UDK: 616.314-089.843-033.3

CONTEMPORARY ASPECTS OF AUTOTRANSPLANTATION OF TEETH (WITH SPECIAL REFERENCE TO PRF-ASSISTED AUTOTRANSPLANTATION) - REVIEW ARTICLE

СОВРЕМЕНИ ПОГЛЕДИ НА АВТОТРАНСПЛАНТАЦИЈА НА ЗАБИ (СО ПОСЕБЕН ОСВРТ НА ПРФ ПОТПОМОГНАТА АВТОРАНСПЛАНТАЦИЈА) – ЛИТЕРАТУРЕН ПРЕГЛЕД

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Abstract

Introduction. ATT is defined as surgical transposition of a tooth from its original place in the alveolar ridge, to a new place in the ridge. The tooth-donor can be erupted or impacted, vital or non-vital, with completed or uncompleted root formation. The recipient bed can be a fresh extraction socket, with or without infection, it can have all 4 bony walls, or less than 4, ATT can be finished later (after couple of weeks following extraction) or in newly formed socket (prepared bed). **Aim.**The aim of this review is to summarize the contemporary aspects of the autotransplantation of teeth, review the latest published articles, and also to review the role of PRF in the treatment plan for autotransplantation of teeth. **Material and method.** To accomplish our goalof reviewing the contemporary aspects of autotransplantation of teeth, we reviewed existing papers in the PubMed medical database as our main source as well as Web of Science, and Google Scholar search that covers wider variety of publications offering easier access to full-text documents, searching for the studies written in the last 10 years (30 analyzed articles). **Results.** A presentation and comparison of modern aspects of autotransplantation was made. **Concslusion.** Autotransplantation is a reliable treatment option in patients that need tooth replacement due to tooth loss or partial edentulism, especially in young patients where the processes of bone growth are still active and it is an accepted and predictable procedure for replacing an irreparable tooth. Following the strict criteria for patient selection and following the steps of the therapeutic protocol greatly improves the outcome of the therapyand increasesthe percent of survival and success rate of the transplanted tooth. Also, including the latest therapy modalities can make a positive impact on the therapy outcome. **Key words:** Autotransplantation, periodontal ligament, PRF, A-PRF.

Апстракт

Вовед: АТТ претставува хируршко преместување (пресадување) на заб од своето оригинално место во алвеоларниот гребен, на друго место во алвеоларниот гребен. Забот донор може да биде изникнат или импактиран, витален или авитален, со завршен или незавршен раст на корен. Местото-примател може да биде свежа екстракциона алвеола со или без присутна инфекција, може да ги има сите 4 ѕидови интактни или да недостасува некој од нив, автотрансплантацијата може да биде одложена трансплантација (после неколку недели од екстракција) или трансплантација во новоформирана алвеола (препарирано лежиште). **Цел:** Целта преку овој преглед е да ги сумираме современите аспекти на автотрансплантација на заби, да ги прегледаме најновите објавени статии, а исто така да ја разгледаме улогата на PRF во третманотсо автотрансплантација на заби. **Материјал и метод:** За да ја постигнеме нашата цел да ги разгледаме современите аспекти на автотрансплантација на заби, ги прегледавме постоечките трудови во медицинската база на податоци PubMed како наш главен извор, како и пребарувањето на WebofScience и GoogleScholar што опфаќа поширок спектар на публикации кои нудат полесен пристап до целосни текстуални документи, барајќи ги студиите напишани во последните 10 години (30 анализирани статии). **Резултати:** Направен е приказ и споредба на современите аспекти на автотрансплантација. **Заклучок.** Автотрансплантацијата е сигурна опција за третман кај пациенти на кои им е потребно надоместување на заб поради губење на заб или делумна беззабост, особено кај млади пациенти каде што растот на коските е сè уште активен и е прифатена и предвидлива процедура за замена на безнадежен заб. Следењетона строгите критериуми за избор на пациент и следењето на чекорите од терапевтскиот протокол, значително го подобруваат исходот од терапијата, и го подигнуваат процентот на преживување и стапката на успех на трансплантираниот заб. Исто така, вклучувањето на најновите модалитети на терапија може да има позитивно влијание на исходот на терапијата. **Клучни зборови:** Автотрансплантација, периодонтален лигамент, PRF, A-PRF.

