condition of the temporomandibular joint that is an extremely complex condition accompanied by pain of varying severity, in order to avoid those manifestations, a method to identify the optimal bite height has been developed; (5) the duration and quality of filling material retention in the tooth cavity treated for filling is an important problem of cariesology and it is affected by a degree of adhesion of the material to the hard tissues of the tooth. To improve the adhesive efficiency, a zinc oxide-based filling material was developed; (6) the assessment of the antiviral and immunomodulatory drug efficiency plays an important role, particularly in the treatment of herpetic stomatitis, in order to improve the assessment efficiency, a method for modeling recurrent herpes of the mice mucosa was developed [74, 189, 225, 241, 242].

4.1. Teeth cleaning appliance

The utility model belongs to preventive dentistry and periodontology toolset, and more precisely to disposable sanitary and hygienic supplies, and one can use it to prevent caries and improve personal hygiene in various dental situations and in different age groups (Figure 4.1).


РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ПОЛЕЗНУЮ МОДЕЛЬ

№ 104059

ПРИСПОСОБЛЕНИЕ ДЛЯ ЧИСТКИ ЗУБОВ И ОДНОРАЗОВЫЙ КОМПЛЕКТ НА ЕГО ОСНОВЕ

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Б.П. Симонов

Figure 4.1. Utility model patent No. 104059. An appliance for cleaning teeth and a disposable kit based on it.

1. A teeth cleaning appliance consisting of a fingercot-shaped base surface with spike-like elements made on the outer surface of the fingercot (Figure 4.1.).

2. An appliance specified in paragraph 1 has spike-like elements made of polyurethane.

3. An appliance specified in paragraph, with spike-shaped elements is higher than fingercot outer surface by 2-3 mm and it has a diameter at the base surface of 1.0-1.5 mm.

4. A set for cleaning teeth, consisting of two fingercots with spike-shaped elements and a capsule with toothpaste.

Currently, to clean teeth by removing plaque and tartar from their surfaces, various toothbrushes are most often used, usually containing a handle and a head

connected to it that has a base surface with cleaning elements attached to it, usually in a shape of bristles (in large quantities), made of various materials [1, 2, 3, 4, 5, 6].

However, known toothbrushes [1-6] do not allow achieving the technical result by means of the solution specified for the following reasons. In preventive dentistry the tooth surface is conditionally divided into 5 sections [7].

At the same time, the MATS (mesial area of the tooth surface) and DATS – (distal area of the tooth surface) being in contact with the corresponding areas of adjacent teeth, are considered to be the contact surfaces of the teeth. In clinical practice, examination and treatment of dental patients, the MATS and DATS are further conventionally divided into zones, respectively: mesial-cervical and mesial-occlusal, distal-cervical and distal-occlusal. Those areas are considered hard to reach for cleaning. Toothbrushes of a standard shape, as a rule, provide fairly high-quality cleaning of the MOATS and the CATS However, the design features of these brushes (flat cut of the bristles, their relatively high height, their rigid fixation to the base surface, that is usually made of plastic) determine the limited ability of the WE to adapt to the curvature of the TS, as well as the impossibility of reciprocating the movement of the bristles, which is essential reduces the probability of contact between the WE (working elemens/surfaces) and the TS (tooth surfaces) on its CATS, DATS and MATS. Therefore, cleaning those areas of the tooth is only possible if the user applies additional force to bend the bristles. However, even in this case, it is possible to clean only the MCATS, as well as the MATS and DATS areas in contact with the middle part of the tooth (MOATS and DOATS), and the quality of cleaning of these areas (zones) is significantly lower (compared to the MATS and CATS (central area of tooth surface)) due to the multidirectional bending bristles. The bristles can hardly penetrate (even if they are bent in the desired direction) into the MCATS and DCATS that eliminates the opportunity to clean those areas almost completely, thereby contributing to dental caries. At the same time, if the user applies additional effort the injury to the gingival margin, including the gingival sulcus and interdental gingival papilla, become growingly possible that significantly increases the risk of periodontal tissue and oral mucosa infection by pathogenic endogenous

microorganisms and makes gingivitis and marginal periodontitis to be highly likely (i.e. because a damaged gingival sulcus does not have the property of regeneration) with the subsequent development of periodontitis likely. In addition, if the cleaning process is accompanied with pressure the cleaning agent is introduced into the spaces between the tooth contact surfaces along with food debris and microorganisms (hereinafter referred to as “cleaning waste”) that additionally cause the infection of periodontal and oral tissues. Missing opportunity to perform gum massage (simultaneously with brushing eliminates the opportunity of gingivitis regression) almost completely, and also does not prevent the progression of gingivitis and marginal periodontitis with their transformation into periodontitis. In addition, such toothbrushes have a limited ability to hold teeth cleaning agent. During brushing with a toothbrush, the cleaning agent usually slips between the tufts of bristles, ending up outside the contact area between the bristles and the toothbrush. It results in a low concentration of that product at the point where the bristles come into contact with the mouth, but is distributed throughout the oral cavity that reduces the cleaning efficiency. The reusability makes infection of periodontal tissues and the oral mucosa of the user's face by pathogenic exogenous microorganisms highly likely, in particular owing to poor-quality rinsing of the toothbrush after completion of the current cleaning procedure or when the brush is used by third parties, that is a commonplace in public places (in hotels, in transport, etc.) [81].

To reduce the risk of infection by pathogenic exogenous microflora, particularly when people travel by public transport or when they stay in hotels, an individual kit is available, containing, in particular, a toothbrush and a capsule with toothpaste placed in a case [8].

An analogue kit [8] allows reducing the opportunity to infect the users with pathogenic exogenous microflora. However, the standard-shaped toothbrushes used in the set are of relatively low quality that produce all negative effects inherent in analogue toothbrushes [1-6] that manifest themselves distinctly.

There is a disposable single-use appliance for cleaning teeth [9] with an external and internal housing containing a toothbrush with a head, bristles, neck and

handle placed inside the internal housing. Meanwhile the internal housing is installed inside the external one on a sliding fit; that type of installation builds up a cavity between their edge perforated walls to accommodate the cleaning agent.

The abobe-mentioned appliance [9], a capacity kit, containing a toothbrush and a dispenser with a cleaning agent is functionally integral unit. However, the use of a standard toothbrush as part of the kit provokes a variety of negative effects of analogue products [1-6] (except the infection by pathogenic exogenous microorganisms). In addition, internal and external housings movable relative to each other, perforated walls make that appliance a technically complex one in terms of manufacture.

The appliance, an adopted prototype, consists of a base surface shaped as a silicone fingercot (hereinafter referred to as “SFBS”), equipped with spherical elements (9 pieces) and a tuft of bristles on the outer surface to perform work surface functions in the AP (adopted as a prototype) (hereinafter, respectively, - "APWE" (adopted prototype working elements), "APSE" (adopted prototype sphrerical elements), "APBWE" (adopted prototype bristle working elements)). At the same time, APSE and APBWE are placed on two opposite sections of the PBS (prototype base surface) of a ring-shaped area located in the upper third of the fingercot, and the outer surface of each of the working sections is a quarter of the outer surface of the specified ring-shaped area.

Adopted prototype does not ensure a technical result of the specified appliance function. By the applicant’s opinion in the progress of adopted prototype implementation one can clean teeth, only with the help of APBWE (Adopted prototype bristle working elements). One can use APSWE (adopted prototype spherical working elements) exclusively for gum massage, because the spherical surface is not able to hold cleaning agent (slippage occurs). In toddlers teeth brushing is usually performed by third parties (for example, parents) due to the lack of fine motor skills in children (appears approximately at age of 7 years). In this regard, the use of a fingercot of a similar design instead of standard children's toothbrushes with a relatively hard handle may guarantee certain advantages specifically in that age

group, because an elastic APS that ensures, in particular, better coordination of the cleaning movements of a person who cleans, it will help reduce traumatic effect to the child's mouth and gums during cleaning and massage. However, for that group of users, a number of design-conditioned negative effects of adopted prototype manifest themselves regardless of the user age.

The use of adopted prototype in adults, as well as in children over 7 years of age, does not ensure the desired technical result of the declared group. Placing APWE of different types on opposite sections of the APBS (adopted prototype base surface), as well as specific implementation of APSWE and APBWE outlining their specific functional suitability (each of the APWE is suitable for performing hygienic procedures of only one specific type), nessesitate stage-by-stage implementation of hygienic procedures of different types (brushing teeth and gum massage) alternately on each side of the dentition (vestibular and oral). It make completely impossible to simultaneously perform one-step teeth cleaning (from the vestibulo-oral side of the dentition) in combination with one-step gum massage(from the indicated sides of the dentition). It has a negativ impact on those hygiene procedures (for users of any age) in terms of efficiency. The placement of APWE (each type) conditioned by the adopted prototype design in opposite areas of a relatively small APBS area results in an unjustified complication of fingercot movements in cleaning the surfaces of lateral teeth (both from the vestibular and oral sides of the dentition) since it is needed to avoid caused injury to the cheek and tongue, opposite to those currently in use, thus, preventing the contact of the APWE surfaces with the surfaces of the specified teeth. Particularly it refers to in hard-to-reach areas of the TCS (tooth contact surfaces). This, in particular, necessitates applying additional efforts when cleaning hard-to-reach TCS (tooth contact surface) areas, namely the MCATS (mesial-cervical area of the tooth surface) and DCATS (distal-cervical area of the tooth surface) (cleaning with pressure) that makes the injury to the gingival margin and IGP (interdental gingival papilla) (due to the relatively long length of the APBWE bristles) highly likely. Besides relatively high bristles prevents (despite their elasticity) the manifestation of a distinct adherence of the of the APWE surfaces to the AP and

prevents possible adhesion of APBS (adopted prototype base surface) to the TS (tooth surface) that on one hand, prevents circular cleaning movements, and, on the other, determines the relative small total working surface area of the AP (for users of any age). The shape of the APBWE, their relatively small number, their location at a considerable distance from each other (approximately 0.5 cm), as well as their opposite position in relation to the APWE enable massaging only the gingival margin, and only in the area of the anterior teeth. Massage of the gingival margin in the area of the lateral teeth is practically impossible (due to the extreme technical complexity), because in this case, performing massage movements (reciprocating/horizontal and vertical/ and circular) with the help of APBWE will inevitably entail the injury to oral mucosa of the cheek and tongue of the APWE. At the same time, the indicated design of the APBWE exclude the opportunity to perform massage of IGP (interdental gingival papilla) and GS (gingival sulcus) (along its entire length) (for users of any age) almost completely. In this regard, the use of AP does not eliminate the risk of infection to periodontal tissue and oral mucosa by pathogenic endogenous microorganisms, and does not allow preventing caries in hard-to-reach areas of the TCS (particularly in the MCATS (mesial-cervical area of the tooth surface) and DCATS (distal-cervical area of the tooth surface) - in individuals using AP with both normal and and with poor oral hygiene, does not exclude gingivitis and marginal periodontitis (including the subsequent development of periodontitis) - in AP users with NOH (normal oral hygiene); in some cases does not allow eliminating gingivitis (both the initial form and hypertrophic one), and also does not prevent (in some cases) the further development of gingivitis and the progression of marginal periodontitis with their transition to periodontitis in PP users with POH (poor oral hygiene) . In addition to above-mentioned reasons the reusable AP makes oral mucosa periodontal tissue infection by pathogenic exogenous microflora with all the ensuing consequences [81] highly likely.

The objective of the utility model is to create an appliance for cleaning teeth and a corresponding disposable kit that allows preventing the occurrence of periodontal diseases and eliminating the oral cavity infection when brushing teeth

taking advantage of one-step complex cleaning, in particular with a vacuum effect, vestibulo-oral surfaces of the anterior and lateral teeth, including their medial and distal surfaces with occlusal and cervical areas, as well as the posterior teeth, in combination with a one-stage complex massage accompanied by a vacuum effect, the vestibulo-oral surfaces of the gums, the gingival margin mucosa, including the posterior teeth, and IGP (interdental gingival papilla) without injury to tooth enamel, gingival margin, incl. GS (gingival sulcus), and IGP (interdental gingival papilla).

The problem is solved by the AP base surface in a shape of a fingercot as a utility model, awl-shaped elements are made on the fingercot external surface. At the same time, the subulate elements protrude 2.0-3.0 mm above the outer surface of the fingercot and have 1.0-1.5 mm in a base diameter. The fingercot and spike-shaped elements are made of polyurethane. The teeth cleaning kit consists of two fingercots with awl-shaped elements and a capsule with toothpaste. The technical result is achieved by the following features of utility model. The design of the cleaning appliance implies placement over the entire base surface, made of an elastic material (polyurethane), elastic with spike-shaped elements meeting the declared parameters that perform WE functions in the claimed appliance - allow combining teeth cleaning with gum massage . When selling the claimed appliance as an independent product (in particular, with a cleaning agent enclosed to it, for example, toothpaste) /hereinafter - “option for independent implementation of the CA (claimed appliance)”, “option of CAWE (Claimed appliance working elements)”/ the vestibular and oral surfaces of the front and lateral teeth can be cleaned alternately in combination with alternating massage of the vestibular and oral surfaces of the gums, the mucous membrane of the gingival margin and IGP. Within the CAWE option, the CA design enable performing combined cleaning and massage procedures involving mechanically reciprocating (horizontal and vertical) and circular movements /hereinafter referred to as “working movements of the CAWE option”/. At the same time, in the course of any of these types of movements, an elastic atraumatic adhesion to the TS (regardless of its curvature), as well as to the vestibulo-oral surfaces of the GSE (regardless of their relief) is achieved, not only the surfaces of the CAWE (from

the top to the base of the spine), but also the CABS (claimed appliance base surface) that starts to function as a working unit (along with the CAWE surfaces) /hereinafter referred to as the “CAWE adjacency effect”, “the working surface of the CAF”. On the one hand it increases the total working surface area, and on the other hand, it promotes adaptation the working surface to the curvature and the relief of the GSE (gingival structural elements) increasing the efficiency of the cleaning and massaging while making injury to tooth enamel, gingival tissue edges and IGS impossible. Changes in the relative position of the CAWE and CABS enabled by any of the CAWE working movements press spike-shaped CAWE (in particular, with a cleaning agent applied to them) into the spaces between the TCS /hereinafter referred to as the “CAWE pressing effect” providing deeper penetration of CAWE into hard-to-reach areas of the penstock protection zone (MCATS, MOATS, DCATS, DOATS), and, it improves the quality of their cleaning. In addition, the indicated design features of the CAWE, which are causally significant (including additionally contributing /stated parameters of the spikes/) for the manifestation of the effects of the contact of the CAWE and CABS and the effect of pressing the CAWE /hereinafter referred to as the “effects of the CAWE option”/, also determine relatively high ability of the CAWE to retain the cleaning agent with its subsequent uniform distribution over the entire working surface of the CAWE that boosts cleaning efficiency incl. and hard-to-reach areas of the bullpen. Eliminating the possibility of damage to the gingival margin and IGP, combined with improving the quality of cleaning of hard-to-reach areas of TS, makes infection of periodontal tissues and the oral mucosa less likely, thus, minimizing the risk of developing gingivitis and marginal periodontitis, as well as the risk of ulcers and aphthae of the oral mucosa [81].

Data from the clinical observations performed by the PM authors (in particular, the study of the microvasculature by rheoparodontography) indicated that massage of the vestibular and oral surfaces of GSE (gingival structural elements) by meams of CA (claimed appliance) improves the microvasculature hemodynamics. It is achieved a gentle effect on the microvessel walls and improved blood flow enhancing local immunity and, thus, minimizing the opportunity of developing local inflammation of

the gum mucosa and preventing gingivitis.

At the same time, the relatively large total area of the working surface of the CA ensured an necessary and sufficient amplitude of massaging movements (without distinct pathological changes in the gums) the maximum possible growth of local blood flow (for each specific patient) in the GSE (gingival structural elements) area by one time. The distribution of CAWE throughout the entire CABS, their shape and parameters ensured a stimulating effect on regeneration of pathologically altered GSE tissues (when inflammation is localized within the gums without periodontal involvement) thta eliminate the symptoms of primary gingivitis (gingival margin and IGP (interdental gingival papilla) mucosa hyperemia and swelling). Thus, in CAWE option the CA design allows combining mechanical atraumatic effects on periodontium structural elements - cleansing (alternately, from the vestibular and oral sides of the dentition) and stimulating (in the same way) based on unilateral adjacency effects of CAWE and CABS and CAWE indentation. The CA implementation as a set of two finger cots when used simultaneously (in particular, with a cleaning agent applied to them as part of the set) /hereinafter referred to as “the option for CA kit implementation”, “the RZGTK option”/ allows for a simultaneous two-way impact on structural elements of periodontium - one-step cleaning of the vestibulo-oral surfaces of the anterior and lateral teeth in combination with one-step massage of the vestibulo-oral surfaces of the gums, the gingival margin and IGP mucosa. At the same time the simultaneous use of two fingercots (as components of the set) that enables another type of movement -pinch-like reciprocating (vertical) movements /hereinafter - “PRVM” along with the working movements of the SRZP ”, as well as, as components, “PRM” (pinch-like reverse movements), “PFM” (pinch-like forward movement)/ that owing to CA design are atraumatic to tooth enamel, gingival margin and IGP (like all previously discussed working movements of SRZP option). During PFM (pinch-like forward movements), when placed on the vestibular and oral sides of the dentition the opposing styloid elements of the opposing fingercots with the PSE (periodontium structural elements) are in contact, it helps to achieve a prolonged adherence of the CAWE and CABS

surfaces to the vestibulo-oral surfaces of the teeth, gums, gingival margin mucosa, including the GS (gingival sulcus). IGP /hereinafter - “the effect of prolonged adhesion of the CAWE and CAF”/. It creates micro-areas of rarefaction located between the opposing CAWE between the TCS (tooth contact surface) and the areas of the GSE (gingival structural elements) tissues (including in the GS (gingival sulcus) area that disappears in during the execution of the PRM (pinch-like reverse movements) /hereinafter - “discrete vacuum effect of the RZPK option”/. Both of these effects (prolonged adhesion of CAWE and CAF and the resulting discrete vacuum effect) are specifically inherent only in the CAWE variant. Cleaning wastes are sucked from the CA (including from hard-to-reach areas of the TCS), from the IGP into the micro-areas of vacuum formed during the PFM (pinch-like forward movements), which are localized in the spaces between the TCSs. During the cleaning process, when the contact of the oncoming REZP with the PSE (periodontium structural elements) ceases, the micro-areas of vacuum disappear entailing automatic removal of cleaning waste from the tooth and gum surface into the oral cavity /hereinafter referred to as “cleaning with a discrete vacuum effect”/, from where, after the completion of the cleaning process, they are washed out. mechanically, for example, by rinsing. Discrete creation of micro-areas of rarefaction in the TDSE areas (including in the GS (gingival sulcus) area) located between the opposing CAWE during massage PRVM helps to increase the blood supply to the gingival margin mucosa, including the GS and IGP sufficiently to provide a number of lymphocytes and macrophages in the blood vessels of the indicated GSE sufficient to ensure a persistent improvement of gum mucosa local immunity and completely destroy pathogenic endogenous microorganisms in the gum mucosa epithelium, particularly in GS /hereinafter - “massage with a discrete vacuum effect "/.

In this regard, the RZPK option not only prevents gingivitis and marginal periodontitis, but eliminates the manifestations of both primary gingivitis and hypertrophic gingivitis (hyperemia and swelling of the the gingival margin mucosa, including gingivitis, and IGP, friability of the gingival mucosa). It ensures cleaning of gingival pockets, thus, reducing the severity of marginal periodontitis (reduced

bleeding from the GP (gingival pockets), reduced hyperemia and swelling of the IGP), thereby preventing its progression, thereby, preventing periodontitis [81].

Thus, CA design within CAWE option provide combined complex atraumatic effects on the PSE (periodontium structural elements) - bilateral effect-based one-stage (from the vestibulo-oral sides of the dentition) cleansing and one-stage stimulating. Bilateral effects comprise adjacency of the CAWE and CABS, indentation of the CAWE, prolonged fit of CAWE and CABS). It allows combining heterogeneous principle-based procedures - mechanical cleaning and massaging with a discrete vacuum effect.

The above-mentined complex effect ensures removal of cleaning waste from hard-to-reach areas of the CTS, high-quality cleaning of hard-to-reach GS (gingival sulcus) (including GP (gingival pockets)), and maintains stable strengthening local gum mucosa immunity that in particular, determines local regeneration in pathologically altered GSET (gum structural element tissue) (including those with periodontal involvement), avoiding to tooth enamel, gingival margin (including GS (gingival sulcus)) and IGP damage that almost completely eliminate the risk of periodontal tissue and oral mucosa infection by pathogenic endogenous eliminated.

The disposable CA, provided within RZPK option, completely prevents the infection of periodontal tissues and the oral mucosa by pathogenic exogenous microflora inevitably generated by a reusable tooth cleaning appliance (of any design) as mentioned above. That appliance (after routine hygiene procedures) is disinfected in domestic conditions. All above-mentioned, in its turn, minimizes the caries onset probability (including in hard-to-reach areas of the TCS) - in people who use dental care with both NOH and POH (normal oral hygiene and poor oral hygiene); provides prevention of gingivitis, marginal periodontitis and periodontitis - in people who use CA with NOH, and allows eliminating gingivitis (including hypertrophic) and, it not only prevents the progressing marginal periodontitis, thereby eliminating the opportunity of developing periodontitis, and reducing its severity - in people with POH.

The utility model is illustrated by graphic materials, where figure 4.2 shows a

teeth cleaning appliance, a general view; figure 2 - disposable kit for cleaning teeth, general view [81].

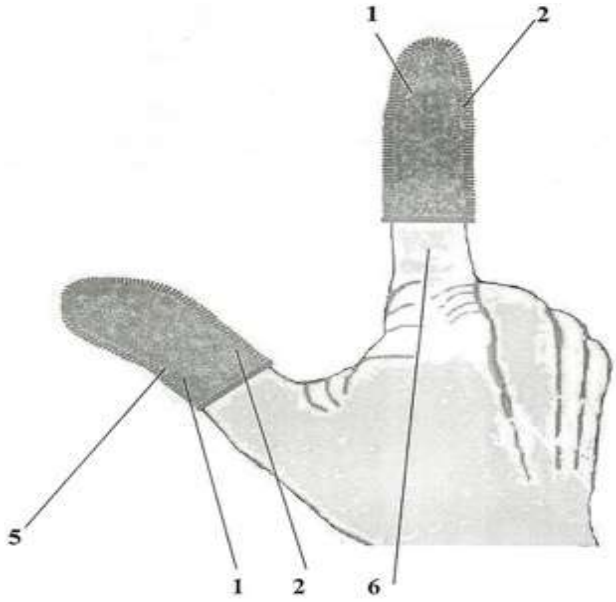

Figure 4.2. Model of teeth cleaning appliance.

The tooth cleaning appliance (Figure 4.2.) is a fingercot 1, equipped on the with awl-shaped elements (spikes) 2 on external surface. The fingercot, together with the spikes, is cast integrally from polyurethane or other elastic material. A disposable kit for cleaning teeth consists of two fingercots 1 and a capsule 3 with toothpaste enclosed in a package 4 to ensure sterility conditions. It is made, for example, in a shape of a transparent case.

