MILITARY MEDICAL ACADEMY NAMED AFTER S.M. KIROVA

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TREATMENT AND REHABILITATION OF PATIENTS AFTER DENTAL REPLANTATION

Scientific specialty 3.1.7. Dentistry
THESIS
for the degree of
Candidate of Medical Sciences

Translation from Russian

Scientific supervisor:
Doctor of Medical Sciences
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Saint - Petersburg
2024

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INTRODUCTION

The relevance of the problem. The provision of high-quality medical care, including dental care, is one of the priorities of modern healthcare, reflecting the general trend towards improving human living standards. The issue of dental surgeries has recently become increasingly important, this is due to the increased demands of patients not only for aesthetic, but also for material costs of dental treatment (Bochkareva, V. V., 2018; Brutyan, V. A., 2021; Velichko, L.S., 2014).

Dental replantation operations in modern economic conditions of import substitution are becoming more and more in demand, as they do not require expensive equipment and materials.

During the preparation and after the dental replantation operation, it is necessary to implement measures that promote the "engraftment" of the replanted tooth. In almost 100% of cases, obvious signs of an acute inflammatory reaction of periodontal tissues are diagnosed. It is the timely diagnosis of this condition and the correctly selected treatment tactics that make it possible to ensure the best engraftment of the replanted tooth (Azizov K.Sh., Kunin V.A., 2020; Borisova E.G., 2019).

Studies have shown that after tooth engraftment, the periodontal ligament is restored, the level of tissue microcirculation increases and functionally the graft differs little from other teeth (Wu et al., 2019). Long-term observations also prove the effectiveness of this method with a survival rate of more than 7 years of about 85% of teeth (Chung et al., 2014; Jang et al., 2016; Mendoza-Mendoza et al., 2012).

Despite the overwhelming majority of positive results, many clinicians have doubts about this operation due to the uncertainty of the intervention technique, the complexity of its execution, possible tooth resorption, the formation of periodontal pockets, as well as the method of forming a conical well for the transplant. In addition, the few studies conducted to determine the timing of splinting and the time of endodontic intervention are very ambiguous and contradictory (Kuznetsov V.A., 2018; Bochkareva V.V., 2018; Ivashchenko A.V., 2017

The rational choice of methods of preparatory measures, their high-quality implementation, mandatory study and consideration of the individual characteristics of the patient's body contribute to the success of dental replantation, and, if necessary, successful subsequent orthopedic treatment and reduction of the adaptation period.

In the future, it is very important to carry out rehabilitation measures to consolidate the success of the treatment

The appropriate choice of methods of rehabilitation measures, their high-quality implementation, mandatory study and consideration of the individual characteristics of the patient's body contribute to achieving success in treatment and reducing the duration of the adaptation period.

It follows from the above that the relevance of the issue lies in the need to develop new and modify already known methods of treating histopathological conditions of the oral cavity, taking into account previously performed dental preservation procedures, in particular, dental replantation.

An integrated approach to the diagnosis and treatment of pathologies of the tissues surrounding the replanted tooth that occur after dental replantation will reduce the rehabilitation period, as well as increase the overall level of treatment in dentistry.

Taking into account the available data, the author of the study declares the following goals and objectives.

The purpose of the study. To develop and implement the concept of ensuring high efficiency of dental replantation through the use of new diagnostic approaches and complex therapy based on the use of therapeutic and combined physical factors.

Research objectives

1. To conduct a retrospective analysis of medical documentation on the use of M-Chip nanocapsules and phototherapy of red light LED radiation in the complex treatment of patients after dental replantation in comparison with traditional rehabilitation methods.
2. To evaluate in a comparative aspect the clinical and functional effectiveness of red light LED radiation for the correction of histopathological changes in the tissues surrounding the replanted tooth after surgery.
3. Based on the data of periotestometry, clinical examination, radiography and ultrasound Dopplerography, to conduct a comparative study of the periodontal condition after replantation in the study groups.
4. To substantiate the possibility and necessity of dental replantation surgery in modern economic conditions

Scientific novelty of the research

1. A comprehensive method of treatment and rehabilitation of pathological conditions of tissues surrounding the replanted tooth after dental replantation surgery has been developed.
2. The use of red light LED radiation in the complex treatment of patients makes it possible to increase the effectiveness of rehabilitation of patients after dental replantation, reducing the time to 3-4 weeks compared with the traditional method (5-6 weeks), which is statistically confirmed.
3. For the first time, the use of phototherapy (red light LED radiation) after dental replantation surgery has been scientifically substantiated according to the established parameters of the effect of red light LED radiation on the tissues surrounding the replanted tooth.
4. A correlation analysis of ultrasound Dopplerography and periotestometry data with clinical and X-ray examination data for three years after surgery was performed, which makes it possible to assess the periodontal condition in dynamics, as well as predict the outcome of replantation in the early stages.

The theoretical significance of the work

Based on the clinical and functional research methods, the necessity of using LED red light radiation to correct histopathological changes in the tissues surrounding the replanted tooth after surgery has been established.

The data of ultrasound Dopplerography and periotestometry after dental replantation surgery make it possible to assess the periodontal condition in dynamics and identify the need for further orthopedic treatment of patients.

The practical significance of the work

The use of red light LED radiation in the complex treatment of patients makes it possible to increase the effectiveness of rehabilitation of patients after dental replantation, which helps to reduce the duration of rehabilitation treatment and improves the quality of life of patients.

The results of scientific research allow a practicing dentist to use the data obtained to improve the quality of diagnosis and treatment of patients during dental replantation.

The complex of diagnostic methods used makes it possible to identify pathological conditions of the tissues surrounding the replanted tooth at the earliest possible time before performing dental replantation surgery, and at the early stages of these processes to determine the tactics of their treatment.

Methodology and methods of dissertation research

The basis of the methodology of this dissertation research is the use of empirical and theoretical methods of scientific cognition. A retrospective analysis of outpatient records of patients who were included in the selection criteria of this dissertation study was carried out, taking into account the diagnosis during dental replantation according to indications, the time of treatment after injury, and the timing of dispensary follow-up.

The study examined data on the applied basic and additional diagnostic methods in dentistry in 127 outpatient records of dental patients, which were divided into 2 groups. The first group consisted of 66 outpatient records, of which

it is known that patients with traumatic dislocations of teeth sought medical help within 24 hours after injury. He underwent a surgical operation of tooth replantation, endodontic treatment, developed a comprehensive treatment aimed at relieving an acute inflammatory reaction of a post-traumatic nature, and carrying out the necessary splinting measures. The second group consisted of 61 outpatient records, of which it is known that patients with traumatic dislocations of teeth sought medical help 24 hours or later.

The structure and scope of the dissertation

The dissertation is presented in 3 chapters, conclusion and appendices, is presented on 122 pages, illustrated with 17 figures and 15 tables. The list of references includes 159 sources, of which 107 are domestic and 52 are foreign.

Main scientific results

1. The analysis of the possibility of therapy of various periodontal diseases and oral mucosa using low-intensity lasers in the clinic of orthopedic dentistry was carried out [70, pp. 15, 24, 26]. The results are published in [70]. Personal participation of the author in obtaining these results: collecting material, interpreting the results, writing an article.

2. The results of the clinical evaluation of the use of modulated red light in the complex therapy of inflammatory conditions of periodontal tissues after dental replantation have been analyzed [2, pp. 29, 47, 48]. The results are published in [2]. Personal participation of the author in obtaining these results: collecting material, interpreting the results, writing an article

3. The effectiveness of combined preparation and pharmacological therapy in the prevention of the inflammatory process of periodontal tissues after dental replantation was evaluated. The condition of the periodontal mucosa and the periodontal ligamentous apparatus in the area of the supporting teeth was studied in preparation for orthopedic treatment of dentition defects, after their dental replantation operation [1, pp. 14, 24, 30, 32] - The results are published in [1]. Personal participation of the author in obtaining these results: collecting material, interpreting the results, writing an article.

4. The necessity of clear tactics of diagnostic measures both at the initial admission and at all stages of treatment in the rehabilitation of dental injuries during dental replantation is shown. The patients underwent a macrohistochemical examination and measurement of the dentoalveolar attachment using a periodontal probe. The effectiveness of early interventions during dental replantation has been revealed [15, pp. 18, 25, 48, 56, 59]. - The results are published in [15]. Personal participation of the author in obtaining these results: collecting material, interpreting the results, writing an article.

5. The advantage of physiotherapy procedures after dental replantation has been proven [107, pp. 35, 37, 48] - The results are published in [107]. Personal participation of the author in obtaining these results: collecting material, interpreting the results, writing an article.

6. Preventive measures and treatment of pathological conditions of the tissues of the oral cavity were carried out during the preparation for orthopedic treatment [80, pp. 16, 17, 20]. The results are published in [80]. Personal participation of the author in obtaining these results: collecting material, interpreting the results, writing an article.

7. We have written an educational and methodological manual on the use of light physical factors in various fields of clinical medicine, which is used in the educational process when teaching students and trainees of dental faculties [79, pp. 29-30, 44]. The results are published in [79]. The author's personal participation in the writing of the training manual is 23%.

8. A monograph has been published describing the use of light physical factors in orthopedic dentistry [89, pp. 29-30, 44]. The results are published in [89]. The author's personal participation in the writing of the monograph is 25%.

The results of the study are used in the educational process and practical activities of the Department of General Dentistry of the Federal State Budgetary Military Educational Institution of Higher Education "Military Medical Academy named after S.M. Kirov, Department of Orthopedic Dentistry of the Voronezh

State Medical University named after N.N. Burdenko, in the Children's Clinical Dental Polyclinic No. 2 of Voronezh.

According to the research topic, the dissertation conducted an analysis of foreign and domestic sources of specialized literature. In the course of the work, the author personally conducted a retrospective analysis of 127 outpatient dental records. The results of clinical and functional studies are analyzed, on the basis of which statistical data processing is performed. A method of restorative treatment after dental replantation has been developed. The conclusions of the study are formulated and practical recommendations for dentists are given. The share of the dissertation's participation in clinical and functional research was 100%, and 95% in statistical data processing. The provisions and conclusions formulated in the dissertation work are reliable, justified and directly follow from the results of research and statistical processing of materials. The theory is based on well-known verifiable data and facts using 195 scientific literature sources, with which the results of the dissertation research are consistent. All data was entered into an Excel spreadsheet and statistical analysis was performed. The data were reflected as the mean ± standard deviation for continuous variables, as the median, as a percentage in determining the proportion of relapses in the study groups. The Student's t-test was used to statistically test the hypothesis.

List of conferences, congresses and symposiums in which the author took part:

The research materials were presented at the IV and VI scientific and practical conferences "Commonwealth of Scientific, educational and professional communities" (Grozny, 2017, 2021);

Scientific and practical conference "Diseases of the mucous membrane of the oral cavity and lips" (Voronezh, 2019);

All-Russian scientific and practical conference "Theoretical and practical issues of clinical dentistry" (St. Petersburg, 2021);

Interregional scientific and practical conference "Current trends in modern orthopedic dentistry" (online: Voronezh, Moscow, Grozny, Belgorod, Alekseevka, Stavropol, Sochi, Lipetsk, Rostov 2021).

8 scientific articles have been published on the topic of the dissertation research, 6 of them by the Higher Attestation Commission and the RSCI, 1 teaching manual, 1 monograph, an application for an invention has been submitted.

The main results and provisions of the dissertation research are presented in the publications:

1. Azizov, K. Sh., Borisova, E.G. Clinical evaluation of the results of preparation for non-removable prosthetics after dental replantation / Medical and pharmaceutical journal Pulse. 2024. Vol. 26 No.3. pp. 107-111.
2. Borisova, E.G., Azizov, K.S. Methods of medical support for patients after dental replantation / Medical and pharmaceutical journal Pulse. 2024. Vol. 26 No. 4. pp. 33-38.
3. Azizov, K. Sh., Kunin V.A. The use of modulated red light in the complex therapy of inflammatory conditions of periodontal tissues after dental replantation / Caphedra. Department. Medical education. 2022. Vol. 3. No. 81. pp. 52-54.
4. The effectiveness of physiotherapy procedures after dental replantation / Kunin V.A., Azizov K.Sh., Tsapina A.A., Gerez M.V., Donov A.N., Gerez V.S. // Applied information aspects of medicine. 2022. Vol. 25. No. 3. pp. 74-78.
5. Prevention and treatment of pathological conditions of oral tissues during preparation for orthopedic treatment / Kunin V.A., Lesnykh N.I., Azizov K.Sh., Tsapina A.A., Onuprienko O.Yu. // Applied information aspects of medicine. 2022. Vol. 25. No. 2. pp. 29-33.
6. The experience of using light physical factors in the clinic of orthopedic dentistry in the implementation of non-removable prosthetics / Tsapina A.A., Rudenky O.V., Kovaleva A.A., Azizov K.Sh., Kunin V.A. //

System analysis and management in biomedical systems. 2015. T 14. No. 3. pp. 453-456.

7. The use of light physical factors in various fields of clinical medicine: an educational and methodological manual / A. A. Kunin, V. A. Kunin, N. I. Lesnykh, V. V. Kunina, A. A. Tsapina, K. Sh. Azizov, Yu. A. Umarov, R. U. Bersanov, O. Yu. Onuprienko, M. V. Gerez; FSB VO Burdenko State Medical University of the Ministry of Health of the Russian Federation. – Voronezh: Publishing and Printing Center "Scientific Book", 2022 – p. 84 – ISBN 978-5-4446-1706-9.

8. Light physical factors. Complex use in orthopedic dentistry: monograph / under the general editorship of V. A. Kunin; N. I. Lesnykh, A. A. Tsapina, O. V. Rudensky, K. Sh. Azizov, I. A. Belenova, T. A. Gordeeva, E. Yu. Kaverina, S.V. Polukazakov, A. A. Smolina, M. V. Voronova, K. P. Kubyshkina, O. Yu. Onuprienko, M. V. Gerez ; Burdenko State Medical University of the Ministry of Health of the Russian Federation. — Voronezh : Publishing and Printing Center "Scientific Book", 2021 – p. 78 — ISBN 978-5-4446-1509-6

Provisions to be defended

- The expediency and importance of using methods for a comprehensive assessment of the condition of the tissues surrounding the replanted tooth after dental replantation surgery has been determined.
- Measuring the mobility of teeth using a periotestometer is a fairly informative modern method for assessing the condition of the periodontal complex in patients with dislocated teeth after replantation, allowing to assess the degree of stability of the tooth in the well.

- A new technique has been developed for the rehabilitation of pathological conditions of tissues surrounding the replanted tooth, including the use of LED red light radiation and M-chip nanocapsules.
- The data obtained by analyzing the results of using a new comprehensive method of therapeutic and rehabilitation measures to eliminate pathological conditions of the tissues surrounding the replanted tooth, detected after dental replantation surgery, reliably confirm the advantages of its use in clinical dental practice.

CHAPTER I. LITERATURE REVIEW

1.1. Modern views on the necessity and possibility of dental replantation surgery

Modern dental science is aimed at the application of low-traumatic methods of treatment of diseases of the oral cavity. This fact determines the need for wider use of various kinds of dental operations. This type of surgery includes root apical resection, hemisection and replantation. The successes achieved in the field of therapeutic, surgical and orthopedic dentistry allow a new approach to the technique of dental replantation [23, 59].

Despite the fact that many authors recommend a wider use of this procedure, dental replantation should be carried out according to strict indications. It should be borne in mind that after replantation, ankylosis of the root part of the tooth may occur, which leads to a violation of the function of the supporting apparatus of the tooth, usually such teeth are not recommended to be used as support teeth during subsequent prosthetics [47, 77, 158].

However, despite all the above disadvantages, this procedure is one of the effective methods of treating some forms of chronic periodontitis, traumatic dislocation of teeth, and is also applicable in case of erroneous removal of intact teeth.

The technique under consideration allows you to save a tooth, which in the future can be a supporting element during prosthetics. The Russian authors present indications for replantation: the presence of an infection focus in the periapical region with the ineffectiveness of conservative treatment methods, the impossibility of resection of the tip of the root, etc. In the course of the research, a replantation was performed followed by orthopedic treatment [5, 63, 67, 101, 155].

A number of authors [1, 25, 38] consider the work of a dentist aimed at preserving the tooth as an organ. Among them, a significant place is occupied by the operation is the tooth replantation. The conducted studies also talk about indications for this operation, which have a fairly wide range: impenetrable, pathologically curved root canals of the tooth, as well as previously treated with resorcinol-formalin method; the inability to perform root resection due to the closely located maxillary sinus, mandibular nerve, etc. [21].

At the same time, at the moment, dental replantation has not become widespread among the manipulations performed by dental surgeons of the outpatient clinic [44, 47, 55]. This is partly due to the small number of scientific studies describing the pros and cons of this operation, as well as its outcomes, which gives rise to fears and distrust of this method. There are scientific publications on the original method of dental replantation with further evaluation of the effectiveness of orthopedic rehabilitation of patients. According to the authors [3, 56, 159], during extracorporeal preparation of the tooth, the posterior ledge fell by 0.5 mm from the level of the clinical neck of the tooth to the root of the tooth, a temporary crown was made and fixed on the tooth by an extracorporeal method. In this clinical case, odontopreparation outside the oral cavity and the manufacture of a temporary crown relied on a replanted tooth, and the use of the author's algorithm made it possible to create a tooth stump with a vertical wall at a given angle of convergence, as well as a ledge of equal width and established shape along the clinical neck of the replanted tooth with an anatomically natural gum along it [45].

The fact that dental replantation surgery is a rather rare dental manipulation is noted by domestic scientists [70]. It is noted that the success of this manipulation is determined by the length of time that has elapsed since the injury, the preservation of the ligamentous apparatus of the periodontium and the degree of formation of the tooth root. The replantation operation allows to prevent bone atrophy, occlusion deformation, which has a significant impact on the holistic functioning of the dental system [57, 59].

It is noted that it is advisable to consider autotransplantation of teeth as an alternative to dental implantation [111, 115, 134].

Despite the fact that dental implantology has allowed to solve many issues of rehabilitation of patients with dentition defects, this intervention is in some way dangerous for the patient [157]. Therefore, the further development of replantation and autotransplantation methods is of great importance, it will solve many problems related to the restoration of dentition and the manufacture of full-fledged prostheses, using the latest scientific and practical knowledge [22, 49, 77].

Authors [3, 17, 19, 22, 49] The creation of dental autotransplantation and replantation technologies has been studied as a factor improving the quality of life. They described cases of successful performance of such operations, some of which were performed using the latest dental navigation system. Thus, using pins of our own design and special tools, we managed to avoid possible complications of dental replantation using intraosseous root fixation. The use of innovative technology, which increased the likelihood of a favorable outcome, made it possible to significantly increase the list of indications for extracorporeal dental replantation.

In the works of Russian scientists [57, 65, 80, 93], it is noted that the accuracy of the preparation of supporting teeth, as well as the reliable fixation of bridges, are the basis for high-quality orthopedic treatment of patients using non-removable prostheses. The results of the experiment described in the study [136] indicate the high efficiency of the latest dental navigation system, which makes it possible to form an even cylindrical support stump, which is of great importance for reliable fixation of a non-removable prosthesis.

Taking into account the most relevant data, it becomes clear that the key medical task during dental replantation surgery is to preserve the walls of the dental alveoli and periodontal structures, since any damage to these elements negates the chance of achieving an optimal result of replantation. The described traditional method of performing this operation is performed without the use of

auxiliary equipment, however, it requires maximum scrupulousness from a medical professional [14, 17, 32].

According to [148], when performing a tooth replantation operation, undesirable conditions may occur that lead to a decrease in its effectiveness or make it impractical. One of the most common complications that occurs when teeth are extracted is a fracture of their roots. Practice shows that in such situations it is recommended to stop the operation. If the replantation is still completed, the results of the operation are usually in doubt in the immediate postoperative period [7].

In addition, it should be borne in mind that when removing a replanted tooth, other complications are possible, for example, rupture of the gingival mucosa around the neck of the tooth. It is also necessary to note the difficulties that arise when the prepared tooth is immersed in the alveoli, especially in the case of multi-root teeth. However, with certain skills and abilities, it is always possible to achieve the desired results even in these situations [8, 54].

According to the opinion of domestic and foreign authors [4, 46, 78, 95, 116, 118], The function of single-root teeth is restored within 21-28 days after their replantation. X-ray images during this period clearly show uniform bands of the periodontal gap around the replant. Clinically, the postoperative period is characterized by painless percussion of the replant and palpation of the surrounding gum; the tooth is firmly fixed or remains slightly mobile; the gum acquires a physiological pink color. X-ray examination confirms the positive dynamics in subsequent periods, for example, 3 months after surgery, the bone of the alveolar process will be completely restored, and structural transformations of the periodontal fissure will be revealed, depending on the features of the pathology that led to the replantation [45, 73, 80, 99, 115]. After 6-8 months, complete functional recovery is achieved, it is determined that patients stop noticing the difference between the replants and the rest of the teeth and begin to use them equally [26, 95].