Introduction

Autotransplantation of a tooth represents the surgical relocation (transplantation) of a tooth from its original place in the alveolar ridge, to another place in the alveolar ridge. Of course, this definition is not complete, so its explanations complete the picture for this procedure. The procedure is performed by avulsion (removal with minimal trauma) of the donor tooth, and moving it into an already existing or newly created alveolus (place-recipient). The donor tooth can be erupted or impacted, vital or non-vital, with completed or unfinished root growth. The recipient site can be a fresh extraction alveolus with or without infection present, it can have all 4 walls intact or one of them missing, autotransplantation can be performed as a delayed transplantation (after several weeks of extraction) or a transplantation into a newly formed alveolus (prepared bearing)[1,2].

According to Bauss et al.[3] ATT is an accepted and predictable procedure for replacing an irreparable tooth. Contrary to implants, the transplant adapts to the eruption of the surrounding teeth and developmental changes in the oral region, but it can also be orthodontically moved. It is therefore considered an ideal tooth replacement treatment for growing patients. Furthermore, given the regenerative potential of the periodontal ligament (PDL), the graft itself stimulates the regeneration of the soft tissue attachment (epithelial and connective tissue), leading to restoration of the normal alveolar ridge and preservation of the gingival architecture[3].

On the other hand, several authors give preference to other indications for ATT, emphasizing that it is a therapeutic option in cases of tooth loss due to trauma, caries, periodontal disease, endodontic problems, but also in cases of impaction or agenesis. They emphasize that, unlike implants, transplanted teeth keep their periodontium alive, thus providing the above-mentioned advantages in terms of bone and soft tissue preservation, as well as the possibility of orthodontic or physiological movement. However, one of the biggest advantages of this procedure is that it can be performed in young patients who are still growing, in whom, on the other hand, the incidence of tooth loss due to trauma is relatively high[1-3].

Tooth ATT was performed many years ago, but with varying degrees of success. Even in the time of the pharaohs, attempts were made to transplant teeth from the slaves of the pharaohs, but due to histocompatibility, those interventions, as expected, ended in failure. If the procedure is performed carefully, with a full understanding of the biological principles involved, and if appropriate clinical techniques are implemented, the procedure can be very successful[2,4].

Subsequently, the foundations of the modern dental AT were laid by M. L. Hale, who in 1954 documented the first AT of teeth (4), and Slagsvold and Bjercke in 1960 at the University of Oslo established the first surgical protocol for this procedure (5). With that, the predictability and success of this treatment rose to a much higher level than before, which was proven by numerous long-term studies on the subject. The predictive factors for graft survival are directly related to the preservation of cell viability of the periodontal ligament of the donor tooth. Improper handling of the tooth during the intervention and its extraoral time can lead to damage to the ligament structure, which leads to postoperative complications of various kinds. Therefore, this procedure requires very gentle, atraumatic tooth extraction and careful handling during the procedure[6].

Several authors deal with this problem. In their paper, Yong Yoon et al.[7] state that despite the widespread use of dental implants and the experience gained, however, ATT of teeth can be a very difficult procedure to perform. A number of factors affect the success rate, including: developmental stage of the donor tooth root, tooth anatomy, surgical trauma, time the tooth spends outside the alveolar socket, shape and size of the recipient alveolus, condition of the recipient alveolus (the diagnosis of the tooth being extracted) and the blood supply of the bearing. The outcome of autotransplantation also depends on careful patient/case selection, delicate surgical technique, and understanding of the biological principles at work.

The survival and prognosis of autotransplanted teeth is similar to that of dental implants. However, it must be emphasized that certain complications can undermine the clinical outcome of these teeth. These include complications such as: root resorption which can be inflammatory resorption or replacement resorption which will lead to ankylosis, pulp necrosis, impaired periodontal healing, etc.[1,3,6].