The appliance is used as follows. Fingercots 1 are taken out of the package 4, put on the 5^{th} thumb and/or 6^{th} index finger and clean the teeth, removing dirt and tartar with the spikes 2, if necessary, using toothpaste 3. Brushing the teeth is combined with a massage of gums that provides an additional positive effect. After use, the fingercots are discharged.

Thus, the implementation of the claimed appliance enables prevention of periodontal disease and eliminating the oral infection when brushing teeth. Portability and sterility are the advantages of the claimed appliance [81].

4.2. Method of crowded teeth orthodontic treatment

The invention belongs to dental healthcare sphere, namely to orthodontics, and it is applicable in diagnostics to select an option for orthodontic treatment with/without tooth extraction, as well as to correct insufficient space in the dentition for various anomalies (Figure 4.3.).

It is known that patients with dental anomalies, as a rule, have anomalies in the shape, size, position of individual teeth that cause various deformations and anomalies in the shape and size of the dentition [Nanda R., 2009; Tikhonov A.V., Popov S.A., Basha O.V., 2015].

In patients with misaligned teeth caused by various anomalies it is important to identify the severity of crowding (in mm), as well as to find space on the dental arches of both jaws in order to plan orthodontic treatment [84, 252, 253, 258, 262, 272, 283, 286].


РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2692453

Способ ортодонтического лечения при скученности зубов

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Руководитель Федеральной службы по интеллектуальной собственности

Figure 4.3. Patent № 2692453

To achieve it first assess the severity of tooth crowding by measuring on plaster diagnostic models of the jaws.

Known methods to assess teeth crowding include finding the difference in the sum of the teeth mesio-distal dimensions and the actual total length on models of jaws [Netzel F., Schultz K., 2006] and segmental dental arch [Netzel F., Schultz K., 2006]. There is a method to assess the mesial displacement of lateral teeth according to Schwarz, however, the disadvantage of this method is the inability to find the abnormal position of individual teeth and groups of teeth, as well as plan the correct movement of teeth.

Besides there is another known method to assess the symmetry and correlation of dental arche segments according to H.G. Gerlach [Rabukhina N.A., Arzhantsev N.A., 2003; Rabukhina N.A., Golubeva G.I., Perfilieva S.A., 2006], but it is labor intensive and resource-consuming, as well as the inability to identify the incorrect position of individual teeth of the segments and, as a result, plan the operation.

The most appropriate method to assess of the dentition condition to the claimed one is the method of choosing an option for orthodontic treatment with/without extraction of teeth [RU2547998, 2015], in which marks are made on the middle of the distal approximal surface of the first premolars D14 and D24, perpendiculars are lowered from them onto the MRI line and receive points K14 and K24. Then measure lines D14-K14 and D24-K24. Basing on the chosen option, find Table standard value for Dnorm/Knorm distance to the MRI line, with an existing oral displacement of one or both first premolars, compensate by expanding the dental arch in the transversal plane without removing teeth. If the value of the mesial displacement of one or both first premolars is equal to or greater than the value of mesiodistal size of the corresponding tooth, remove the first premolars with distalization of the canines. When the mesial displacement of one or both first premolars is less than the mesiodistal size of the corresponding tooth by 1/2 to 2/3 and the normal relationship of those teeth in the transversal plane in relation to the midsagittal suture, remove the second premolars or third molars.

That method has disadvantages of being effort-consuming, inable to obtain reliable data in case of an anomaly in the apical balance of the patient's jaw [84].

The objective of the invention, solved by the authors, is to reduce the labor intensity of diagnosing orthodontic treatment by a simpler and faster assessment of its prospects.

The result is achieved by the orthodontic treatment of crowded teeth in the anterior part of the dentition, biometric methods are used based on computed tomography (CT). The thickness of the cortical plate on the vestibular and oral sides and the thickness of the roots of the anterior teeth, as well as the apical base of each jaw are measured and the correction factor (K) that is found using the formula:

$$K = \Sigma \frac{(OS+VS)}{TRW} * \frac{AB}{SAB} \qquad (4.1)$$

where

OS - thickness of the cortical plate on the oral side, mm;

VS- thickness of the cortical plate on the vestibular side, mm; TRW - width of tooth roots, mm;

AB – apical base of a given patient;

SAB- the standard apical base value amounts to 44 mm for the maxilla and 43 mm for the mandible; while K = 0.4 or more, treatment performed using an orthodontic structure; when K is less than 0.4 and more than 0.2, teeth are separated; and when K = 0.2 or less, consider the opportunity of removing teeth, for example, paired premolars or wisdom teeth.

One considers the shift of the teeth when the real apical balance deviates from the ideal setting [Snagina N.G., Rotokina E.B., 1988] by introducing the factor AB/AN into the formula.

The method is performed as follows. A computed tomogram (CT) is performed and measurements are taken. Then the correction factor for n/h and/or h/h is determined and, analyzing its value, further treatment is planned.

The method in question is illustrated by the following graphic materials [84].

The industrial applicability of the method is illustrated by the following examples:

Example 1. Patient S., 29 years old. Diagnosis: crowding of anterior teeth (Table 4.1.).

Table 4.1. Twelve permanent teeth: mesiodistal dimensions

10	7	7	8	7	9	9	7	8	7	7	10	96
6	5	4	3	2	1	1	2	3	4	5	6	∑
11	7	7	7	6	6	6	6	7	7	7	11	88

According to Snagina the ratio of the apical base width to the sum of the mesiodistal dimensions of 12 teeth is 43.7 mm – the standard.

A CT scan of the central teeth of the maxilla was taken (Figure 4.4.). Significant parameters were measured in the image and the correction factor K was found. The obtained results are shown in Table 4.2.

Table 4.2. Calculation of the correction factor K for patient C.

Tooth	OS	VS	TRW	AB	SAB
13	1,9	1,3	6,8	43,7	44
12	2,0	1,1	5,4	43,7	44
11	2,1	0,8	6,1	43,7	44
21	2,2	0,8	6,7	43,7	44
22	2,1	0,9	6,1	43,7	44
23	1,8	0,7	7,1	43,7	44

The width of the apical base of the h/h and n/h is normal, K h/h=0.63

Solution: we perform orthodontic treatment using an orthodontic structure.

Result: We achieved alignment of the dentition

Example 2. Patient: B., 32 years old. Diagnosis: crowding of anterior teeth in the the maxilla and mandible – 2nd degree of severity (Table 4.3.).

Table 4.3. Twelve permanent teeth: mesiodistal dimensions

11	7	7	8	7	9	9	7	8	7	7	11	98
6	5	4	3	2	1	1	2	3	4	5	6	∑
11	7	7	7	6	6	6	6	7	7	7	11	88

According to Snagina the ratio of the apical base width of the to the sum of the mesiodistal dimensions of 12 teeth in maxilla amounts to 39 mm – the width of the AB is narrowed - 1 degree of severity; in mandible it amounts to 38.5 mm – narrowed - 2nd degree of severity

Using the method of example 1, the correction factor K was found for maxilla and mandible. The obtained results are shown in Table 4.4.

Table 4.4. Calculation of the correction factor K for patient B.

Tooth	OS	VS	TRW	AB	SAB
13	1,7	1,3	6,8	39	44
12	1,6	1,1	5,4	39	44
11	1,9	0,8	6,1	39	44
21	1,9	0,8	6,7	39	44
22	2,0	0,9	6,1	39	44
23	1,4	0,7	7,1	39	44
33	1,1	0,8	7,5	38,5	43
32	1,1	0,6	6,0	38,5	43
31	1,0	0,8	5,8	38,5	43
41	1,0	0,8	5,4	38,5	43
42	1,2	0,7	5,8	38,5	43
43	1,3	1,0	7,6	38,5	43

The apical base of the maxilla and mandible is less than normal.

$K_{maxilla}$=0.36; $K_{mandible}$ =0.25

Solution: Maxilla - we perform orthodontic treatment using separation. Mandible - we perform treatment using separation.

Result: We have achieved alignment of the dentition on both jaws.

Example 3. Patient: K. Diagnosis: crowding of teeth in the anterior part of the maxilla and mandible (Table 4.5).

Table 4.5. Twelve permanent teeth: mesiodistal dimensions

11	*8*	*8*	*9*	*8*	*9*	*9*	*8*	*9*	*8*	*8*	*11*	*106*
6	*5*	*4*	*3*	*2*	*1*	*1*	*2*	*3*	*4*	*5*	*6*	∑
11	*9*	*8*	*9*	*7*	*6*	*6*	*7*	*9*	*8*	*9*	*11*	*100*

According to Snagina the ratio of the apical base width of the to the sum of the mesiodistal dimensions of 12 teeth in maxilla amounts to 32 mm – the width of the AB is narrowed - 2 degree of severity; in mandible it amounts to 38.5 mm – narrowed - 2nd degree of severity

Using the method of example 1, the correction factor K was found for maxilla and mandible. The obtained results are shown in Table 4.6.

Table 4.6. Calculation of the correction factor K for patient B.

Tooth	OS	VS	TRW	AB	SAB
13	1,7	1,3	6,8	32	44
12	1,6	1,1	5,4	32	44
11	1,9	0,8	6,1	32	44
21	1,9	0,8	6,7	32	44
22	2,0	0,9	6,1	32	44
23	1,4	0,7	7,1	32	44
33	1,1	0,6	7,7	34	43
32	1,0	0,5	6,8	34	43
31	1,0	0,6	6,8	34	43
41	1,0	0,6	6,4	34	43
42	1,2	0,7	6,6	34	43
43	1,3	0,7	7,8	34	43

Solution: Maxilla - K = 0.31, we separate the central and lateral incisors of the maxilla, Corrective mandible K = 0.18. Extraction of lower third molars

Result: We achieved alignment of the dentition

Example 4. CT scans of 45 patients with different treatment outcomes were reviewed and K was calculated for each patient. The obtained results are shown in Table 4.7.

Table 4.7. K value in patients with different treatment options

Treatment option	Number of patients	K
Treatment with orthodontic construction	19	0,65±0,24
Teeth separation	10	0,31±0,10
Tooth extraction	16	0,16±0,04

The tests have shown that the advantage of the declared method over analogue ones is the simplicity and minimal complexity of the method. At the same time, diagnostic time is reduced from 8-12 hours to 20-30 minutes.

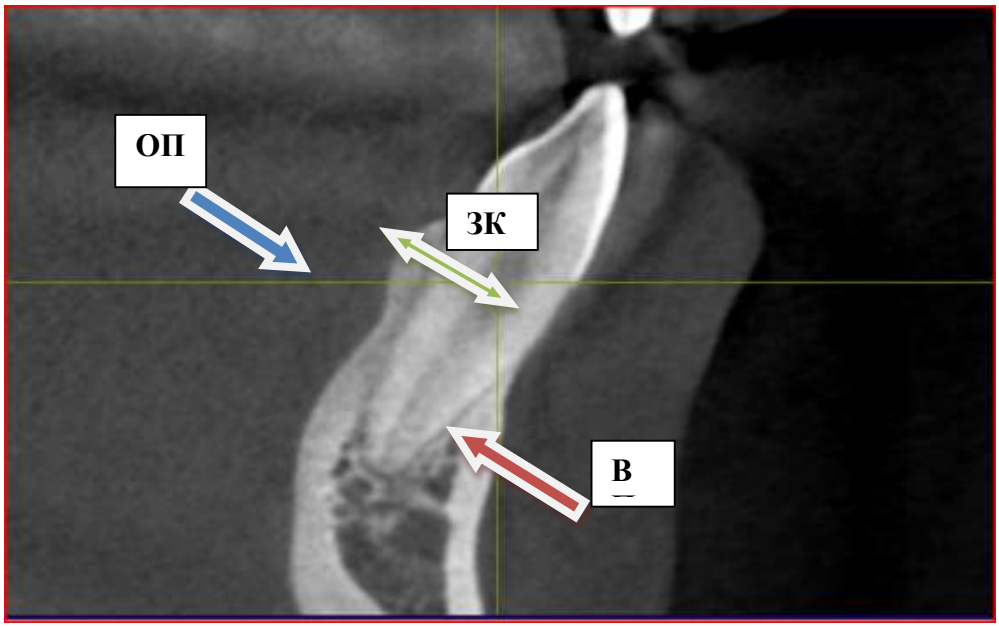

Figure 4.4. Method of orthodontic treatment for crowded teeth

Figure 4.4. a snapshot of a jaw fragment is shown indicating the measured parameters, where

OS - thickness of the cortical plate on the oral side, mm;

VS - thickness of the cortical plate on the vestibular side, mm;

TRW - width of dental roots, mm;

AB is the apical base of this patient.

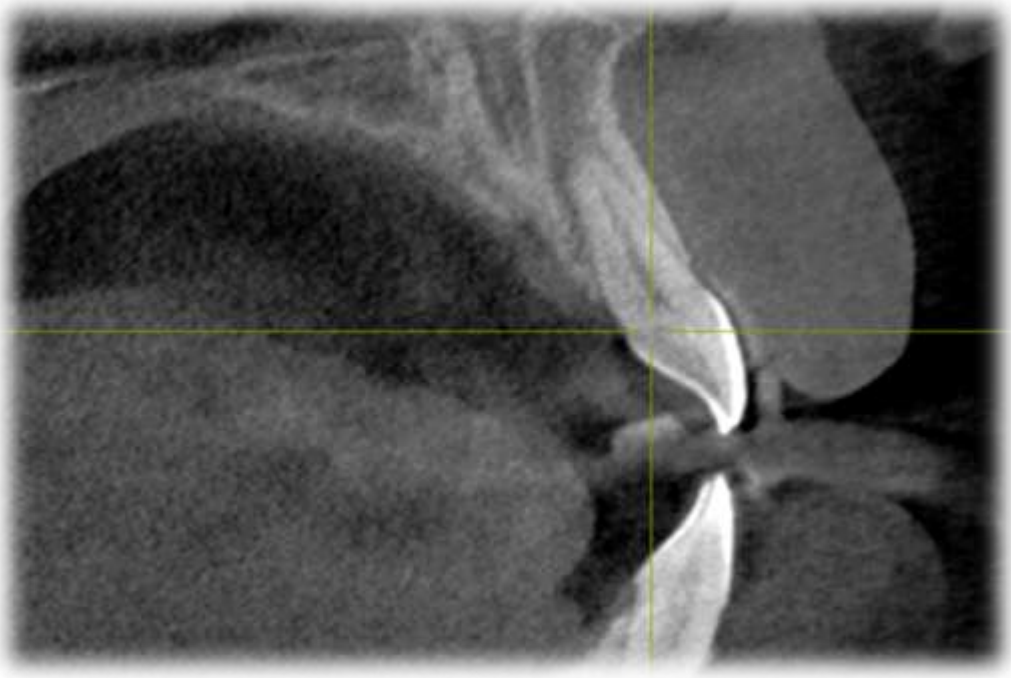

Figure 4.5. Tomogram of the jaw

Figure 4.5. tomogram of the patient’s jaw if it is possible to use fixed orthodontic equipment during treatment, for example, a brace system (K = 0.40).

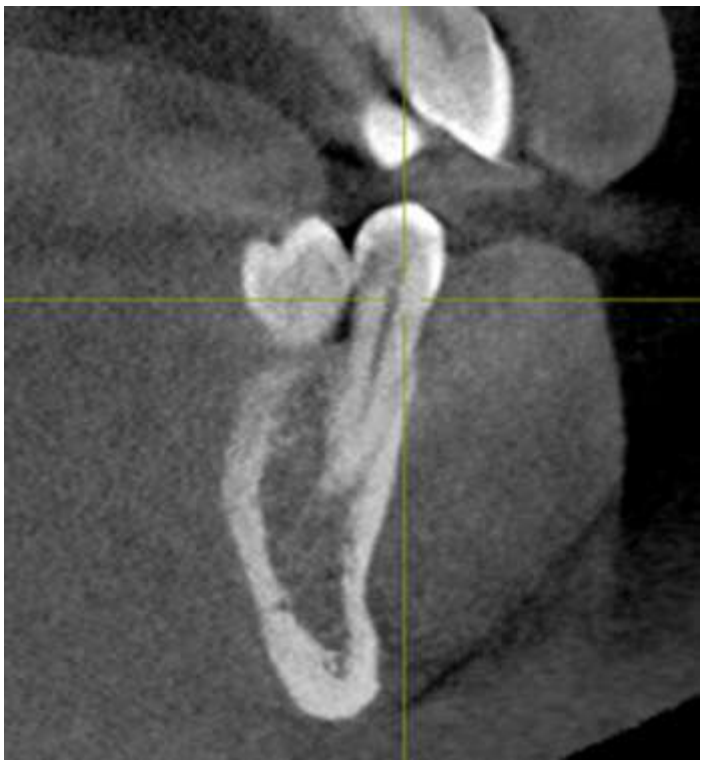

Figure 4.6. Tomogram of the patient's jaw.

Figure 4.6 tomogram of the patient's jaw in the case of using tooth separation in the treatment (K = 0.32).

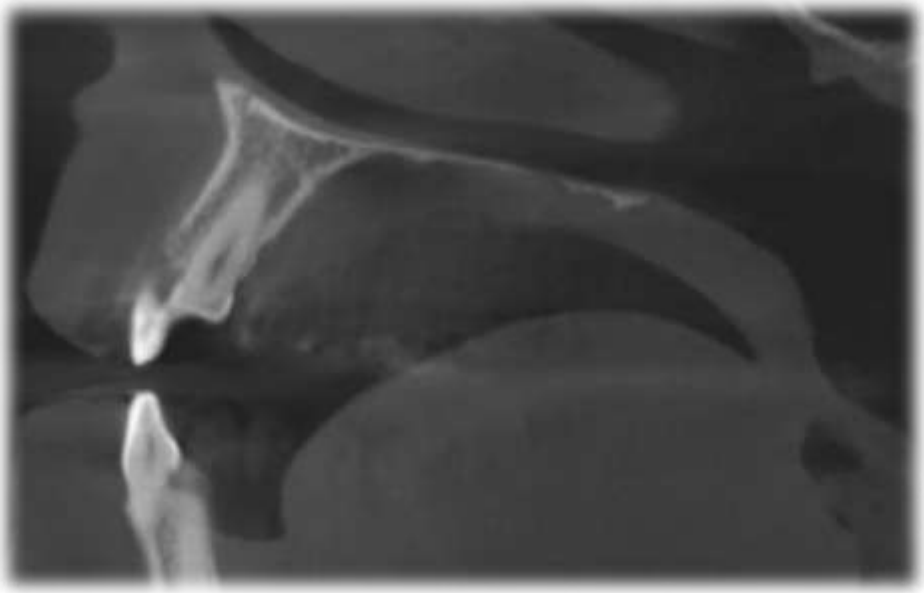

Figure 4.7. Tomogram of the patient's jaw.

Figure 4.7. tomogram of the patient's jaw, if tooth extraction necessary (K = 0.17) during the treatment.

4.3. Method of orthodontic treatment of distal occlusion

This method is intended for use in the orthopedic treatment of patients with distal occlusion (Figure 4.8.) [85]. Applying that method, a teleroentgenogram is performed and an x-ray cephalometric analysis of its lateral projection is performed. Next, the rotational torque index RTI is calculated using the formula

$$RTI = \frac{SNA - SNB}{ILS/NL - Ili/ML} \times 100, \qquad (4.2)$$

where

SNA - angle characterizing the position of the base of the maxilla relative to the the skull underlying structure (base);

SNB - angle characterizing the position of the mandible underlying structure relative to the skull underlying structure (base);

ILS/NL - angle characterizing the position of the maxillary jaw incisors relative to the underlying structure;

Ili/ML - angle characterizing the position of the mandibular incisors relative to the underlying structure.

Distal occlusion is a serious pathology that has a negative impact not only on the dentofacial apparatus, but on all body systems as a whole stimulating in particular irreversible structural and morphological changes (violation of facial harmony, chewing and swallowing, diction, etc.). There are various methods for treating distal occlusion.

One of the well-known methods for moving teeth in patients with distal occlusion [RU2648828, 2018] is a one leveraging overall examination of the patient including computed tomography, teleradiography, orthopantomography and photography, taking impressions from the maxilla and mandible for subsequent scanning in a laboratory, developing a computer model of a dentition, modeling teeth movement in compliance with the doctor's treatment plan in a computer program,

The described method is one of the alternative existing methods of orthodontic treatment of distal occlusion (using an aligner with a mini-implant for rubber traction) characterized by low efficiency. This method does not allow assessing the severity of the pathology, and, therefore, selecting adequate treatment plan (a sufficient, but not excessively increased list of measures).

ЕВРАЗИЙСКАЯ ПАТЕНТНАЯ ОРГАНИЗАЦИЯ
ЕВРАЗИЙСКОЕ ПАТЕНТНОЕ ВЕДОМСТВО

ЕВРАЗИЙСКИЙ ПАТЕНТ
НА ИЗОБРЕТЕНИЕ
№ 042335

Название изобретения:
«СПОСОБ ОРТОДОНТИЧЕСКОГО ЛЕЧЕНИЯ ДИСТАЛЬНОЙ ОККЛЮЗИИ»

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Настоящим удостоверяется, что евразийский патент выдан на изобретение с формулой, опубликованной в Бюллетене Евразийского патентного ведомства «Изобретения (евразийские заявки и патенты)» № 2 / 2023 год.

При уплате установленных годовых пошлин патент действует на территории государств-участников Евразийской патентной конвенции – Азербайджанской Республики, Кыргызской Республики, Республики Армения, Республики Беларусь, Республики Казахстан, Республики Таджикистан, Российской Федерации, Туркменистана.

ДОКУМЕНТ ПОДПИСАН ЭЛЕКТРОННОЙ ПОДПИСЬЮ
Сертификат: 1650024017000
Владелец: Ивлиев Григорий Петрович
Действителен с 15.04.2022 по 14.04.2027

ИВЛИЕВ Григорий Петрович
Президент Евразийского патентного ведомства

Figure 4.8. Eurasian patent № 042335

Secondly, using a computer program to model the track of teeth movement not allow taking into consideration all the factors that affect teeth movement and manifest themselves only in the patient's real life conditions that distort a model for the manufacture of an aligner, improper installation of the appropriate attachments on it and, consequently, misadjustment of the distal occlusion (that requires to continue treatment). In addition, the need to remove the third upper molars that complicates the treatment elongating the recovery time and increasing the risks of complications owing to tooth extraction is another disadvantage [85, 121, 126, 244-250].

The most appropriate method is a one based on identifying anomalies in the position of teeth and choosing treatment tactics [RU2561293, 2015].

The disadvantage of the described method adopted as a prototype is a low efficiency. A jaw orthopantomogram-based analysis enabled assessment of teeth condition, i.e. planar (one-dimensional) scan of the patient's jaws resulting in

significant distortions in the image of true jaw condition and allows assessing roughly the periodontium condition. Additionally using such a planar scan, it is not possible to assess the root inclination of anterior and lateral teeth in the sagittal plane. It makes that method ineffective, and often completely impossible for correcting distal occlusion being a sagittal type of malocclusion.

The technical issue is a need to develop a minimally invasive, effective and easy-to-implement method for orthodontic treatment of distal occlusion.

Providing highly accurate diagnosis of the distal occlusion severity and choice of treatment tactics meeting that severity constiture the technical result.