Since it is known that the use of dental splinting and plastic devices can cause complications, an innovative method of fixation of the replant by the intraosseous root method was created. For this purpose, unique pins have been developed and special tools have been used [58].

An integral part of the replantation process is the preparation of the alveoli of the tooth [93, 127, 149]. After its treatment, the formation of a tunnel begins on the lateral surface of the root of the replanted tooth. The bioengineered structure is removed from an antiseptic solution and the root is immersed in the alveoli. After the tooth is lowered as deeply as possible into the alveoli and fixed in this position, the outer cortical plate of the alveoli is drilled using a special "guide", and then the inner wall is partially pierced through an already formed tunnel in the root of the tooth. Next, the biodegrading pin is removed from the sterile packaging and carefully but forcefully inserted into the bone tunnel [2, 47, 93]. Sometimes, to achieve stable primary stability, the pin is struck with a dental rubberized hammer using a special guide. Excess biodegrading pin is cut off.

The choice of the best position for the installation of autografts and replants in their alveoli was based on the results of the application of a three-dimensional coordinate system. Using the results of computed tomography, intraoral sighting radiography, orthopantomography and analysis of plaster models, the limits of acceptable surgical intervention to create dental alveoli for further immersion of autografts in them were determined [45, 78, 91, 101]. At the same time, the drilling direction of the alveolar ridge was selected according to the principle of eliminating the risk of damage to the lower alveolar neurovascular bundle and maxillary sinus.

It is indicated that clinical data and observations of the dynamics of restorative processes in the tooth-pin-periodontal system, revealed during successful dental replantation operations using innovative technologies, justify the expansion of indications for such operations and extracurricular dental treatment [48]. The results obtained open up the possibility of using replants as a solid

foundation for non-removable metal-ceramic bridges during dental restoration [7, 15, 29, 71].

Research conducted by the authors [6, 32, 73, 85, 159], presents an analysis of the advantages and disadvantages of dental autotransplantation and replantation methods, taking into account environmental conditions. They described the results of experiments performed on mongrel dogs, in which intraosseous fixators were used for dental autotransplantation and replantation in accordance with the methodology developed by them. This technique has noticeable advantages over existing patented methods: the use of unique equipment and mathematical calculations made it possible to create an ideal bone pin and firmly fix teeth in the alveoli. The use of a bone biodegradating pin ensured complete primary stabilization of the replant in the dental alveolus, as well as initiated the restoration processes of myeloid tissue and spongy bone of the alveolar process [73].

The key indicator of dental health is the safety of one's own teeth, their condition is influenced by a number of factors, and environmental factors are of great importance [1, 45, 94].

Thus, some authors [25, 37, 67] indicate that the number of teeth removed annually in Russian medical organizations significantly exceeds the limits acceptable from the point of view of common sense. As a result, there is an increase in the number of patients who suffer from secondary adentia and seek the help of orthopedic dentists for this reason. However, current patients express dissatisfaction with the ethical and aesthetic aspects of using removable dentures. They prefer to avoid dissecting and sometimes removing the pulp of intact teeth to install bridges.

Since the success of implantation depends on the complex interaction of mechanical, biomedical, physical and many other factors, it carries a number of risks for patients. Also, at present, there is a significant frequency of implant rejection, which is about 30%. At the same time, the noticeable high cost of implantation systems puts them beyond the reach of the vast majority of the ordinary population [23, 78, 81].

Dental replantation and autotransplantation techniques represent advanced technologies in the field of aesthetic restoration and contribute to a significant improvement in the quality of life of patients, they are the best alternative compared to traditional prosthetics and dental implants. A significant advantage of these methods is the preservation of the tooth, which prevents the displacement of adjacent teeth and atrophy of the bone of the alveolar process, leveling aesthetic defects and ensuring the stability of the functions of the dental system. A number of researchers indicate that when these operations are performed correctly, it is possible to achieve a long-term positive result [12, 42, 45, 98].

1.2. Splinting as a mandatory step after dental replantation

One of the important stages in the process of dental autotransplantation and replantation is splinting, which consists in fixing teeth to adjacent intact teeth to achieve complete immobilization. Some researchers [2, 34, 65] propose to abandon splinting during these procedures, but it is impossible to completely exclude this manipulation from practice. Splinting reduces the intensity and duration of local symptoms that occur after surgery, which has a positive effect on the final result [80]. Modern standard removable splints, when worn, can generate a feeling of discomfort, disrupt speech and mastication, as well as lead to the formation of plaque and the development of inflammation. An additional disadvantage of such structures is their insufficiently strong fixation to the teeth, which slows down the process of primary stabilization of the operated teeth, as well as delays the integration of the implant into the bone tissue. A method of intraosseous fixation of teeth that have undergone autotransplantation and replantation is described; endodonto-endoosal implants made of osteoplastic materials or various metal alloys are used for its implementation [65].

The development of a new, practically used method of intraosseous fixation of teeth during autotransplantation and replantation surgery using osteobiodegrading materials, as well as the accumulation of basic data on the

response and degree of preservation of the functions of tissues directly exposed during the intervention, are the key objectives of the study using dogs as models. [23, 48, 56].

The use of a mathematical model helped to study the distribution of biomechanical load on the tooth and the surrounding bone tissue, which in turn allowed us to establish the spatial location and diameter of the intraosseous pin. The authors [137] of this work used the ANSYS5.6 program for data processing, it not only facilitates the process of planning dental autotransplantation and replantation surgery, since it takes into account the mechanical properties of living tissues, but also allows predicting the results of the operation in the near and long term. In addition, specialized programs for evaluating the stress-strain complex "pin - tooth - periodontal" were used. The model was based on the anthropometry data of 4 groups of teeth, commensurate with the average values described in the literature.

After analyzing the data, the authors concluded that the long-term functioning of the replanted tooth is possible without damage to the root if it experiences the loads taken into account in the study [32, 46, 87],

It is important to say that endodontic treatment was performed in 100% of cases before the operation of autotransplantation and dental replantation. During treatment, future replants were extracted according to a standard protocol [37]. The preservation of the desmodont was of key importance, as it plays a key role in the functioning of the maxillary segment. Its significance is due to the fact that the process of bone resorption and formation in the alveolus of the tooth is more active than the processes of formation of new bone tissue in other parts of the human skeleton.

During the experiment on dogs, important conditions were met: 1) creating an obstacle to prevent the germination of the gingival mucosa into the periodontium; 2) maintaining free space separating the walls of the alveoli of the tooth from the structures of the tooth itself; 3) using bone pins to fix the tooth in the alveoli with maximum rigidity and strength.

15 days after dental replantation, loose unformed connective tissue containing many cells and vasoids was found in the periodontium [24]. The cellular elements were connected by narrow long processes formed by the cytoplasm, forming a common syncytium. The decorated collagen fibers were absent in the primary regenerate under study, however, after 60-90 days, the composition of cells in the regenerate was markedly modified. Clusters of cells with a rounded shape and a small nucleus on the periphery were found forming chains, they were located near the cement of the dental roots and the walls of the alveoli. Presumably, these cells are similar to polyblasts, which were found in a temporary regenerate at the site of insertion of a bone pin made of biodegradable material [32, 45, 81]. At the same time, periodontal cells, capable of potentially differentiating into different cell types, showed an orientation towards fibroblastic differentiation instead of osteogenic. This is confirmed by the formation of a large number of collagen fibrils, which were directly associated with the cytoplasm of polyblasts. The process of collagen formation was most actively observed in the area of the walls of the alveoli and cement of autotransplanted and replanted teeth, that is, at the site of attachment of desmodont fragments to skeletal elements of different phylogenetic origin (inner and outer skeleton, respectively). Collagen fibrils were only adjacent to the cell-free cement, but at the same time they were embedded in the structure of the inner compact plate of the alveoli of the tooth. During the first 60-90 days after autotransplantation and replantation, remnants of loose unformed connective tissue containing many cells and vasoids can still be observed in the periodontal center [147, 153].

Some authors note that "post-traumatic bone regeneration is accompanied by the activation of fibroblasts, including fibrocytes, and then their proliferation, where numerous macrophages appear in the regeneration zone, removing tissue detritus. Subsequently, granulation tissue is formed and bone regeneration is activated. With the right medical and drug tactics, as well as timely treatment of patients in medical institutions, a favorable result is determined in the long term after transplantation" [9, 10, 38, 39, 40, 41, 60, 64, 65, 72].

To date, the issues of post-traumatic regeneration of bone tissue and marginal periodontium, restoration of its former intact structure are priorities in replantation. In this regard, before performing replantation, it is necessary to take into account the morphological features of the alveolar processes of the lower and upper jaws, the depth of the alveoli in the bone tissue, their shape, the structure of the outer and inner walls, the thickness of their compact plates [14, 34, 68]. The restoration of adequate biomechanical stability of the tooth in the alveolus has an important effect on the process of osseointegration of the replanted tooth, only then is it possible to restore periodontal function. But, at the same time, the unsuccessful results of dental replantation are mainly associated with their unstable fixation in the "maternal" bed of the alveoli and a violation of reparative processes in the ligamentous apparatus and the marginal periodontium. This situation leads to the fact that during dental replantation, it is necessary to carry out a gentle reconstruction with the exception of occlusion [3, 47, 138].

After 90 days from the moment of autotransplantation or replantation, the first collagen fibrils with a certain orientation in the form of bundles were found in the area of dental root cement. Along with the development of mature lymphatic and blood vessels, nervous innervation of newly formed structures, the mechanism of periodontal space is also launched, designed to absorb loads. Its effectiveness depends on the specifics of periodontal hematolymphatic connections. Arterioles adjacent to the walls of lymphatic capillaries, devoid of muscular structures, promote lymph circulation and lymph formation. At the same time, single-layer hemato- and lymphocapillaries in close proximity act as lymphovenous anastomoses.

Domestic authors [16, 23, 31, 58] found that by the 120th day after dental autotransplantation and replantation, the histological structure of gingiva and all its components was assessed as normal for the ongoing adaptation process. The postoperative period for the general population of experimental animals included in the main group was successful, the severity of the mobility of the operated teeth did not exceed the first degree, and by 30-60 days it was completely absent, and

therefore it was decided to switch the diet of dogs to a standard regime. The results of the X-ray examination showed only the remains of absorbable bone pins. It follows from the above that the conducted experiment on dogs reliably showed the possibility of fixing dental replants to the walls of the alveoli of the teeth according to the periodontal type.

Further support of patients who have undergone dental replantation surgery is often reasonably associated with further orthopedic treatment [1, 34, 67, 70, 98]. This is due to both the necessary splinting of the replanted teeth and the need to correct defects in the tissue structures of the teeth themselves and their mutual location [23, 47, 89, 103].

The inclusion of anesthesia in the dental preparation technique is an integral component of it, since the formation of pain and negative emotions is an undesirable consequence of the manipulations carried out. Surgical procedures performed by orthopedists often entail intense pain [81].

In terms of the influence exerted on an individual, the psycho-emotional factor plays the same significant role as the physical component. In some cases, it can generate even more significant and profound transformations of the functioning of various body systems, compared with the effects caused by the influence of physical factors. To prevent the development of responses that cause a functional restructuring of the connections of the cortical layer of the brain, it is advisable to use sedatives when performing traumatic manipulations on teeth [88, 115]. The preliminary psychotherapeutic preparation of a person who is about to undergo a dental procedure, combined with adequate anesthesia, shows that it can significantly improve the quality of treatment [27, 78, 94, 116, 156].

1.3. Diagnosis of pathological conditions of periodontal tissues after dental replantation surgery

To determine the features of the anatomical and physiological conditions of periodontal tissues after various interventions, including dental replantation, it is necessary to perform appropriate diagnostic measures [77].

Timely diagnosis of pathological processes occurring in the tissues of the oral cavity makes it possible to treat them at the early stages of their development [77, 83].

The most important means of prevention is the identification of risk groups during preventive examination. During the examination, a group of people at high risk is identified. It includes patients with comorbid conditions in the gastrointestinal system and other concomitant somatic disorders, severe allergic reactions, as well as individuals who have various pathologies of the oral mucosa [56, 72, 91, 100].

To achieve this goal, an integrated approach is used, which includes the use of a Schiller-Pisarev solution in combination with a 1% solution of tolluidine blue [2, 15]. These reagents make it possible to detect inflammation in the early stages by detecting glycogen in the epithelial cells forming the gingival mucosa, which helps in situations where visual diagnosis of inflammatory reactions is difficult [45, 77, 83].

The use of a variety of diagnostic indices during the examination of the patient is important, as it provides an opportunity to quantify the data obtained [14, 34, 45, 57]. In addition to indices, techniques that allow determining the depth of the periodontal pocket are meaningful for understanding the condition of periodontal tissues [152].

The data obtained during the bacterioscopic examination are quite informative [43, 64, 66, 125, 149]. There are classifications of changes in the epithelial structures of the oral mucosa based on stomatoscopy data [64]. It is important to use these techniques to assess the condition of mucosal tissues both in

normal and pathological conditions [61]. To carry out such studies, the methods of cheilo- and stomatoscopy are widely used [65, 67], which play an essential role in this process.

The characteristics of periodontal disease in orthopedic treatment were studied, and the indicators of gingival fluid were analyzed. As a result, a formula has been developed that reflects these indicators [32]:

IGF (Index of gingival fluid)	The sum of individual indicators of the quality of gingival fluid obtained from gingival grooves, gingival and periodontal pockets
	The number of gingival grooves, gingival or periodontal pockets examined

The liquid was taken in the area of 20 of the following teeth	654321123456
	654321123456

According to the measurement of the impregnation area and weighing of the paper strip, they are: with intact periodontitis – from 0 to 0.5 mm2, from 0 to 0.1 mg; with chronic catarrhal gingivitis - from 0.5 to 1 mm2, from 0.1 to 0.3 mg; with periodontitis - 1 mm2 or more, from 0.1 to 0.3 mg.

The study of the effect of temporary crowns on the severity of inflammatory processes occurring in marginal periodontitis was carried out. During the study, the interdental papilla bleeding index (PBI) was developed, which showed a downward trend after 7 days. There is evidence [70, 145] that temporary crowns can cause a reaction from the marginal periodontium due to the accumulation of colonies of microorganisms on themselves. The intensity of inflammatory reactions decreased 7 days after preparation, which was reflected in a decrease in PBI. However, with an increase in the duration of use of temporary crowns, the PBI indicators increased again.

An effective and timely complex of diagnostic measures performed at the preparatory stage, as well as at the time of direct dental treatment, aimed at identifying various pathologies of the histostructures of the oral cavity, allows the most optimal way to correct pathological changes affecting the success of comprehensive dental treatment.

4.4. Treatment of pathological conditions of periodontal tissues after dental replantation surgery

Upon completion of a thorough and timely diagnosis of inflammatory changes in the mucous membrane of the oral cavity and periodontium, it is necessary to stop these changes before the start of the clinical stages of surgical treatment.

Various methods are used for this purpose. The most optimal way is to use the methods in a complex. For example, physiotherapy (exposure to light physical factors) and medication [77].

Russian and foreign authors are actively studying the problem of the development of allergic stomatitis in patients. L.D. Gozhaya played a significant role in solving this issue [29]. To eliminate allergic conditions, antihistamines that block histamine receptors and have antiallergic activity are recommended. It is recommended [115] "Fencarol", "Diprazine", "Diazoline", "Suprastin", "Tavegil".

It is noted in the literature that stomatitis that occurs in people using prostheses has a multifactorial nature [131]. The importance of Candida fungi detected in the oral cavity of the majority of people suffering from stomatitis has been studied in detail. These microorganisms still remain the key causative agents of this disease, even taking into account the fact that the use of nystatin therapy did not allow to completely cope with stomatitis.

The scientific literature mentions methods [88, 115] that describe in detail various strategies for the use of drug therapy, taking into account the specifics of

the detected pathologies of periodontitis and oral mucosa, in particular periodontitis [115]. Preparations obtained from animal and vegetable raw materials play an important role.

Herbal remedies are allocated that have clearly defined indications for use: "Aloe extract liquid for injection", "Aloe juice", "Biosed", "Rosehip oil", "Carotolin", "Sea buckthorn oil", "Colanchoe juice".

Of medicinal products of animal origin, according to certain indications, [1, 115] are recommended: "Placenta extract for injection", "Solcoseryl".

In scientific studies [59, 88], it is noted that pain is the earliest sign of the development of inflammation. Therefore, special attention is paid to the elimination of pain that may occur in patients and interfere with the processes of adaptation to the prostheses they have installed for certain conditions [51, 59]. At the same time as providing specialized dental care, it is important to provide effective pain relief. It is proposed [115] to apply Propoceum ointment and Proposol aerosol.

There are descriptions of various strategies for the use of drug therapy for the treatment of local periodontal pathologies, so a number of antibiotics and antiseptics have been proposed [115], mainly acting on the oral mucosa.

It is proposed to use propolis, which has an antimicrobial effect [82, 87, 124]. Lidase, lysozyme and others can be used among the drugs with enzymatic activity [81, 115]. Among astringents and antibiotics, the following are recommended: Salvin, Romazulone, Metronidazole, Chlorophyllipt, St. John's Wort herb and Chamomile Flowers [8, 115]. The use of drugs that activate metabolism helps to stimulate the processes associated with the formation of new leukocytes, cell growth and division, as well as the speedy healing of trophic ulcers and wounds. The regulation of calcium and phosphorus metabolism is performed using the drug "Dihydrotachisterol". In addition to these drugs, it is possible to use sulfonamide preparations and antibiotics [88, 115]. At the same time, a significant number of Russian medical workers in their research talk about a large number of unreasonably prescribed antibacterial drugs and those adverse reactions and

complications that occur, in particular, side effects from the oral mucosa and their prevention [2, 9, 10, 51, 54]. Unjustified and improper antibiotic treatment, in some cases, leads to the formation of oral candidiasis.

There is a risk of developing allergic reactions and the possibility of alleviating these conditions with the use of appropriate pharmacological agents [38]. The methods of application of physiotherapy methods have found their comprehensive application in medicine and dentistry, in particular. There are known [73, 79, 89] interesting positive results of the use of low-intensity laser radiation (LILR) and monochromatic red light in orthopedic dentistry.

In the late 1960s, in the field of therapeutic dentistry, a new promising possibility was discovered for the treatment of various periodontal diseases and oral mucosa using low-intensity lasers [69, 79, 89]. This issue was actively studied by both Soviet and, later, Russian authors, as well as foreign ones [69, 107, 108, 134, 139, 141, 147]. The Central Research Institute of Dentistry played a leading role in the creation and practical application of such techniques, it was the first to address the issue of developing a methodology for the use of low-intensity laser radiation in dentistry [5, 109, 110, 111, 112].

Four LILR effects have been identified and determined [79, 89, 109, 110]. This is a therapeutic effect at the cellular level and in inflammatory processes in tissues, as well as the ability to increase cell resistance to damage and stimulate regeneration occurring in cells and tissues.

Optimal parameters of laser radiation action have been established [69]: stimulation of cell proliferation (0.1-100 MW/cm2, 30 sec - 5 min., up to 20 min. in one session); anti-inflammatory and analgesic effect (100-200 MW/cm2, 2-5 min., 1-20 min. in one session); photodynamic effect (power density -100-400 MW/cm2, exposure - 1-20 min., total exposure time in one session - 1- 20 min.).

A comparison of the outcomes of therapy using traditional and laser techniques has shown a significant advantage of using low-intensity laser radiation in terms of cost-effectiveness and ease of organization, as well as medical effectiveness of treatment [79, 89, 90].

For clinicians, it is important to understand the mechanism of LILR's effect on inflammatory processes and the principle of their suppression [69, 104].

The increase in fluid transfer and the formation of cellular edema are one of the indicators of damage to cellular structures (A.M. Chernukh, 1978). The mitotic activity of cells is an indicator of the severity of their proliferation, reflecting the essence of this process [112].

Analyzing the effect of a low-intensity laser on reparative processes in the oral mucosa, the researchers note that this effect should be studied at the cell level, since radiation affects histopathomorphology, dose-dependent changes the functioning of mastocytes, modifies the work of enzyme systems, and also affects organelles and nucleic acids. LILR, due to its ability to influence the rheological properties of blood and improve the microcirculation of tissues, stimulates the exchange of oxygen in them. This positive effect on oxygen metabolism is accompanied by activation of the process of tissue repair and aeration, stimulation of cell proliferation, as well as a decrease in inflammatory processes (A.A. Prokhonchukov, 2009) [81].