In literature, various numerical data can be found about the percentage of survival/success/complications, but for the purpose of this paper, we decided to single out the data of a meta-study that has summarized the data of 32 other studies, considering that it shows the most objective picture. The author Evelyn C. et al.[1] found in his meta-analysis that the survival rate of these teeth, shown after 1, 5 and 10 years, was 97.4, 97.8 and 96.3 % respectively. They also show the one-year success rate of the intervention, which is 96.6%, but also the rate of complications such as ankylosis (2.0%), root resorption (2.9%) and pulp necrosis (3.3%).

Andreasen J.O et al.[4], in their study of patients aged 7-35 years with a total of 370 autotransplanted teeth, examined root resorption in these teeth. According to their results, root resorption was observed in 52 of the examined teeth. They found that root resorption is significantly related to the degree of root development of the donor

tooth, as well as to the degree of eruption of the donor tooth. According to them, trauma to the periodontal ligament is a key factor in the development of root resorption later.

1. Platelet-enriched fibrin (with special reference to A-PRF)

By definition, Platelet-Rich Fibrin (PRF) is defined as an autogenous fibrin plug enriched with platelets and leukocytes that can be used as a biomaterial in the form of a plug or pressed membrane. It belongs to the second generation of platelet concentrates obtained by simple physical procedures on autologous blood taken from the patient, as products are obtained that are proven to accelerate the healing of soft and hard tissues during guided tissue and bone regeneration. The method is developed by J. Choukroun et al. in 2001 (Kumar and Shubhashini, 2013)[8].

The essence of the second generation is in the protocol for obtaining PRF that is created and directed to cause the accumulation of platelets and released cytokines in the fibrin plug[9], which means that a concentrate of a multitude of promoters of wound healing are obtained in one place, and which are usually diluted in the initially collected blood. The slow polymerization of fibrin during the processing and obtaining of PRF leads to the incorporation of platelet-derived cytokines inside the fibrin network. This indicates that PRF, unlike other platelet concentrates (first generation), will gradually release the trapped cytokines during fibrin remodeling, which in turn explains the positive impact on the speed of tissue healing that we can clinically register[9].

The mechanism of action of PRF is through its structure and its composition. It represents a network of densely distributed fibrin fibers with a tri- and tetramolecular structure in which a huge number of platelets and leukocytes are incorporated. By degranulation of platelets from their dense α-granules, plasmin proteins, pro- and anti-inflammatory cytokines (IL-1, IL-6, IL-4, IL-8) and growth factors (TGF, VEGF, PDGF, IGF) are released[10].

Because of such properties of PRF, it finds application in a large number of medical branches as an autologous biomaterial in oral and maxillofacial surgery, ear, nose and throat surgery, plastic surgery, orthopedics, etc. In oral and maxillofacial surgery, it can be used alone or in combination with graft materials in: periodontal surgery, sinus floor elevation[11,12], ridge augmentation[13], jaw reconstruction[13], regeneration after cyst enucleation[11], guided bone regeneration[13], alveolar preservation[14], MRONJ[15], autotransplantation[16] etc.

2. Surgical protocol

Before the oral-surgical intervention itself, antibiotic prophylaxis is administered (Tabl.Amoxicillinum+acidi clavici a' 2g per os, one hour before intervention, or Caps. Clindamycin a 600 mg per os, 1 hour before the intervention, in patients with a history of previous allergic reaction to penicillin). If the patients have an infection in the donor site,we administer antibiotic therapy one week before the intervention, in standard prescribed doses, in order to calm all the symptoms of infection and inflammation around the tooth, and at the same time, for several days before the intervention, we give advise to rinse the mouth with Cetylpyridinum chloridum 0.05%.

On the day of the intervention, patients rinse their mouth with Cetylpyridinum chloridum 0.05% for 2 minutes. Further procedures are performed according to all principles of asepsis and antisepsis. Anesthesia is applied using the necessary anesthetic technique depending on the region of the donor tooth and the recipient bed.

2.1 Autotransplantation of a tooth in an already existing extraction alveolus

At the beginning, extraction of the damaged tooth is performed with the help of elevators and appropriate pliers. Care is taken to ensure that the extraction is as trauma-free as possible, with maximum preservation of the bone walls. This is followed by preparation of the extraction alveolus, which entails vigorous curettage of all pathological tissues from the inside, breaking of the interdental septum if necessary, and osteotomy, if necessary.