The following factors help ti achieve the technical result in orthodontic treatment of distal occlusion in adolescents: a teleroentgenogram (hereinafter referred to as “TRG”) is performed as well as a radiocephalometric analysis of its lateral projection, and the rotational torque index RTI is calculated using the formula:

$$RTI = \frac{SNA - SNB}{ILS/NL - Ili/ML} \times 100, \qquad (4.3)$$

where SNA is the angle characterizing the position of the the maxilla base relative to the skull underlying structure (base); SNB is the angle characterizing the position of the mandible base relative to the skull underlying structure, ILS/NL is the angle characterizing the position of the maxillary incisors relative to the underlying structure, Ili/ML is the angle characterizing the position of the mandibular incisors relative to the underlying structure; calculated rotational-torque index RTI using a bracket system help to choose treatment tactics, where if the RTI value exceeds 28, treatment is performed using class II elastics, if RTI value ranges 12 to 28, treatment is performed using class II elastics and additional measures aimed at controlling the torques of the incisors, their separation on mandible, additional bends on the arch of the maxilla, and if the RTI value is under 12, treatment is performed using miniscrews and/or distalizers.

The authors of the claimed invention performing a retrospective analysis of treatment results in a group of 320 patients, revealed the greatest treatment efficiency being ensured by the rotation-torque index RTI (Rotation-Torc-Index)-based TRH assessment, The ranges of rotational torque indices RTI have been identified

empirically characterizing mild, moderate and severe degrees of pathology (over 28, from 12 to 28 and below 12, respectively) that allows building treatment tactics, in particular making up a sufficient list of measures and means used for treatment. Evaluation of treatment efficiency within a claimed method in the analyzed group of patients was performed by assessing the patient's appearance, analyzing TRG and examining plaster models of jaws to find multiple contacts between the teeth of the maxilla and mandibles. In case of mild distal occlusion the duration of treatment amounted to 1-1.5 years, 1.5-2 years for moderate pathology, and 2-2.5 years for severe pathology [215, 217-219, 223, 224, 228, 23-235].

The claimed invention is illustrated by the following graphic materials, where Figure 4.4.1 shows the TRG of patient A (example 1), Figure 4.4.2 – TRG of patient E (example 2), Figure 4.4.3 – TRG of patient C (example 3).

The inventive method is illustrated with examples.

Example 1

Patient A., 14 years old, came to the orthodontics clinic complaining about facial aesthetics. After a clinical and radiological examination distal occlusion of the dentition was diagnosed. An X-ray cephalometric analysis of TRG was performed, see the image on Fig. 1. The results of the TRG analysis the following angle values were found: SNA=87º, SNB=80º, ILS=120º, ILI=96º. The RTI index was calculated: RTI=29.1.

Following the obtained RTI index the treatment was performed with a brace system involving class II elastics. Physiological occlusion was achieved one and a half years after the start of treatment.

Example 2

Patient E., 15 years old. Complaints about difficulty when biting and chewing food, aesthetic defect. Having reviewed clinical and paraclinical studies, a diagnosis was made: distal occlusion of the dentition. An analysis of the TRG was performed, the image of which is shown in Figure 4.4.2. Resulting from TRG analysis the following angle values were identified: SNA=82º, SNB=76º, ILS=131º, ILI=94º. The RTI index was calculated: RTI=16.2.

Considering the obtained RTI index, treatment was performed with a brace system with class II elastics, as well as separation of the lower incisors to normalize the torque. The treatment lasted 24 months, after the jaws were placed in physiological occlusion [79, 85, 166, 170, 172, 174, 175, 182, 195, 197, 199, 208, 211, 212, 213].

Example 3

Patient V., 15 years old. Complaints about difficulty when biting food, unattractive teeth. Basing on clinical and paraclinical studies a diagnosis was made: distal occlusion of the dentition. An analysis of the TRG was performed, the image is shown in Figure 4.11. Resulting from TRG analysis the following angle values were defined: SNA=88.3º, SNB=86.2º, ILS=138º, ILI=110.2º. The RTI index was calculated: RTI=7.55.

In compliance with the obtained RTI index, treatment was performed using a brace system with class II elastics. However, distal movement of the maxillary teeth was impaired due to significant protrusion of the upper anterior teeth. Therefore, miniscrew implants were used that were installed in the retromolar area of the maxilla. A diamond discs 0.2 mm thick was used to ensure separation with of the lower incisors at the transition stage to dental metal arches of rectangular cross-section within 1.2 mm. The treatment lasted 2.5 years with setting the dentition in physiological occlusion.

Thus, this method ensures accurate diagnosing the severity of distal occlusion and selecting an appropriate treatment tactics corresponding to that degree that generally enhances treatment efficiency.

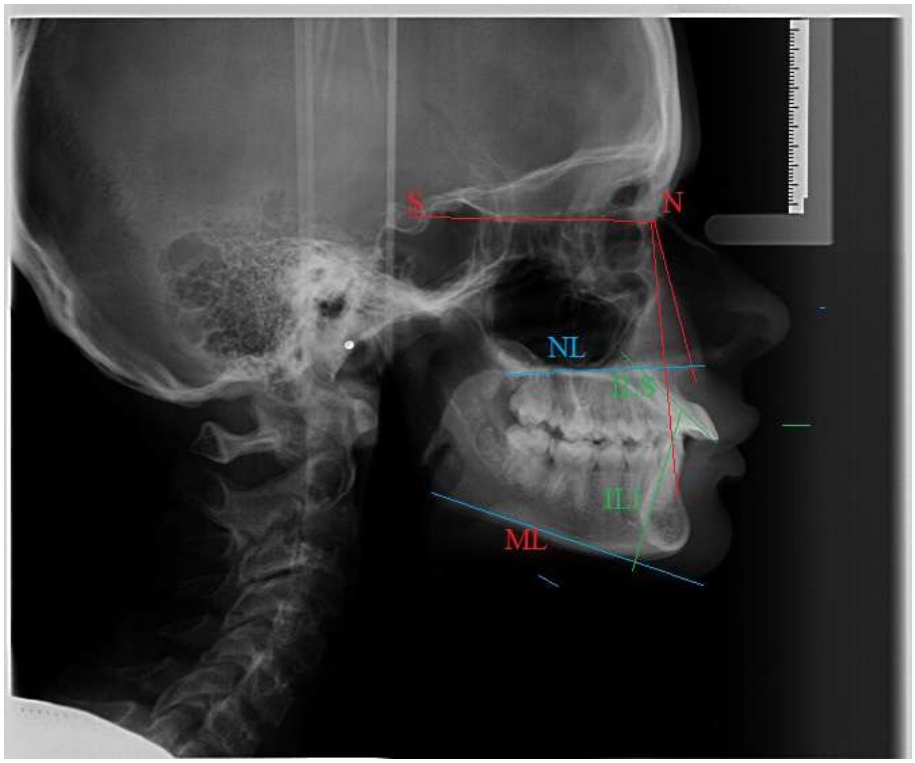

Figure 4.9. TRG of patient A., 14 years before treatment.

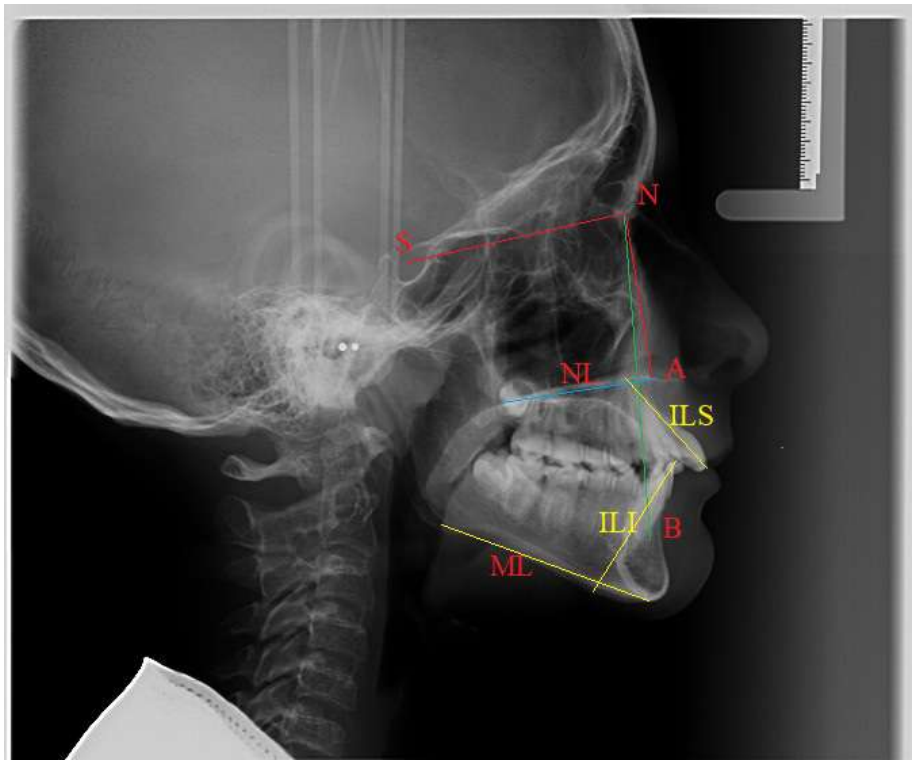

Figure 4.10. TRG of patient E., 15 years before treatment.

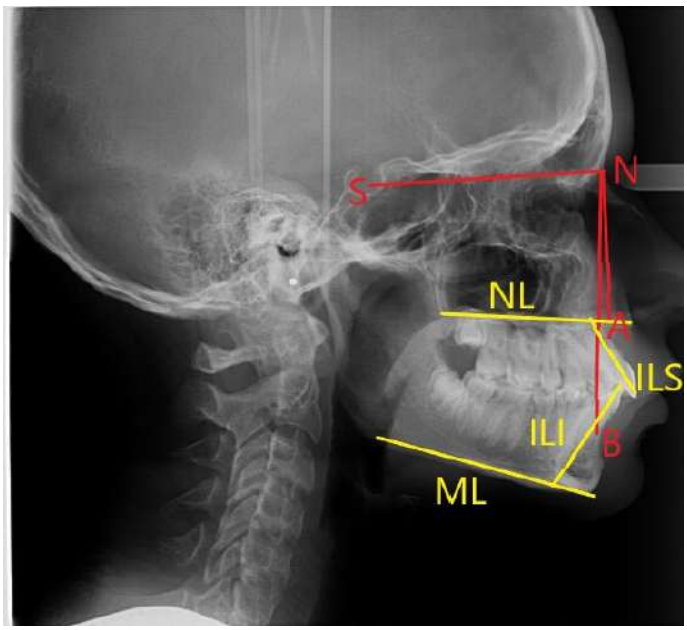

Figure 4.11. TRG (teleradiography) of the patient B., 15 years, before treatment.

4.4. Method to identify the optimal bite height

РОССИЙСКАЯ ФЕДЕРАЦИЯ

СВИДЕТЕЛЬСТВО

об официальной регистрации программы для ЭВМ

№ 2007613744

«Определение оптимальной высоты прикуса по томограмме височно-нижнечелюстных суставов» (TMJ test)

Правообладатель(ли): ***Фищев Сергей Борисович (RU)***

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3 сентября 2007 г.

Руководитель Федеральной службы по интеллектуальной собственности, патентам и товарным знакам

Б.П. Симонов

Fig. 4.12. Patent № 2007613744.

A method to assess the optimal bite height, including the assessment of parameters characterizing the functional patient's masticatory apparatus condition in the dentition occlusion that has a primary assess the patient's nosological form of the dentoalveolar anomaly and/or deformation of the maxillofacial area, then using tomographic examination of the area of the temporomandibular joints in the position of the dentition in central occlusion perform the assessment of patient's masticatory apparatus parameters, while the patient's dentition is closed in physiological occlusion that is his typical, then perform a tomography of the right and left temporomandibular joints in the lateral projection, in the resulting image of the right temporomandibular joint in the sagittal plane of projection, first, identify the zone of closest approximation of the contour line of the right mandibular fossa in the area of its anterior wall to the contour line of the right mandibular head, find points on the indicated contour lines in the above-mentioned zone, the distance between which is the smallest, conditionally designating them respectively as the first and second right points of approach, draw a straight line through them and find the width of the joint space in the anterior part of the right temporomandibular joint, measuring the length of the straight line segment limited by the first and second right points of approach, then identify the point localizations of the apex of the articular tubercle and the lower edge of the external auditory canal of the right temporomandibular joint [80].

And a straight line is drawn through the identified points of the indicated anatomical formation fragments, conventionally marking it with the right tubercle-auricular line, thus outlining the area of greatest convexity of the mandibular right head between its anterior and posterior surfaces, in the indicated zone a straight line is drawn parallel to the right tubercle-auricular line continuing it in both directions until it intersects with the contour line of the mandibular right head at two points, conventionally designated respectively by the first and second right intersection points, and the diameter is found of the mandibular right head by measuring the length of the straight line segment restricted by the first and second right intersection points, then divide the diameter of the mandibular right head into two equal parts, conventionally considering the dividing point as the center of the mandibular right

head, find the point at the longest distance from the center of the mandibular right head on its contour line, conventionally marking it as the first right point of removal, after that from the center of the mandibular right head a straight line is drawn through the first right point of removal, conventionally marked the first right approximate straight line, continuing it until it intersects the contour line of the right mandibular fossa at a point conventionally marked as a third right intersection point, and the width of the joint space in the anterior upper part of the temporomandibular joint is found, measuring the length of the straight line between the first and right points of removal and the third right point of section, after which the point furthest from the center of the mandibular right head is identified on the contour line of the mandibular fossa, conventionally marked as the second point of removal, draw a straight line through the center of the mandibular right head and the second right point of removal, conventionally marked as the second right approximate straight line, identify the point of its intersection with the contour line of the mandibular right head on the second right approximate straight line, conventionally mark it as the fourth point of intersection, and find the width of the joint space in the posterior upper part of the right temporomandibular joint, measuring the length of the straight line between the second right point of removal and the fourth point of intersection, then identify the area of closest approximation of the contour line of the right mandibular fossa in the area of its posterior wall to the contour line of the mandibular right head, find it on the indicated contour lines points, the distance between which is the smallest, conditionally marking them respectively as the third and fourth right points of approach, draw a straight line through those points and find the width of the joint gap in the posterior part of the right temporomandibular joint, measuring the length of the straight line segment limited by the third and fourth right points of approach, after that, on the resulting image of the left temporomandibular joint in the sagittal plane of projections, use the similar way to find the width of the joint space in the anterior, anterior-superior, postero-superior and posterior sections of the left temporomandibular joint, then the average width of the joint space is calculated as the average value the width of the joint space of all four sections of the right and left

temporomandibular joints as well as the optimal bite height according to the formula:

$\Delta h = K \times [(DR1+DR2+DR3+DR4+ DL1+DL2+DL3+DL4):8 - D']$ (4.4)

where:

Δh - height to which the gnathic part of the face needs to be increased.

K - the experimentally derived index for increased tooth abrasion is 19.6; for distal bite, incl. deep bite – 7.8; for mesial bite – 10.4;

D1, D2, D3, D4 - width of the joint space in the anterior, anterior superior, posterior superior and posterior sections, respectively.

R - right tempromandibular joint, L - left tempromandibular joint.

D′ - experimentally derived average value of the joint space for four parameters: for increased tooth abrasion - 2.9 mm; for mesial bite - 2.3 mm; for distal bite, incl. deep bite - 2.7 mm. [80].

4.5. Zinc oxide-based filling material


РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2558801

ПЛОМБИРОВОЧНЫЙ МАТЕРИАЛ

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Врио руководителя Федеральной службы по интеллектуальной собственности

Л.Л. Кирий

Figure 4.13. Patent № 2558801.

A filling material has been developed containing a zinc oxide-based charge and a aqueous solution-based mixing liquid of 45-50% orthophosphoric acid, additionally containing castor oil and ethanol with the following ratio of ingredients (wt.%): mixing liquid - 60-80 %; castor oil – 1-2%; ethanol is the rest, and the mixture additionally contains phenol-formaldehyde resin, polyvinyl butyral, rosin and dibutyl phtholate in the following ratio of ingredients (wt.%): phenol-formaldehyde resin - 0.5-2.0%, polyvinyl butyral - 5-8%, rosin - 0.2 -1.5%, dibutyl phtholate – 1-4%, charge – the rest [82].

This filling material contains a mixture of zinc-silicophosphate cement. A filling material contains zinc-silicophosphate cement-based mixing liquid. This filling material contains up to 5% of auxiliary substances from groups that include pigments, biocidal and adhesive additives, components that stabilize the composition or improve adhesive properties.

Example: two extracted teeth with class 1 carious cavities according to Black were chosen. The cavities were prepared and filled - the first tooth with ordinary silico-phosphate cement, the second with the cement we have proposed. The teeth were immersed in a 0.5% solution of methylene blue and left in a thermostat at 36 degrees for 1 month. A month later, longitudinal cuts were made. In a tooth filled with conventional cement, blue staining is visible over the entire surface of the filling's contact with the tooth hard tissues, and in the second tooth it is clear that there is no marginal permeability that indicates adhesive efficiency (Figure 4.14.) [82].

A B

Figure 4.14. A – tooth filled with ordinary cement; B – tooth filled with the stated cement.

4.6. Method for modeling experimental recurrent herpetic stomatitis

To assess the efficiency of antiviral and immunomodulatory drugs for the treatment of herpetic stomatitis, recurrent herpes of the oral mucosa was modelled on laboratory mice.

Herpes infection is very common worldwide and poorly controlled. Herpes simplex virus (HSV) ranks second in mortality among infectious diseases of children (15.8%) after influenza (35.8%) [Rabinovich I.M., Rabinovich O.F., Razzhivina M.V., 2005; Levonchuk E.A., 2005; Kokryakov V.N., 2006; Kovalchuk L.V. Khoreva M.V., Varivoda A.S., 2008; Levy-Polack M.P., Sebelli P., Polack N.L., 1998; Langendijk J.A. et al., 2004; Naidu M.N. et al., 2004; Leoni V. et al., 2012].


РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2709842

СПОСОБ МОДЕЛИРОВАНИЯ ЭКСПЕРИМЕНТАЛЬНОГО РЕЦИДИВИРУЮЩЕГО ГЕРПЕТИЧЕСКОГО СТОМАТИТА

Патентообладатель: *Федеральное государственное бюджетное военное образовательное учреждение высшего образования "Военно-медицинская академия имени С.М. Кирова" Министерства обороны Российской Федерации (ВМедА) (RU)*

Авторы: *см. на обороте*

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Срок действия исключительного права на изобретение истекает 10 декабря 2038 г.

Руководитель Федеральной службы по интеллектуальной собственности Г.П. Ивлиев

Figure 4.15. Patent № 2709842

There are no vaccines to completely cure herpesvirus infection, so one needs methods for modeling the pathology in experiments.

Modelling chronic recurrent herpes infection in mammals [Poryvaeva A.P., 2015] is similar to the above-mentioned, but to assess the clinic situation during exacerbation of chronic herpes, it is necessary to monitor mice infected with the herpes simplex virus (HSV-1) for about 320 days. In that method that time can be reduced to 50-60 days.

This method of modeling recurrent herpetic stomatitis includes dosed infusion of a suspension of the herpes simplex virus (HSV-1, strain US) [Kostyuk V.A., Potapovich A.I., Kovaleva Zh.V., 1990] and glutathione peroxidase using the method [Korolyuk M.A., Ivanova L.I., Mayorova I.G. et al., 1988].

The assessment was performed by the Schiller-Pisarev test and the intensity test of gum bleeding. Bacteriological methods were used to assess changes in the oral mucosa microflora.

Thus, as a result of the study, the possibility of free radical genesis of disturbances in the microbiocenosis of the oral cavity with a predominance of colonization by the yeast fungi C. albicans and C. Glabrata was found [83, 86].

CHAPTER 5. STUDYING METHODS OF DENTAL DISEASE TREATMENT IN EXPERIMENTS ON ANIMALS

5.1. Oral microbiocenosis condition of experimental animals with recurrent herpetic stomatitis

The performed research have shown that the development of experimental stomatitis, both with isolated cytostatic and with combined cytostatic and herpetic effects was accompanied by a significant growth in microbial contamination of the oral mucosa (Table 5.1.).

Table 5.1. Effect of molixan on the spectrum of rat oral mucosa microflora with herpetic stomatitis ($M \pm m_x$)

Types of microorganisms	The number of microorganisms detected on rat oral mucosa prior to and after viral and chemoviral exposure, lg KOE				
	before exposure (intact animals)	HSV-1	HSV-1 + Molixan	cyclophosphamide + HSV-1	cyclophosphamide + HSV-1+ Molixan
β- hemolytic streptococcus	3,4±0,32	5,6±0,35*	3,9±0,4 #	7,5±0,5*	4,5±0,1*#
Non-hemolytic streptococcus	2,9±0,3	4,7±0,2*	3,6±0,2#	6,8±0,2*	3,4±0,2*#
Staphylococcus	4,0±0,4	5,2±0,4*	2,0±0,3#	6,2±0,4*	2,1±0,2*#
Enterobacteriaceae	80 cells in a swab/sample	3,8±0,15*	2,4±0,1#	4,8±0,2*	2,8±0,2*#
Candida (C. albicans and C. glabrata)	Not identifiable	3,4±0,3*	2,4±0,2#	5,7±0,3*	2,9±0,3*#
Anaerobes	80-100 cells in a swab/sample	3,6±0,2*	2,2±0,1#	4,4±0,2*	2,6±0,2*#

Note: * – differences with the group "before exposure (intact animals)", p≤0,05; # – differences with the group «HSV-1», p≤0,05; *# – differences with the group «cyclophosphamide + HSV-1», p≤0,05. HSV - herpes simplex virus.

In intact animals, β-hemolytic streptococcus (2.4±0.25), non-hemolytic streptococcus (1.9±0.1), staphylococci (2.0±0.1), as well as enterobacteria were

cultured in swabs from the oral mucosa and anaerobes (up to 60–80 cells in a swab/sample).

On the 21st day after infection of rats at a dose of 2LD50, the number of colonies of β-hemolytic streptococcus, non-hemolytic streptococcus and staphylococcus increased on average by 2–2.5 times compared to those animals that were not infected. Even more distinct changes were detected in microbial contamination with enterobacteria (3.5 times), anaerobes (3.4 times) and candida (on average 3 times).

The data obtained on Molixan effect on the rat oral mucosa microflora growth allowed assuming that the drug under study has its proprietary antimicrobial activity that is shown in Table 5.2.

Table 5.2. Evaluation of Molixan's proprietary antimicrobial activity on a model of the gram-positive and gram-negative microorganism vegetative form

Drug under assessment	Drug concentration in sample, μg/ml						
	1000	800	400	200	50	25	12,5
Staphylococcus aureus							
Molixan	-	-	-	+	+	+	+
saline	+	+	+	+	+	+	+
Escherichia coli							
Molixan	-	-	-	+	+	+	+
saline	+	+	+	+	+	+	+
Salmonella typhymurium							
Molixan	-	-	-	+	+	+	+
saline	+	+	+	+	+	+	+

Note: «+» –growth of the test microorganism available in the sample; «-» – growth of the test microorganism in the missing sample.