Regulation of microcirculation is one of the main actions of low-intensity laser radiation. It has been established that radiation from the visible part of the light spectrum causes hyperemia - an increase in blood filling and vasodilation, which directly depends on the density of the light beam and the time of its exposure [52, 79, 89]. Studies have shown that LILR is able to restore microcirculation even in capillaries where blood flow is in a prestatic state [73]. The effect of a low-intensity laser causes the restoration of microcirculation in inflamed tissues, which occurs due to normalization of the tone of the smooth muscles of the capillaries, reduction of the release of inflammatory mediators, stabilization of vascular walls and, as a result, the histohematic barrier, as well as improvement of the rheological properties of blood [112]. Exposure to low-intensity radiation reduces the permeability of the vascular wall, which causes its property to reduce edema [1, 73]. The laser stimulates fibrinolysis, which, in combination with improved microcirculation, promotes thrombolysis [73].

LILR exhibits a bacteriostatic effect, despite the fact that no direct bactericidal action has been detected behind it [69, 73]. With suitable values of radiation power and time, as well as the choice of the optimal exposure zone, it stimulates local and general immunity, increases resistance to infections, including viral ones.

Based on the above, it can be concluded that the use of low-intensity laser radiation contributes to the activation of the hematopoiesis process and normalization of hematological parameters. Also, according to the analysis of the available literature, it follows that LILR has analgesic properties by reducing wound healing time and reducing soreness [79, 89]. When irradiating healthy tissue, there is a feeling of numbness. It has been proven that a low-intensity laser stimulates neurons and improves the conduction of nerve impulses [73].

Semiconductor lasers have an efficiency similar to and even superior to the action of helium-neon lasers [69, 79, 89]. Such laser equipment is characterized by compactness, lightness and ease of operation [65]. At the same time, [65] helium-neon lasers have an overwhelming effect, when working with them, visual control of the laser beam can be performed, which makes it possible to ensure high accuracy and variability of the treatment.

The results of clinical trials show that laser therapy can be effective in accelerating the process of repair and epithelialization of the oral mucosa in various pathologies. In addition, this type of radiation has an anti-inflammatory effect, which is important in the context of orthopedic practice [69].

The combined use of laser radiation and pharmacotherapy makes it possible to achieve the desired effects in the treatment of various diseases of the oral mucosa and periodontal structures, as well as allergic reactions [69].

Due to the great attention paid to the safety of medical personnel, a complex designated by the term "laser disease" has been identified. In order to ensure the safety of health of medical workers performing laser therapy as a therapeutic procedure, a document was created and adopted that establishes requirements for laser equipment [4].

Despite the widespread use of light therapy methods in clinical practice, including laser therapy [7, 10], the exact mechanisms by which it exerts its therapeutic effect are still unclear. Often, the severity of the positive therapeutic effect, when using laser radiation, is explained by its almost one hundred percent polarization, as well as coherence.

It was found [119, 120] that it is possible to reduce or completely eliminate the effect of resonant magnification due to an increase in the pulse duration of more than 4 ms, this allows for stimulation of cell membranes just at the end of their depolarization, the beginning of repolarization, or even later.

The described physiotherapy technique [119, 120] can be used in various medical fields, including dentistry, dermatology, reflexology, surgery, rheumatology and many others. For this therapy, it is possible to use a device called Svetozar, which provides local irradiation of the skin with light in the infrared spectrum [1, 67, 107]. The complete set of the device includes a brochure containing detailed instructions for conducting physiotherapy procedures.

The use of modulated radiation, which provokes a resonant increase in the permeability of cell membranes, allows to reduce the duration of physiotherapy procedures, their number, and also increase their effectiveness [52, 78, 87].

The method of exposure to converted electromagnetic radiation with pulse duration from 2 to 4 ms and pauses between them from 9 to 12 ms, used in physiotherapy, can be an effective tool in dental practice [119, 120]. It is based on the use of low-intensity radiation of the visible or infrared spectrum. Under its influence, the ability of tissues to adsorb improves, the passage of substances through cell membranes is facilitated, and microcirculation becomes better.

The physiotherapy technique, which formed the basis of the invention [119, 120], includes the use of pulsed electromagnetic radiation having a wavelength entering the infrared or visible range, as well as low energy. It takes into account the most effective approaches, namely the optimal combination of pulse execution time and pauses between them, thanks to which a resonant increase in the permeability of cell membranes is achieved, leading to an increase in the

effectiveness of the therapy by reducing the duration of the procedures and their number.

It has been proved that the phenomenon of electrical breakdown of cell membranes is one of the principles by which light radiation has its therapeutic effects. It causes the membrane to depolarize, which leads to a change in the electrical potential on both sides of the membrane. After depolarization, repolarization occurs, ending with the development of a refractory period, during which the voltage on the membrane returns to its original value. The above processes are accompanied by a significant increase in the permeability of cell membranes [7, 12, 20, 40, 58].

Based on the data obtained, the following conclusions were drawn: the optimal modulation frequency of therapeutic low-intensity light exposure is probably in the range of 80-90 Hz; there is a more pronounced therapeutic effect for low-intensity light exposure with a higher pulse rate compared with low-intensity light exposure with a lower pulse rate, which indirectly confirms the assumption about the above mechanism of influence of low-intensity modulation light exposure; the effect of increasing the power of low—intensity light exposure is comparable to the effect of using pulsed low-intensity light exposure of a higher range at an optimal modulation frequency, which also indirectly confirms the above assumptions; exposure to low-intensity near-infrared light exposure (maximum - 720 nm) gave a lesser therapeutic effect compared with low-intensity light exposure to visible light (maximum — 640 nm) even at higher radiation power; the proposed devices with LED emitters are convenient, compact and easy to use in a dental office; the obtained clinical results make it possible to use them in the treatment of dental diseases; their further improvement should be considered promising to find an effective spectrum of low-intensity light exposure to create an optimal therapeutic effect [52, 79, 89, 107].

Thus, the use of light as one of the physical factors in the form of LILR, as well as monochromatic and modulated red light for the treatment of inflammation

of periodontal structures and tissues of the oral mucosa is scientifically justified and recommended in the practice of dentists.

An important element of the complex of measures that reduce the scale of the development of pathological conditions of dental and periodontal tissues is the implementation of preventive measures that are protective for tissues.

Thus, the issue of dental replantation in modern conditions is quite relevant and requires new methodological approaches.

CHAPTER 2. RESEARCH MATERIALS AND METHODS

Modern dentistry is aimed at the use of minimally invasive interventions in the preservation of dentition. This fact determines the need for wider use of various kinds of dental operations. In modern conditions, dental surgeries are increasingly performed with a predictable successful outcome. The treatment of dental injuries includes complex endodontic or surgical treatment protocols. An important aspect in the rehabilitation of dental injuries is the development of clear tactics of diagnostic measures both at the initial admission and at all stages of treatment.

The main advantage of dental replantation surgery is the fact that the tooth is preserved, which avoids the development of deformation of neighboring teeth and eliminates aesthetic defects of the dentition, as well as to prevent atrophy of the surrounding bone structures. The correct implementation of this technique makes it possible to achieve, in most patients, a favorable outcome of orthopedic treatment in the long term.

To solve the tasks set out in the dissertation work, studies of outpatient dental patient records were conducted on the basis of the City Budget Healthcare Institution "Voronezh Children's Clinical Dental Clinic No. 2" in Voronezh, licensed for all types of dental activities for both children and adult dental appointments (license No. L041-01136-36/00351169 dated 03.11. 2017).

In the department of Surgical and Orthopedic Dentistry, using the developed algorithm, as part of the dissertation research, a retrospective analysis of outpatient records of dental patients after their dental replantation surgery performed in the period from 2017 to 2023 and a set of diagnostic methods was carried out. The indicators of the state of the periodontal complex in the period after surgical treatment, as well as the periodontal ligamentous apparatus in the dental area in preparation for orthopedic treatment (if necessary) were studied.

2.1 Research design

A retrospective analysis of outpatient records of patients who were included in the selection criteria of this dissertation study was carried out, taking into account the diagnosis during dental replantation according to indications, the time of treatment after injury, and the timing of follow-up.

The study examined data on the main and additional diagnostic methods used in dentistry. The main methods included: dental examination, probing with a periodontal probe, palpation, questioning and anamnesis collection (including clarification of the circumstances of the injury), clarification of the allergic status.

Additional clinical research methods were: X-ray examination, bacteriological examination, functional diagnostic method (ultrasound Dopplerography, periotestometry), pH examination of oral fluid, macrohistochemical examination.

It is known from outpatient records that at the first admission, patients underwent endodontic treatment and tooth replantation after injury, splinting. Medication therapy and local physiotherapy have been prescribed.

In the process of dynamic observation for 7 years and evaluation of the results of dental replantation in the groups of subjects, techniques aimed at restoring the aesthetics of the dentition were used. If necessary, the final stage of the study, after stabilization of the condition of the replanted tooth, was a full-fledged orthopedic treatment with an individual choice of the type and design of orthopedic structures in accordance with the clinical picture.

2.2. General characteristics of patients (based on the analysis of outpatient records) who participated in the study

As part of the dissertation research, 127 outpatient records of dental patients in need of dental replantation surgery after dental trauma, who underwent

comprehensive examination and treatment from 2012 to 2023, were studied at the BHI Dental clinic in VCCDC No. 2.

Inclusion criteria: outpatient records of patients who were diagnosed with complete or incomplete dislocation of the tooth, uncomplicated or complicated fractures of the crown of the tooth, age and gender characteristics - men and women aged 18 to 40 years.

Exclusion criteria: outpatient charts of patients under the age of 18 and after 40 years, with diagnoses: longitudinal crown-root fractures, fractures of the roots of teeth, fractures of the alveolar process, chronic generalized periodontitis, a condition in the process of orthodontic treatment. Outpatient cards were not taken into account, in which the patient refused to strictly follow the protocol of diagnostic and therapeutic manipulations, timely visits to the attending dentist.

During the analysis of the maps, the distribution of patients by gender was as follows: 69 female patients, which was 54.33%, 58 male patients, which corresponded to 45.67% of the total number of subjects (Figure 1).

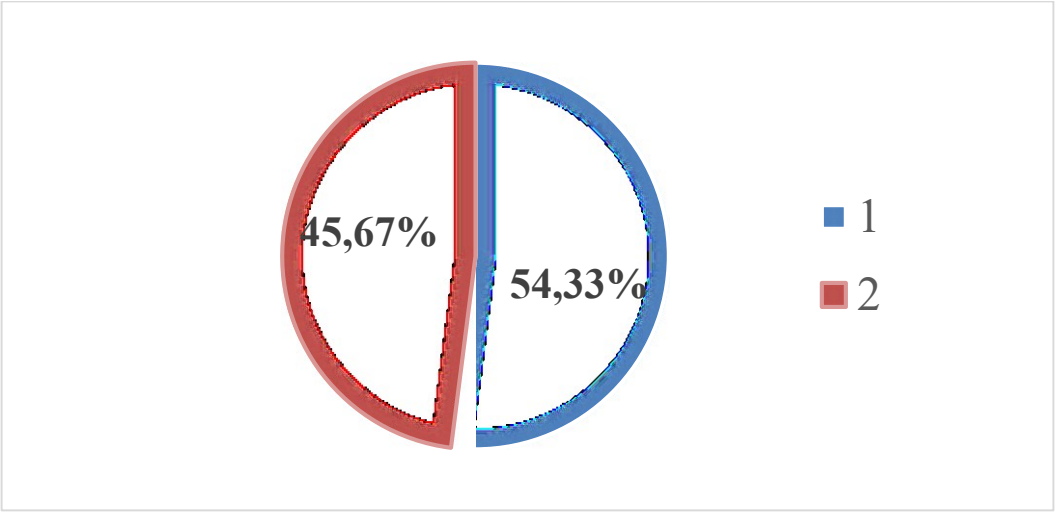

Figure 1. Distribution of patients by gender

(1 –male. 2 –female.)

In our opinion, this percentage of predominance of female patients is explained by the fact that women take a more responsible approach to their aesthetic condition.

All 127 outpatient cards were divided into 2 groups. The first group consisted of 66 outpatient records, of which it is known that patients with traumatic dislocations of teeth sought medical help within 24 hours after injury. He underwent a surgical operation of tooth replantation, endodontic treatment, developed a comprehensive treatment aimed at relieving an acute inflammatory reaction of a post-traumatic nature, and carrying out the necessary splinting measures. The second group consisted of 61 outpatient records, of which it is known that patients with traumatic dislocations of teeth sought medical help 24 hours or later.

2.3. The applied methods of treatment of patients (according to medical documentation)

Two subgroups were identified in the first group of outpatient cards: the first subgroup 1a (32 outpatient cards) included patients who underwent tooth replantation surgery and preparation for it, splinting, and rehabilitation was carried out using the traditional method. The second subgroup 1b consisted of 34 outpatient charts, from which it is known that the preparation for replantation included the use of bioactive M-Chip matrices in the form of granules and physiotherapy treatment after surgery.

In the second group of outpatient records, patients also underwent dental replantation surgery, endodontic treatment, and necessary splinting measures. There are also two subgroups of outpatient cards: the first subgroup 2a, in the amount of 30 pieces, included cards where patients were treated in accordance with group 1a according to the traditional method. The second subgroup 2b consisted of outpatient cards, in the number of 31, where the patient treatment plan was similar to group 1b (Table 1).

Table 1 – Methods of treatment of patients (according to medical documentation)

Therapeutic manipulations	Subjects (n=127)			
	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1б (n=34)	Group 2a (n=30)	Group 2б (n=31)
Replantation	✓	✓	✓	✓
Endodontic treatment	✓	✓	✓	✓
Splinting of replanted teeth	✓	✓	✓	✓
The use of the Svetozar physiotherapy device		✓		✓
Application of bioactive M-Chip matrices in the form of granules		✓		✓
Orthopedic treatment (according to indications)	✓	✓	✓	✓

2.3.1. Surgical and therapeutic protocols of dental replantation

Replantation is a method of choosing a tooth-preserving tactic for the treatment of dislocations of teeth, in our study, replantation was carried out according to the standard method.

A study of outpatient dental patient records showed that patients underwent local anesthesia using a carpool syringe HLW-Dentalinstruments, Germany (RU No.RZN 2016/3602 dated 01/25/2016), a needle for carpool syringes 27G*30MM (hereinafter referred to as the manufacturer), a preparation Septanest, France (RU No. N012998/01 dated 07/9/2007). Next, the circular ligament of the tooth was carefully peeled off with a sickle-shaped ironer and tooth extraction was performed using an Omnident Dental kit-Handelsgesellschaf, Germany (RU No. FSZ 2009/05012 dated 08/27/2009)

The removed tooth was immersed in a warm (37 ° C) 0.9% sodium chloride solution of JSC "Firm Medpolymer" (RU No. R N003758/01 dated 09/19/2011) with the addition of 0.02% nitrofural solution of JSC "Avexima" (RU No. LSR-009026/10 dated 08/31/2010).

The well of the removed tooth was cleaned from granulations using a 2.0 mm curved curettage spoon lukas (HLW 25-3), HLW Dental, Germany (RU No. FSZ 2009/04952 dated 08/12/2009), washed with isotonic sodium chloride solution of JSC Firm Medpolymer, Russia, then 0.02% nitrofural solution of JSC Avexima, Russia, after revision. For example, patients were asked to "bite" a sterile gauze swab.

The treatment of the replant was carried out by mechanical cleaning of the carious cavities and endodontic treatment in compliance with the rules of asepsis. The tooth was held in a sterile gauze cloth moistened with isotonic sodium chloride solution with furacilin. The therapeutic part of the treatment was carried out using the KaVo Estetica E30 dental unit, Kaltenbach & Voigt GmbH, Germany (RU No. FSZ 2012/13462 dated 12/26/2012). For the preparation of hard tooth tissues, sterile turbine tip Pana-Max Pax-Su M4, NSK, Japan (RU No. FSZ 2009/05573 dated 07/28/2009) and angular dental tip S-Max M25l push-button with optics, with water C1024, NSK, Japan (RU No. FSZ 2009/05572 dated 07/28/2009), drill set Mani Dia-Burs, Japan (RU No. FSZ 2012/13495 dated 12/27/2012). The carious cavity was filled with glass ionomer cement for this purpose, a set of Vitremer glass ionomer filling material was used, 3M ESPE Dental Products, USA (RU No. FSZ 2010/06859 dated 06/02/2017)

For endodontic treatment, a set of tools with accessories was used by Mani Inc., Japan (RU No. FSZ 2012/13495 dated 12/27/2012). Endodontic treatment included preparation of access to the pulp chamber, pulpoectomy and root canal treatment by mechanical and medicinal method with 3.25% sodium hypochlorite solution of NKF OMEGA-DENT LLC, Russia (RU No. FSR 2010/09807 dated 31.12.2010). For mechanical processing, an endodontic X-SMART device was used with Maillefer Instruments Holding Sarl accessories, Switzerland (RU No.

FSZ 2009/04920 dated 03/15/2010) and Mtwo NiTi - machine files, a set of VDW GmbH, Germany (RU No. FSZ 2010/07056 dated 05/28/2020). Root canals were dried with paper pins Meta Biomed Co., Korea (RU No. FSZ 2010/08740 dated 03/29/2016).

The root canal of the teeth was filled with ProRoot MTA material, Dentsplay, USA (RU No. FSZ 2007/00866 dated 12/20/2007). In the literature, it is theoretically justified that the process of resorption of the tooth root can be prevented if endodontic treatment is carried out qualitatively. The MTA material contains tricalcium and dicalcium silicates, tricalcium aluminate, bismuth oxide, gypsum and is ideal for preparing a tooth for replantation into a well. Calcium-containing materials for filling the roots of teeth have antimicrobial and regenerative properties. Mineral trioxide aggregate has been repeatedly investigated as a filling material for apexification in the endodontic stage of resection of the tip of the tooth root in order to stimulate apexification, in therapeutic dentistry, MTA is used for direct and indirect coating of pulp. The composition of ProRoot MTA also has antimicrobial action, good biocompatibility and the ability to induce cementogenesis. Given the biological properties of MTA, this material was the drug of choice for endodontic preparation of the replanted tooth.

After filling the root canals, the tops of the teeth roots of the replanted teeth were resected with a cutter into a truncated cone from a set of Mani Dia-Burs drills, Japan, and MTA apexification was performed. After careful treatment of the tooth from carious tissues and endodontic treatment, the tooth was immersed in an isotonic sodium chloride solution. The remains of the ligamentous apparatus on the surface of the tooth root were not removed.

Instruments for tooth extraction and before preparing the tooth for replantation were sterilized in an autoclave LF-22L-E by Medline LLC, Russia (RU No. RZN 2018/7150 dated 12.12.2018) in packages of combined self-adhesive sterites for sterilization Vinar, Russia (RU No. RZN 2013/19 dated 04.04.2016) at a temperature of 120 °C.

Before the direct replantation procedure, the well was treated. A tampon and a blood clot were removed, the well was washed with a solution of 0.02% furacilin, iodoform powder of JSC Troitskiy Iodine Plant, Russia (RU No. R N003698/01 dated 08/04/2010) was added to the well for patients of groups 1a and 2a. For patients of groups 1b and 2b, a well with a solution of 0.02% furacilin and at the time of direct replantation of the prepared tooth was installed in the periodontal space of M-Chip Double White, Russia (SGR No. KG.11.01.09.014.E.005502.10.17 dated 10/24/2017) in the form of powder in capsules containing benzyldimethyl ammonium chloride monohydrate, sodium fluoride, amino acids. The main nanomatrix of M-Chip is medical gelatin, the active ingredients have an antiseptic effect. The contents of the capsule were injected directly into the area of the replanted tooth, the drug dissolved slowly, releasing active substances. M-Chip capsules were the drug of choice in the treatment of patients of groups 1b and 2b, since the active ingredients help strengthen tissues after dental replantation, providing prolonged antiseptic, homeostatic, immunoadjuvant, osteotropic effects, the substances included in the composition do not change the balance of microflora in the oral cavity, do not cause resistance of microflora to active antiseptics.

After placing the tooth in the hole, seams were applied with the material Resolon 6-0 USP, 0.45 m, 3 Blue, Resorba, Germany (RU No. FSZ 2010/08364 dated 07/18/2017), splinting was carried out for 3-4 weeks using the set for splinting teeth "Armosplint", VladMiVa, Russia (RU No. FSR 2010/07933 dated 09/11/2017).

On the day of patients of groups 1b, 2b, a periodontal bandage Septo-Pack, Septodont, France (RU No. FSZ 2011/10578 dated 09/20/2011) was applied to fix the M-Chip nanocapsules in the surgical field.

The analysis of outpatient records also showed that all patients were given recommendations: a gentle diet was prescribed, medication for 3-5 days: nonsteroidal anti-inflammatory drug Ketanov, Desloratadine 5 mg 1 time a day.