Furthermore, the impacted tooth is extracted. If the donor tooth has erupted, it is extracted without raising the mucoperiosteal flap, but by sharply cutting the fibers of the epithelial

Figure 1. *Placing and splinting the donor tooth*

attachment using a scalpel. Extraction is done carefully with a suitable elevator and forceps. If the tooth is partially or fully impacted, it is approached with a classic surgical procedure. In doing so, care must be taken not to damage the crown of the tooth, but much more importantly, not to damage the root and the periodontal ligament on it. A triangular incision is made and a mucoperiosteal flap is raised. Furthermore, a more extensive but very careful osteotomy is made around the crown of the tooth (vestibulally and distally), in order to allow an unobstructed path of the tooth during extraction, without crushing or injuring the PDL. The tooth is carefully extracted and immediately placed in its new socket. If the tooth enters easily, without pressure and is placed in infraocclusion, we continue with the procedure (Picture 1.).

If the tooth does not fit the bearing, it is necessary to make an additional adjustment to the bearing, and finally to the occlusal surface of the tooth. During this time, it is very important, if possible, to return the tooth to its original alveolus, and if not, to complete the adjustment as quickly as possible. The extra-alveolar time of the tooth is extremely important and related to the prognosis of the tooth. Once the tooth is placed in its socket, it should be in infraocclusion, and not put under pressure.

Figure 2. *Splinting the donor tooth*

Furthermore, sutures are placed on the soft tissue, but also over the occlusal surface of the tooth, with the aim of its initial stabilization. After that, an elastic splint must be placed (an elastic wire that is glued with composite material to the vestibular surface of the tooth and two other adjacent teeth) in order to immobilize the transplant. (Picture 2)

The splint remains for 2-3 weeks, and then it must be removed, to prevent ankylosis of the tooth. The sutures are removed after 7-14 days. In teeth with complete root growth, endodontic treatment of the tooth starts after 1 month, and teeth with incomplete root growth are checked for vitality subsequently after 1-3-6 months. The patient is prescribed antibiotic therapy for one week postoperatively as well as vitamin supplementation (Vit C a 1000 and Vit D a 2000) for several months, maintenance of exceptional oral hygiene as well as scheduled check-ups.

2.2. Autotransplantation of a tooth in a newly prepared alveolus

In case when the tooth transplant is performed at a recipient site where there is no previous presence of a tooth, i.e. on an edentulous alveolar ridge, then a new transplant bed preparation must be performed. The osteotomy/preparation is done using drills from any implant set. In doing so, it is necessary to have data on the length and width of the donor tooth beforehand. The best way to get that data is through a 3D image of both jaws. In relation to the obtained data on the dimensions of the tooth, we use the implant drills and prepare the space in the bone.

2.3. Autotransplantation of a tooth using A-PRF

Since it is the same procedure, only those parts of the therapy protocol that are different from the previous case will be described below. Immediately before the start of the surgical intervention itself, venous blood is collected from the cubital vein, from which the platelet derivatives will be made. (Picture 3)

Once the donor tooth is extracted, it is set to sit submerged in the collected PRF exudate for as long as necessary while other preparations are made.Before placing the donor tooth in its socket, the socket is lined with a chopped PRF membrane, and the tooth is pushed through it, in order for the membrane to act as a physical shock absorber to protect against excessive pressure, but also as a biological substrate for assisted healing.

The rest of the procedures were identical to the first case.

2.4. Postoperative care of the patient

Postoperatively, for 7 days, the patient is prescribed antibiotic therapy, as well as vitamin supplementation (Vit C a 1000 and Vit D a 2000) for several months. The patient is