The obtained data indicate that Molixan displays antimicrobial activity against staphylococci, Escherichia and Salmonella only in concentrations of 400 μg/ml and above. One should note that the identified antimicrobial efficiency of Molixan is significantly lower than that of antimicrobial drugs; in the most effective antibiotics, this effect is recorded when used at a concentration of 1.0 μg/ml or lower [Reference

Vidal, 2012; Paolicchi A., Dominici S., Pieri L., 2002; Plemons J.M., Rankin K.V., Benton E., 2013].

Antimicrobial peptides occupy a special position among the products of activated phagocytes that, on one hand are natural endogenous antibiotics and on the other hand, signaling molecules that activate immune system cells and tissue repair [Kokryakov V.N., 2006; Kovalchuk L.V. et al., 2008; De Smet K, 2005; Lee, H.Y., 2009].

Having assumed that impaired synthesis of antimicrobial peptides could be one of the causes of immune dysfunction in chemoradiation stomatitis, we studied their secretion, as well as the regulation in vivo with the Molixan drug (Table 5.3.).

Table 5.3. The effect of Molixan on the content of α-defensin HNP 1-3 in the rat blood serum exposed to the combined effects of chemical and viral damaging factors, ng/ml ($M \pm m_x$)

Antimicrobial peptide	Peptide concentration in blood serum, ng/ml				
	before exposure (intact animals)	HSV-1	HSV-1+ Molixan	cyclophosphamide + HSV-1	cyclophosphamide + HSV1 + Molixan
α- defensin HNP 1-3	49,2±5,7	37,1±2,5*	42,3±4,8$^{\#}$	26,4±2,1	41,1±4,7*$^{\#}$

Note: * – differences with the group "before exposure (intact animals)", p≤0,05; $^{\#}$ – differences with the group «HSV-1», p≤0,05; *$^{\#}$ – differences with the group «cyclophosphamide + HSV-1», p≤0,05 n=10 in each group. HSV - herpes simplex virus.

As one can see from the Table 5.3, isolated infection of experimental animals with herpesvirus caused a drop in the amount of α-defensin HNP 1-3 (on average by 40%) in the blood of rats compared to the group of intact animals.

Some authors claim that the initial cascade of innate immune reactions including of antimicrobial peptide production by inflammatory cells such as neutrophils and tissue phagocytes, and including macrophages, is part of a response to the inflammatory process [236, 238, 239, 260, 261, 263, 264, 265, 267, 269, 274, 281, 288, 291].

5.2. Results of mucisa restoration in experimental herpetic stomatitis

Experimental studies have shown that the clinical picture of oral mucositis (herpetic stomatitis) in rats infected with herpes simplex virus type 1 at a dose of 1 LD50 manifested itself in hyperemia, single or confluent petechiae, vesicles, dryness and swelling of the oral mucosa (Table 5.4). By 21 days. There was a complete restoration of the oral mucosa epithelium integrity.

In animals that received a single dose of CFA at a dose of 100.0 mg/kg, stomatitis practically did not develop that may indicate missing toxicity of the cytostatic drug at this dose in relation to the oral mucosa (Table 5.4).

Modeling chemoherpetic stomatitis has revealed CPA reducing the dose threshold of herpetic exposure for the development of herpetic stomatitis in rats. Thus, when animals were infected with HSV-1 at a dose of 2LD50 with CPA administered at a subtoxic dose of 100.0 mg/kg, already on the 3rd day of observation, the animals developed a distinct clinical picture of AFS (Table 5.5). The general condition of the animals was depressed, about 50% rats were inactive and refused to eat. When examining the mouth, diffuse hyperemia of the periodontal margin was found at the incisors of the mandible and the bottom of the mouth. For 5 days. a distinct inhibition of motor activity was observed in 60% of rats, a decrease in food excitability – in almost 80% of animals.

Petechiae showed up on the oral mucosa in 50% individuals, and erosions and even ulcers in 20-30%. By 5 days. observations, erosive and ulcerative lesions of the oral mucosa were detected in 60-70% experimental animals. The gum and cheek mucosa was pale, swollen, loose, and the saliva released was viscous. The clinical picture of severe erosive and ulcerative stomatitis persisted in 60-70% rats up to 21 days. observations, de-epithelialization worsened. The severity of clinical manifestations of herpes viral stomatitis decreased only by 20 days. after exposure, there was an improvement in the general condition and food excitability normalized. The obtained results may indicate the sensitizing effect of cytostatics [116, 149, 150, 155, 267].

When modeling herpetic stomatitis with secondary immunosuppression of the infection, a distinct oral mucositis in laboratory animals manifested itself within 1 day. after herpes virus exposure. In animals infected with HSV-1, a clear clinical picture of AFS developed following the administration of CFA. The general condition of the rats was depressed, about 80% animals were inactive and refused to eat. When examining the mouth, diffuse hyperemia of the periodontal margin was found at the incisors of the mandible and the floor of the mouth. On day 3, a distinct inhibition of motor activity and food excitability was observed in 100% rats.

During the same period, 100% individuals developed petechiae on the oral mucosa, and 80% developed deep erosions and ulcers. By day 5, distinct symptoms of oral mucositis in the form of erosions and ulcers were detected in 100% experimental animals. Up to 21 days of observation deepithelialization grew, manifesting itself as confluent epitheliitis and ulcerative necrotic mucositis. The development of stage 3–4 herpetic stomatitis led to the death of 40% rats. In the remaining animals, clinical manifestations persisted for up to 30 days, after which there was some improvement in the general condition, food excitability and motor activity normalized.

Table 5.4. Frequency of oropharyngeal syndrome clinical manifestations in rats under the combined exposure of herpes viral factors, % (M ± m, n = 20)

Symptoms	Groups of experiments	Duration of study after irradiation, days			
		3	5	10	15
Inhibited motor activity	Irradiation	0 ± 7	10 ± 8	40 ± 7	10 ± 10
	Cyclophosphamide	10 ± 6	15 ± 7	30 ± 6	10 ± 8
	Cyclophosphamide + Irradiation	50 ± 7*	60 ± 6*	70 ± 8*	70 ± 8*
	HSV-1 + cyclophosphamide+ Irradiation	80 ± 5*	100 ± 8*#	100 ± 8*#	100 ± 8*#
Reduced food excitability	Irradiation	0 ± 6	20 ± 5	30 ± 5	30 ± 8
	Cyclophosphamide	0 ± 6	15 ± 5	20 ± 5	15 ± 8
	Cyclophosphamide + Irradiation	30 ± 6*	80 ± 6*	80 ± 8*	80 ± 8*
	HSV-1 + cyclophosphamide + Irradiation	100 ± 7*#	100 ± 5*	100 ± 8*	100 ± 5*
Weight loss	Irradiation	0 ± 6	10 ± 5	30 ± 5	20 ± 7
	Cyclophosphamide	0 ± 6	10 ± 5	20 ± 6	15 ± 6
	Cyclophosphamide + Irradiation	30 ± 8	50 ± 6*	75 ± 6*	100 ± 8*

	HSV-1 + cyclophosphamide + Irradiation	100 ± 6*#	100 ± 5*#	100 ± 8*#	100 ± 5*
Petechiae	Irradiation	30 ± 6	10 ± 6	10 ± 8	0 ± 5
	Cyclophosphamide	10 ± 10	10 ± 7	10 ± 6	10 ± 6
	Cisplatin + Irradiation	50 ± 8	60 ± 10*	40 ± 10*	40 ± 7*
	HSV-1 + cyclophosphamide + Irradiation	100 ± 6*#	100 ± 9*#	100 ± 8*#	80 ± 7*#
Erosion	Irradiation	15 ± 5	20 ± 10	10 ± 7	10 ± 10
	Cyclophosphamide	10 ± 7	20 ± 6	20 ± 7	15 ± 6
	Cyclophosphamide + Irradiation	50 ± 8*	65 ± 6*	60 ± 10*	50 ± 6*
	HSV-1 + cyclophosphamide + Irradiation	80 ± 5*	100 ± 5*#	100 ± 8*#	100 ± 5*#
Focal and confluent epitheliitis	Irradiation	10 ± 6	10 ± 5	10 ± 6	10 ± 10
	Cyclophosphamide	10 ± 10	10 ± 5	10 ± 6	10 ± 10
	Cyclophosphamide + Irradiation	50 ± 6	70 ± 8*	80 ± 9*	60 ± 10
	HSV-1 + cyclophosphamide + Irradiation	100 ± 5*#	100 ± 8*#	100 ± 8	100 ± 8*#
Ulcers	Irradiation	10 ± 10	20 ± 7	30 ± 8	10 ± 10
	Cyclophosphamide	10 ± 10	15 ± 6	20 ± 7	10 ± 8
	Cyclophosphamide + Irradiation	30 ± 8	70 ± 8*	70 ± 8*	60 ± 8
	HSV-1 + cyclophosphamide + Irradiation	80 ± 5*#	100 ± 8*#	100 ± 8*#	100 ± 8*#

* $p < 0,05$ – compared to the group «Irradiation»; # $p < 0,05$ – compared to the group «Cyclophosphamide + Irradiation».

Table 5.5. Effect of Na_2GCGI on the frequency of clinical oropharyngeal syndrome manifestations in rats under the combined exposure of herpes viral factors, % (M ± m, n = 20)

Symptoms	Groups of experiments	Duration of study after irradiation, days			
		3	5	10	20
Inhibited motor activity	Irradiation	20 ± 7	20± 8	20 ± 7	10 ± 10
	Cyclophosphamide	30 ± 6	20 ± 7	30 ± 6	10 ± 8
	HSV-1 + cyclophosphamide+ Irradiation	80 ± 5*	100 ± 8*#	100 ± 8*#	100 ± 8*#
	HSV-1 + cyclophosphamide+ Irradiation+ Molixan	80 ± 5*	100 ± 8*#	100 ± 8*#	100 ± 8*#
Reduced food excitability	Irradiation	0 ± 6	20 ± 5	30 ± 5	30 ± 8
	Cyclophosphamide	0 ± 6	15 ± 5	20 ± 5	15 ± 8
	HSV-1+Cyclophosphamide + Irradiation	30 ± 6*	80 ± 6*	80 ± 8*	80 ± 8*
	HSV-1 + cyclophosphamide + Irradiation + Molixan	100 ± 7*#	100 ± 5*	100 ± 8*	100 ± 5*

Weight loss	Irradiation	0 ± 6	10 ± 5	30 ± 5	20 ± 7
	Cyclophosphamide	0 ± 6	10 ± 5	20 ± 6	15 ± 6
	HSV-1 + cyclophosphamide + Irradiation	100 ± 6*#	100 ± 5*#	100 ± 8*#	100 ± 5*
	HSV-1 + cyclophosphamide + Irradiation + Molixan	100 ± 6*#	100 ± 5*#	100 ± 8*#	100 ± 5*
Petechiae	Irradiation	30 ± 6	10 ± 6	10 ± 8	0 ± 5
	Cyclophosphamide	10 ± 10	10 ± 7	10 ± 6	10 ± 6
	HSV-1+Cisplatin + Irradiation	50 ± 8	60 ± 10*	40 ± 10*	40 ± 7*
	HSV-1 + cyclophosphamide + Irradiation + Molixan	100 ± 6*#	100 ± 9*#	100 ± 8*#	80 ± 7*#
Erosion	Irradiation	15 ± 5	20 ± 10	10 ± 7	10 ± 10
	Cyclophosphamide	10 ± 7	20 ± 6	20 ± 7	15 ± 6
	HSV-1+Cyclophosphamide + Irradiation	50 ± 8*	65 ± 6*	60 ± 10*	50 ± 6*
	HSV-1 + cyclophosphamide + Irradiation + molixan	80 ± 5*	100 ± 5*#	100 ± 8*#	100 ± 5*#
Focal and confluent epitheliitis	Irradiation	10 ± 6	10 ± 5	10 ± 6	10 ± 10
	Cyclophosphamide	10 ± 10	10 ± 5	10 ± 6	10 ± 10
	Cyclophosphamide + Irradiation	50 ± 6	70 ± 8*	80 ± 9*	60 ± 10
	HSV-1 + cyclophosphamide + Irradiation+Molixan	100 ± 5*#	100 ± 8*#	100 ± 8	100 ± 8*#
Ulcers	Irradiation	10 ± 10	20 ± 7	30 ± 8	10 ± 10
	Cyclophosphamide	10 ± 10	15 ± 6	20 ± 7	10 ± 8
	HSV-1+Cyclophosphamide + Irradiation +Molixan	30 ± 8	70 ± 8*	70 ± 8*	60 ± 8

Table 5.6. Effect of the Molixan on the frequency of clinical oropharyngeal syndrome manifestations in rats under the combined exposure of herpes viral factors, % (M ± m, n = 20)

Symptoms	Groups of experiments	Duration of study after irradiation, days			
		3	5	10	20
Inhibited motor activity	Cyclophosphamide+ HSV-1 + Irradiation	80 ± 5	100 ± 8	100 ± 8	100 ± 8
	HSV-1 + cyclophosphamide + Irradiation + Molixan	20 ± 8*	40 ± 8*	50 ± 4*	40 ± 10*
Reduced food excitability	HSV-1 + cyclophosphamide + Irradiation	100 ± 7	100 ± 5	100 ± 8	100 ± 5
	HSV-1 + cyclophosphamide + Irradiation + Molixan	25 ± 4*	40 ± 5*	40 ± 8*[*]	30 ± 7*
Reduced food	HSV-1 + cyclophosphamide +	100 ± 6	100 ± 5	100 ± 8	100 ± 5

excitability	Irradiation				
	HSV-1 + cyclophosphamide + Irradiation + Molixan	20 ± 7*	40 ± 6*	50 ± 5*	40 ± 9*
Petechiae	HSV-1 + cyclophosphamide + Irradiation	100 ± 6	100 ± 9	100 ± 8	80 ± 7
	HSV-1 + cyclophosphamide + Irradiation + Molixan	50 ± 5*	50 ± 7*	40 ± 6*	30 ± 4*
Erosions	HSV-1 + cyclophosphamide + Irradiation	80 ± 5	100 ± 5	100 ± 8	100 ± 5
	HSV-1 + cyclophosphamide + Irradiation + Molixan	40 ± 8*	50 ± 6*	50 ± 10*	40 ± 5*
Focal and confluent epitheliitis	HSV-1 + cyclophosphamide + Irradiation	100 ± 5	100 ± 8	100 ± 8	100 ± 8
	HSV-1 + cyclophosphamide + Irradiation + Molixan	20 ± 7*	30 ± 5*	20 ± 4*	20 ± 3*
Ulcers	HSV-1 + cyclophosphamide + Irradiation	80 ± 5	100 ± 8	100 ± 8	100 ± 8
	HSV-1 + cyclophosphamide + Irradiation + Molixan	20 ± 7*	30 ± 8*	40 ± 8*	40 ± 8*

* $p < 0,05$ – compared to the group «HSV-1 + cyclophosphamide + Irradiation».

The data in Table 5.6 testify that the use of Na_2GCGI promotes a 2-3-fold reduction in the OS (oropharyngeal syndrome) incidence in animals exposed to the combined effects of the chemotherapy damaging factors and an infectious (herpesvirus) agent. Thus, on the 3rd day of observation, inhibited motor activity and food excitability was revealed in only 20-25% individuals treated with Na_2GCGI, while 80-100% in the control group. The oral mucositis in the form of erosive-ulcerative epitheliitis occurred in animals of the experimental group 3-4 times less often than that in the control group. Such dynamics persisted throughout the entire observation period. One should note that the preventive use of Na_2GCGI reduced the severity of OS clinical manifestations and helped all animals in the experimental group to survive, with 40% death in the control group.

According to the literature sources herpes virus infection caused by HSV-1 results in the dysfunctions of immunoreactivity systems that are secondary as a rule and those dysfunctions are one of the leading links in the pathogenesis of this disease [18, 20, 73, 74]. In conditions of secondary immunodeficiencies caused by the combined effect of herpes virus, chemical and radiation damaging factors on the body, the OS clinical manifestations are based on functional disorganization of

immunoreactivity systems, the most significant manifestation of which there is a decline of innate immunity, in particular, inhibition of the synthesis of antimicrobial peptides (difensins and cathelicidins) [48, 73, 86, 187, 240].

Of immune modulators diphensins HNP-1, -2, and -3 stimulate the production of tumor necrosis factor alpha (TNF-α) and interleukin-1 (IL-1) in human monocytes activated by bacteria [210]. Moreover, the antimicrobial peptides HNP-1 and -2 are capable of killing directly gram-negative and gram-positive bacteria [210, 223, 240] fungi Candida albicans [210, 274], as well as enveloped viruses, in particular, representatives of the Herpes family [236, 274]. It is particularly important, since in the pathogenesis of stomatitis, the decisive role belongs to the activation of conditionally pathogenic microflora, in particular candida, as well as stimulation of inflammatory processes and inhibition of proliferative processes in the oral mucosa [240].

One can associate the positive preventive effect of the immunomodulator Na_2GCGI with the immunotropic effect of that drug, namely, with its restoration abilities in emerging immunocompromising conditions during the development of herpesvirus infection. In addition, it is possible that the drug may normalize the synthesis of antimicrobial peptides with subsequent restoration of the microbiocinosis balance in the irradiated oral mucosa and activation of reparative processes. The demonstrated Na_2GCGI efficiency can serve as an evidence of herpesvirus infection important role in the formation of radiation-induced OS.

5.3. The effect of Molixan on oral microbiocenosis after combined exposure

The performed researches have shown that the development of experimental oral mucositis under combined exposure was accompanied by a significant rise in microbial contamination of the oral mucosa (Table 5.7).

Table 5.7. The effect of Molixan on the oral mucosa microflora spectrum in rats subjected to combined chemoradiotherapy ($M \pm m_x$)

Types of microorganisms	Amount of microorganisms detected on the oral mucosa of rats before and after radiation and chemoradiotherapy, lg KOE		
	before exposure (intact animals)	cisplatin + Irradiation	cisplatin + Irradiation + Molixan
α- hemolytic streptococcus	Not identifiable	4,1±0,2*	2,9±0,2*#
β- hemolytic streptococcus	2,4±0,25	6,5±0,3*	2,5±0,1*#
Non-hemolytic streptococcus	1,9±0,1	5,6±0,2*	2,4±0,2*#
Staphylococcus	2,0±0,1	6,2±0,2*	2,1±0,2*#
Enterobacteriaceae	70 cells in a swab/sample	4,8±0,2*	2,7±0,2*#
Candida (*Candida albicans* and *Candida glabrata*)	Not identifiable	5,4±0,2*	1,8±0,1*#
Anaerobes	60-80 cells in a swab/sample	4,4±0,2*	2,6±0,2*#

* compared to the group "before exposure (intact animals)", $p \leq 0,05$.
# compared to the group «cisplatin + Irradiation», $p \leq 0,05$.

Noteworthy is the fact that the greatest growth (more than 5 times) was detected in candida. The fungi Candida albicans and Candida glabrata were sown in almost all animals subjected to combined chemoradiotherapy.

After Molixan-based treatment, the number of anaerobes in the animals' mouths decreased by an average of 1.7 times. In 60% cases, the number of enterobacteria colonies decreased by 1.6 times. In 40% of animals treated with Molixan, a 2.2-fold reduction in the number of non-hemolytic streptococcus colonies was detected. In 55% cases, Molixan reduced in the number of candida, the number of colonies of which decreased by an average of 3 times.

The obtained data on Molixan effect on the growth of rat oral mucosa microflora allowed assuming antimicrobial activity of the drug under study has, the results are shown in Table 5.8.

Table 5.8. Assessment of Molixan's proprietary antimicrobial activity on a model of the gram-positive and gram-negative microorganism vegetative form

Drug under assessment	Drug concentration in sample, μg/ml						
	1000	800	400	200	50	25	12,5
Staphylococcus aureus							
Molixan	–	–	–	+	+	+	+
Saline	+	+	+	+	+	+	+
Escherichia coli							
Molixan	–	–	–	+	+	+	+
Saline	+	+	+	+	+	+	+
Salmonella typhymurium							
Molixan	–	–	–	+	+	+	+
Saline	+	+	+	+	+	+	+

+ Growth of the test microorganism in the sample available.
–Missing growth of the test microorganism in the sample.

The obtained data indicate that Molixan displays antimicrobial activity against staphylococci, Escherichia and salmonella only in concentrations of 400 μg/ml and higher [3, 168].

Thus, Molixan is able to stimulate endogenous antimicrobial immunity factors that normalize microflora [39, 41, 103, 155].

The level of sIgA largely determines the restoration of microbiocenosis, and in particular the reduction in the severity of oral mucosa candidiasis, that is associated with the aggregation of candida and the suppression of their adhesion to epithelial cells [4, 115, 116, 151, 160, 164, 188]. One should note that candida is able to resist the action of sIgA [264].

Molixan is a combination drug containing peptide and nucleoside components [280]. Oxidized glutathione has an effect on on the sulfhydryl groups of molecules resulting in a restoration of the disulfide bond, a change in conformation and, as a consequence, normalized functional activity of the secretory immunoglobulin molecule sIgA and IgA, as well as cationic antimicrobial peptides [4, 116, 118, 280].

CHAPTER 6. UP-TO-DATE CONCEPT OF THE NATIONAL DENTAL DISEASES PREVENTION PROGRAM

6.1 Basic provisions for the development and implementation of dental disease national prevention program

The elements of the National Preventive Program for Individuals are:

➢ the practical efficiency of two-component fluoride varnish in the comprehensive prevention of dental caries that is used in the following situations, thereby determining the basic directions of preventive programs:

- in general practice of prevention of major dental diseases:
- preservation of milk teeth until permanent teeth appear;
- in the prevention of caries in children, adolescents and adults;
- when fissures change color;
- preservation of falling out temporary teeth, when permanent teeth are displaced (anomaly position of permanent teeth);
- during orthodontic treatment and upon its completion:
- with various orthodontic structures, both removable and non-removable;
- after removal of temporary crowns;
- after removal of braces;
- after "intensive" polishing (or extensive grinding) of tooth crowns;
- during orthopedic treatment:
- after tooth preparation;
- with sensitive surfaces of tooth crowns, particularly in the cervical area;
- after grinding or filing down the chewing surfaces of the teeth to correct the occlusion (after selective grinding);
- in conservative dentistry:
- after polishing newly placed fillings, restorations and adjacent enamel;

- after using (applying) the etch technique (composite restorations, fissure sealing), i.e. after using the etching technique (composite restorations, fissure sealing);

- in hypersensitivity therapy:

increased tooth sensitivity after or during orthopedic treatment;

- sensitivity associated with the use of removable dentures (partial abrasion of the natural tooth crown surface resulting from a regular contact with the clasp);

- after professional oral hygiene (removal of dental plaque and cleaning procedures);

- in case of tooth crown cervical area hypersensitivity;

- in case of hypersensitivity of teeth (cervical area, exposed roots of teeth) with progressing periodontal diseases.

- defective enamel:

- cracks in the enamel caused by injuries;

- abrasive damage to enamel/dentin/base cement due to poor oral hygiene; - defective (demineralized enamel).

➢ The group of sealants includes products intended for closing fissures on the chewing surfaces of teeth.

To optimize dental care practice and maintain proper dental health for children, we have developed a pattern for dental monitoring of children throughout childhood, it is presented in Figure 6.1.