2.3.2. Physiotherapy treatment with the Svetozar device

As shown by a retrospective analysis of outpatient records, in subgroups 1b and 2b, red diode light radiation with parameters (Table 2) was used, allowing to induce the necessary physical and biological effects, combined with drug treatment. Therapy by exposure to modulated red light was carried out using a physiotherapy device "Svetozar", Russia (RU No. RZN 2014/1398 dated 01/23/2014) (Fig. 1, 2).

Table 2 – Characteristics of the Svetozar physiotherapy device

Parameters	Indicator
The wavelength of the maximum radiation	665±15 nm
The width of the radiation spectrum	no more than 10 nm
Pulse modulation frequency	80±5 Hz
Pulse modulation duty cycle	4,3
Radiation power	up to 30 MW

Figure 2. Source of modulated red light "Svetozar"

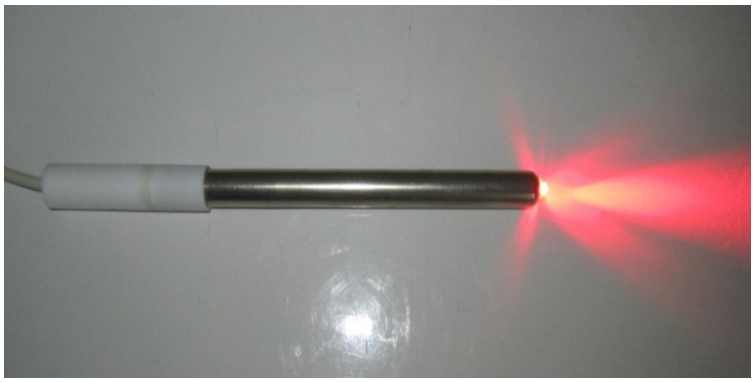

Figure 3. Source of modulated red light "Svetozar"
(in working condition)

The applied effect of modulated red light with the Svetozar physiotherapy device, as shown by the analysis of outpatient charts, allowed to normalize the physiological processes occurring in the tissues surrounding the replanted tooth.

Photobiochemical phenomena in cells caused by exposure to red light are similar to photosynthesis carried out by plants: modulated low-intensity red light affects the cell population, photons are absorbed by electrons of photoreceptors or chromophores of the cellular system [52, 79, 89, 107].

One of the main mechanisms of action of red light is the stimulation of mitochondria, which are the key target of the phototherapy mechanism of the Svetozar apparatus, electron transfer by photons is accelerated in the visible and near-infrared regions of the light spectrum by modulating the activity of cytochrome c oxidase. This mechanism triggers an increase in the production of adenosine triphosphate and the induction of transcription factors. Thus, the therapeutic effect arises due to combinations of biological effects occurring at the intracellular level. When the rehabilitation complex of physiotherapy treatment with the Svetozar device is turned on, the following biological effects are achieved: at the molecular level - pronounced stimulation of cell membranes, at the cellular level - improvement of trophic, blood circulation, regeneration and hematopoiesis, activation of metabolism. The positive effects on the morphofunctional state of the immune and neuroendocrine systems are the protection of the following clinical

effects: regenerative, desensitizing, anti-inflammatory, decongestant, analgesic, immunocorrective, bactericidal and bacteriostatic.

2.3.3. Diagnostic methods of examination of patients (according to medical documentation)

Diagnosis, as shown by the analysis of outpatient records, was carried out comprehensively on the basis of clinical and laboratory research methods (Table 3).

Before starting treatment, all patients underwent a dental examination in the KaVo Estetica E30 dental chair, Kaltenbach & Voigt GmbH, Germany (RU No. FSZ 2012/13462 dated 12/26/2012). anamnesis was carefully collected, the data of which allowed to clarify the time of injury, the mechanism of damage. We collected data on the state of health, allergic history.

Table 3 – Diagnostic methods used in the study in patients before and after transplantation (according to medical documentation)

Type of diagnostic method	Control dates of the event
X-ray examination	Before the replantation, immediately after the replantation, after 14 days, after 1 year, after 3, 5 years
Macrohistochemical study	Before the replantation, 7 days after the replantation
Probing with a periodontal probe	Before the replantation, 14 days later, 1 year after the replantation
Ultrasound Dopplerography	14 days, 1 and 3 years after the replantation
Measuring the pH of gingival fluid	14 days after replantation
Priotestometry	1 and 3 years after replantation

All patients, as indicated and confirmed, underwent X–ray diagnostics on the device Visiograph dental CSN Industrie, Italy (RU No. RZN 2017/5414 dated 03/25/2017) - radiation dose 2-3 mSv. X–ray examination was performed 6 times (individually according to indications - more often): at the initial admission before

the start of treatment, immediately after replantation and splinting, 4 weeks after replantation, one year after replantation, 3 to 5 years after replantation.

The outpatient charts selected by us for retrospective analysis described the clinical picture after the clinical stage of dental replantation and a set of studies of pathological conditions from the moment of their detection, and within 10 days, taking into account the control visit.

2.3.4. The main methods of examination of patients (according to medical documentation)

As is known, the purpose of clinical methods of examination of patients is to determine the diagnosis of the disease, assess the general and local statuses, which is the key to successful comprehensive treatment based on surgical operation of tooth replantation in dislocation.

The following data were obtained from the outpatient records of the dental patient: all those who sought medical help underwent a visual assessment of the state of the structures of the oral cavity, which occupied a significant part of the examination of patients in clinical practice. During the visual assessment of the condition of the oral cavity, the following were revealed: damage to the crown of the tooth, swelling and redness of the mucous membrane and dentoalveolar papillae, the presence of carious cavities, the condition of hard tissues of the teeth, tooth mobility, orthodontic status, chewing efficiency.

The structural and topographic characteristics of the transitional folds, as well as the attachment points of the ligamentous apparatus, tongue, frenules of the lower and upper lip were also studied. The analysis of these parameters is necessary to determine the unique morphofunctional features of the patient's oral cavity. The severity of gum recession, the presence of a periodontal pocket allows classifying the degree of atrophy of the gingival mucosa during a dental examination, this plays an important role in analyzing the state of compensatory capabilities of the dental system.

Next, a palpatory examination was performed, aimed at forming a deeper understanding of the condition of the oral cavity of the subject. Special attention was paid to regional lymph nodes: submandibular, parotid, occipital. Their following characteristics were evaluated: size, mobility, soreness. The assessment of the tone of the masticatory and facial muscles, palpation of the temporomandibular joint was also performed.

During palpation of the oral mucosa, data on the presence of edema, hyperemia and pain in the area of the gingival papillae and gums were recorded in the outpatient chart. The mobility of individual teeth in the area of injury made it possible to establish the state of the dentition in order to assess the state of periodontal compensatory capabilities and the feasibility of dental replantation surgery. The outpatient charts after the replantation operation also noted the condition of the tissues surrounding the replanted tooth, the results of diagnostic measures and correction of pathological conditions of the mucous membrane of an inflammatory nature

2.3.5. Examination of the periodontal status of patients (according to medical documentation)

For the most accurate and early diagnosis of pathological changes in the periodontal complex, and the identification of specific areas of inflammatory reaction, a macrohistochemical study was used [2]. It was performed at the initial visit before replantation by staining the mucous membrane of the gingival margin, the dentoalveolar papillae in the area of the supporting teeth, and teeth with upcoming replantation. The rationale for this study was to exclude or confirm inflammatory changes in the oral mucosa. As part of the work carried out, the oral mucosa was stained using the Schiller-Pisarev reagent and a 1% toluidine blue solution. The study was repeated 7 days after replantation in order to monitor the successful implementation of rehabilitation measures, the presence and nature of inflammation in the area of tooth injury.

When analyzing medical documentation, it was determined that staining was performed using a Schiller-Pisarev solution in the form of Color test Liquid No. 1 VladMiVa, Russia (RU No. FSR No. 2010/06809 dated 11/22/2017) containing J2 + KJ + H2O (distilled), and the proportions were: J2 - 1.0 ml, KJ - 2.0 ml, H2O - 40.0 ml. After that, a 1% solution of tolluidine blue Ergoprodaction, Russia (RU No. RZN 2013/775 dated 03/23/2015) was applied.

When applying the Schiller-Pisarev solution to the oral mucosa, glycogen produced by epithelial cells in response to their inflammation reacts with reagents and gives enhanced coloration in the affected areas. The amount of glycogen produced is directly proportional to the severity of the inflammatory reaction, respectively, and the color saturation will depend on it. A solution of tolluidine blue pigments the nucleoli of epithelial cells [2, 15].

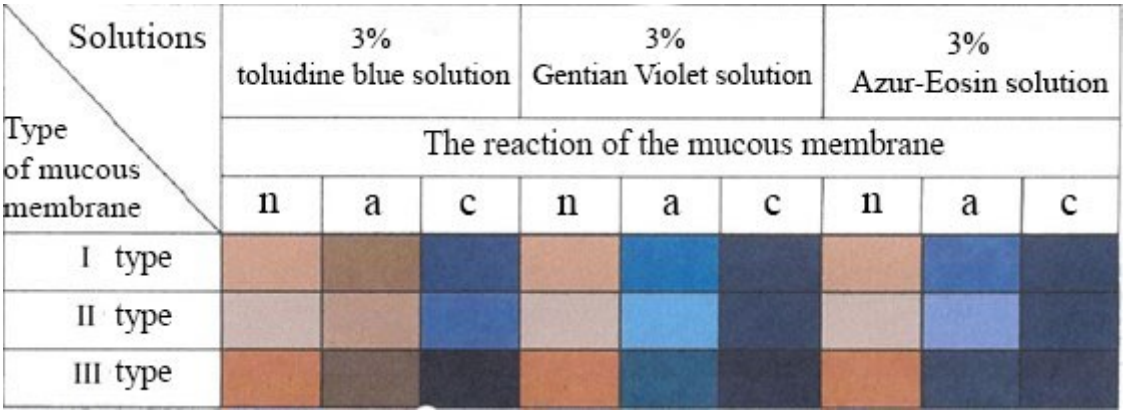

Figure 4. The intensity scale of mucosal staining in the normal state, reactions of acute and chronic inflammatory response, the author's method of Doctor of Medical Sciences, Professor N.I. Lesnykh

In order to evaluate the effectiveness of therapy for inflammatory conditions, in comparison with the control group subjected to standard treatment methods, information is required on the reduction of the total area (S) of inflammatory areas [15].

In order to monitor this process, a transparent millimeter polyethylene film was used, on which there is a marking (in mm) (Figure 5). The measured values of the inflammatory areas were summarized.

The sum of the areas of the inflammatory reaction zones is calculated as follows:

$$\Sigma S = S_1 + S_2 + S_3 + S_4 + S_5 + S_n,$$

where: ΣS is the total area; S1, S2, S3, S4, S5, Sn are the areas of individual zones of inflammatory reaction of the oral mucosa and periodontal in each patient.

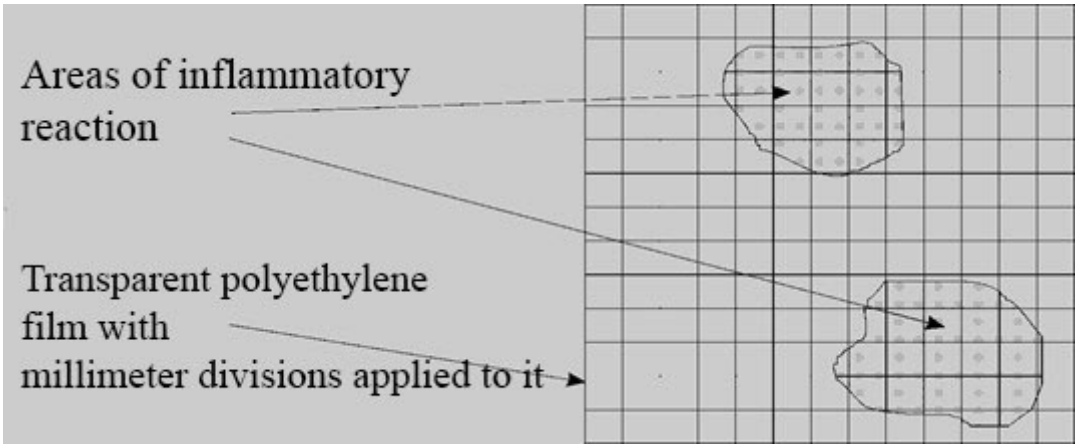

Figure 5. Determination of the area (S) of the sites (zones) of the inflammatory reaction of the oral mucosa and periodontal

The next method of assessing the periodontal status was the measurement of dentoalveolar attachment using a periodontal probe PCPUNC15 (HLW 27-22A), HLW Dental, Germany (RU No.RZN 2015/3418 dated 12/21/2015). A graduated periodontal probe allows measuring violations of dentoalveolar attachment, the presence of a violation of the attachment of the periodontal ligament, the depth of the dentoalveolar groove. This study was used to assess the condition of periodontal tissues before and 14 days after replantation, if necessary during subsequent orthopedic treatment in order to determine the depth of immersion of the artificial crown into the dentoalveolar groove.

One of the methods for assessing the periodontal status of patients after transplantation was the measurement of the pH of the gingival fluid. Gingival fluid is a physiological medium that fills the volume of the gingival groove. The gingival fluid has a biochemical composition close to the parameters of blood plasma. With a healthy periodontal complex, the production of gingival fluid during the day is up to 2.4 ml, however, with inflammatory changes in the

periodontal structure, its secretion increases due to increased interstitial pressure, vascular permeability, and a shift in the osmotic gradient. The chemical composition and properties of the gingival fluid is an indicator characterizing the condition of the periodontium, and with a healthy periodontium, the pH has an alkaline medium of 7.9—8.3.

Gingival fluid intake technique. Before the procedure, the hygiene of the examined tooth was performed in a dental office using Superpolish Kerr polishing paste, Italy (RU No.FSZ 2008/02494 of 08/12/2008) and a soft brush Prophylaxe NTI, Germany (RU No.FSZ 2007/01011 of 12/27/2007). The liquid was collected using retraction threads Sure Cord No.000 without impregnation Sure Dent, Korea (RU No.FSZ 2012/12133 dated 05/04/2012) from gingival grooves, HI 99165 portable pH meter with auto-calibration and auto-thermal compensation Hanna Instruments, Hungary (SI No. 46716-11 dated 04/22/2021) was used to measure the pH of gingival fluid. The apparation has a temperature compensation and measurement range from 0.0 to 14.0, the error is ± 0.1 pH. The study was performed on day 14 after tooth replantation.

2.3.6. Ultrasound Dopplerography

Ultrasound dopplerography allowed clinicians to evaluate blood flow in microvascular systems. Ultrasonic Dopplerography (USDG) is based on the "Doppler" effect, and the source of the measurement method is ultrasound. An ultrasonic sensor emits an ultrasonic wave into a moving red blood cell, then the wave is reflected. The frequency of the reflected wave changes during exposure in accordance with the Doppler principle, based on the proven fact that the pulse reflected from a moving object changes by an amount proportional to the speed of movement of this object. Thus, the operation of diagnostic ultrasound devices involves two main processes – registration of propagation and reflection of ultrasonic vibrations. The ultrasound method of Dopplerography uses short wavelengths – 600 nm with a frequency of 20 MHz, which allow you to work in

the area of microcirculatory blood flow. The USDG device detects and analyzes the frequency shift.

The use of ultrasound in dentistry has recently become more widespread, according to the literature, there are studies on the use of ultrasound in the diagnosis of periapical changes, changes in the pulp chamber, inflammatory periodontal diseases, the basis of the study is the registration of changes in the microcirculatory bed, during treatment and dynamic observation, the method can be used to evaluate treatment in dynamics. Numerous studies in the field of dentistry have established that USDG provides a reliable assessment of changes in microcirculation in tissues.

In the course of treatment of patients of both groups, as shown by the analysis of medical documentation, ultrasound Dopplerography was used using (Figure 6) Minimax-Doppler-K Minimax device, Russia (RU No. FSR 2007/00810 dated 10/16/2014). The study was conducted on day 14 after replantation and 12 months later in the process of dynamic observation.

Figure 6. Minimax-Doppler-K Minimax device

The purpose of this study was to measure the blood flow rate in periodontal tissues of patients of groups 1a, 2a and groups 1b, 2b after dental replantation using ultrasound Dopplerography in the area of the attached gum in the projection of the root of the tooth under study in each patient.

Doppler assessment of blood flow in the periodontal complex was performed using a 20 MHz sensor. The results of the ultrasound Doppler study were displayed on a computer monitor and visualized with a color Doppler image to obtain indicators of linear blood flow velocity (maximum systolic velocity - Vas, final diastolic blood flow velocity - Vakd, average systolic blood flow velocity - Vam,) and volumetric blood flow velocity (maximum systolic - Qas and average systolic – Qam). The pulsing index (PI) and the resistance index (RI) were also determined.

2.3.7. Periotestometry (according to medical records)

Assessment of dental mobility is of clinical importance not only for the diagnosis of periodontal tissues, but also for determining the trajectory of treatment. Over the years, domestic and foreign authors have conducted numerous studies related to measuring dental mobility with the most accurate non-abstract assessment, including the proposal of various classifications, as well as the development of electronic devices for objective measurement without subjective assessment by a dentist. However, there is still no consensus on measurement methods and criteria for assessing dental mobility.

Instrumental methods are being introduced to replace the main methods of examining the dental status of patients, which have clear criteria for evaluating a certain parameter under study: in the 80s of the 20th century, the "Periotest" device was created, which became widespread in the practice of a dentist. The mechanism of the diagnostic protocol is based on an assessment of the physiological and subclinical mobility of teeth with an error of about 4% of the measured value.

Over the decades of using the pre-testometer, numerous studies have been accumulated confirming the high level of significance of the research results in dental practice. The study of statistical reliability has been repeatedly verified by the correlation of measurements by the device with X-ray examination data, thus the periotestometer is a reliable device for determining the pathological condition of the periodontium. The use of the periotestometer is not limited to studies in inflammatory and atrophic periodontal diseases, the device is successfully used to diagnose pathologies of the temporomandibular joint, to assess the success of implantation, autotransplantation and replantation of teeth.

To optimize the assessment of mobility after replantation, as shown by the analysis of medical documentation, a digital approach was used that is able to register micro-movements of teeth caused by dynamic loading. For the study, the device Periotest, Medizintechnik Gulden, Germany (RU No. RZN 2013/637 dated 05/17/2013) was used, which consists of a tip (working part) and a device measuring the time of return of the movable part of the device to its original position, as shown in the Figure. The working part of the tip transmits an electronically controlled mechanical impulse to the tooth. The control coil of the Periotest device in operation ensures the maintenance of a certain pulse frequency of the striker with simultaneous compensation of friction and gravity (Figure 7).

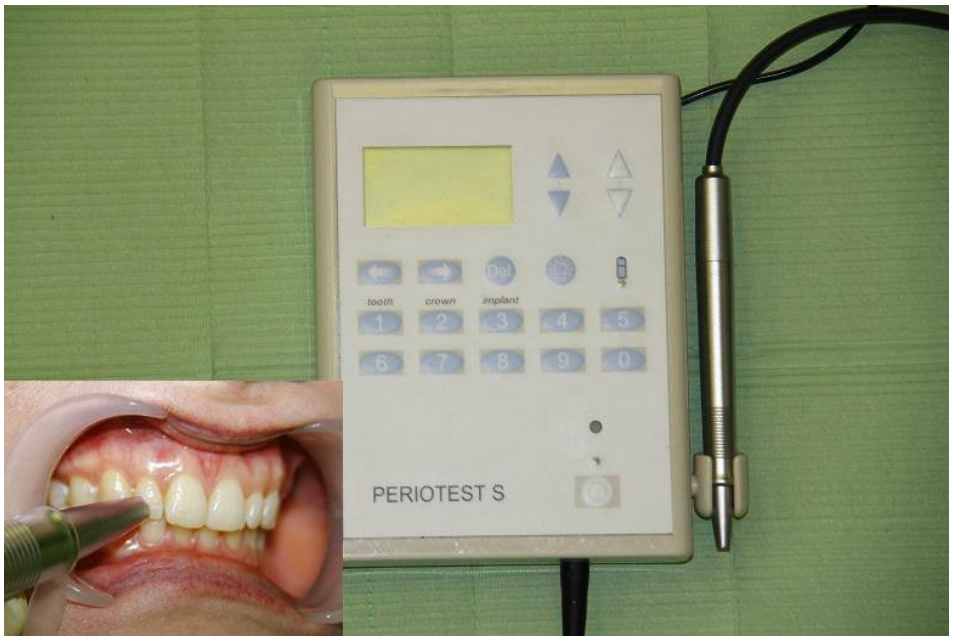

Figure 7. Application of the Periotest device in the study

The method of the study: the patient was in a semi-horizontal position in a dental chair, the patient's mouth was open, the teeth of the upper jaw and lower jaw did not have contact. The working part of the tip of the Periotest device was located from the vestibular in the direction of the lingual or palatine surface of the crown of the tooth.