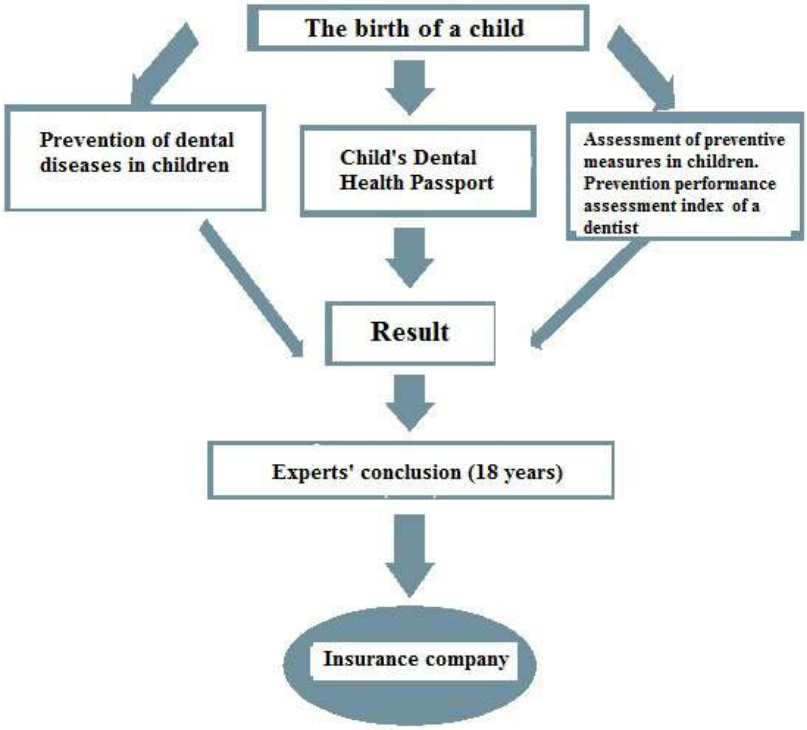


Figure 6.1. Child lifelong dental health monitoring pattern.

The given pattern clarifies the practice of issuing a "Passport of dental health of a child" in accordance with the staged child idividual dental prevention program recording all the activities and treatment procedures performed from the moment of the initial visit to the children's dental clinic or the children's department of the dental clinic. Concurrently with those activities, an assessment of the child's dental health is performed at various stages of his/her life using various diagnostic indices (such as hygiene indices, periodontal indices, etc.). Such monitoring is performed for 18 years, i.e. till adulthood.

All activities are based on the Polyprogram "Ten grades of dental prevention in children", which development and implementation started within the "Decade of Childhood" currently being held in the Russian Federation. "Child's dental passport": this document is a part of the compulsory medical insurance and after the child reaches 18 years of age, the insurance company identifies what type of dental

certificate to issue. It is determined by the quality of dental health and the implementation of all recommendations specified in the "Child's Dental Passport".

Based on the set goals and objectives for the implementation of the “Program”, we have developed:

“Ten grades of dental prevention in children":

☒ In pregnant women during pregnancy:

* 1st trimester of pregnancy

1.1. Dental instruction.

1.2. Maintaining calcium in the body.

1.3. Sanitation of the pregnant woman.

* 2nd trimester of pregnancy

2.1. Dental instruction.

2.2. Maintaining calcium in the body.

2.3. Sanitation of the pregnant woman.

* 3rd trimester of pregnancy

3.1. Dental education.

3.2. Maintaining calcium in the body.

3.3. Sanitation of the pregnant woman.

☒ 4. in newborns:

4.1. Prevention of microbial contamination in the mouth:

4.1.1. Treatment of the mouth with an antiseptic solution.

4.1.2. Teaching the newborn to take care of the mouth (removing food debris from the mouth after eating).

4.1.3. Hygienic treatment of the mouth (by parents using a finger brush).

4.2. Instructing parents.

4.3. Monitoring the condition of the mouth.

☒ 5. for children under 3 years of age:

5.1. Instructing parents.

5.2. Teaching the child personal hygiene.

5.3. Monitoring oral condition.

☒ 6. for children aged 4 to 6 years:

6.1. Educating parents and children and kindergarten teachers.

6.2. Teaching children personal hygiene.

6.3. Fissure sealing.

6.4. Oral sanitation.

6.5. Monitoring oral health.

☒ 7. for children aged 7 to 10 years:

7.1. Instructing children and teachers.

7.2. Teaching children personal hygiene.

7.3. Sealing.

7.4. Oral sanitation.

7.5. Coating teeth with fluoride varnish and gel.

7.6. Monitoring oral health.

☒ 8. for children aged 11 to 12 years:

8.1. Instructing children and teachers.

8.2. Teaching children personal hygiene.

8.3. Coating teeth with fluoride varnish and gel.

8.4. Monitoring oral health.

☒ 9. in adolescents from 13 to 14 years old:

9.1. Instructing teenagers.

9.2. Teaching children personal hygiene.

9.3. Sanitation.

9.4. Coating teeth with fluoride varnish and gel.

9.5. Monitoring oral health.

☒ 10. in adolescents from 15 to 18 years old:

10.1. Instructing teenagers.

10.2. Teaching children personal hygiene.

10.3. Oral sanitation.

10.4. Coating teeth with fluoride varnish and gel.

10.5. Monitoring oral health.

Considering the proposed prevention grades, it should start already during pregnancy and differ depending on its terms. In the 1st trimester of pregnancy, preventive measures are reduced to (1.1.) Dental instruction performed by dentists or dental hygienists in the antenatal clinic (the plan of those activities is approved by the head physician and chief physician). To implement this plan, books, posters, booklets, CDs, thematic cartoons specially developed in accordance with the upcoming topic of the lesson/lecture for pregnant women and literature and booklets reproduced for those purposes distributed among the participants of the event, are used. It is necessary to monitor the assimilation of the information received and its survival in women, targeting them at bearing a fetus and giving birth to a healthy child, and subsequent education considering sanitary and hygienic rules. The place where classes/lectures are held is supposed to be arranged following the topic of the upcoming lesson that creates a certain mood for the assimilation of the learning material. To achieve the above purpose, thematic posters, booklets, phantoms and simulators are used demonstrating what happens to the fetus during different periods of pregnancy and how those changes affect the formation of the rudiments of the dental area and their subsequent development. Understanding those processes simplifies understanding for a pregnant woman the role and importance of preventive measures.

For the correct formation of the skeletal system of the future child, including the dental system, a sufficient amount of calcium entering the body of the pregnant woman is necessary, through the consumption of calcium drugs that provide for the needs of the developing body of the fetus and maintaining the health of the mother, for this it is necessary to monitor (1.2.) Maintaining the level of calcium in the body.

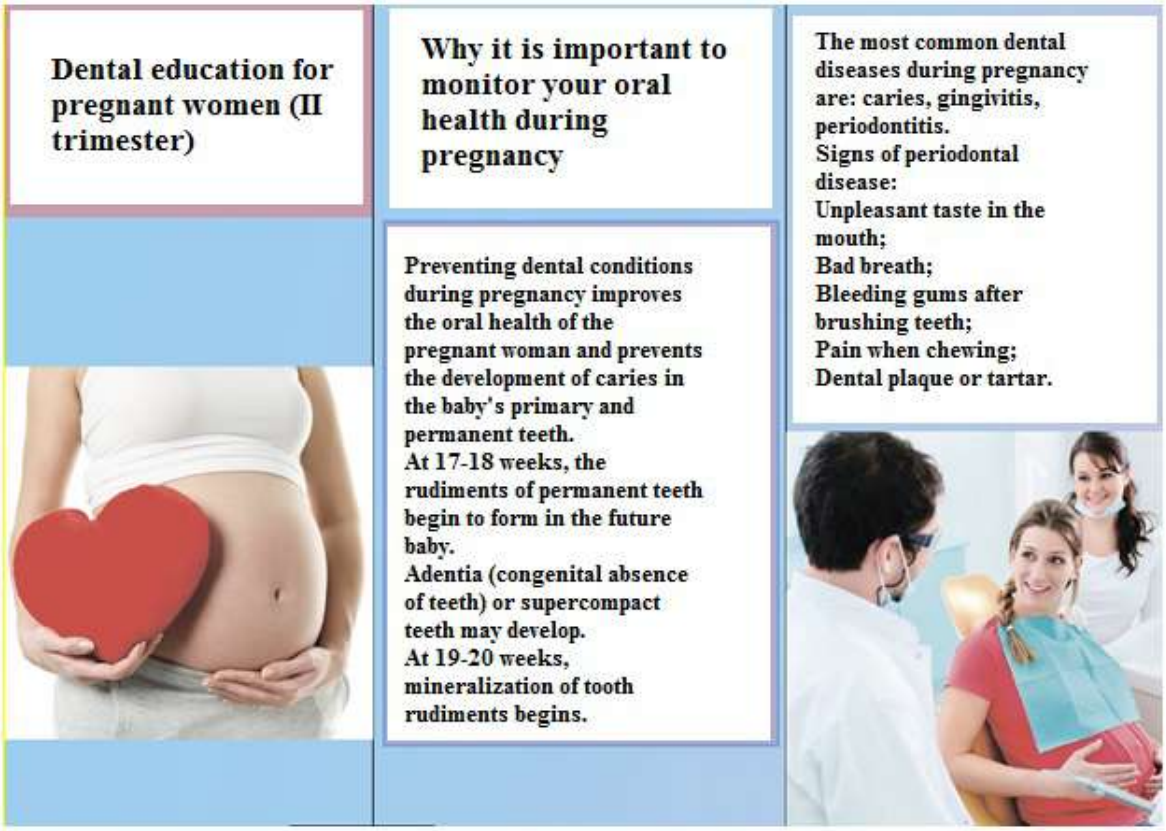
No less important is the preparation of the pregnant woman herself for bearing the fetus and the subsequent birth of the child. To achieve it an important role is played by timely (1.3.) sanitation of the pregnant woman, with subsequent monitoring her dental health and timely sanitation of emerging foci of the pathological process. Thus, the place where dental care is provided to pregnant women is of great importance. It seems to us that after the liquidation of dental offices in antenatal clinics, it will be easier and cheaper to ensure a "department for pregnant women" in existing dental clinics. Moreover, it is important that this department is located next to the children's department, so that from the beginning, the expectant mother understands where, when and why she should bring her child in order to maintain his dental health. In this situation, it will be easier to conduct dental education for pregnant women, mothers and children. Then we will not be limited to women's consultations that will significantly expand the education and instruction opportunities for that population.

Each stage of pregnancy has its own peculiarities, so in the 2nd trimester of pregnancy there are its own peculiarities in (2.1.) Dental instruction. To implement it, appropriate books, posters, booklets, CDs, thematic cartoons are required, specially developed with regard to the upcoming topic of the lesson/lecture for pregnant women and literature and booklets reproduced to meet those purposes that are distributed to the participants of the event. It is necessary to monitor the assimilation of the information received and its survival in women, targeting them at bearing a fetus and giving birth to a healthy child, and subsequent education with regard to sanitary and hygienic rules.

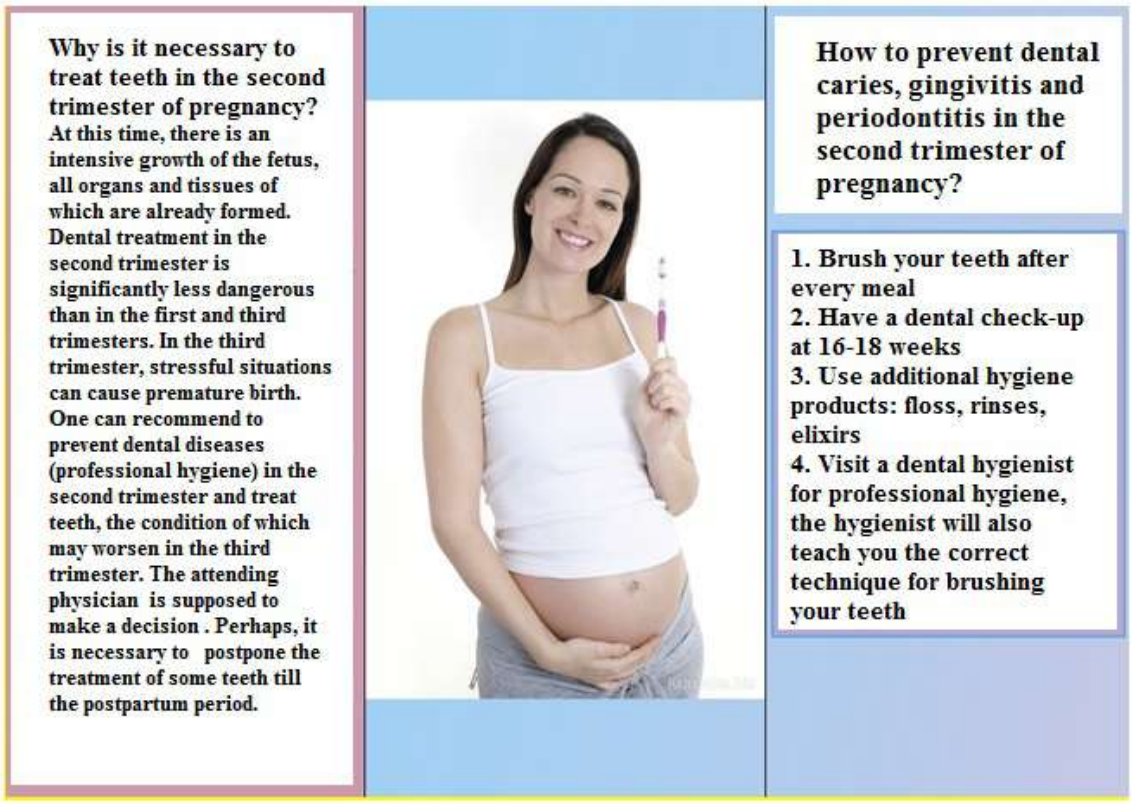
In the second trimester, the dental system begins to form, which requires an increased intake of calcium preparations, which determines the need for monitoring (2.2.) the level of calcium in the body.

Timely (2.3.) Sanitation of the mouth of a pregnant woman will ensure the safety of her teeth and gums, or reduce to a minimum such conditions as gingivitis of pregnancy, increased bleeding of the gums. In addition, timely sanitation of the mouth at the beginning of pregnancy will significantly reduce the need for dental care

in pregnant woman in the second trimester. In addition, this will strengthen the psychological state of the pregnant woman, as it will eliminate excessive psychological trauma and stress associated with serious dental treatment. In addition, pregnancy itself puts certain restrictions on the dentist in the treatment and methods of examination and diagnosis, sometimes not in favor of the pregnant woman. Those factors are to be communicated to women at the pre-conception level in order to ensure the timely readiness of the woman's body for the successful course of pregnancy.



6.2.



6.3.

Figures 6.2. and 6.3. Sample. A brochure for pregnant women in the second trimester with recommendations on preventing dental problems during that period of pregnancy.

The final 3 trimester of pregnancy plays a very important role in carrying a fetus, any stress can result in a miscarriage or unwanted termination of pregnancy. At this stage of pregnancy, as part of (3.1.) dental education activities, it is necessary to begin preparing a woman in two directions: 1. Restoring the lost calcium and other element reserves by her body, in order to restore the condition of the woman's body after childbirth; 2. Teaching the expectant mother to care for the mouth of the newborn.

At this stage of pregnancy, the greatest rise in calcium loss by the mother's body is observed resulting from fetal development and a growing need for micro and macroelements for body growth. Therefore, there is a need for (3.2.) maintaining calcium in the body. The condition and need of a pregnant woman for (3.3.) oral sanitation depends on the entire course of pregnancy and the condition of the dental

system. In case of initial "dental" readiness of the woman's body for pregnancy, the need for dental treatment in the third trimester will be minimal, and on the contrary, a low level of dental health at the beginning of pregnancy and insufficient consumption of vitamin-mineral complexes throughout the pregnancy will result in an extremely severe condition of the teeth and gums, up to acidic dissolution of the crown parts of the teeth and as a result of uncompensated consumption of mineral components by the fetus from the mother's body. After the birth of the child, the fourth stage of preventive measures (4.) in newborns begins including (4.1.) prevention of microbial contamination in the mouth that includes the prevention of microbial invasion through contacts with relatives (kisses of parents, feeding with a spoon after its "licking" by parents or grandmothers, etc.) inevitably leading to significant seeding of the oral cavity of the newborn with microflora that can cause the onset and development of various pathological conditions in the child's mouth, from thrush to more serious conditions. Microbes build up an ecosystem in the human mouth that colonizes both the hard surfaces of the teeth and the soft tissues. When this ecosystem is balanced health usually prevails. However, poor oral hygiene, unbalanced diet, tobacco use, stress and other factors can result in an imbalance, a condition called dysbiosis, with corresponding harmful health consequences [150, 160, 167, 169].

To fight pathological microbiota, it is necessary to leverage (4.1.1.) antiseptic mouth treatment, but one should perform that procedure only in cases of severe dysbiosis or suspected primary microbial invasion. An important preventive measure is (4.1.2.) Teaching a newborn to take care of his mouth (removing food debris, mucus from the mouth after eating). Parents should perform that procedure immediately after the birth of the child, using a latex finger brush or a soft terry cloth soaked in warm boiled water. The purpose of this procedure is to remove food debris and mucus remaining after eating and accumulated between the mucous folds, and it also teaches the child to the hygienic procedure itself. As a result, when switching to a toothbrush, the child will not have any irritating factors, and the change of hygiene product will be painless and calm. The child will perceive this procedure as a natural part of the hygiene and food ritual. The (4.1.3.) Hygienic treatment of the mouth

itself is performed by parents using a finger brush. To achieve it it is necessary to practice (4.2.) Dental Instruction of Parents involving a variety of information materials - books deliberately written for this purpose, posters, booklets, memos, CDs, special cartoons, games. When instructing parents, it is necessary to demonstrate all the approaches that they should use when teaching newborns. The meaning of the event is to educate the child through training parents. In order to achieve a real effect from the performed activities, it is necessary for parents to conduct constant (4.3.) monitoring of the mouth condition. One should instruct parents to pay attention to the changing condition of the oral mucosa by dental hygienists or dentists, or representatives of the home care service at each visit to the child through dental education. Figure 6.3. A poster for dental education of children is presented and tells about the structure of teeth.

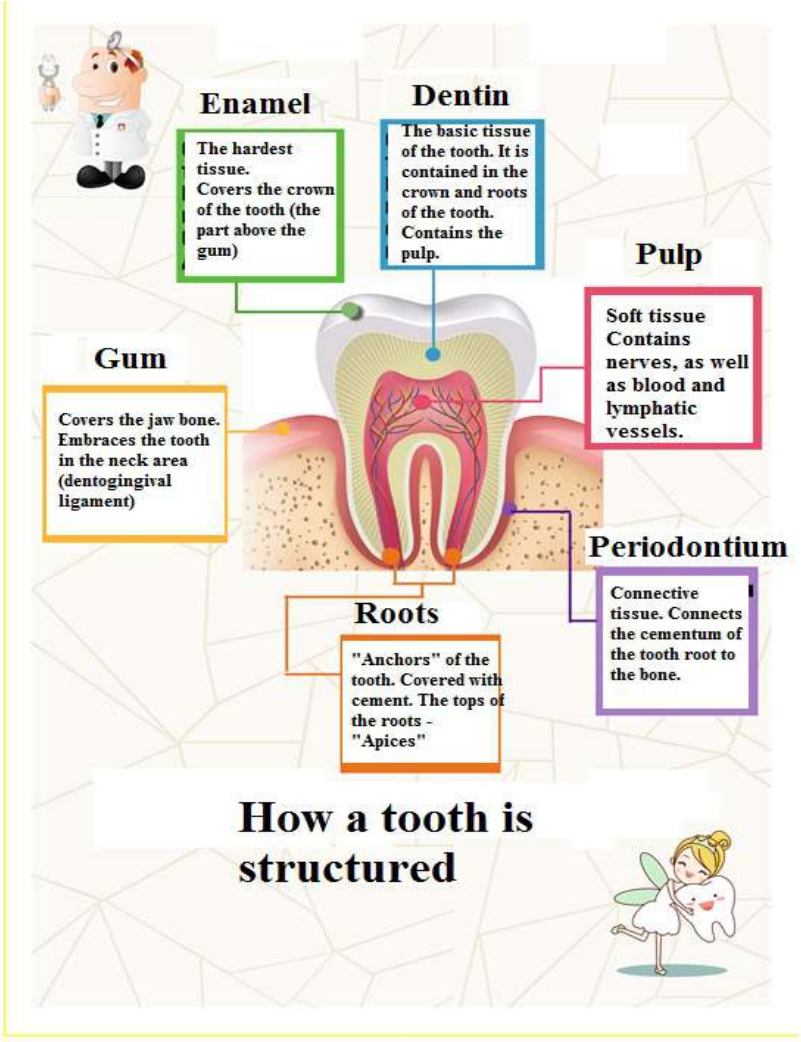


Figure 6.3. Sample. Poster for children - "The structure of teeth".

The next stage is the implementation of preventive measures (5.) for children aged under 3 years including instructing parents during each home visit to the pediatric service staff and subsequently during preventive visits to the children's clinic by parents. To implement it it is necessary to prepare a teaching aid for home care workers and children's clinic staff on dental preventive measures that they have to teach parents as part of their professional activities. It will provide a standard for the information that they will provide to parents. In addition, this manual will eliminate arbitrary information that home care workers can give out in order to eliminate misunderstandings that arise in those matters due to a lack of information.

(5.1.) Instruction of parents includes teaching the child's mother hygienic care of his mouth and control of nasal breathing.

(5.2.) Teaching the child personal hygiene including a story on the feeding schedule, risk factors for dental caries (sweet water in a drinking bottle, sweet juices between the child's main feedings). Teaching oral care using a silicone finger brush or a terry cloth soaked in warm boiled water to remove food debris and mucus from the folds of the oral mucosa. To achieve it it is necessary to use a teaching aid, posters, booklets and memos with relevant information for health workers and parents. The quality of oral hygiene in newborns and at three years of age differs. If it is initially perormed by parents, then at three years of age the child is taught to independently carry out the procedure being the supervised by parents. If parents teach the child oral hygiene from the moment of birth, then the transition from a finger brush to a toothbrush will be painless and easy. One should consider that at first the child is taught to brush his teeth with a brush without toothpaste.

(5.3.) Monitoring the oral condition. It is necessary to control the oral condition, prevent the development of candidiasis such as thrush and its timely treatment.

At this age (6.) children from 4 to 6 years old are supposed to use a soft-bristled toothbrush with fluoride-containing toothpaste. It is preferable to perform the oral hygiene procedure after each meal. At that age, parents continue to brush their teeth and teach the child the correct movements. The child develops skills gradually

by the age of 5, and after this age can brush his teeth independently. Parents should monitor the quality of brushing and, in some cases, demonstrate it to the child, explaining what mistakes he made. To achieve it parents themselves have to be able to correctly perform the oral hygiene procedure. To control the quality of tooth cleaning, one should apply dyes to indicate plaque allowing clear demonstration to the child his mistakes.