The measuring cycle of the "Periotest" device consists of 16 pulses of the pressure-sensitive working part of the head to the tooth being measured. According to the instructions of the device, the measuring range of the periotestometer ranges from -8.0 to +50.0, the result has conventional units reflected in Table 4.

Table 4– Estimated measurement scale of the "Periotest" device

Evaluation of the result	Indications
Normal value	from -8 to +9
A small degree of mobility (not visually definable)	from +10 to +19
Explicit mobility (visually defined)	from +20 to +29
Strong mobility (visually defined)	from +30 to +50

2.3.8. Statistical data processing

Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS) 17.0 program. According to the descriptive data analysis, the average value of quantitative variables with deviation and median with minimum and maximum values were presented. The Kolmogorov–Smirnov and Shapiro–Wilk criterion was used in the study of hypotheses about the normality of the distribution of parameters. The Mann-Whitney U-test was used to compare the quantitative sizes of two groups and the Kruskal—Wallis criterion of four independent groups. The nonparametric Wilcoxon criterion was used for quantitatively dependent data. The differences were considered statistically significant at $P < 0.05$.

The relationship of qualitative characteristics was assessed using the chi-square criterion (χ^2).

CHAPTER 3. RESULTS AND THEIR DISCUSSION

3.1. Results of the main research methods (according to medical documentation)

As shown by a retrospective analysis of 127 outpatient dental records of patients, during the survey, collecting anamnesis at the first visit, it was found that 66 cards (group 1) noted dental injury during the past 24 hours, and 61 cards (group 2) noted that patients went to the dentist through 24 hours after the injury and later. At the same time, patients whose cards were identified in the first group complained of pain when biting, tooth mobility, bleeding, a change in the position of the tooth in the dentition, a fracture of the crown of the tooth. Complaints of patients whose cards were assigned to the second group were for pain when biting, a change in the color of the crown of the tooth.

The most common causes of dislocations of teeth (from anamnestic data) of patients were: falls, active contact sports, domestic injuries due to interpersonal conflicts, traffic accidents.

It follows from the analyzed medical documentation that patients who considered the condition urgent immediately sought medical help within a day after receiving an injury. Only group 1 (treatment within the first 24 hours) included patients diagnosed with complete dislocation of the tooth in the number of 36 people (28.3%). Patients diagnosed with complete dislocation of the tooth were divided into groups: group 1a included 17 people, group 1b -19 people (according to medical documentation).

According to the inclusion criteria, 127 people participated in the study: 69 men (54.33%), 58 women, which corresponded to 45.67% of the total number of patients. When analyzing the gender and age distribution indicators by groups, we found that the proportion of men aged 18 to 29 years was 30.7% (39 people), from

30 to 40 years – 23.6% (30 people), the proportion of women aged 18 to 29 years was 24.4% (31 people), from 30 under 40 years of age – 21.3% (27 people).

Table 5 – Gender and age characteristics of patients (according to medical records)

Gender and age characteristics of the subjects	Subjects (n=127)			
	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
Men from 18 to 29 years old	n=11	n=10	n=10	n=8
Men from 30 to 40 years old	n=8	n=8	n=6	n=8
Women from 18 to 29 years old	n=7	n=9	n=7	n=8
Women from 30 to 40 years old	n=6	n=7	n=7	n=7

During the examination at the initial admission, the following clinical data were recorded and entered into the outpatient chart: mobility of the 1st degree – 35.43% (45 patient cards.), mobility of the 2nd degree – 10.23% (13 patient cards.), mobility of the 3rd degree – 3.14% (4 patient cards), bleeding from the dentoalveolar attachments – 51.97% (66 patient cards), tooth avulsion – 28.34% (36 patient cards), hematoma of the mucous membrane of the alveolar process above the causal tooth – 63.77% (81 patient cards), positive symptom of horizontal and/or vertical percussion – 80.31% (102 patient cards), discoloritis of the tooth – 44.88% (57 patient cards), violation of the integrity of the crown part of the tooth – 33.86% (43 patient cards), decrease in the height of the crown part of the tooth – 6.29% (8 patient cards), soft tissue edema – 29.92% (38 patient cards).

During the dental examination, according to medical documentation, it was found that all dental injuries were localized in the frontal group, of which 99 cases (77.95%) had localization of the upper jaw, 28 cases (22.05%) localization of the lower jaw.

Table 6 – Distribution of dental injuries in the examined patients during the initial examination (according to medical documentation)

Groups of teeth	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
Central incisors of the upper jaw	12 (37,5%)	13 (38,25%)	12 (40,0%)	11 (35,48%)
Central incisors of the lower jaw	4 (12,5%)	5 (14,7%)	4 (13,33%)	4 (12,9%)
Lateral incisors of the upper jaw	8 (25,0%)	9 (26,47%)	6 (20,0%)	5 (16,13%)
Lateral incisors of the lower jaw	1 (3,12%)	2 (5,88%)	1(3,33%)	3 (9,68%)
Canines of the upper jaw	6 (18,75%)	5 (14,7%)	6 (20,0%)	6(19,35%)
Canines of the lower jaw	1 (3,12%)	1 (2,94%)	1 (3,33%)	1 (3,23%)

Thus, the analysis of medical documentation showed that the central and lateral incisors of the upper jaw (from 16 to 40%) are most often injured and, accordingly, dental replantation operations.

3.2. Results of macrohistochemical examination and periodontal probe examination (according to medical documentation)

After the main methods of examination of patients at the initial admission, all patients, according to medical documentation, underwent a macroscopic assessment of inflammatory changes in the mucogingival complex in the area of the causal tooth with diagnoses of "dislocation of the tooth" [15]. The average area

of inflammatory phenomena in the macrohistochemical study of the first group (outpatient charts) was 6.5 ± 0.3 mm2, in the second group - 8.4 ± 1.1 mm2.

Thus, in the outpatient records of the first group, whose patients sought medical help within 24 hours, the area of inflammatory phenomena is 22.6% less than in the outpatient records of the second group, whose patients sought an appointment with a dentist later than 24 hours. At the initial examination in group 1a, the area of inflammatory phenomena was 8.82% less than in group 1b (6.2 ± 0.4 mm2) and amounted to 6.8 ± 0.3 mm2. In group 2a, the area of inflammatory changes in the mucogingival complex was 6.9% less than in group 2b (8.7 ± 2.4 mm2) and amounted to 8.1 ± 1.8 mm2.

In order to assess the effectiveness of early treatment results for dislocated teeth, a repeated macrohistochemical study was conducted after 7 days (this fact is also reflected in the medical documentation). The average area of inflammatory phenomena during macrohistochemical examination in the first group after 7 days was 2.05 ± 0.4 mm2, in the second group - 2.15 ± 0.5 mm2. Thus, 7 days after the start of treatment, in the 1st group, whose patients sought medical help within 24 hours, the area of inflammatory phenomena was 4.65% smaller compared to the 2nd group, whose patients went to a dentist and received dental treatment later than 24 hours. On examination 7 days after the start of treatment in group 1b, the area of inflammatory phenomena was 21.74% less than in group 1a (2.3 ± 0.5 mm2) and amounted to 1.8 ± 0.3 mm2. In group 2b, the area of inflammatory changes in the mucogingival complex was 61.29% smaller than in group 2a (3.1 ± 0.6 mm2) and amounted to 1.2 ± 0.4 mm2.

According to the results of a macrohistochemical study 7 days after replantation, it was found that in groups 1b and 2b, whose patients received complex treatment according to the developed method, the area of inflammation of the mucogingival complex is smaller than in patients of groups 1a and 2a who were treated according to the traditional method (Table 7).

Table 7 - Total area (ΣS) of inflammatory phenomena according to the results of a macrohistochemical study of patients at the first visit before transplantation and 7 days after transplantation

ΣS (mm^2)	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
Initial visit	6,2 ± 0,4 mm^2	6,8 ± 0,3 mm^2	8,1 ± 2,4 mm^2	8,7 ± 1,8 mm^2
7 days after replantation	2,3 ± 0,5 mm^2	1,8 ± 0,3 mm^2	3,1 ± 0,6 mm^2	1,2 ± 0,4 mm^2

The analysis of medical documentation showed that only 65% of patients (83 people) with a diagnosis of incomplete dislocation were measured the depth of dentoalveolar attachment before replantation. The average violation of dentoalveolar attachment in patients who were treated using the traditional method was 4.2 ± 0.3 mm, in patients who were treated using M-Chir capsules and LED radiation - 3.8 ± 0.4 mm [15].

14 days after replantation, repeated probing was performed: the average depth of the violation of the dentoalveolar attachment in the first group was 3.6 ± 0.3 mm, in the second group - 3.9 ± 0.4 mm. Thus, in patients of the first group, the violation of dentoalveolar attachment is less by 7.7% compared with the second group. In group 1b, the depth of the dentoalveolar attachment disorder was 26.2% less than in group 1a (4.2 ± 0.3 mm) and amounted to 3.1 ± 0.3 mm. In group 2b, the depth of the dentoalveolar attachment disorder was 26.7% less than in group 2a (4.5 ± 0.4 mm) and amounted to 3.3 ± 0.5 mm.

The results of the periodontal probe study, reflected in outpatient charts, showed that groups 1b and 2b, whose patients received comprehensive treatment according to the developed method, had a lower level of dental attachment disorder than patients in groups 1a and 2a who were treated according to the traditional method (Table 8).

Table 8 – Results of the periodontal probe examination in subjects 14 days and 1 year after replantation

The depth of the periodontal pocket (mm)	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
14 days after replantation	4,2 ± 0,3	3,1 ± 0,3	4,5 ± 0,4	3,3 ± 0,5
1 year after the replantation	2,7 ± 0,4	1,6 ± 0,2	3,2 ± 0,3	1,8 ± 0,2

12 months after replantation, there are records in outpatient records of a control measurement of dentoalveolar attachment: the average depth of violation of dentoalveolar attachment in group 1 was 2.1 ± 0.3 mm, in group 2 - 2.5 ± 0.3 mm. Thus, in group 1, the violation of dentoalveolar attachment is 16.2% less compared to group 2. In group 1b, the depth of the dentoalveolar attachment disorder was 40.7% less than in group 1a (2.7 ± 0.4 mm) and amounted to 1.6 ± 0.2 mm. In group 2b, the depth of dentoalveolar attachment disorder was 43.8% less than in group 2a (3.2 ± 0.3 mm) and amounted to 1.8 ± 0.2 mm.

The results of the probing found that in groups 1b and 2b, whose patients received comprehensive treatment according to the developed method, the dentoalveolar attachment corresponds to normal indicators of a healthy periodontal complex than in patients of groups 1a and 2a, who were treated according to the traditional method.

3. 3. Periotestometry results (according to medical documentation)

The stability of teeth in the well is an important indicator in assessing the long-term results of dental replantation, due to the inferiority of the periodontal complex after tooth extraction, ankylosis plays a leading role in ensuring tooth stability.

The first measurement of dental mobility using the "Periotest" device was carried out 12 months after tooth replantation in order to assess the long-term postoperative indicators.

The average values of periotestometry (M±m) in group 1a were 7.61±4.77, in group 1b 1.23±5.08, in group 2a 6.57±5.11, in group 2b 1.62±5.04. Thus, the results of this survey found that in the main groups 1b and 2b, the indicators of the "Periotest" device were 1.42 ± 5.06, in control groups 1a and 2a, the indicators were higher and amounted to 7.09 ± 4.94. The maximum indicator was recorded in group 2a – 16.7 -7.1 was the minimum (group 2b) indicator (Figure 8).

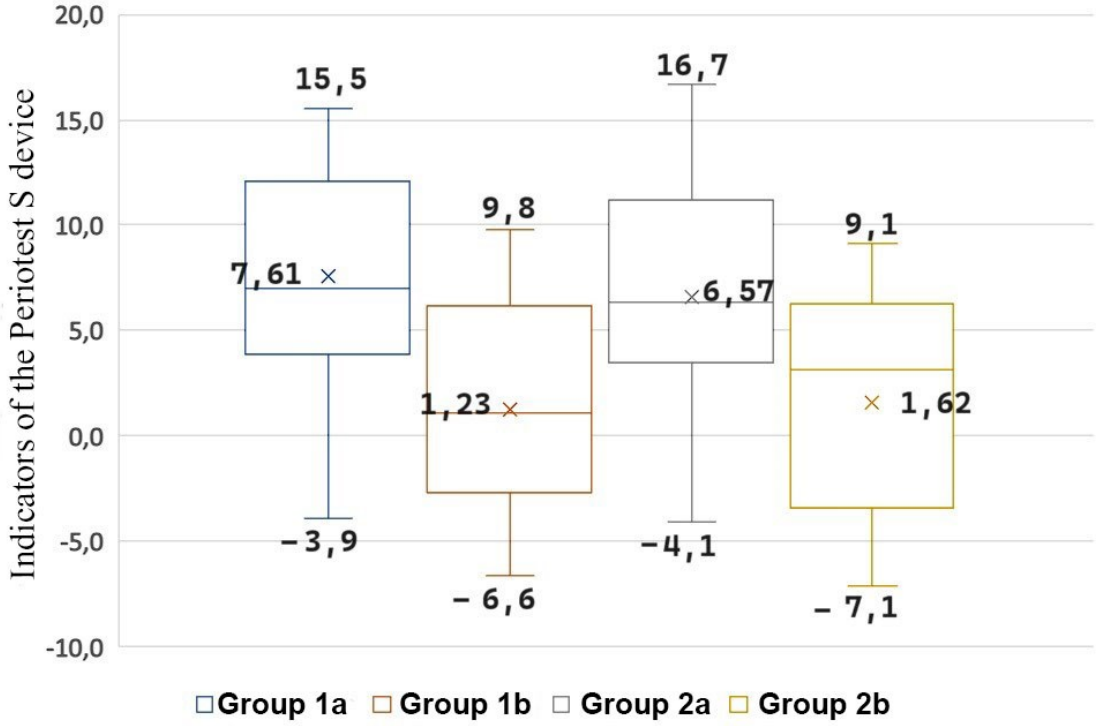

Figure 8. Measurement results with the "Periotest" device 12 months after replantation

3 years after the replantation, repeated periotestometry was performed to assess the long-term treatment outcomes of the main (1b and 2b) and control (1a and 2a) groups. The average values of periotestometry after 3 years (M±m) in group 1a were 11.44±3.74, in group 1b 6.27±4.31, in group 2a 10.91±2.97, in group 2b 5.83±4.67. Thus, the results of this survey found that in groups 1b and 2b, the indicators of the "Periotest" device were 6.05 ± 4.48, in groups 1a and 2a, the indicators were higher and amounted to 11.17 ± 3.34. The maximum indicator

was recorded in group 1a – 17.4±2.6, the minimum indicator was only in one outpatient card from group 2b.

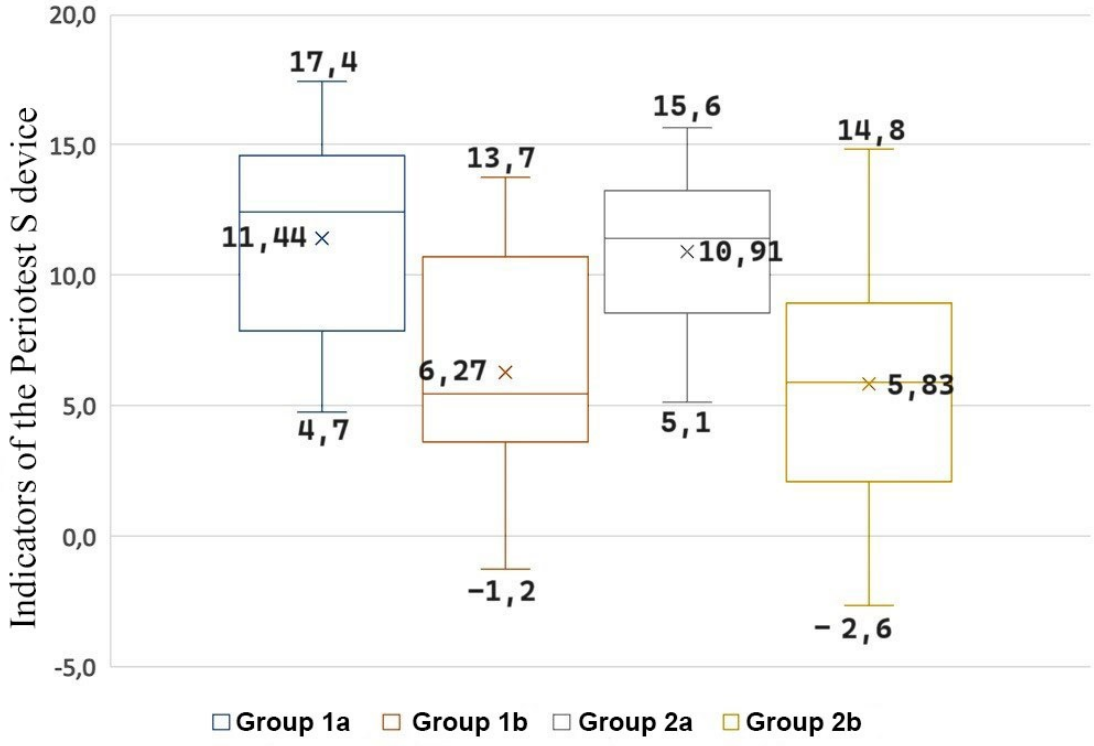

Figure 9. Measurement results with the "Periotest" device 3 years after replantation

3.4. The results of the study by ultrasound Dopplerography (according to medical documentation)

Within 3 years from the moment of replantation, the parameters of ultrasound Dopplerography were evaluated (according to medical documentation).

The average values (M±m) of hemodynamic parameters of blood flow in the microcirculatory bed of the tissues of the attached gum in the projection area of the roots of the replanted teeth, recorded 14 days, 1 and 3 years after transplantation, are shown in Tables 9, 10, 11.

Table 9 - Results of the ultrasound Dopplerography examination 14 days after the start of treatment

USDG indicators	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
Vas (cm/sec)	0,458 ± 0,034	0,675 ± 0,042	0,435 ± 0,024	0,669 ± 0,037
Vakd (cm/sec)	0,203 ± 0,012	0,237 ± 0,008	0,178 ± 0,012	0,229 ± 0,005
Vam (cm/sec)	0,162 ± 0,053	0,318 ± 0,007	0,173 ± 0,034	0,325 ± 0,006
Qas (ml/min)	0,025 ± 0,006	0,028 ± 0,003	0,019 ± 0,003	0,03 ± 0,004
Qam (ml/min)	0,007 ± 0,002	0,017 ± 0,004	0,006 ± 0,004	0,015 ± 0,008
PI	2,356 ± 0,048	2,248 ± 0,047	2,471 ± 0,032	2,288 ± 0,032
RI	0,897 ± 0,028	0,872 ± 0,032	0,904 ± 0,022	0,886 ± 0,025

Table 10 - Results of the ultrasound Dopplerography examination 12 months after the start of treatment

USDG indicators	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
Vas (cm/sec)	0,686 ± 0,021	0,704 ± 0,006	0,697 ± 0,012	0,712 ± 0,009
Vakd (cm/sec)	0,365 ± 0,017	0,442 ± 0,013	0,379 ± 0,008	0,432 ± 0,018
Vam (cm/sec)	0,374 ± 0,013	0,429 ± 0,021	0,387 ± 0,011	0,454 ± 0,014
Qas (ml/min)	0,027 ± 0,002	0,032 ± 0,003	0,028 ± 0,003	0,034 ± 0,005
Qam (ml/min)	0,02 ± 0,003	0,024 ± 0,003	0,017 ± 0,005	0.02 ± 0,001
PI	1,952 ± 0,034	1,796 ± 0,054	1,886 ± 0,029	1,783 ± 0,035
RI	0,832 ± 0,023	0,755 ± 0,027	0,826 ± 0,037	0,739 ±0,033

Table 11 - Results of the ultrasound Dopplerography examination 3 years after the start of treatment

USDG indicators	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
Vas (cm/sec)	0,693 ± 0,012	0,728 ± 0,009	0,701 ± 0,02	0,723 ± 0,018
Vakd (cm/sec)	0,385 ± 0,02	0,433 ± 0,013	0,398 ± 0,015	0,456 ± 0,028
Vam (cm/sec)	0,396 ± 0,028	0,454 ± 0,032	0,414 ± 0,009	0,472 ± 0,023
Qas (ml/min)	0,027 ± 0,002	0,033 ± 0,002	0,03 ± 0,005	0,032 ± 0,003
Qam (ml/min)	0,019 ± 0,002	0,022 ± 0,006	0,020 ± 0,003	0.019 ± 0,004
PI	1,862 ± 0,023	1,782 ± 0,04	1,836 ± 0,03	1,779 ± 0,07
RI	0,806 ± 0,021	0,745 ± 0,038	0,796 ± 0,018	0,752 ±0,041

The study of microcirculation parameters using ultrasound Dopplerography in dynamics and the systematization of data allowed us to more accurately determine the condition of the tissues surrounding the replanted tooth and thereby develop more reasonable approaches to the management of patients after dental replantation.

The changes in the indicators of Vas – weighted average systolic velocity along the average velocity curve in dynamic patient follow-up over 3 years are shown in Figure 10.

14 days after replantation, the best average Vas was recorded in group 1b and was 0.675±0.042. In group 2b, this indicator was 0.669±0.037, in groups 1a and 2a, the results were 0.458±0.034 and 0.435±0.024, respectively, were themselves low averages.

12 months after the start of dynamic observation of the replanted teeth, the best average Vas was recorded in group 2b and was 0.712±0.009. In group 1b, this indicator also corresponded to the range of healthy periodontal tissues and was

0.704±0.006, in groups 1a and 2a the results were 0.686±0.021 and 0.697±0.012, respectively, these average The values in groups 1a and 2a did not correspond to the control reference values of healthy tissues surrounding the tooth.

3 years after the start of dynamic observation of the replanted teeth, the best average Vas was recorded in group 1b and was 0.728±0.009. In group 2b, this indicator also corresponded to the range of healthy periodontal tissues and was 0.723±0.018, in groups 1a and 2a the results were 0.693±0.012 and 0.701±0.02, respectively, these average The values in groups 1a did not correspond to the control reference values of healthy tissues surrounding the tooth.

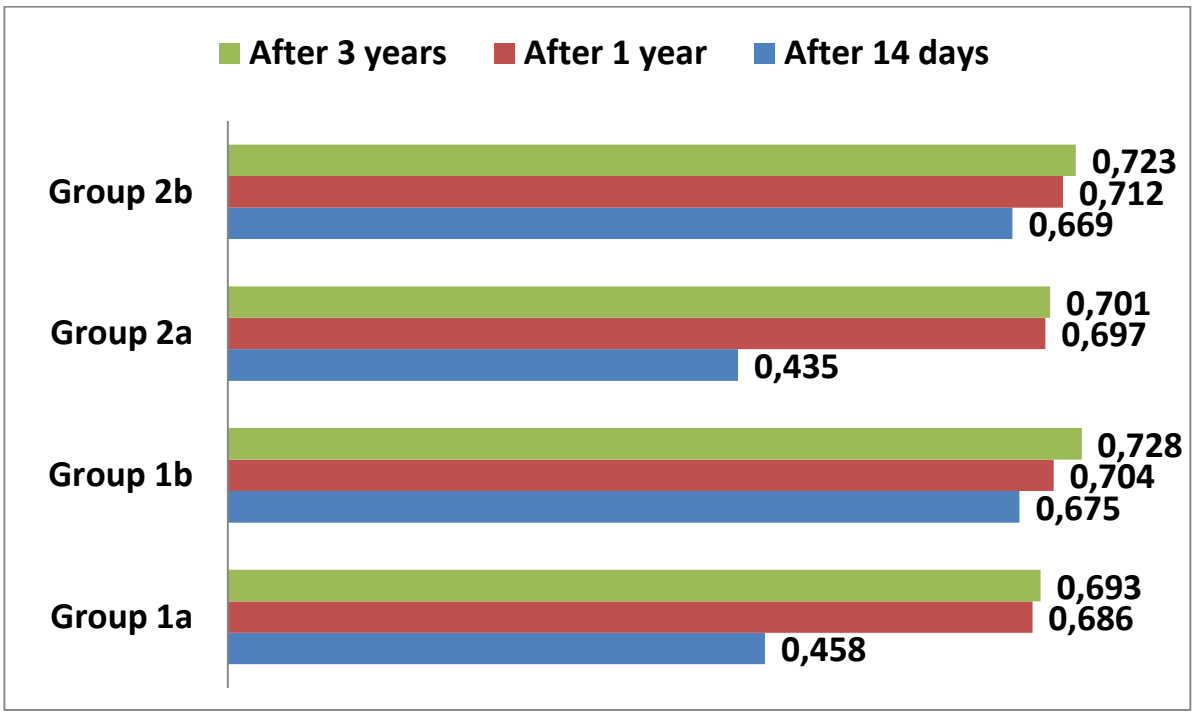

Figure 10. Dynamics of changes in the indicators of average Vas values (cm/sec)

The change in the indicators of the Vakd – terminal in the selected speed range along the average speed curve in dynamic patient follow-up over 3 years is shown in Figure 11.

14 days after replantation, the best average Vakd was recorded in group 1b and was 0.237±0.008. In group 2b, this indicator was 0.229±0.005, in groups 1a and 2a, the results were 0.203±0.012 and 0.178±0.012, respectively, were the lowest averages in the subjects.

12 months after the start of dynamic observation of the replanted teeth, the best average Vakd was recorded in group 1b and was 0.442±0.013. In group 2b,

this indicator also corresponded to the range of healthy periodontal tissues and was 0.432±0.018, in groups 1a and 2a the results were 0.365±0.017 and 0.379±0.008, respectively, the data The average values in groups 1a and 2a did not correspond to the control reference values of healthy tissues surrounding the tooth.

3 years after the start of dynamic observation of the replanted teeth, the best average Vakd was recorded in group 2b and was 0.456±0.028. In group 1b, this indicator also corresponded to the range of healthy periodontal tissues and was 0.433±0.013, in groups 1a and 2a the results were 0.385±0.02 and 0.398±0.015, respectively, these average The values in groups 1a did not correspond to the control reference values of healthy tissues surrounding the tooth.

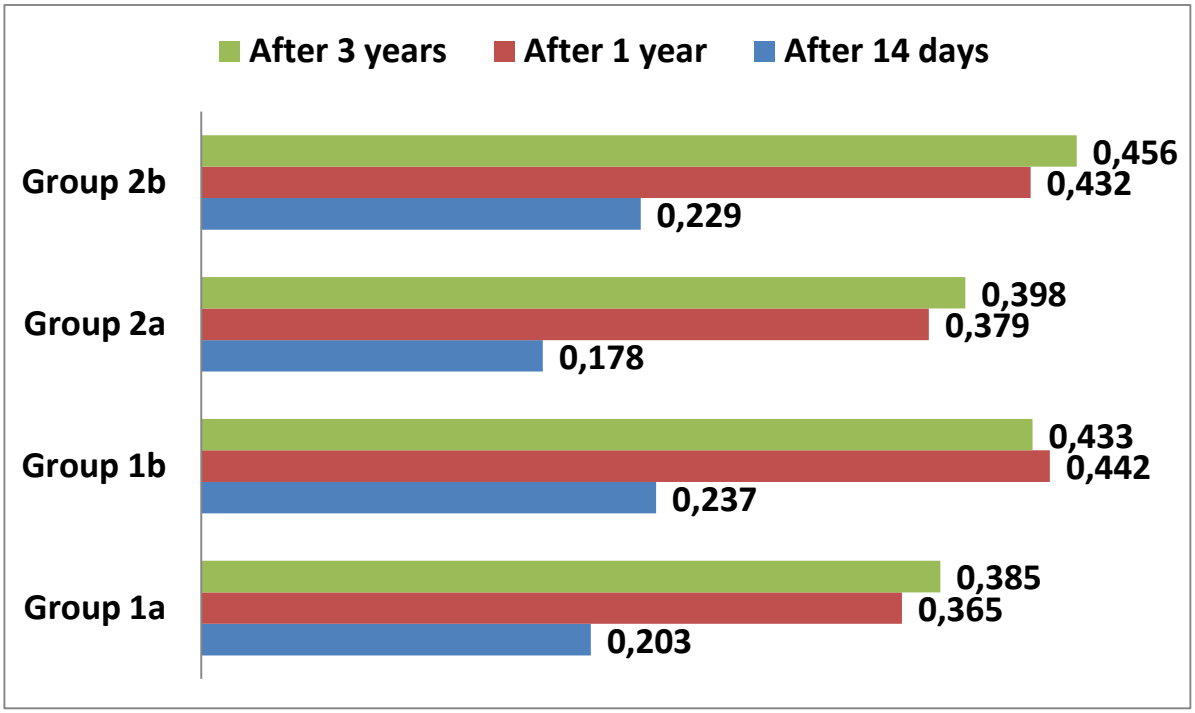

Figure 11. Dynamics of changes in the indicators of average values of Vakd (cm/sec)

The change in Vam indicators – the velocity weighted by the cross section of the vessels of the microcirculatory bed of the replanted teeth along the curve of the average velocity in dynamic observation of patients for 3 years, is shown in Figure 12.

14 days after replantation, the best average Vam was recorded in group 2b and was 0.325±0.006. In group 1b, this indicator was 0.318±0.007, in groups 1a

and 2a, the results were 0.162±0.053 and 0.173±0.034, respectively, were themselves low averages.

1 year after the start of dynamic observation of the replanted teeth, the best average Vam was recorded in group 2b and was 0.454±0.014. In group 1b, this indicator also corresponded to the range of healthy periodontal tissues and was 0.429±0.021, in groups 1a and 2a the results were 0.374±0.013 and 0.387±0.011, respectively, the data The average values in groups 1a and 2a did not correspond to the control reference values of healthy tissues surrounding the tooth.

3 years after the start of dynamic observation of the replanted teeth, the best average Vam was recorded in group 2b and was 0.472±0.023. In group 1b, this indicator also corresponded to the range of healthy periodontal tissues and was 0.454±0.032, in groups 1a and 2a the results were 0.396±0.028 and 0.414±0.009, respectively, these average The values in groups 1a did not correspond to the control reference values of healthy tissues surrounding the tooth.

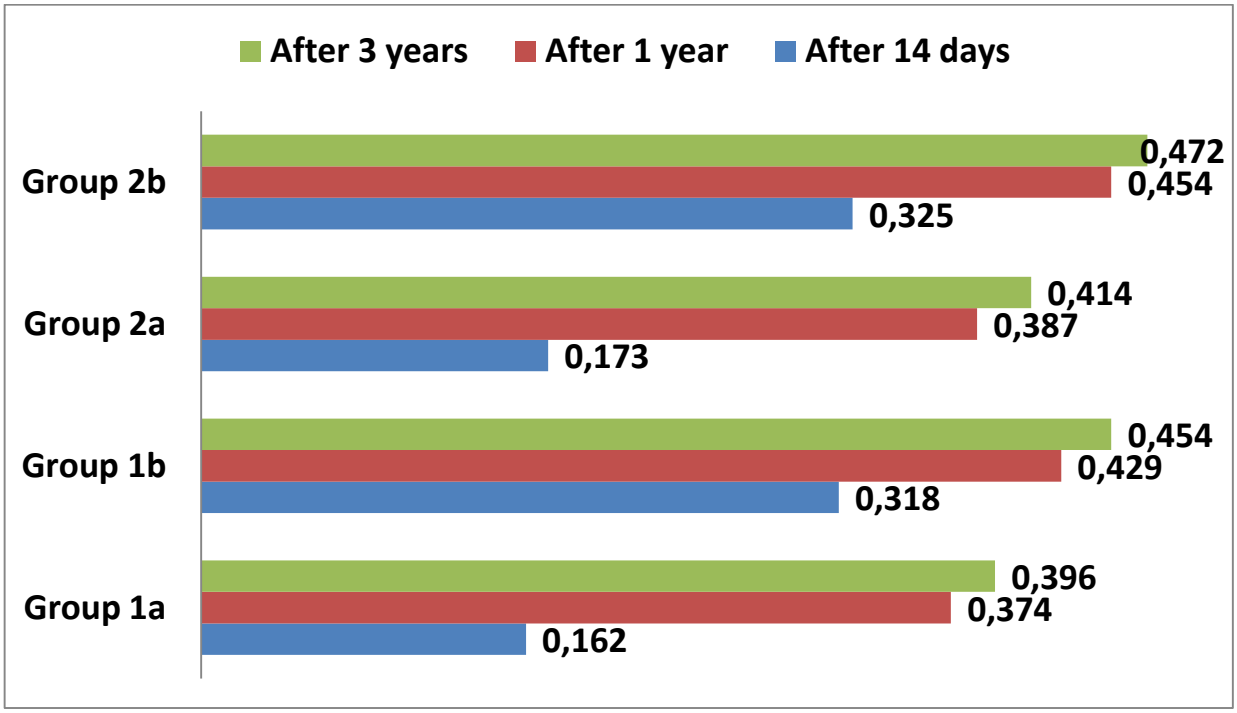

Figure 12. Dynamics of changes in the indicators of average Vam values (cm/sec)

The changes in the Qas indicators – weighted average systolic velocity along the average velocity curve in the dynamic follow-up of patients in observation groups for 3 years are shown in Figure 13.

14 days after replantation, the best average Qas was recorded in group 2b and was 0.03±0.004. In group 1b, this indicator was 0.028±0.003, in groups 1a and 2a, the results were 0.025±0.006 and 0.019±0.003, respectively, were the lowest averages in the subjects.

1 year after the start of dynamic observation of the replanted teeth, the best average Qas was recorded in group 2b and was 0.034±0.005. In group 1b, this indicator also corresponded to the range of healthy periodontal complex tissues and was 0.032±0.003, in groups 1a and 2a the results were 0.027±0.002 and 0.028±0.003, respectively, these average values in groups 1a and 2a did not correspond to the control reference values of healthy tissues surrounding the tooth.

3 years after the start of dynamic observation of the replanted teeth, the best average Qas was recorded in group 1b and was 0.033±0.002. In group 2b, this indicator also corresponded to the range of healthy periodontal tissues and was 0.032±0.003, in groups 1a and 2a the results were 0.027±0.002 and 0.03±0.005, respectively, these average The values in groups 1a did not correspond to the control reference values of healthy tissues surrounding the tooth, in group 2b the Qas index corresponded to the normal values of periodontal complex tissues.

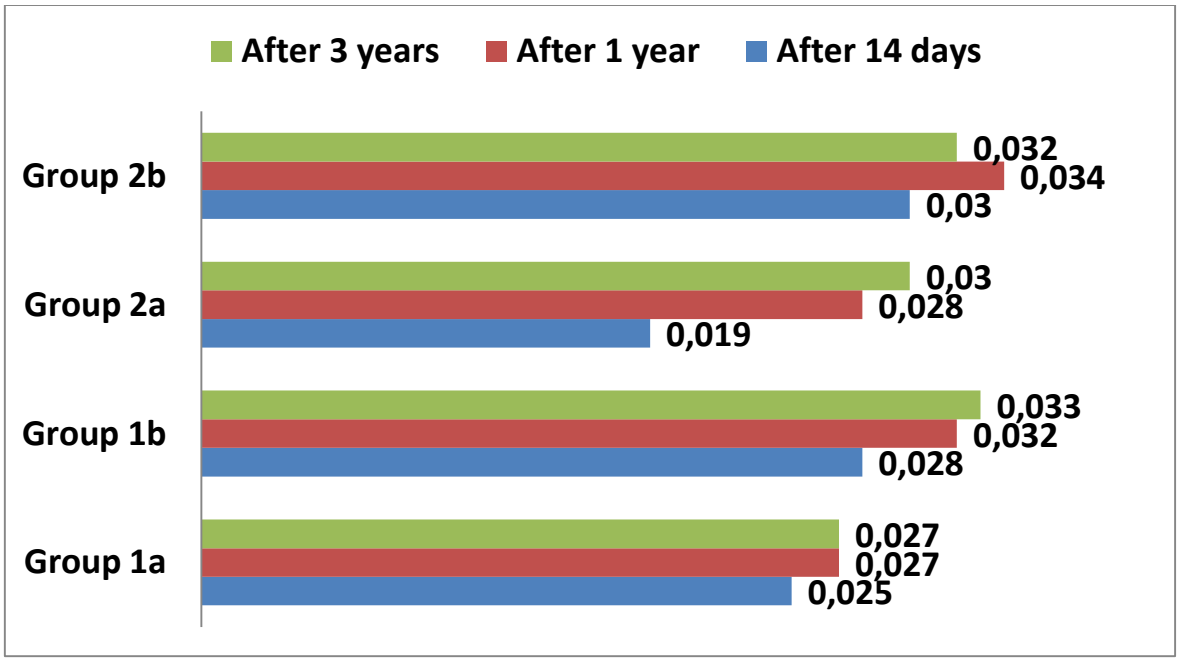

Figure 13. Dynamics of changes in the indicators of average Qas values (ml/min)

The change in Qam indicators – the capillary cross-section weighted average velocity along the average velocity curve in dynamic follow-up of patients in observation groups for 3 years is shown in Figure 14.

14 days after replantation, the best average Qam was recorded in group 1b and was 0.017±0.004. In group 2b, this indicator was 0.015±0.008, in groups 1a and 2a, the results were 0.007±0.002 and 0.006±0.004, respectively, were themselves low averages.

1 year after the start of dynamic observation of the replanted teeth, the best average Qam was recorded in group 1b and was 0.024±0.003. In group 2b, this indicator also corresponded to the range of healthy tissues of the periodontal complex and was 0.02±0.001, in groups 1a and 2a the results were 0.02±0.003 and 0.017±0.005, respectively, the data The average values in group 2a did not correspond to the control reference values of healthy tissues surrounding the tooth.

3 years after the start of dynamic observation of the replanted teeth, the best average Qam was recorded in group 1b and was 0.022±0.006. In group 2b, this indicator also corresponded to the range of healthy periodontal tissues and was 0.019±0.004, in groups 1a and 2a the results were 0.019±0.002 and 0.02±0.003, respectively, these average The values in groups 1a and 2a corresponded to the control reference values of healthy tissues surrounding the tooth.

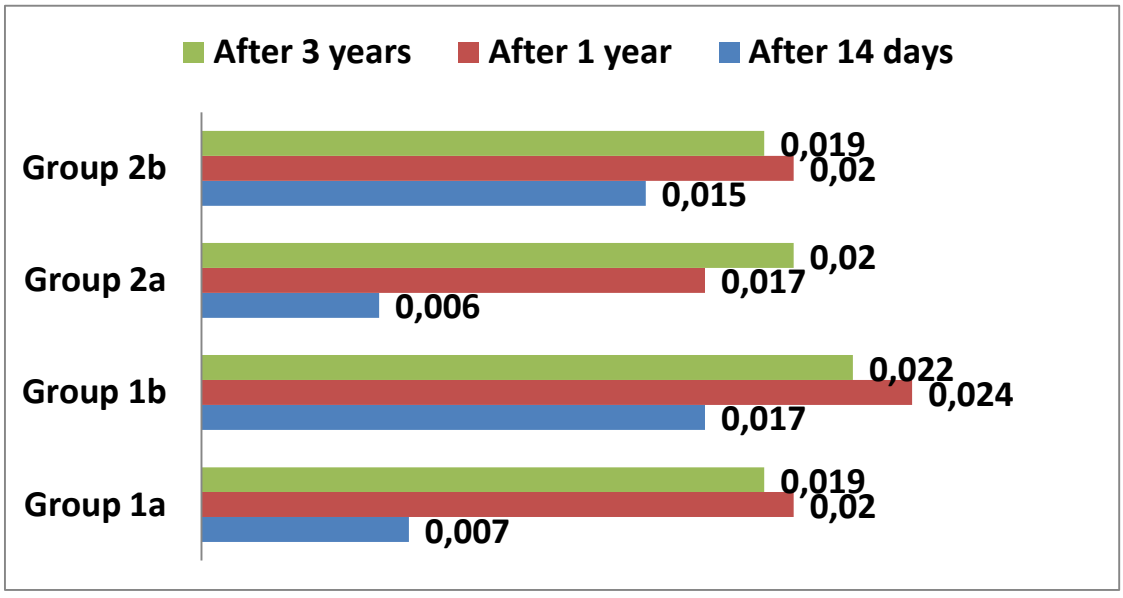

Figure 14. Dynamics of changes in the indicators of average Qam values (ml/min)

Dynamic monitoring of the PI index of pulsation (Gosling), reflecting the elastic properties of the arteries in patients of groups 1 (a, b) and 2 (a, b) for 3 years, is shown in Figure 15.

14 days after replantation, the best (lower) average PI was recorded in group 1b and was 2.248±0.047. In group 2b, this indicator was 2.288±0.032, in groups 1a and 2a, the results were 2.356±0.048 and 2.472±0.032, respectively, were the highest averages in the subjects, which reflected the values, not corresponding to the normal Gosling index.