(6.1.) Instruction of parents and children and kindergarten teachers. It is a very important and complex issue, its complexity lies in the psychological conviction of parents and educators that they themselves have perfect hygiene skills and can teach their children without external help. However, experience and assessment of the level of hygiene knowledge of the adult population indicate the opposite, i.e. an extremely low level of hygiene knowledge and inability to properly carry out hygiene measures. Based on the above-mentioned practice when parents visit a children's clinic or a Children's Health Center, it is necessary to:

(6.1.1.) instruct parents in the rules of hygienic care of the mouth of their children;

(6.1.2.) tell about the benefits and role of fluoride-containing toothpastes, and select oral hygiene products;

(6.1.3.) tell about proper nutrition for children, focusing on taking dietary supplements with mineral components, taking into account the composition of drinking water in the region and the age of the child;

(6.1.4.) tell about nasal (nasopharynx) hygiene and prevention of oral breathing disorders.

(6.2.) Teaching the child personal hygiene. Children should be taught from the moment of birth, then there will be no problems with the transition to independent toothbrushing. The technique of brushing teeth at this age differs from the technique for adults. It is specially simplified and consists of three movements, so that it is easier for children to implement it, taking into account the difficulties in holding the brush and performing manipulations.

(6.3.) Fissure sealing is an effective manipulation that is performed immediately after the eruption of the first molar and involves closing the fissures, and thereby eliminating the likelihood of the occurrence and development of fissure caries (this is the main type of dental caries at that age resulting from low mineralization of the fissures causing a rapid and easy development of caries in them).

(6.4.) Oral sanitation at this age implies the absence of inflammation in the gums and the absence of carious cavities (primarily fissure caries) or their treatment with the placement of a filling.

(6.5.) Monitoring the oral condition involves constant monitoring the condition of hard dental tissues and identifying areas with demineralization. In those cases the demineralization areas are coated with fluoride varnish to compensate for the lost enamel minerals. Concurrently teeth are cleaned with fluoride-containing pastes and sodium fluoride tablets are prescribed orally.

(7.) Starting from age children aging 7 to 10 years old start "Mixed dentition" period, i.e. the time when permanent teeth begin to erupt, but temporary teeth are still retained. During this period, children have a non-fixed occlusion caused by the growth of the jaws and the eruption of the permanent teeth crowns. It is a very important period that determines the subsequent condition of the teeth (their degree of mineralization, location in the dental arch, type of occlusion, quality of mineralization and its resistance to acids (i.e. available / missing hydroxyapatite / hydroxyfluororapatite / fluorapatite). At that time, children go to school, their daily routine changes, the daily workload changes, their life gets more stressful resulting from various stressful situations arise motivating them to somehow get out. And adults are supposed to tell them how to get out.

(7.1.) Instructing children and teachers. Changes in the maxillofacial region entails changes in the size of the teeth, jaws, nutrition, the need for vitamin and mineral complexes, methods and means of oral care. To achieve it it is necessary to conduct classes with children covering various topics following the intensive development of their body. It is also necessary to prepare teachers to conduct

conversations and classes with children on the topics of growing body-associated changes inevitably affecting their condition.

(7.2.) Teaching personal hygiene to the child. Children of that age perform oral hygiene independently in the morning and evening at home under the periodic supervision of their parents and during the day at school under the supervision of the class teacher or paramedical personnel. Children's toothbrushes are supposed have soft bristles so as not to disrupt the mineralization processes in the maturing enamel of erupting permanent teeth. The brush field should be multi-level to maximally cover the protruding crown of the tooth, the head of the brush should be no larger than 1.5-2 teeth, thus, ensuring its maximum maneuverability in the mouth. The handle of the brush should be large and voluminous to provide good holding of the brush and its manipulation during brushing. The maximum contact area of the brush field with the surface of the tooth crown ensures the most effective cleaning of the tooth surfaces. A small amount of toothpaste the size of a pea is applied to the brush field. The paste should contain fluoride components ensuring the formation of a protective layer on the surface of the tooth crown due to CaF2, this layer is unstable and quickly deteriorates. Therefore, constant replenishment of mineral components that ensure those processes is required. The recommended content of fluoride ion in toothpaste amounts to 1000-1500 ppm.

From the moment of eruption of molars and premolars, it is necessary to perform (7.3.) sealing dental fissures. It is even more important because the enamel in those areas has not yet mineralized and requires protection from the effects of acids secreted by acid-producing microorganisms that accumulate in hard-to-reach places on the surfaces of teeth, which primarily include fissures.

(7.4.) Oral sanitation. This is a very important dental procedure that is performed by a pediatric dentist in a dental office. First of all, it includes the treatment of dental caries. At that age fissures in the crowns of teeth are most often affected. Therefore, it is so important to seal them in a timely manner with sealants (composite materials used to close the grooves between the tubercles of the crown of the tooth).

(7.5.) Coating teeth with fluoride varnish and gel. Those procedures are performed by a dentist or dental hygienist to coat the lateral surfaces of the teeth, to stimulate remineralization processes and provide an anti-caries effect during tooth growth during the "Mixed dentition" period.

(7.6.) Monitoring the mouth condition. It is performed by parents at home to control the quality of hygienic procedures. At school, it is performed by a teacher or paramedical personnel. And during visits to the dental clinic, a pediatric dentist or dental hygienist evaluates the quality of oral hygiene during preventive examinations.

Over that period (8.) in children from 11 to 12 years old, the period of mixed dentition ends and the time of permanent dentition begins, and, consequently, it completes the formation of permanent occlusion. At that age pediatric dentists, dental hygienists and parents monitor the quality of dental health.

To meet that purpose, (8.1.) the instruction of children and teachers continues, but the program of educational classes changes consideringt the changes undergone by the child's body and environment. It is the starting point for drawing up programs, teaching methods, selecting products and nutrition.

(8.2.) Teaching the child's personal hygiene. At that age the main emphasis is made on local remedies using fluoride-containing toothpaste with a recommended fluoride content of 1000 - 1500 ppm (0.1 - 0.15%) fluoride ion. They should be combined with the use of fluoride-containing rinses as well. They should be used during the day, after daytime snacks and meals, in the form of "passive" rinses, i.e. there is practically no movement of the liquid, it is slightly shaken so that it is not washed out, but on the contrary, so that contact with the surface layers of the enamel of the tooth crowns occurs.

(8.3.) Coating teeth with fluoride varnish and gel. By that age, all fissures on premolars and molars should be sealed, and only minor correction may be required to restore fragments and other sealant defects. Therefore, to prevent the development of caries in other areas of the tooth crown, it is necessary to resort to the use of fluoride varnish and fluoride gel for application to the teeth or for applications in mouth guards.

(8.4.) Monitoring oral health. Dentists and dental hygienists should monitor the quality of dental health during preventive annual examinations or during children's interim visits for dental care.

Within that period when (9.) adolescents aged 13 to 14 years begin to experience changes in hormonal levels affecting all organs and tissues of the body, as well as the condition of the organs and tissues of the mouth. The abrupt restructuring of the body results in a more intense need for calcium, fluorine, phosphorus, and other micro and macroelements necessary for the rapidly growing body of a teenager.

(9.1.) Education of adolescents. At that age it is necessary to explain to teenagers not only how to brush their teeth that they should have learned in previous years, but to explain the negative impact on the body of smoking, drugs, poor nutrition, injuries as well that one can find on the face and in the dental area when using scooters, skateboards, unicycles and other modern devices used for transportation. The difficulty of education lies in the confidence of young people that they know better what and how to do. It results in a growing number of injuries and diseases, including infectious ones, since teenagers stop observing personal hygiene, including hand washing. Instruction utilizes "playing" on the teenager's pride.

(9.2.) Teaching personal hygiene to teenagers. It lies more in the difficulties of performing hygienic procedures resulting from various removable and non-removable orthodontic devices, most often in the form of braces. A large number of locks, connections, arches and other elements contribute to the intensive accumulation and growth of soft dental deposits. The fight against biofilm is an important and complex factor contributing to demineralization, and, consequently, the quality of brace fixation that is likely to fall off with part of the demineralized enamel to which it is fixed.

(9.3.) Sanitation. It is supposed to be performed regularly, since at this age the carious destruction of teeth is very intensive.

(9.4.) Coating teeth with fluoride varnish and gel. The procedure is necessary and important, particularly with growth and orthodontic treatment.

(9.5.) Monitoring of teenager's mouth should be performed regularly in order to provide timely assistance.

In order to implement the prevention program for children of primary and secondary school age, it is necessary to provide necessary instruction for dentists and dental hygienists involved in the program to update their knowledge and skills. Lectures and manuals for school teachers on methods and means of preventing dental caries and periodontal diseases in school-age children as part of the school curriculum aimed at instilling healthy habits in children and instilling the need in them to maintain a healthy lifestyle and dental health. Teaching schoolchildren at a dentist's or dental hygienist's appointment on the rules of oral care, selection of the necessary means and methods of hygienic manipulations. Teaching schoolchildren's parents at school and at a dentist's and/or dental hygienist's appointment. Individual preventive measures are discussed during an appointment with a dentist or dental hygienist. For these purposes, it is necessary to use teaching aids, textbooks, booklets and posters for schoolchildren, school teachers, parents and medical personnel involved in the program.

Another, rather complicated period starts (10.) in teenagers from 15 to 18 years, associated with hormonal changes in the body and the period of growth. Those conditions, as well as external environment, the teenager's perception of the external world in perticular, play an important role in the formation of the teenager.

That process affects the way the teenager perceives the information during (10.1.) instruction of teenagers. It reflects the current hygienic practice within the teenager formation as an adult.

(10.2.) Teaching personal hygiene to a teenager. The hygienic procedure is performed independently at least twice a day (morning and evening, after meals) using toothbrushes with soft (at 15-16 years) and medium hardness (17-18 years) bristles using fluoride-containing toothpaste (1500 - 2800 ppm) during the day using rinses and foams. Over that period it is necessary to select and use floss (dental thread) and superfloss, interdental brushes, toothpicks that is determined by the dental, hygienic and orthodontic status of young people. Dentists and dental

hygienists register the dental status that serves as a basis to correct hygienic skills using controlled tooth brushing, select a complete set of oral hygiene products to be practiced in an individual hygiene program. Hygienic education of adolescents with orthopedic structures and orthodontic devices is particularly emphasized.

The timely regular implementation of (10.3.) oral sanitation is an integral part of maintaining dental health.

If necessary it is implemented in (10.4.) coating of teeth with fluoride varnish and gel in the areas of enamel demineralization.

Subsequently, the dentist and dental hygienist conduct (10.5.) monitoring of the oral condition during to identify the hygienic indices (Green-Vermillion), periodontal (RMA), and the intensity of dental caries according to the CRS index. To consolidate the acquired knowledge they use brochures and manuals on nutrition, hygiene measures, and bad habits.

The activities for implementing the program for young people include the following: 1. Training performed at a dentist and/or dental hygienist appointment that should include oral hygiene level monitoring, the ability and observance of the rules for brushing teeth, selection of fluoride-containing toothpaste, and consultations on healthy eating. 2. Conducting professional oral hygiene and drawing up an "Individual Hygiene Program for the Prevention of Dental Diseases". To meet that goal one should use educational and methodological manuals and brochures, visual posters and booklets on hygiene and the selection of oral care products (models of jaws, toothbrushes and pastes).

6.2. Staffing

Dentists and mid-level medical personnel participate in the implementation of the "National Preventive Program with Individual Action Focus" at the local level. Administrative personnel at all levels (federation, republic, territory, region, city, district, village):

- issuing orders, instructions, guidelines, and instructional materials on organizing a prevention program;

- creating the necessary conditions for implementing the planned activities within the program at the appropriate level;
- material and technical support for the program.

Ministry of Health of the Russian Federation:

- performes general management of the preventive program,
- identifies the regional need for preventive drugs,
- collects results and generally monitors the situation,
- basing on the results obtained identifies the need for funding and personnel for a subsequent periods of of the preventive program implementation,
- summarizes the results of the all-Russian preventive program to reduce the prevalence of dental caries among the child and adolescent population of the country and identifies the opportunities and needs to expand the implementation of the program among the population of the country,
- identifies the prospects for further implementation of the preventive program based on the results obtained,
- performs general management of the preventive program implementation in the regions.

Local health boards distribute the received preventive means among the participants of this program, who are under their control:

- state children's dental clinics,
- state dental clinics for adults, serving the adolescent and child population (children's dental departments),
- state general somatic clinics, which have dental departments,
- state children's clinics, which have dental departments;
- state children's dental clinics,
- dental offices operating in schools, orphanages, enterprises, and those belonging to state district dental clinics.

The local health board of the Government (Administration) of the city/region/region supervises the implementation and practice of the preventive program. The received

data is processed by the chief regional expert (Chief Dentist of the health board, Chief Dentist of the health board for children):

1. monitoring dental morbidity in the region's population;
2. studying the efficiency of prevention programs' implementation and, if indicated, adjusting the distribution of preventive measures;
3. coordinating the work of dental clinics, children's dental clinics, departments and offices;
4. collecting the results of the preventive program and summing up the intermediate results at the intermediate stages of program implementation;
5. monitoring and assisting in the distribution of preventive measures in the region between dental treatment institutions.

The dentist is a core executive of the program. He decides to whom of the patients, and when it is necessary to perform fissure sealing and fluoride varnish coating of teeth, he identifies the conditions and indications for the implementation of the individual component of the prevention program, as they depend on the individual dental, hygienic, periodontal, orthopedic, orthodontic and surgical status of each specific patient. It is those conditions that determine the frequency of sessions, the amount of drugs spent.

Dentists, dental surgeons and dental hygienists:

- practical implementation of preventive measures in compliance with the program;
- holding discussions and seminars with teachers and instructors of preschool institutions on the implementation of preventive measures.

Dental hygienist – ensures preparatory work, conducting explanatory and popularizing sanitary and educational work with patients, prepares teeth for the necessary procedures by teaching patients hygiene skills and supervised cleaning of teeth immediately before the preventive procedure. The hygienist can independently, but under the supervision of a dentist, perform special preventive procedures, such as applying fluoride varnish to teeth, rinsing the mouth with fluoride solutions.

Nursing and non-dental staff:

- practical implementation of preventive measures under the supervision of a doctor.

Nurses – perform auxiliary functions, assisting the dentist and/or dental hygienist to perform preventive procedures.

Teaching staff of dental department and researchers:

- organizing and conducting epidemiological studies to assess the efficiency of the prevention program.

6.3. Material support

To implement the "National Comprehensive Program for the Prevention of Dental Diseases in Children and Adolescents", it is necessary to prepare:

- health education materials,
- medications,
- oral hygiene products.

The "National Comprehensive Program for the Prevention of Dental Diseases in Children and Adolescents" is a long-term program, therefore, the calculations of materials are performed for the entire period of the planned program, for the next decade within the "Decade of Childhood" National Project for a decade and for the first two years of the program implementation.

The positive aspect of the "National Comprehensive Program for the Prevention of Dental Diseases in Children and Adolescents" is the fact that during its implementation, it is possible to expand or narrow the scale of the activities perormed. This circumstance is dictated precisely by the individual focus of the program.

One can implement the “National Program for the Prevention of Dental Diseases with an Individual Approach” both in state medical institutions and in commercial medical institutions, since it is equally beneficial and easy to implement by institutions of all types of ownership.

6.4. Information support

It is advisable to implement a computer information system for monitoring the dental status of the population participating in the "National Comprehensive Program

for the Prevention of Dental Diseases in Children and Adolescents" to assess the efficiency of the prevention program. In cases where it is difficult to use computer equipment, particularly in rural areas and areas outlying from the center, paper information carriers can be used.

If the amount of information is small, it can be processed manually. One should conduct dental examinations of the population using a uniform methodology in order to ensure the continuity of the information received and its comparability. Specialists evaluating the implementation of the prevention program should be calibrated using uniform methods of examination and evaluation of results.

6.5. Program Efficiency Assessment

The efficiency assessment of the "National Comprehensive Program for the Prevention of Dental Diseases in Children and Adolescents" is developed at the planning stage. The evaluation criteria must be objective and measurable. Those criteria allow evaluating the final results of the preventive program. They can also help determine the intermediate results of the implementation of the preventive program as a whole or its individual components.

According to the World Health Organization (1984), the percentage of caries reduction from the use of fluoride applications (fluoride varnish) locally, professionally 2 times a year in childhood and adolescence, the percentage of caries reduction is 30-40%, and when sealing fissures with sealants in the period from 6 to 13 years, the percentage of caries reduction reaches 90%

The main evaluation criteria used in dentistry to determine the results of program implementation among the population are the following indicators:

- intensity of dental caries вуаштув by indices CSE_{teeth}, $cs_{зубов}$, $cs_{поверхностей}$, $CSE_{sutfaces}$, CSE+cs $_{teeth}$, CSE+$cs_{surfaces}$;
- • quality of oral hygiene according to the Fedorov-Volodkina and Green-Vermillion hygiene indices;
- hygiene indices-based cleansing effect;
- prevalence of dental caries.

6.6. Economic feasibility of national comprehensive program implementation a for the prevention of dental diseases in children and adolescents

When the caries-preventive role of fluoride was discovered in the world, all developed countries start putting it widely to practice. And it started with the construction of expensive bulky fluoride installations and implementing mass fluoridation of water.

A.V. Alimsky (2007) noted that at present the introduction of individual caries prevention measures is the only correct approach considering the actual level of caries incidence in the child population.

K.N. Kosenko et al. (1984) emphasized that the results of two-year use of fluoride varnish allowed concluding that its wide implementation will significantly reduce the rapid growth in dental caries in children, and thereby reduce the cost of working time on their treatment and increase the volume of preventive work.

In recent years, there has been a steady decline in the number of dentists in Russia, despite the constant growth in graduation rates of young dentists from dental departments. It has fallen from 4.5 dentists per 10,000 population to 4.1 over the past seven years, while in such dentally prosperous countries as Sweden there are 8 dentists per 10,000 population, that rate exceeds almost twice that in Russia, and this while the prevalence and intensity of the main dental diseases (dental caries and periodontal disease) are significantly lower than those in Russia, by 2-3 times in some indicators. That situation results from higher priority given to treatment rather than to prevention. As a result, we witness a deterioration in the dental health of the country's population, despite the growth of dental clinics of all types of ownership. This situation is also worsened by the lack of any national preventive dental programs.

In current situation one should consider an inseparable relationship and interdependence between dental diseases and the general body somatic condition.
With gum diseases, the number of inflammatory mediators increases throughout the body leading to an exacerbation of endocrine diseases, particularly diabetes; the

condition of patients with cardiovascular diseases worsens; with pulmonary pathology, and all other systemic diseases. As a result of an unfavorable dental situation, premature births can occur and it does frequently.

Thus, the worse the condition of the oral cavity, the more severe the course of all other general diseases of the body will be. Therefore, if we do not sanitize the oral cavity, then all other measures for the prevention and treatment of systemic diseases will be ineffective or, at all, will not give any results.

Untreated dental caries is not as harmless as one may think:

- At the beginning, dental caries develops → once timely treatment is missing, it results in the nerve (pulp) inflammation → that can transform into the inflammation of the periodontium (tissues surronding the tooth) → and then a granuloma will form up → which will subsequently lead to the formation of a cyst → and it, in turn, to the formation of phlegmon → in this case, three scenarios for the further development of events are possible:

1. treatment - conservative and surgical;
2. sepsis of the body with a fatal outcome;
3. pus flowed from phlegmon into the pericardium resulting in death.

But, one can avoid all that closing the fissures of the teeth with sealants (sealants) in time or cover the teeth with fluoride varnish. But it has to be done regularly, with monitoring of the situation. It will cost less smultaneously saving people's teeth and their lives. And, with healthy teeth, the treatment of general somatic diseases will be cheaper and more effective.

There is international experience in calculating the economic effect (economic feasibility, economic benefit) of prevention programs.

Economic benefit (EB) is calculated by the formula:

$$EB = (CP \times NP \times T) / (Avr\ CSE \times NP \times T) \qquad (6.1)$$

where

CP – cost of procedure;

NP –number of people;

T – time;

Avr CSE – average index of prevented caries CSE.

Economic benefit (EB) is determined by finding the difference between the funds spent on the prevention program and the expected cost of treatment (ECT)::

$$EE = EB - CT \qquad (6.2)$$

The economic effect of the implementation of the "National Preventive Program with Individual Action Focus" is as follows:

1. reduced treatment costs;
2. reduced costs of medicines, filling materials;
3. reduced cost of a single visit;
4. reduced depreciation costs of equipment, devices and instruments;
5. reduced depreciation costs of medical instruments and devices;
6. reduced depreciation costs of medical instruments and devices in the treatment of uncomplicated and complicated forms of caries;
7. reduced labor costs of medical personnel;
8. reduced labor costs of service personnel;
9. reduced costs of renting premises calcualated per visit;
10. strengthening the dental health of the country growing population, and on its basis strengthening the health of the whole body;
11. the situation in question should increase the number of healthy conscripts, resulting from to the strengthening of general and dental health;
12. will gradually lead to the restructuring of dentistry and its transition to a prevention-based practice.

Thus, the quality of dental health of the population is an important national factor affecting the security of the country and the combat readiness of its armed forces, in particular, and the entire population as a whole.

6.7. Results of the regional prevention program implementation

The overwhelming majority of regional programs have been developed and some of them are being developed utilizing standard models (Figure 6.1).

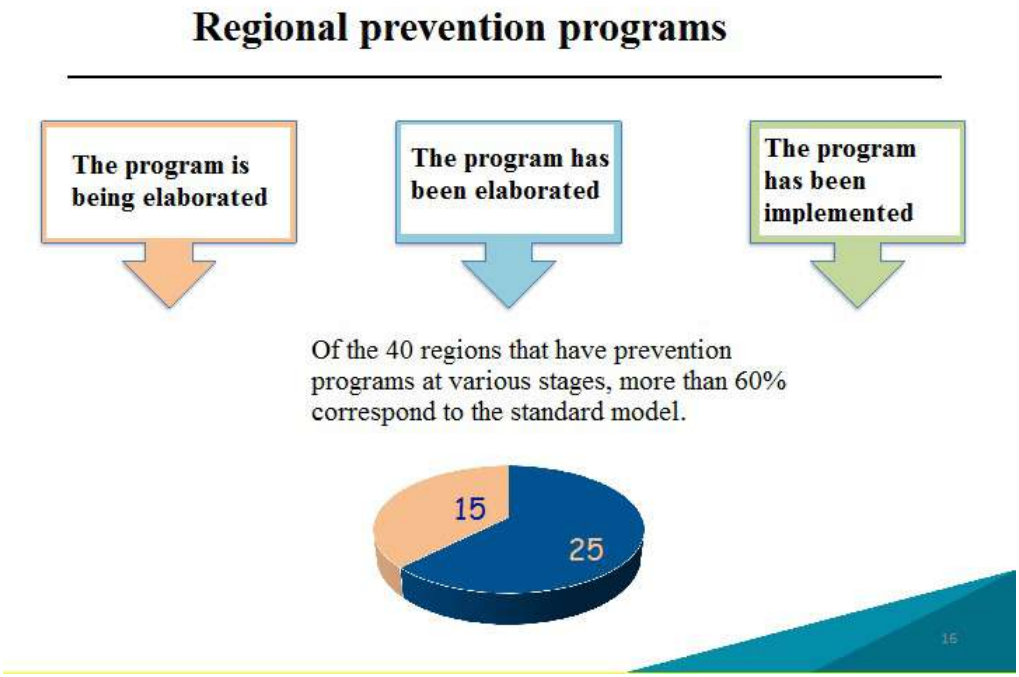


Figure 6.1. Distribution of stages of Regional prevention programs by different regions.