1 year after the start of dynamic observation of the replanted teeth, the best (lower) average PI was recorded in group 2b and was 1.783±0.035. In group 1b, this indicator also corresponded to the value of healthy periodontal complex tissues and was 1.796 ±0.054, in groups 1a and 2a the results were 1.952±0.034 and 1.886±0.029 Accordingly, these average values in groups 1a and 2a did not correspond to the control reference values of the Gosling index of healthy tissues surrounding the tooth.

3 years after the start of dynamic observation of the replanted teeth, the best average Gosling index was recorded in group 2b and was 1.779±0.07. In group 1b, this indicator also corresponded to the range of healthy periodontal tissues and was 1,782±0.04, in groups 1a and 2a the results were 1,862±0.023 and 1,836±0.03, respectively, these average values in groups 1a and 2a did not correspond to the control reference values of healthy tissues surrounding the tooth, but were as close as possible to the indicators of normal values of healthy periodontal complex tissues.

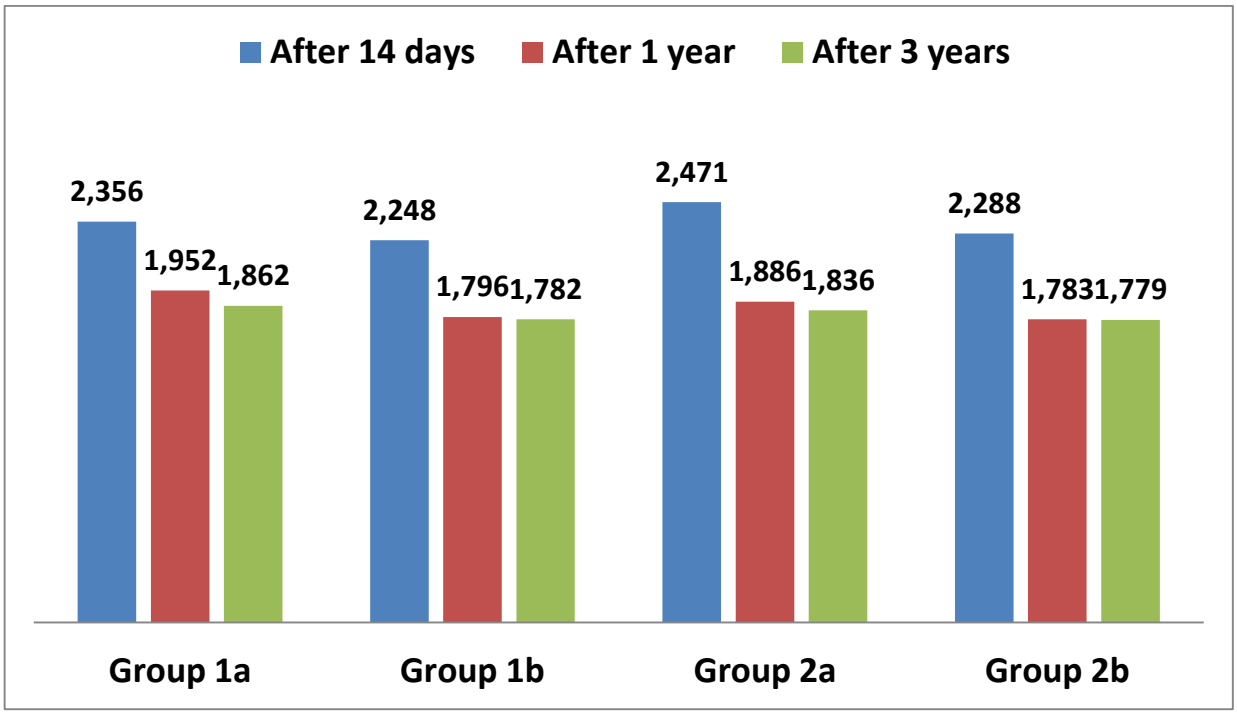

Figure 15. Dynamics of changes in the indicators of the average PI values

Dynamic monitoring of the RI index of peripheral resistance (Pourcelot index), reflecting the state of blood flow resistance distal to the measurement site, in patients of groups 1 (a, b) and 2 (a, b) for 3 years, is shown in Figure 16.

14 days after replantation, the best (lower) average RI was recorded in group 1b and was 0.872±0.032. In group 2b, this indicator was 0.886±0.025, in groups 1a and 2a, the results were 0.897±0.028 and 0.904±0.022, respectively, were the highest averages in the subjects, which reflected the values, not corresponding to the normal Pourcelot index.

1 year after the start of dynamic observation of the replanted teeth, the best (lower) average RI was recorded in group 2b and was 0.739±0.033. In group 1b, this indicator also corresponded to the value of healthy periodontal complex tissues and was 0.755±0.027, in groups 1a and 2a the results were 0.832±0.023 and 0.826±0.037 Accordingly, these average values in groups 1a and 2a did not correspond to the control reference values of the Pourcelo index of healthy tissues surrounding the tooth.

3 years after the start of dynamic observation of the replanted teeth, the best average index of the Pourcelot index was recorded in group 1b and was

0.745±0.038. In group 2b, this indicator also corresponded to the range of healthy periodontal tissues and was 0.752±0.041, in groups 1a and 2a the results were 0.806±0.021 and 0.796±0.018, respectively, these average values in groups 1a and 2a did not correspond to the control reference values of healthy tissues surrounding the tooth, however, the RI values in group 2a were they are as close as possible to the indicators of normal values of healthy tissues of the periodontal complex.

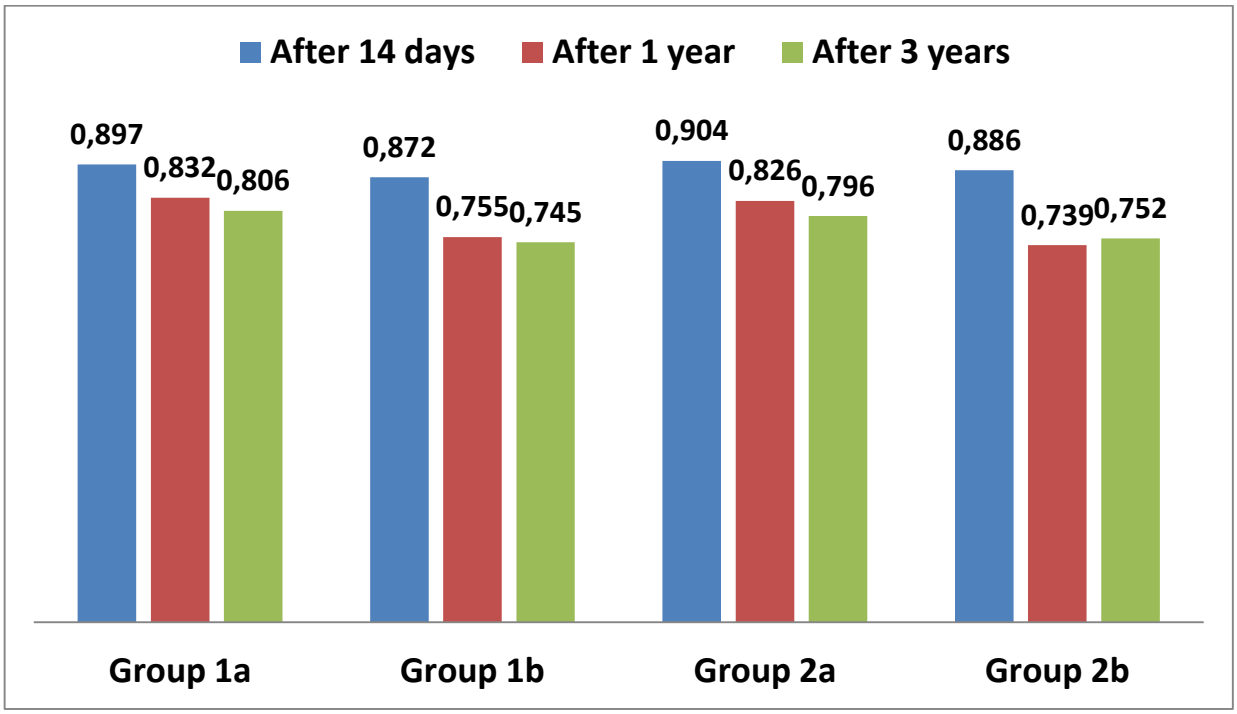

Figure 16. Dynamics of changes in indicators of average RI values

3.5. The results of pH-metry of gingival fluid (according to medical documentation)

In our study, attention was paid to the fixation in the medical documentation of the study of the level of the hydrogen index of the gingival fluid, in order to determine the significance of the hydrogen index (pH) in assessing the immediate

postoperative results of replantation. Since active inflammatory processes occur in the periodontal fissure after extraction and replantation of teeth, we believe that one of the markers of anti-inflammatory postoperative dynamics of the tissues around the replanted tooth may be a study of the pH level of the gingival fluid.

On the 14th day after replantation, all patients underwent a measurement of the acidity of the gingival fluid, the best average hydrogen number was recorded in group 2b and was 7.09±0.29. In group 1b, this indicator is 6.96±0.48, in group 1a – 5.51±0.71, in group 2a – 5.43±0.74.

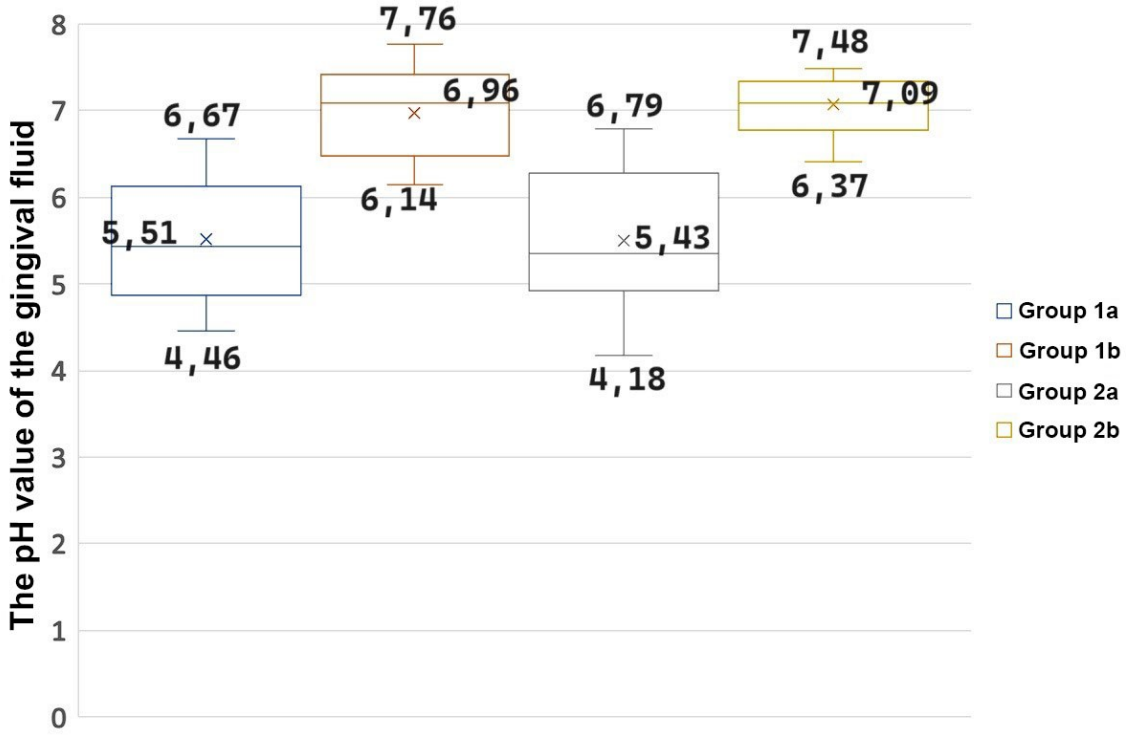

Figure 17. The results of the study of the hydrogen index of gingival fluid

It should be noted that this clinical study was conducted for the first time, in which the pH of gingival fluid was studied after dental replantation due to dislocations. In group 1a, where patients were treated within the first 24 hours after injury and received treatment according to the traditional method, the minimum pH value was 4.46, the maximum was 6.67. In group 1b, where patients were treated within the first 24 hours after injury and received treatment according to the developed comprehensive improved technique, the minimum pH value was 6.14, the maximum was 7.67. In group 2a, where patients were treated after 24 hours

from the moment of injury and received treatment according to the traditional method, the minimum pH value was 4.18, the maximum was 6.79. In group 2b, where patients were treated after 24 hours from the moment of injury and received treatment according to an improved comprehensive method, the minimum pH value was 6.37, the maximum – 7.48.

Thus, the results and a comparative assessment of measurements of the hydrogen index of gingival fluid in subgroups 1b and 2b and 1a and 2a subgroups revealed that the average pH values are closer to the alkaline marker of the normal environment in the main group and equal to 7.02±0.38, in the control group this indicator is 21.37% lower and equal to 5.51 ±0.72. Due to this research method, minimal biochemical processes of inflammatory reactions after dental replantation were established in the main groups compared with the control groups. Determination of the pH of gingival fluid using a microelectrode is a suitable method for measuring the pH of the contents of the gingival sulcus and demonstrates the activity of inflammatory processes in the postoperative period.

Thus, successful replantation after dental injuries (complete, incomplete dislocations) and preparation for orthopedic treatment depends on several factors: atraumatic removal, replantation with the addition of a nanotechnology M-Chip capsule, the appointment of complex treatment, including red light physiotherapy, antibacterial, anti-inflammatory treatment, competent immobilization by splinting.

3.6. The results of the X-ray examination

According to the outpatient patient records, X-ray examination was performed for all study participants before replantation, immediately after replantation, after 14 days, after 1 year, after 3, 5 years. According to the indications, in the interim, however, these studies were not included in the dynamic observation within the framework of the dissertation research.

Before starting treatment, during the initial treatment, all patients underwent an X-ray examination in order to exclude alveolar bone fracture, horizontal and vertical fractures of the roots of the teeth. None of the patients showed these clinical signs during the X-ray examination at the first visit. All patients have a tooth displacement in the well or its absence with complete dislocation. Thus, prior to the replantation, we confirmed that all 127 patients fit the criteria for inclusion in the study and they did not have a clinical picture that meets the exclusion criteria.

Due to the violation of the periodontal complex due to trauma, X-ray images in patients with incomplete dislocation of teeth showed a decrease or expansion of the periodontal space throughout the root of the tooth. The periodontal ligament is a complex that binds the cement of the tooth root and the alveolar bone, since with dislocations of the tooth, the fibers of the periodontal ligament rupture, this leads to partial or complete displacement of the tooth in the well. Traumatic effects lead to neurovascular disorders and further to pulp necrosis. The fibers of the periodontal ligament rupture during traumatic injury, however, the literature on histological studies contains information that the cell population on the surface of the tooth root remains viable, therefore, in order to minimize damage to the cement of the tooth root, curettage of the surface of the root of the removed teeth was not performed before replantation.

For the second time, an X-ray examination was performed immediately after the replantation. In this case, the X-ray picture of the patients did not differ fundamentally from each other. The X-ray image showed a narrowing expansion of the periodontal gap of the replanted teeth throughout, a resected tip of the roots of the teeth, the presence of radiopaque material in the root canals of the replanted teeth, a light-curing fixation material of the reinforcing structure.

After 14 days, an X-ray examination was necessary to register postoperative complications, which could include secondary to the replantation of damaged teeth, including an infectious process, discoloration of the crown of the tooth, fistulous passages, inflammatory root resorption, ankylosis of the root to the

alveoli, apical periodontitis. The analysis of X-ray images of replanted teeth in 127 patients did not establish any deviations from the norm of the X-ray picture 14 days after surgery.

Table 12 - Complications 1 year after the replantation, revealed by X-ray examination

Complications diagnosed by X-ray examination 1 year after surgery	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
External root resorption	n=1	n=0	n=3	n=0
Communicating internal and external root resorption	n=0	n=0	n=2	n=0
Ankylosis	n=2	n=1	n=1	n=1
Bone resorption less than 4 mm	n=3	n=1	n=2	n=1
Bone resorption of more than 4 mm	n=1	n=0	n=2	n=0

1 year after the replantation, the registration of the first long-term complications after the replantation, presented in the TABLE, began. Radiographs performed one year after replantation showed an X-ray pattern of external root resorption in 4 patients (3.15%). In 2 patients (1.57%), complicated communicating internal and external root resorption was recorded on an X-ray at an angle of 20°. The X-ray picture of ankylosis was noted in 5 patients (3.94%). After assessing the bone tissue surrounding the tooth, bone resorption of less than 4 mm was determined in 7 patients (5.51%), more than 4 mm in 3 patients (2.36%).

Long-term complications after dental replantation were re-evaluated on X-ray examination after 3 years. Radiographs performed 3 years after replantation combined with previous X-ray examinations showed an X-ray picture of external root resorption in 10 patients (7.87%), and communicating internal and external root resorption was recorded in 8 patients (6.29%). An X-ray picture of ankylosis was noted in 13 patients (10.24%), an X-ray assessment of the alveolar bone

surrounding the tooth established bone resorption of less than 4 mm in 13 patients (10.24%), more than 4 mm in 5 patients (3.94%). The data is presented in table 13.

Table 13 - Complications 3 years after the replantation, revealed by X-ray examination

Complications diagnosed by X-ray examination 3 years after surgery	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
External root resorption	n=3	n=2	n=4	n=1
Communicating internal and external root resorption	n=2	n=0	n=5	n=1
Ankylosis	n=4	n=5	n=2	n=4
Bone resorption less than 4 mm	n=6	n=2	n=3	n=2
Bone resorption more than 4 mm	n=3	n=0	n=2	n=0

The final assessment of the X-ray images was an assessment of the results of treatment after 5 years. On radiographs performed 5 years after replantation, in total with previous X–ray examinations, 6 patients (4.72%) showed an X-ray picture of external root resorption, a decrease in complications in the form of external root resorption was due to the transition to a more severe complication of communicating root resorption - in 14 patients (11.02%), a reported internal and external root resorption. The X–ray picture of ankylosis was noted in 23 patients (18.11%), the X-ray assessment of the alveolar bone showed no significant changes compared with the assessment two years earlier, bone resorption of less than 4 mm was diagnosed in 13 patients (10.24%), more than 4 mm in 5 patients (3.94%).

The data is presented in table 14.

Table 14 - Complications 5 years after the replantation, revealed by X-ray examination

Complications diagnosed by X-ray examination 5 years after surgery	Group 1 (n=66)		Group 2 (n=61)	
	Group 1a (n=32)	Group 1b (n=34)	Group 2a (n=30)	Group 2b (n=31)
External root resorption	n=0	n=1	n=3	n=2
Communicating internal and external root resorption	n=5	n=1	n=6	n=2
Ankylosis	n=7	n=5	n=6	n=5
Bone resorption less than 4 mm	n=6	n=2	n=3	n=2
Bone resorption more than 4 mm	n=3	n=0	n=2	n=0
Total:	n=21	n=14	n=20	n=11

As a result of 5-year dynamic monitoring of the condition of the replanted teeth after injury, it was found that the lowest radiologically confirmed number of complications and/or adverse outcomes was found in groups 1b and 2b, whose patients received comprehensive treatment developed during the dissertation study after dental replantation.

Thus, dental injuries in the forms of complete and/or incomplete dislocations require a review by clinicians regarding treatment tactics in order to preserve the integrity of the dentition, it is necessary to improve treatment protocols to achieve a successful result. It should be remembered that treatment by dental replantation in combination with endodontic treatment is aimed at preserving the tooth and bone tissue. The need for early replantation is due to more predictable treatment outcomes.

3.7. The economic feasibility of dental implantation in modern conditions

In the context of the transformation of all economic processes taking place in Russia, the issues of standardization and justification of all types of medical activities of dental blades acquire a fundamentally new importance [9, 11]. One of the priority tasks facing the management of medical dental institutions is to optimize the expenditure of budgetary funds, improve the efficiency of using available resources, and increase the level of medical dental care. The specialists-economists of our dental clinic estimated the cost of dental implantation and dental replantation services, the calculation of which (1 CULI) was carried out taking into account the costs of these operations. The necessary costs were divided into two groups. The first group includes direct expenses that are directly related to the provision of medical services: salaries of basic medical workers, material support, depreciation of equipment, and other expenses directly related to the provision of medical services. The second group includes overhead (indirect) costs necessary to provide the dental clinic as a whole (they are not consumed in the process of providing services): administrative, managerial and maintenance personnel, household expenses, depreciation of the dental clinic building. To assess the economic effectiveness of dental replantation, it was necessary to show that all costs are covered and provide profit, therefore, the cost and profitability prices were included in the calculation.

In most cases, during dental implantation, a traditional scheme is used, when a dental surgeon installs an implant and after 4-6 months a gum shaper, subsequently an orthopedic dentist installs an orthopedic structure (crown).