As one can see from Figure 6.1, out of forty regions that have prevention programs at different stages, more than 60% correspond to the standard model.

Figure 6.2 demonstrates the distribution of prevention programs by federal districts of Russia.

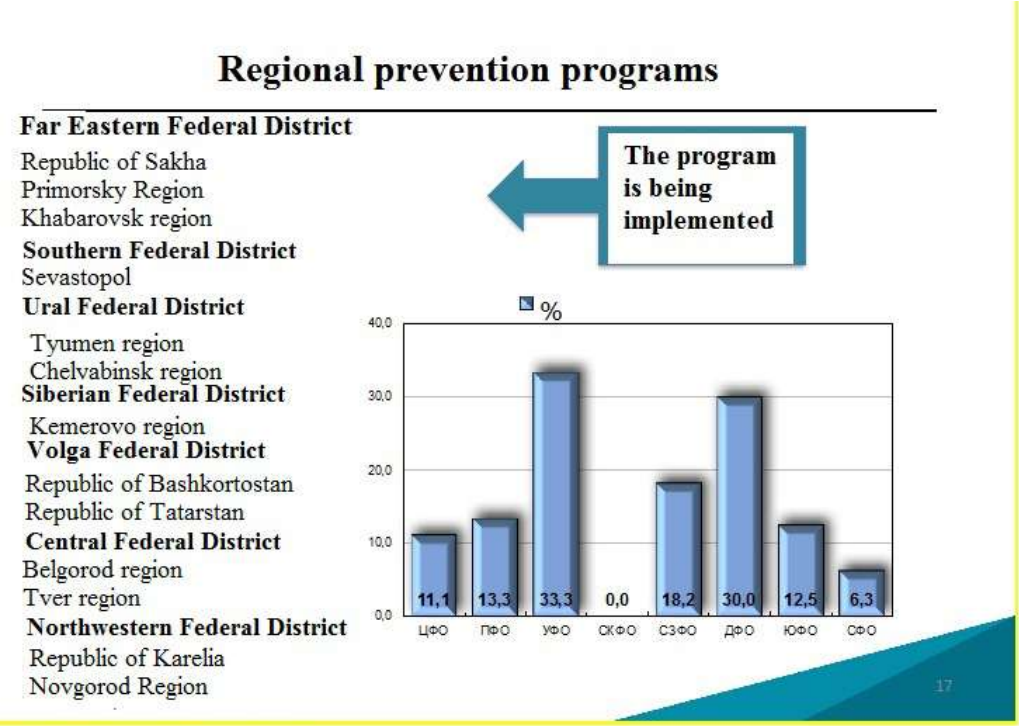


Figure 6.2. List of regions with prevention programs being implemented within the Federal Districts.

Thus, the main areas of organization of the regional program should include:

- creation of a system organizing the major dental diseases prevention using up-to-date technologies and ensuring the availability and quality of preventive measures;
- organization of the school dental service routine with the introduction of dental hygienists;
- dental medical examination;
- programs of sanitary (dental) education;
- improvement of the personnel training system focused on prevention.

All those activities should focus:

✓ formation of motivation to maintain dental health in 75% children and adolescents;

✓ rise in the coverage of preventive dental examinations in children as part of medical examinations to 90%;

✓ the percentage of children (5-6 years old) with healthy teeth will increase from 16 to 20%;

✓ the average CSE in children aged 12 will reach 2.3, in the adult population (35-44 years) it will rich stabilization point at 14.4;

✓ increase in the average number of sextants with healthy periodontium in children aged 15 to 5.0.

6.8. System of actions aimed to reduce dental diseases in children

Figure 6.3 illustrates the occurrence and development of the major dental diseases among children.

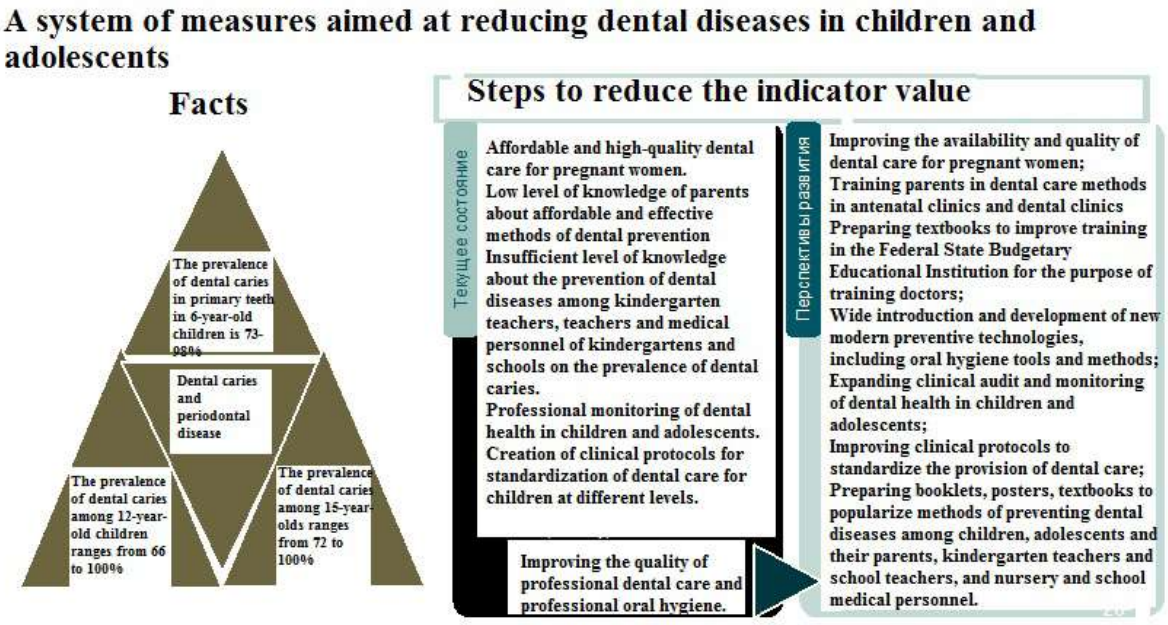


Figure 6.3. Range of activities to reduce dental morbidity in children and adolescents.

Those factors reflecting the prevalence of dental caries and periodontal diseases include:

• the prevalence of caries of primary teeth in 6-year-old children amounts to 73% - 98%;

• the prevalence of permanent teeth caries among 12-year-old children ranges from 66% - 94%;

• the prevalence of permanent teeth caries among 15-year-old adolescents ranges from 72% to 100%.

Considering indicators reflecting the current status one should demonstrate the following:

• affordable and high-quality dental care for pregnant women;

• poor knowledge of parents about affordable and effective methods of dental prevention in children;

• insufficient knowledge on the prevention of dental diseases among kindergarten teachers, school teachers, medical personnel of kindergartens and schools;

• lack of alertness among parents, educators, teachers and medical personnel of kindergartens and schools regarding the prevalence of dental caries;

• professional monitoring of dental health in children and adolescents;

• elaboration of clinical protocols to standardize dental care for children at different levels;

• improving the quality of professional dental care and professional oral hygiene.

CHAPTER 7. DISCUSSION

Global experience shows that the use of fluoride compounds for the prevention of major dental diseases (dental caries and periodontal diseases) is a useful and effective practice, but local fluoride prevention, performed individually can be an efficient alternative to mass fluoridation of water for being no less effective. It can save public money (by abandoning mass fluoride drinking water preventive activities) and replace it with the local use of fluoride preparations available as fluoride varnishes and sealants. The combined use of those preventive measures with high-quality and thorough oral hygiene will provide the user with lasting prevention of major dental diseases, especially dental caries.

By implementing preventive programs, conducting appropriate epidemiological monitoring, it is possible to correctly formulate the needs of society, within each specific generation, in dentists, other dental personnel, and, consequently, in the number of clinics, materials, institutes, students, professors, teaching staff, directions for the development of relevant areas within the dental industry itself. Those trends guiding the development of dentistry will be leading. The periods when surgical dentistry prevailed have already passed; now the period of the orthopedic dentistry prevalence of about to complete, and what comes to replace it is different in different countries. In most cases, periodontology has taken the leading position, in others - hygienic dentistry, thirdly - orthodontics, and fourthly, aesthetic or cosmetic dentistry. The development of dentistry has a direct correlation with living standards, economic and technical development in each of the countries where those changes take place. The material basis of a society determines both the dental status of the population that builds up this society, and the quality of dental care, its accessibility, the quality and qualifications of the specialists providing it.

The highest quality of medical care is provided by a polyclinic equipped with state-of-the-art equipment, staffed with qualified personnel who are proficient in up-to-date methods of diagnosing and treating dental diseases.

The doctors of the clinic posessing extensive practical experience whose professionalism is confirmed by diplomas, certificates and awards in the field of dentistry, pay the greatest attention to the correct, thorough and timely diagnosis of diseases. Patients require special attention and patience as they come with a fear of dental treatment or with “acute” toothache. Fast, timely treatment helps you return to normal pain-free life. oral hygiene is a core factor to maintain healthy teeth.

Owing to the latest scientific developments and treatment methods in compliance with international standards dental experts relieve citizens of dental problems and restore their lost dental health. The clinic is a medical facility where assistance is provided under the 24/7 program.

We fight to preserve every tooth using up-to-date preventive methods, and also pay great attention to dental aesthetics.

We pay special attention to each patient making our patients satisfied with the medical services provided.

The actual degree of skills and professional expertise is a guarantee of fast and high-quality solutions to dental problems.

The entire work of the clinic team is aimed not only at main task performance of the medical institution, but also at elaborating a medical and protective mode for each patient.

The clinic regualrly performed planned tasks, including the Territorial Program of State Guarantees of free medical care to citizens maintaining planned sanitation activities of the children population.

The today’s medical performance enables implementation of up-to-date methods to prevent dental diseases, expanding the work toolset with the latest generation of dental materials to 83.7%, expanding the coverage of preventive measures to 30%, the amount of solid dental structures to 100%, introducing dental implantation as a method of alternative to removable dentures, purchasing the latest generation equipment, ensuring financial stability, and complying with the medical and protective mode.

The created comfortable atmosphere radically changed the citizens' experience of the dental clinic and showed that treatment can be a painless process. Powerful technical base and experienced employees who are dedicated to their work and ready to help in the most difficult situations help to achieve such results.

Guarantees of the diagnostic examination and treatment quality of are confirmed by the use of up-to-date equipment and the well-educated pesonnel with extensive practical experience.

Dental hygiene plays a key role in preventing disease and maintaining oral health.

Professional instruction and support from dentists and healthcare professionals ensures higher dental hygiene awareness of patients and can help prevent complications. The use of up-to-date technologies, such as ultrasonic cleaning, allows achieving a high level of removable structure hygiene without damaging the patient’s health.

In the treatment with a removable denture, an orthopedic dentist has to consider the patient’s financial and physical capabilities to care for his removable denture; according to this, when handing over the denture, the doctor gives recommendations on items and means for oral hygiene and removable dentures. One of the main goals of the doctor is to motivate the patient to carefully and competently care for the removable structure. Collaborating with the patient and discussing his individual dental hygiene needs is a key to more effective treatment and better results.

After assessing the hygienic status of removable structures, both orthopedic and orthodontic, a a satisfactory condition has been revealed. The analysis of the survey has revealed the following situation: over 60% patients, namely the bigger part of them, clean the removable structure once a day, it is not enough, since during the day food debris remains on the removable structure resulting in oral mucosa inflammatory phenomena bad breath. Ultrasonic containers were recommended by 2.4% patients, and used by 7.3% patients; also, during the use of a removable structure, some patients began to use special (low-abrasive) pastes to clean the

removable structure, that doctors recommended to 7.3% patients, and began to be used by 5% more, that is, 12.2% patients.

After fixation of a removable orthopedic or orthodontic structure, patients reported discomfort caused by a foreign body in the mouth. This discomfort is associated with inflammation in adult patients, and half of the patients mentioned bad breath that may be associated with poor hygiene. In children, inflammation in the mouth is less common. To fast adapt to removable appliances one needs to turn to the dentist for corrections, and also maintain oral hygiene to reduce inflammation.

In the course of the survey we have found out that children do not like using removable orthodontic structures. It is worth noting that 90% patients were advised by a dentist on the proper care of removable appliances, but 87.5% patients were not aware of the need to use a plaque indicator to monitor hygiene. Parents should monitor the hygiene of their children's mouths and appliances; during the survey, it has been found that about 68% patients do not clean their appliances themselves, but with the help of adults.

The survey results have revealed that more than half of the patients have experienced mucosa inflammation and bad breath. One can assume that having received a removable structure, patients did not have enough manual skills in prosthesis hygiene, and over 60% patients cleaned their devices once a day that led to retention of plaque and food debris on the removable appliance.

It is necessary to mention that the revealed growth in the number of microorganisms on the oral mucosa in conditions of herpetic stomatitis cannot be explained only by the death of neutrophils and macrophages and the subsequent decline in the pool of antimicrobial peptides. Apparently, the combined effect on experimental animals causes inactivation of extracellularly secreted α-defensins. It has been shown [16] that the secretion of α-defensins provides active functional synergy of antimicrobial peptides. To neutralize microbes, peptides can also act in synergy with body molecules such as proteins, lysozymes, as well as traditional antibiotics. Some antimicrobial peptides, in addition to functioning as chemokines

and attracting migrating and circulatory cells, accelerate wound healing through angiogenesis and epithelial growth [13, 27].

According to O.F. Rabinovich et al. (2011) , restoration of microbiocenosis by means of of immunomodulators, in particular, a decrease in the severity of oral mucosa candidiasis, is largely determined by the sIgA level and is associated with the aggregation of candida and the suppression of their adhesion on epithelial cells [149, 151]. One should remember that candida is able to resist to sIgA. Thus, some strains of C. albicans and C. glabrata produce IgA proteinases that destroy IgAl and sIgA owing to the cleavage of disulfide bridges in the structure of immunoglobulins and defensins resulting in a disruption of their active conformation [4, 39]. Apparently, it was a restoration of antimicrobial peptide, IgA and sIgA functional activity by means of Molixan that significantly reduce the number of candida on the oral mucosa of irradiated animals.

One should know that Molixan is a combination drug containing peptide and nucleoside components. The peptide component is a pharmacological analogue of oxidized glutathione containing disulfide bonds. One of the most important points of oxidized glutathione application outside cells are sulfhydryl groups of regulatory and effector cell surface and dissolved peptide molecules [4]. The result of the oxidized glutathione effect on the sulfhydryl groups of molecules is the formation of a disulfide bond, a change in conformation and, as a consequence, the functional activity of the molecule.

In general, the obtained data on the Molixan affecting the level of antimicrobial peptides and the oral mucosa microbiocenosis to additionally substantiate classifying that drug, as well as the pharmacological analogue of oxidized glutathione - glutoxim, as drugs with an indirect antimicrobial effect.

The revealed positive evolution of of α-defensin HNP 1-3 level and the degree of oral mucosa microbial contamination in rats exposed to combined chemoherpetic effects and treated with Molixan may indicate:

- the important role of disturbances in the production of the studied antimicrobial peptides in the formation of identified changes in the microbiocenosis of the mouth and in the development of herpetic stomatitis;
- the opportunity of inducing antimicrobial peptides using drugs that include oxidized glutathione (Molixan, glutoxim).

In addition, the obtained results indicate the good prospects of searching among the inducers of antimicrobial peptides - cathelicidins, α - and β-defensins - for new highly efficient means of herpetic and chemoherpetic stomatitis prevention and treatment.

Thus, in the course of experimental studies it has been found that preliminary infection of experimental animals(before chemoradiotherapy) with HSV-1 enhanced the damaging effect of cytostatics on the rat oral mucosa and significantly worsened oral mucositis that ultimately led to the death of about 40% individuals. The preventive use of the immunomodulator with antiviral Na_2GCGI (Molixan) drug reduced the frequency (by 2–3 times) of development and severity of OS (oropharyngeal syndrome) clinical manifestations and enabled to save the lives of all animals in the experimental group.

The above mentioned allowed concluding that herpes simplex virus is a trigger in a chain of oral mucosa innate immunity morphofunctional disorder generation caused by chemoradiotherapy, followed by a microbiocenosis balance change and the formation of radiation oropharyngeal syndrome.

Experimental studies have shown that the combined exposure of animals to the cytostatic drug cisplatin and craniocaudal gamma irradiation causes a significant rise in oral mucosa microbial contamination. During the height of chemoradiation stomatitis (15 days after irradiation), the number of non-hemolytic streptococcus, staphylococcus, and enterobacteria colonies rose compared to that of intact animal group by an average of 3 times, and the fungi Candida albicans and Candida glabrata - by 5 times. A course administration of Molixan at a dose of 30 mg/kg (every other day for 15 days after combined chemoradiotherapy) normalized oral microbiocenosis and reduced the oral mucositis severity. In animals treated with Molixan, the number of staphylococcus colonies decreased by 3 times, anaerobes by 1.7 times, enterobacteria by 1.6 times,

non-hemolytic streptococcus by 2.2 times, and candida by 3 times. When assessing Molixan's antimicrobial activity, it was found that the drug had a direct bactericidal effect only in concentrations of 400 μg/ml and higher.

In general, the data obtained on Molixan effect on the oral mucosa microbiocenosis served an additional rationale for classifying this drug, as well as its pharmacological analogue, oxidized glutathione - glutoxim, as drugs with an indirect antimicrobial effect [Manihas G.M. et al., 2008; Manihas G.M., Zhukova I.V., 2012]. In addition, the obtained results indicate the opportunities of searching for new highly effective agents aimed at the prevention of oral mucositis among immunomodulators capable of stimulating natural (innate) immunity factors.

Global experience testifies that fluorine compounds for the prevention of major dental diseases (dental caries and periodontal diseases) are helpful and effective, equally effective local fluoridation prevention practice performed individually that allows saving state money (by abandoning mass fluoridation of drinking water) can replace mass fluoridation of water replacing it with local use of fluoride preparations in the form of fluoride varnishes, sealants. The combined use of these means of prevention with high-quality and thorough oral hygiene will provide the user with stable prevention of major dental diseases, especially dental caries.

Construction of fluorination units is an expensive and economically inefficient enterprise. Fluorinated water used in common pipelines can lead to disruption of the technological process of production of many industrial enterprises. Therefore, fluoridation of drinking water requires the allocation of separate pipelines for technical and drinking water. Fluoridated water results in a faster corrosion of pipes through which it is supplied to consumers. To avoid premature corrosion of metal, it is necessary to coat the inner surfaces of pipes with a special plastic that entails increased cost and making the work more complicated the work of public utilities in cities, regions and the country as a whole. Fluoride varnishes, gels used for sealing dental fissures are the simplest and most economically efficient way to prevent major dental diseases. One can use fluoride varnish at any age. If used correctly and professionally it is easy-to-use and effective. Indications for the use of sealants have

been expanded in recent years, one can use them in all age groups, provided that the fissures are clean and there is no overbite after their installation. This is the simplest and most cost-effective method of preventing major dental diseases with an individual focus of a professional approach.

By implementing preventive programs and conducting appropriate epidemiological program-based monitoring, it is possible to correctly formulate the needs of society within each specific generation, in dentists, other dental personnel, and, consequently, in the number of clinics, materials, institution, students, teaching staff, and development directions of the relevant areas within the dental industry itself. Those trends determine the leading directions in the development of dentistry. The periods when surgical dentistry prevailed have already passed, now the prevalence of orthopedic dentistry is nearing the end, and the directions what follow it, are different in different countries. In most cases, periodontology took the leading positions, in others - hygienic dentistry, thirdly - orthodontics, and fourthly, aesthetic or cosmetic dentistry. All those directions of dentistry development are directly related to the living standard in each of the countries in which those changes take place, as well as to the levels of their economic and technical development. The material resources of society determines both the dental status of the population that makes up the society and the quality of dental care provided for the population, its availability, quality and qualifications of the professionals providing it.

Figure 7.1 demonstrates the prevalence and intensity of dental caries in children and adolescents in the main age groups: 6 years (baby teeth), and 6 years (permanent teeth); 12 and 15 years.

PREVALENCE OF DENTAL CARIES IN CHILDREN AND ADOLESCENTS (varies across regions with minimum and maximum rates)

	Tooth caries					
	Prevalence (%)			Severity (CSR)		
	from	to	Difference	from	to	Difference
6years mb. dis	73	98	25	4,51	6,19	1,68
6 years perm.teeth	2	56	54	0,04	0,61	0,57
12 years	66	94	28	1,82	3,58	1,76
15 years	74	100	26	3,26	4,68	1,42

Figure 7.1. Prevalence of dental caries in children and adolescents

Figure 7.1 demonstrates that in the children's group aged 6 years, the prevalence of dental caries in different regions of Russia fluctuates from 2% to 56%. Considering the fact that the first permanent teeth are just beginning to erupt at that age, 56% rate seems to be quite high. For example, if the first two teeth have erupted, then given statistics testifies that every second tooth is affected by caries, and considering that the rate is by 6% higher, we can assume that the second tooth of the two erupted permanent teeth will demonstrate a fairly low level of mineralization, i.e. will be in a state of demineralization corresponding to initial caries in the chalky spot stage. That rate in different regions will fluctuate from 0.04 to 0.61 in terms of the dental caries intensity, i.e. according to the CSE index.

In the group of 12-year-old children in different regions of Russia, the prevalence of dental caries ranges from 66% to 94%, making CSE index to range from 1.82 to 3.58. Moreover, lower indicators are typical for the southern regions, and higher ones for the northern ones. One should consider those factors when developing and implementing National Prevention Programs and regional and program-associated personalized programs. The rate 94% indicates that the overwhelming majority of 12-year-old children have dental caries, being at the stage when all 28 permanent teeth are erupting, and most of them have not yet formed roots

and the enamel maturation processes have been completed. It serves a symptom that without appropriate preventive activities the person in middle age may have an extremely difficult situation reflecting his dental health.

In the 15-year-old group the prevalence of caries fluctuated from 74% to 100%, along with CSE index ranging from 3.26 to 4.68. In fact, out of 28 teeth, almost 5 teeth will be affected by caries corresponding to 17.9% of the teeth in the mouth. All thuse indicators characterize the serious dental situation among the child population of the country and require the introduction of widespread preventive actions at all health care levels.

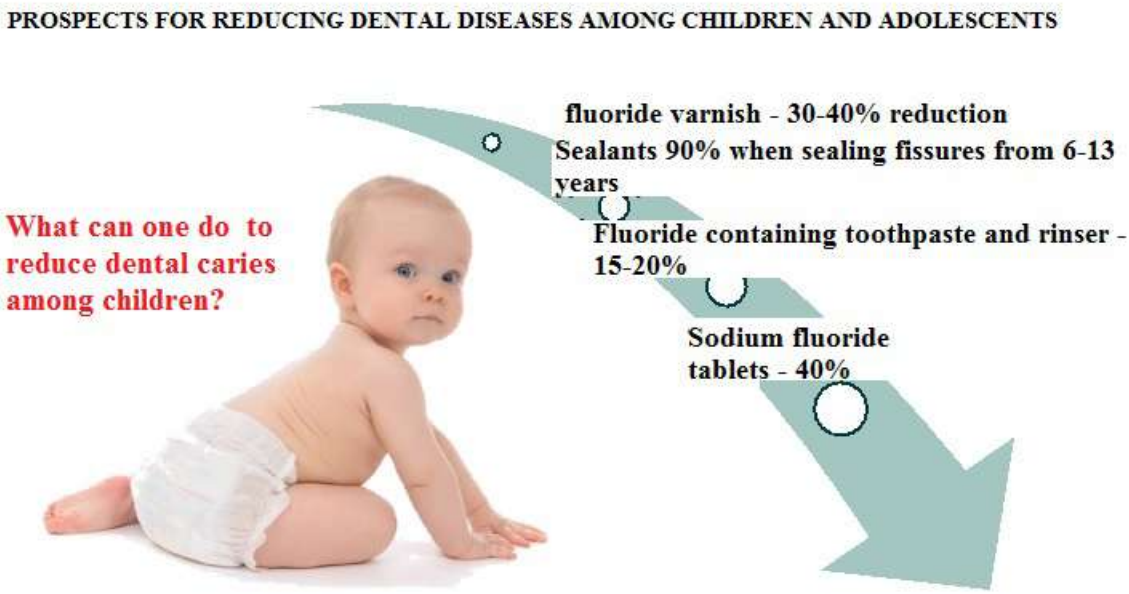


Figure 7.2. Prospects for reducing dental morbidity in children and adolescents.

Figure 7.2 demonstrates that the one should take the following outpatient and individual to reduce the incidence and severity of dental caries: the use of fluoride varnish to coat teeth reduces the incidence of caries by 30-40%; sealing of dental fissures at the age of 6-13 years eliminates fissure caries by 90%; constant use of fluoride-containing toothpastes and rinses reduces the incidence of dental caries by 15-20%; taking sodium fluoride tablets during 200 days of primary school each year reduces the incidence of caries by 40%.

The assessment of the preventive work quality of a pediatric dentist was

performed using the “Index for assessing and monitoring the quality of preventive work of a pediatric dentist” developed by us including all the parameters of the taken preventive actions. This index is aimed at:

- assessment of the preventive work quality performed by the dentist;
- control over its quality;
- monitoring the quality of work of an individual expert, comparative snslysis of that work of different specialists;
- monitoring work by a specialist with a specific group of the population (kindergartens, schools, boarding schools, etc.);
- expert assessment of the dental care quality provided to a specific patient;
- conduct a specific indicator analysis characterizing the quality of dental care;
- conduct an assessment of dental health condition;
- study the patient's satisfaction with dental care;
- identification of diagnostic and treatment defects that have led to a deterioration in the quality of dental health;
- compliance with administrative requirements for the provision of high-quality dental care.

Figure 7.3 shows a system of measures aimed at reducing dental morbidity.

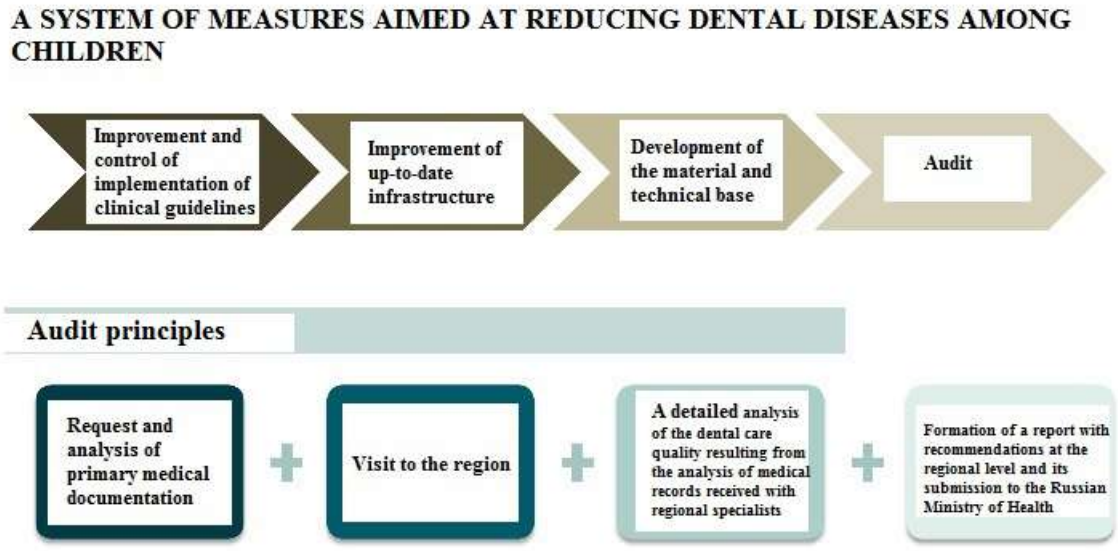


Figure 7.3. System of measures to reduce childhood dental morbidity.

Figure 7.3 shows the following activities to reduce dental morbidity:

- improvement and control of the implementation of clinical recommendations;
- improvement of up-to-date infrastructure;
- development of the material and technical infrustructure; supported by audit activities, to ensure control and efficiency of those actions.

The principles of audit include:

- request and analysis of primary medical documentation;
- visit to the region;
- detailed analysis of the quality of dental care based on the medical records obtained by the specialists in the region;
- Generation and submission of a report to the Russian Ministry of Health with regional level recommendations.

Figure 7.4 shows ways to improve dental prevention practice.

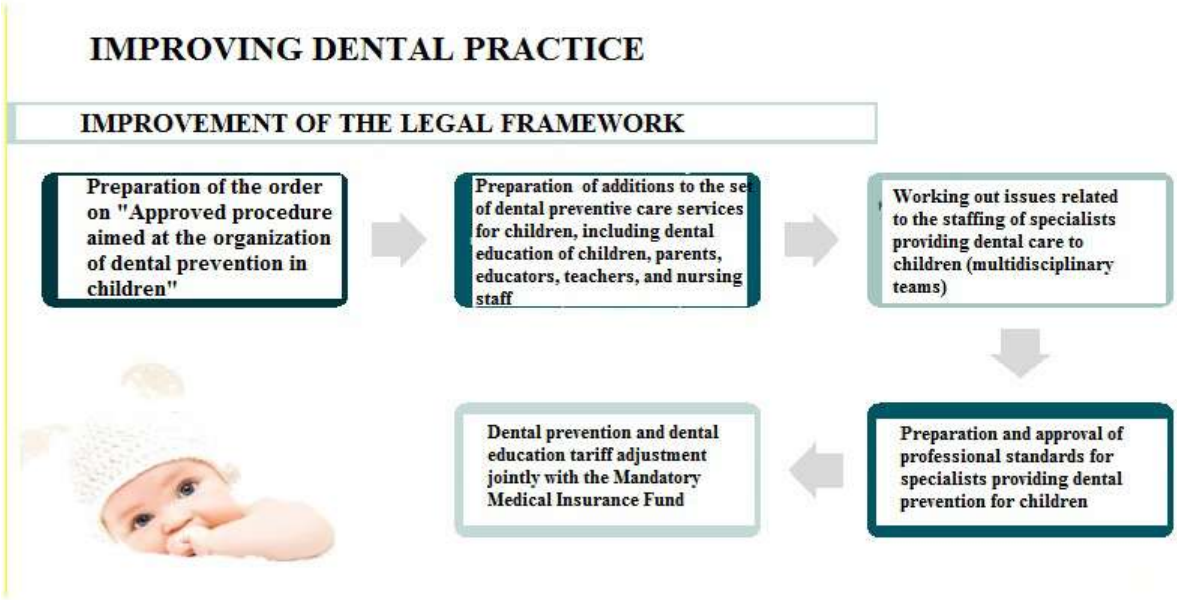


Figure 7.4. Improving the legal regulatory documentation for dental prevention.

Figure 7.4. shows aspects of improving the legal regulatory documentation for dental prevention:

- preparation of the order "On approval of the Procedure for arranging dental prevention for children";

- preparation of amendment proposals to the list of medical services for dental prevention for children, including dental instruction services for children, parents, caregivers, teachers, and mid-level medical personnel;
- elaboration of stuffing-related issues for the specialists providing dental care to children (multidisciplinary teams);
- preparation and approval of professional standards for specialists providing dental prevention for children;
- adjustment of tariffs for the provision of dental prevention and dental education jointly with the Mandatory Medical Insurance Fund.

The problem of dental caries in children that subsequently causes poor dental health in adults.

The results have revealed a distinct growing trend for caries in permanent teeth from 22% among 6-year-olds to 100% at 15 years.

The results of epidemiological dental surveys indicate a high prevalence and intensity of major dental diseases, particularly dental caries, in key age groups of the Russian population. It is necessary to change the priorities of health care somewhat and pay attention to prevention. It is particularly true for the cost of dental disease prevention that is much lower (5-6 times) than that of treatment that will allow maintaining or improving the dental health of the population

Figure 7.5 provides information on the types of up-to-date health-saving technologies in dentistry.

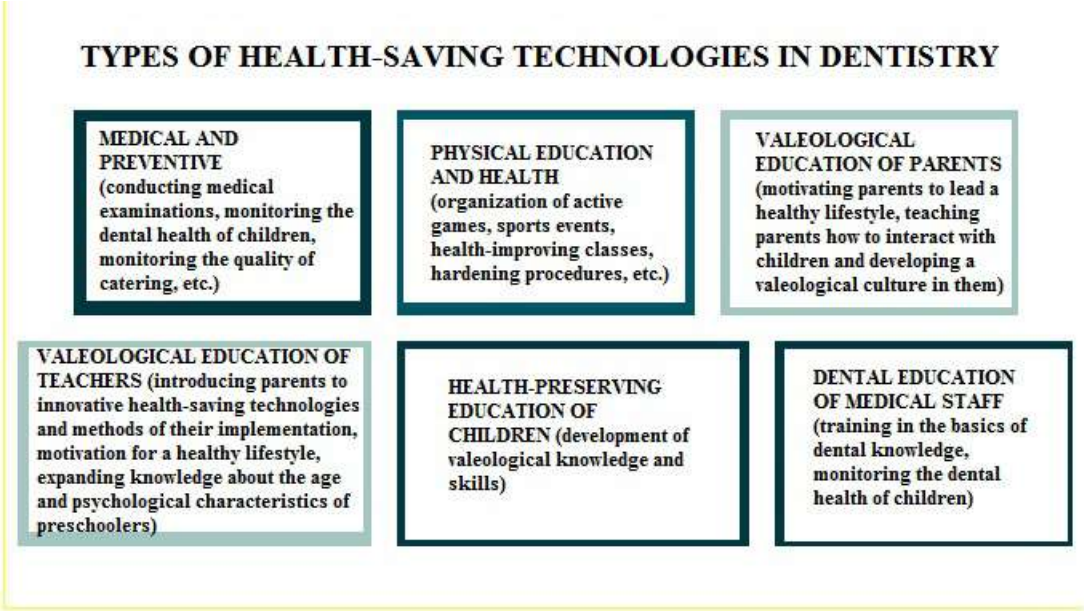


Figure 7.5. Up-to-date health-saving technologies in dentistry.

Health-saving technologies in dentistry include:

- Medical and preventive technologies (conducting medical examinations, monitoring the dental health of children, monitoring the quality of nutrition, etc.);
- Physical education and health (organizing active games, sports events, valeological classes, hardening procedures, etc.);
- Valeological education of parents (motivating parents to lead a healthy lifestyle, teaching parents how to interact with children to develop a valeological culture in them);
- Valeological education of teachers (instructing educators using innovative health-saving technologies and implementation approaches, motivating them to lead a healthy lifestyle, expanding their knowledge of the age-related and psychological features of preschoolers);
- Health-saving education of children (formation of valeological knowledge and skills);
- Dental education of medical personnel (teaching the basics of dental knowledge, monitoring the dental health of children).

Figure 7.6 demonstrates a diagram of the fundamental science evolution in the field of pediatric dentistry.

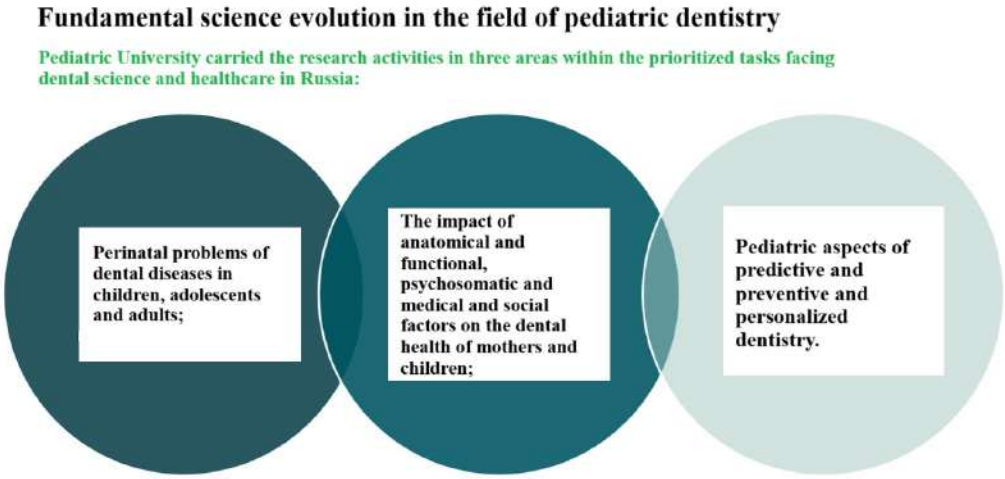


Figure 7.6. Evolution of fundamental science in pediatric dentistry.

Pediatric University carried the research activities in three areas within the prioritized tasks facing dental science and healthcare in Russia:

- perinatal problems of dental diseases in children, adolescents and adults;
- the impact of anatomical and functional, psychosomatic and medical and social factors on the dental health of mothers and children;
- pediatric aspects of predictive and preventive and personalized dentistry.

Figure 7.7 demonstrates the relationship between the qualifications of medical personnel and the health of children.

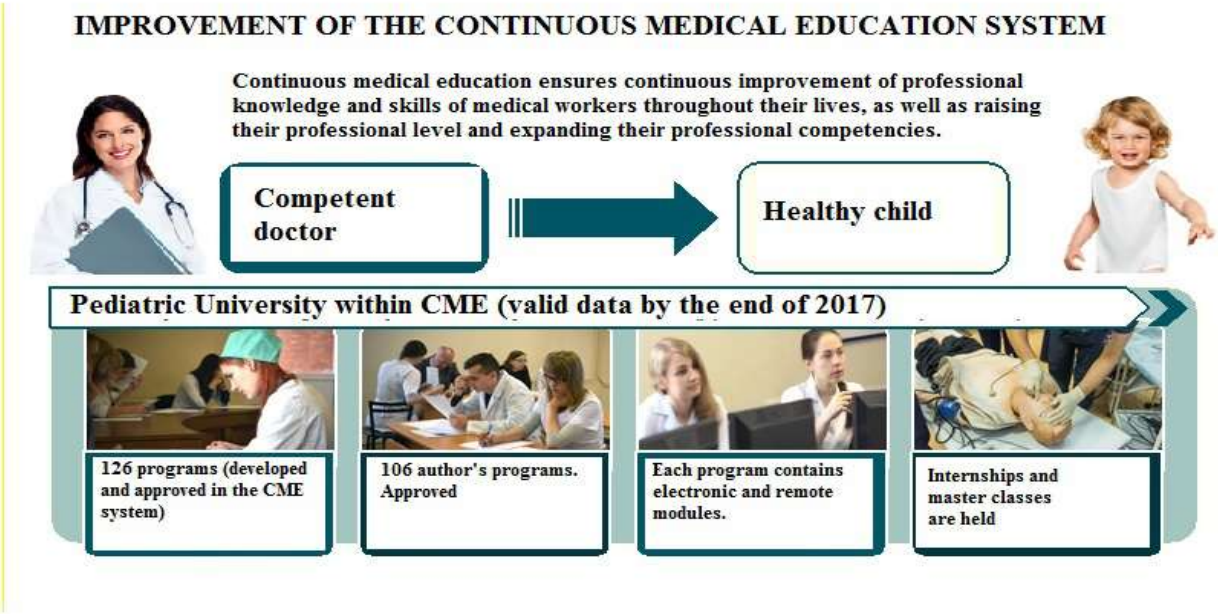


Figure 7.7. Improving the system of advanced training of medical personnel.

Continuous medical education and systematic improvement ensures continuous improvement of professional knowledge and skills of medical workers throughout their lives, as well as raising their professional level and expanding their professional expertise.

Thus, the proposed conditions for the development of the National Program for the Prevention of Dental Diseases and the Personalized Programs that underly it and the "Ten Grades of Dental Prevention in Children" in the decade of childhood difine the details enabling adaptation of preventive practices for each age group and the ways of their implementation. As child development isprogressing, various complex situations are encountered that one should consider when elaborating personalized preventive programs in each specific case considering the dental, hygienic and somatic status of the patient. The survey was conducted in order to clarify the patient's attitude to preventive procedures, the grade of hygienic knowledge, a person's focus on dental health and the resulting performance of hygienic procedures and oral hygiene products used for this purpose.

CONCLUSIONS

The performed research has allowed making the following conclusions:

1. A clinical approach to prevention methods in a dental clinic has been developed and assessed in different age groups of patients, and a set of prevention-oriented personal hygiene product properties have been defined.

2. Organisation issues of preventive care for the children population have been studied using Vyborgsky district of St. Petersburg as a focus location that helped to improve efficiency of preventive programs.

3. The main properties of individual prophylactic toothpastes were studied for their use in prophylactic programs: the anti-caries efficiency rate of the toothpaste "Protection from Caries" amounted to 34.77%; in toothpaste "Kid's Sweet Mint" it did 30.00%; in toothpaste "Kid's Strawberry" - 29.18%; the enamel electrical conductivity-based anti-caries efficiency rate when using "Protection from Caries" increased by 3 times; in toothpaste "Kid's Sweet Mint" by 3.21 times, and in "Kid's Strawberry" toothpaste by 3.42 times. The evoluyion in terms of remineralizing efficiency rate of the used toothpastes "Protection from Caries", "Whitening", "Kid's Sweet Mint" and "Kid's Strawberry" amounted to 31.02%; 26.70%; 37.10% and 36.40%, respectively. The remineralizing efficiency when using the toothpaste "Protection from caries" increased by 3.39 times; in "Whitening" toothpaste by 3.47 times; in "Kid's Sweet Mint" toothpaste - by 3.97 times and the "Kid's Strawberry" toothpaste - by 4.03 times. The growth rate of the hemostatic efficiency indicator in compliance with the Mühlemann and Son bleeding index when using "Comprehensive Care" toothpaste amounted to 47.69% that corresponds to a decrease in bleeding by 2.45 times. The desensitizing efficiency rate when using "Comprehensive Care" toothpaste increased to 60.96% and increased by 2.86 times. The whitening efficiency when using the "Whitening" toothpaste reached 42.86%.

4. A device for cleaning teeth and a disposable kit based on it have been developed (patent for utility model No. 104059).

5. A method for assessing the quality of prosthetics has been developed (patent for invention No. 2617229).

6. Methodology has been developed for orthodontic treatment of crowded teeth (patent for invention No. 2692453) and orthodontic treatment of distal occlusion (Eurasian patent for invention No. 042335).

7. A clinical and experimental rationale of new pathogenetic approaches to improving the herpesviral stomatitis prevention has been performed by studying experimental herpetic stomatitis under combined exposure to herpesviral body damaging factors (Patent for invention No. 2709842).

8. The effect of molixan on the oral microbiocenosis of laboratory animals exposed to combined effects was studied, and the drug's proprietary antimicrobial activity was assessed that demonstrated its efficiency.

9. The combination of the obtained results allowed developing the the National Program for the Prevention of Dental Diseases in Children that specifies the major types of regional programs and their implementation efficiency and use of the "Ten Grades of Dental Prevention in Children". Each of the grades corresponds to a certain period of the child's life, and preventive action characteristic of that period.

10. To solve problems associated with various complex dental situations and take them into account when drawing up "Personalized Prevention Programs" in complex situations, the following items were developed: (1) an appliance for cleaning teeth; (2) a orthodontic treatment methodology of crowded teeth; (3) an orthodontic treatment methodology of distal occlusion; (4) a was to find an optimal bite height; (5) a zinc oxide-bsed filling material; (6) a pattern modeling recurrent herpes of the mice mucosa.

PRACTICAL RECOMMENDATIONS

Individual and professional hygiene measures underly the organization of preventive healthcare in various population groups. To achieve it take preventive measures on a daily basis depending on age using preventive toothpastes that have various preventive effects resulting from the active components.

Thus, for children, choose the pastes with cleansing, anti-caries and remineralizing effects and increased efficiency as main preventive toothpastes. Those pastes are fluoride-based products.

The pastes with an enhanced cleansing effect should prevail among the middle-aged people, including lightening pastes, because they display high efficiency in soft plaque removal and antimicrobial action. The effect on acid-producing microflora is particularly important.

In middle and old age, toothpastes providing anti-inflammatory, hemostatic, antimicrobial effects should prevail, because in thar period, inflammatory diseases in the periodontium develop particularly actively.

In the dental clinic, professional preventive measures are performed for all segments of the population. Depending on the intensity of plaque formation, it is necessary to visit the clinic at least two times a year or more frequently.

Development of Preventive programs depends on the age groups for which they are designed and the intensity of inflammatory and carious processes. It is a multifactorial problem determined by an entire complex of socio-dental characteristics and factors.

LIST OF ABBREVIATIONS

AMP - antimicrobial peptides

AP – adopted for a prototype

APBWE - adopted prototype bristle working elements

APSWE - adopted prototype spherical working elements

BS – base surface

BSP – base surface made of elastic material (polyurethane)

CA – claimed appliance for cleaning teeth

CFU - colony-forming units

CHVI - chronic herpes virus infection

CRT - chemoradiotherapy

CATS - central area of the tooth surface

CULI -conventional unit of labor intensity

CTP – crowded teeth position

DCATS – distal area of the tooth surface

DCATS - distal-cervical area of the tooth surface

DOATS - distal-occlusal area of the tooth surface

DAA - dental alveolar anomalies

ERT – enamel resistance test

HSV – herpes simplex virus

HDVI - highly dangerous viral infections

GSE - gingival structural elements

GP - gum pockets

GS - gingival sulcus

GSET (gingival structural element tissue)

GSET – gum structural element tissue

ITA - increased tooth abrasion

MATS - mesial area of the tooth surface

MOATS - mid-occlusal area of the tooth surface

MCATS - mid-cervical area of the tooth surface

MHRF Ministry of Health of the Russian Federation - Ministry of Health of the Russian Federation

MCATS - mesial-cervical areas of the tooth surface

MOTSA - mesial-occlusive tooth surface area

NOH – normal oral hygiene

OM – oral mucosa

OPA – oropharyngeal area

OPS – oropharyngeal syndrome

POH - poor oral hygiene

PDN - peridental nipple

PRVM - pinch-like reciprocating (vertical) movements

PRM - pinch-like reverse movements,

PFM - pinch-like forward movement

SEP - structural elements of periodontium

SFBS - silicone fingercot base surface

TCS – tooth contact surfaces

TBE - tick-borne encephalitis

TS - tooth surface

TMJ – temporomandibular joint

TS – tooth sensitivity

TRG – teleradiography

TCS – tooth contact surfaces

TBE - tick-borne encephalitis

WE - working elements, working surface

WHO – World Health Organization

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