When calculating the cost of medical services for dental implantation and dental replantation, the costs in our dental clinic are taken into account (Table 15). When calculating the tariff for medical services, the following are taken into account: cost and the amount of profitability (20%). The tariff for the service (price

calculation) of dental implantation surgery was 60097 rubles, while the cost of dental replantation was 11095 rubles.

Table 15 - Comparative characteristics of the costs of dental implantation and dental replantation

Surgery	Оплата труда +начислен. (руб.)	Material costs (RUB)	Overhead costs (RUB)	Cost price, amount (RUB)	Calculation (price) (RUB)
Dental implantation	9159	32586	8336	50081	60097
Dental replantation	5684	1238	3816	9246	11095

Thus, dental replantation performed with the use of modern technologies is a fairly progressive and less expensive method compared to dental implantation: at cost 5.4 times; at cost of materials – 26.3 times; at the price for the medical service provided – 5.4 times.

CONCLUSION

The dissertation study analyzed and studied the outpatient records of patients who were treated from 2012 to 2023 at the dental clinic BHI Dental clinic VCCDC No. 2 in Voronezh.

Patients included in the selection criteria of this dissertation study with a diagnosis of tooth dislocation underwent dental replantation, endodontic treatment, splinting, and dynamic observation. All 127 study participants were divided into experimental (1b and 2b) and control (1a and 2a) groups (according to medical records). For the main group of patients, the treatment additionally includes: surgical replantation using M-Chip matrices and physiotherapy with red light using the Svetozar device. Drug treatment, splinting, dynamic monitoring and diagnostic protocol were no different from the control group.

All the patients included in the dissertation study, according to outpatient records, underwent basic and laboratory diagnostic methods. The main methods included: dental examination, probing with a periodontal probe, palpation, questioning and collection of anamnesis of injury and allergic history. Additional methods included in the patient's treatment plan were: X-ray examination, functional diagnostic method (ultrasound Dopplerography, priotestometry), pH examination of oral fluid, macrohistochemical examination.

The process of dynamic follow-up lasted for 5 years, evaluation of treatment results was carried out after 7, 14 days, 1 month, 1 year, 3 and 5 years. After evaluating the results of dental replantation in the examined groups, patients were sent to the department of orthopedic dentistry in order to restore the aesthetics of the dentition.

Before the replantation and 7 days after the surgical intervention (tooth replantation), for the most accurate and early diagnosis of pathological changes in the periodontal complex, to identify specific areas of inflammatory reaction, a

macrohistochemical study using the Schiller-Pisarev reagent and 1% toluidine blue solution was used.

Before the start of treatment, the average area of inflammatory phenomena in the macrohistochemical study of group 1 was 6.5 = 0.3 mm^2, in group 2 - 8.4 = 1.1 mm2. Thus, in the 1st group, whose patients sought medical help within 24 hours, the area of inflammatory phenomena was 22.6% smaller compared to the 2nd group, whose patients sought an appointment with a dentist later than 24 hours. At the initial examination in group 1a, the area of inflammatory phenomena was 8.82% smaller than in group 1b (6.2 = 0.4 m^2) and amounted to 6.8 ± 0.3 mm^2. In group 2a, the area of inflammatory changes in the mucogingival complex was 6.9% less than in group 2b (8.7 ± 2.4 mm^2) and amounted to 8.1 ± 1.8 mm^2.

The average area of inflammatory phenomena in the macrohistochemical study of group 1 after 7 days was 2.05 ± 0.4 mm2, in group 2 - 2.15 ± 0.5 mm2. Thus, 7 days after the start of treatment, in the 1st group, whose patients sought medical help within 24 hours, the area of inflammatory phenomena was 4.65% smaller compared to the 2nd group, whose patients went to a dentist and received dental treatment later than 24 hours. On examination 7 days after the start of treatment in group 1b, the area of inflammatory phenomena was 21.74% less than in group 1a (2.3 ± 0.5 mm2) and amounted to 1.8 ± 0.3 mm2. In group 2b, the area of inflammatory changes in the mucogingival complex was 61.29% smaller than in group 2a (3.1 ± 0.6 mm2) and amounted to 1.2 ± 0.4 mm2.

The results of a macrohistochemical study 7 days after replantation showed that in groups 1b and 2b, whose patients received complex treatment according to the developed method, the area of inflammation of the mucogingival complex is smaller than in patients of groups 1a and 2a, who were treated according to the traditional method.

The measurement of the depth of dentoalveolar attachment was carried out before replantation only in patients diagnosed with incomplete dislocation of the tooth, the average rates of violation of dentoalveolar attachment in patients of

group 1 before the start of treatment was 4.2 ± 0.3 mm, in patients of group 2 - 3.8 ± 0.4 mm.

127 subjects (according to medical documentation) after 14 days to evaluate the first results and after 1 year to evaluate the long-term results of replantation. 14 days after replantation, the average depth of the violation of the dentoalveolar attachment of group 1 was 3.6 ± 0.3 mm, in group 2 - 3.9 ± 0.4 mm. Thus, in group 1, the violation of dentoalveolar attachment is 7.7% less compared to group 2. In group 1b, the depth of the dentoalveolar attachment disorder was 26.2% less than in group 1a (4.2 ± 0.3 mm) and amounted to 3.1 ± 0.3 mm. In group 2b, the depth of the dentoalveolar attachment disorder was 26.7% less than in group 2a (4.5 ± 0.4 mm) and amounted to 3.3 ± 0.5 mm. 1 year after replantation, a control measurement of dentoalveolar attachment was performed in groups and subgroups: the average depth of violation of dentoalveolar attachment in group 1 was 2.1 ± 0.3 mm, in group 2 - 2.5 ± 0.3 mm. Thus, in group 1, the violation of dentoalveolar attachment is 16.2% less compared to group 2. In group 1b, the depth of the dentoalveolar attachment disorder was 40.7% less than in group 1a (2.7 ± 0.4 mm) and amounted to 1.6 ± 0.2 mm. In group 2b, the depth of dentoalveolar attachment disorder was 43.8% less than in group 2a (3.2 ± 0.3 mm) and amounted to 1.8 ± 0.2 mm.

The results of the study with a periodontal probe in the subgroups of the subjects showed that groups 1b and 2b, whose patients received comprehensive treatment according to the developed method, had a lower level of dental attachment disorder than in patients of groups 1a and 2a, who were treated according to the traditional method.

Periotestometry was used to assess the stability of the replanted teeth in the well and analyze the long-term results 1 year and 3 years after dental replantation.

1 year after surgery, the average periotestometry in group 1a was 7.61±4.77, in group 1b 1.23±5.08, in group 2a 6.57±5.11, in group 2b 1.62±5.04. Thus, the results of this examination established that in the main groups 1b and 2b, the periotestometry indicators were 1.42± 5.06, in control groups 1a and 2a, the

indicators were higher and amounted to 7.09± 4.94. The results of periotestometry established that in the main group, the replanted teeth have greater stability in the well compared with the control group.

Periotestometry was repeated after 3 years in order to assess long-term treatment outcomes of the main and control groups of patients. The average values of periotestometry after 3 years in group 1a were 11.44±3.74, in group 1b 6.27±4.31, in group 2a 10.91±2.97, in group 2b 5.83±4.67. Thus, the results of this survey established that in the main groups 1b and 2b, the indicators of the periotestometer device were 6.05 ± 4.48, in control groups 1a and 2a, the indicators were higher and amounted to 11.17 ± 3.34.

An increase in periotestometry in the control subgroups after 3 years relative to the main subgroups is a sign of impaired dental stability in the well after comprehensive treatment. Thus, measuring the mobility of teeth using a periotestometer is a fairly informative modern method for assessing the condition of the periodontal complex in patients with dislocated teeth after replantation, which allows us to assess the degree of stability of the tooth in the well.

The most extensive diagnostic method as a result of the analysis of outpatient patient records was the collection and evaluation of ultrasound Dopplerography, which was performed on the 14th day after transplantation, after 1 and 3 years to assess the long-term results of complex treatment.

14 days after replantation in groups 1a and 2a, the results were 0.458±0.034 and 0.435±0.024, respectively, were themselves low average Vas values. 1 year after the start of dynamic observation of the replanted teeth, the average values in groups 1a and 2a did not correspond to the control reference values of healthy tissues surrounding the tooth. 3 years after the start of dynamic observation of the replanted teeth, the best average Vas was recorded in group 1b and was 0.728±0.009, the average values in group 1a did not correspond to the control reference values.

14 days after replantation in groups 1a and 2a, the results were 0.203±0.012 and 0.178±0.012, respectively, were the lowest average values in the examined

Vakd. 1 and 3 years after the start of dynamic observation of the replanted teeth, the average values in groups 1a and 2a did not correspond to the control reference values of healthy tissues surrounding the tooth.

Similar data were noted for the Vam indicator. When evaluating long-term results after 1 year in control subgroups 1a and 2a, the indicators did not correspond to the control values of healthy tissues, after 3 years, the measurement of Vam in subgroup 1a established a deviation from normal indicators.

14 days after replantation, the analysis of the Qas indicator found a discrepancy with normal values in all groups, however, after 1 year in groups 1b and 2b, this indicator corresponded to the reference values, and 3 years after the start of dynamic follow-up after dental replantation surgery, only the average values in subgroup 1a did not correspond to the control reference values of healthy tissues surrounding the tooth, In group 2a, the Qas index corresponded to the normal values of periodontal complex tissues.

1 year after the start of dynamic observation of the replanted teeth, the average Qam was recorded in groups 1b and 2b at the level of reference values, these average values in group 2a did not correspond to the control reference values of healthy tissues surrounding the tooth. After 3 years, the Qam values in groups 1a and 2a corresponded to the control reference values of healthy tissues surrounding the tooth.

Dynamic monitoring of the pulsation index (Gosling, PI). Already 14 days after replantation, the best indicators were recorded in groups 1b and 2b, in groups 1a and 2a, indicators that did not correspond to the normal Gosling index were established. After 1 year, in groups 1a and 2a, the indicators also did not correspond to the control reference values of the Gosling index of healthy tissues surrounding the tooth. In the control groups, the results were also outside the limits of normal parameters, but they were as close as possible to the normal values of healthy periodontal tissues.

The peripheral resistance index (Pourcelot index), reflecting the state of blood flow resistance distal to the measurement site, in patients of groups 1 (a, b)

and 2 (a, b) for 3 years, also showed higher values in patients whose rehabilitation included the technique we developed. After 14 days in groups 1a and 2a, the results themselves turned out to be high averages in the subjects, which reflected values that did not correspond to the normal Pourcelot index. After 1 year and 3 years in groups 1a and 2a, the index indicators did not correspond to the control reference values of the RI index, however, the indicators in group 2a were as close as possible to the indicators of normal values of healthy periodontal tissues.

The results of gingival fluid pH-metry were recorded on day 14 after replantation in all patients. In group 2b, the highest index was recorded, as close as possible to the normal hydrogen index of healthy tissues and amounted to 7.09 ± 0.29. In group 1b, this indicator is 6.96± 0.48, in group 1a – 5.51± 0.71, in group 2a – 5.43±0.74. Thus, the results and a comparative assessment of measurements of the hydrogen index of gingival fluid in the main (1b and 2b) and control (1a and 2a) established that the average pH values are closer to the alkaline marker of the normal environment in the main group and equal to 7.02±0.38, in the control group this indicator is 21.37% lower and equal to 5.51±0.72.

Thanks to the comprehensive diagnostic methods carried out over several years, it has been established that in the main groups 1b and 2b, minimal biochemical processes of inflammatory reactions after dental replantation are observed compared with the control subgroups. An analysis of the research results found that in the main groups where complex treatment was used with the inclusion of a nanotechnology M-Chip capsule during replantation and the appointment of physiotherapy with red light, replantation was more successfully performed after dental injuries (complete, incomplete dislocations). Dynamic observation data showed that in groups 1b and 2b, preparation for orthopedic treatment was more effective compared to control groups 1a and 2a.

A retrospective analysis of outpatient records of dental patients, and an assessment of 127 clinical cases of replantation in traumatic tooth damage accompanied by complete dislocation, statistically confirm the possibility not only of its preservation, but also for a long period measured in years, restoration of

aesthetic and functional aspects of the dental system, improvement of the quality of life of patients. The successful result of a tooth replantation operation in case of complete traumatic dislocation depends on timely early medical treatment, correct medical tactics when choosing a method of treatment and rehabilitation, as well as strict compliance by patients with all prescriptions and recommendations of a doctor in the postoperative period.

The replanted tooth takes root for about 2 to 3 months, and the probability of rejection of the "own" tooth is very low. It takes from 5 to 9 months for the implant to take root, and the complete implantation operation lasts even longer, since it implies a stage-by-stage approach. There are also relative and absolute contraindications to implantation, for example, diseases of bone tissue, immune and endocrine systems, etc.

The specialists-economists of our dental clinic calculated the services of dental implantation and dental replantation, which showed that at cost 5.4 times; at cost of materials – 26.3 times; at the price for the medical service provided – 5.4 times cheaper dental replantation.

Thus, dental replantation performed using modern technologies is a fairly progressive and less expensive method compared to implantation.

FINDINGS

1. A retrospective analysis of medical documentation on the use of M-Chip nanocapsules and phototherapy of red light LED radiation in the rehabilitation of patients after dental replantation showed high effectiveness in comparison with traditional methods: a decrease in the number of complications by 4.1%, rejections by 2.3%, as well as a reduction in treatment time by 2.14 times.

2. Comparative assessment of the clinical and functional effectiveness of red light LED radiation to correct histopathological changes in the tissues surrounding the replanted tooth, after surgery reduces the number of complications by 2.5 times; macrohistochemical parameters in group 1, patients who sought medical help within 24 hours, the area of inflammatory phenomena is 22.6% less compared with The 2nd group, whose patients had an appointment with a dentist later than 24 hours (according to medical documentation) .

3. Analysis of the medical documentation of the results of periotestometry showed that in the main group, the replanted teeth have greater stability in the well compared with the control group, dynamic monitoring of the indices of ultrasound Dopplerography turned out to be very high with average values in the subjects in the main group.

4. In modern conditions of import substitution, the possibility and necessity of dental replantation surgery has shown its economic effectiveness: by the cost of 5.4 times; by the cost of materials – 26.3 times; by the price for the medical service provided – 5.4 times cheaper dental replantation.

PRACTICAL RECOMMENDATIONS

In accordance with the results of processing the data obtained during the study, the following recommendations can be formulated that are applicable to practical healthcare.

1. For timely detection of pathologies of periodontal tissues and oral mucosa, at the end of dental replantation, it is recommended to use a set of research methods, including periotestometry, Dopplerography, pH determination of oral fluid.
2. In order to increase the effectiveness of orthopedic treatment of dentition defects, upon completion of dental replantation, it is recommended to analyze the factors determining the specifics of the pathological process of periodontal tissues and oral mucosa, as well as contributing to its occurrence and acceleration of progression, with further justified decision on the use of certain methods of their correction in accordance with the received with data.
3. To correct in the shortest possible time the pathological processes of the mucous membrane of the prosthetic bed and periodontal, detected after the dental replantation operation, it is recommended to use a modified technique for the use of physical light factors (using the Svetozar physiotherapeutic apparatus, with a maximum radiation wavelength of 328 nm, a radiation spectrum width of no more than 10 nm, pulse modulation frequency – 76 Hz, pulse modulation frequency – 4.3, radiation power up to 30 MW), in combination with drug therapy.

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LIST OF ABBREVIATIONS AND SYMBOLS

LILR - low-intensity laser radiation

Vakd – final speed in the selected range

Vam – weighted average velocity over the cross-section of microvasculature vessels

Vas – weighted average systolic velocity

Qam – average velocity over the cross section of the capillaries

Qas – weighted average systolic speed

PI – pulsation index (Gosling),

RI – peripheral resistance index (Pourcelo index),

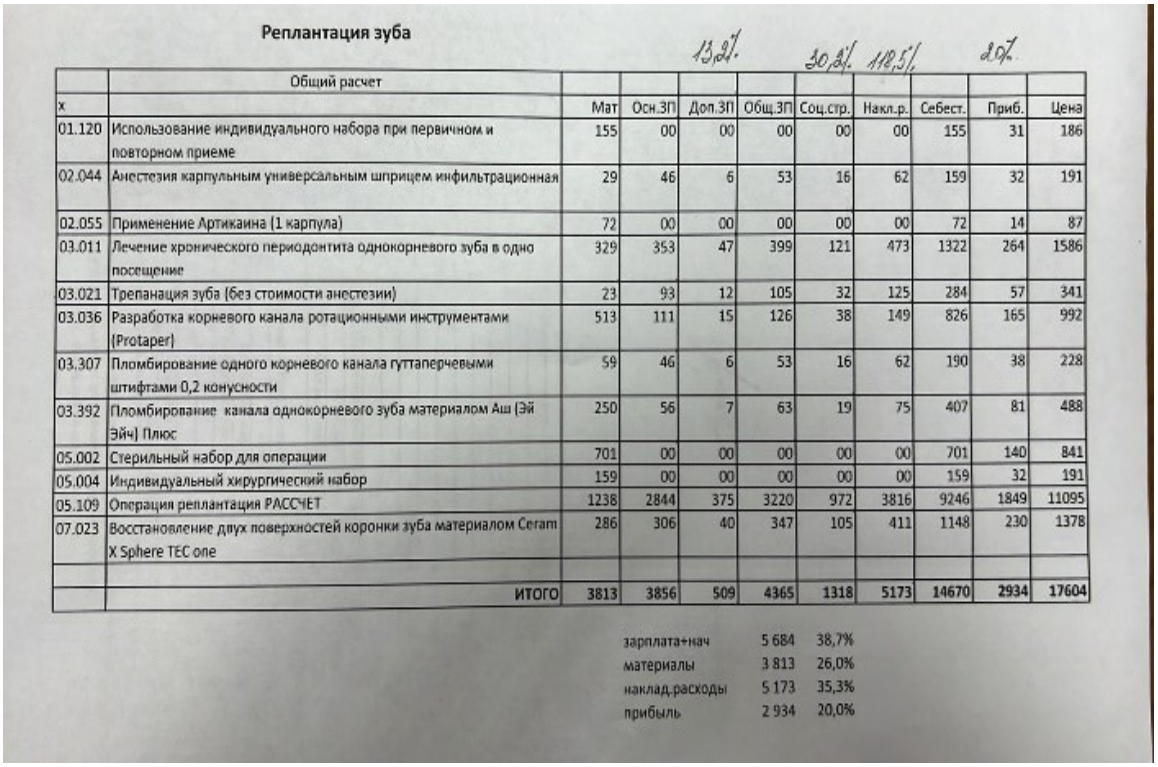
pH - pH value of gingival fluid

APPENDICES

1. Clinical case of a patient's treatment after 36 hours after injury

2. Dental replantation surgery after 36 hours after injury

3. Cost calculation of all costs for dental replantation



Реплантация зуба

13,2%. 20,2%. 112,5%. 20%.

	Общий расчет								
x		Мат	Осн.ЗП	Доп.ЗП	Общ.ЗП	Соц.стр.	Накл.р.	Себест.	Приб.	Цена
01.120	Использование индивидуального набора при первичном и повторном приеме	155	00	00	00	00	00	155	31	186
02.044	Анестезия карпульным универсальным шприцем инфильтрационная	29	46	6	53	16	62	159	32	191
02.055	Применение Артикаина (1 карпула)	72	00	00	00	00	00	72	14	87
03.011	Лечение хронического периодонтита однокорневого зуба в одно посещение	329	353	47	399	121	473	1322	264	1586
03.021	Трепанация зуба (без стоимости анестезии)	23	93	12	105	32	125	284	57	341
03.036	Разработка корневого канала ротационными инструментами (Protaper)	513	111	15	126	38	149	826	165	992
03.307	Пломбирование одного корневого канала гуттаперчевыми штифтами 0,2 конусности	59	46	6	53	16	62	190	38	228
03.392	Пломбирование канала однокорневого зуба материалом Аш (Эй Эйч) Плюс	250	56	7	63	19	75	407	81	488
05.002	Стерильный набор для операции	701	00	00	00	00	00	701	140	841
05.004	Индивидуальный хирургический набор	159	00	00	00	00	00	159	32	191
05.109	Операция реплантация РАССЧЕТ	1238	2844	375	3220	972	3816	9246	1849	11095
07.023	Восстановление двух поверхностей коронки зуба материалом Ceram X Sphere TEC one	286	306	40	347	105	411	1148	230	1378
	ИТОГО	3813	3856	509	4365	1318	5173	14670	2934	17604

зарплата+нач	5 684	38,7%
материалы	3 813	26,0%
наклад.расходы	5 173	35,3%
прибыль	2 934	20,0%