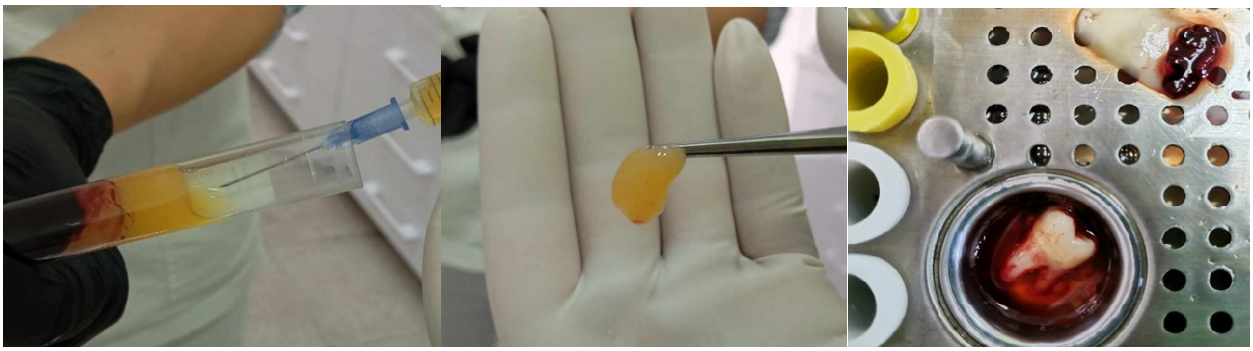

Figure 3. *Preparation of PRF products*

instructed to maintain excellent oral hygiene and to regularly rinse the wound with neutral fluids, saline or alcohol-free mouthwashes (Cetylpyridinumchloridum 0.05%). If necessary, patients are prescribed analgesic therapy from the NSAIL group. It is important to emphasize that patients who have received PRF therapy must not receive enzyme drugs to reduce edema (Chymoral, Serapeptaze) because breakdown of PRF preparations may occur. Frequent postoperative controls are performed, and the sutures are removed in 1-2 weeks.

2.5. A-PRF preparation protocol

Venous blood collection begins with venipuncture from the cubital vein, into two specially designed, patented, glass-coated A-PRF tubes of 10 ml of blood each. They are placed in parallel in a centrifuge BIOBASE LC-H4K, BIOBASE, Jinjan, Shandong, China and centrifuged at 1300 revolutions per minute (rpm), for 8 minutes, noting that the time from venipuncture to the start of centrifugation should not be longer than 2-3 minutes.

After the centrifugation process is completed, the test tubes are left open, covered with sterile gauze, to stabilize for 5 minutes. For manipulation of the PRF coagulum, a specially designed PRF set with instruments and PRF-box is used, which has a grid for obtaining membranes, Teflon molds for obtaining plugs, and a tub for mixing with other graft material and forming sticky bone.

After the stabilization of the coagulum in the test tubes, the collection of the supernatant from the PPP is started, in a sterile syringe of 5 ml with anatomical tweezers, the PRF coagulum is collected together with the erythrocyte sediment. With sterile scissors and the specially designed spatula, gently remove the erythrocyte sediment to the border with the fibrin coagulum, taking care to preserve the entire coagulum, at the expense of the erythrocyte sediment, so that a minor part of the sediment is left on the lower, distal part of the fibrin coagulum. Subsequently, the formation of the PRF membranes and/or the PRF plug (PRF cloth) is approached, depending on our needs. When manipulating the PRF material, a PRF exudate is obtained, which is collected in a sterile syringe and a suitable container. (Picture 3)

The aim of this review is to summarize the contemporary aspects of the autotransplantation of teeth, review the latest published articles, and also to review the role of PRF in the treatment plan for autotransplantation of teeth. Summarizing these information can be a step forward in choosing the most adequate treatment plan and including the new treatment varieties in order to improve the treatment and the outcome in these patients.

Material and method

To accomplish our goal to review the contemporary aspects of autotransplantation of teeth, we reviewed existing papers in the PubMed medical database as our main source as well as Web of Science, and Google Scholar search that covers wider variety of publications offering easier access to full¬-text documents, searching for the studies written in the last 10 years (30 analyzed articles). We used specific search query for every part of our research. For analyzing the contemporary aspects of autotransplantation of teeth, we used this search query: "autotransplantation of teeth, new methods, news, and development of the procedure", with the only filter applied: "in the last 10 years". For analyzing the use of PRF in autotransplantation of teeth we used: "autotransplantation of teeth, PRF".

Results and discussion

In the literature covering this field of research, several criteria are cited as key factors in performing successful autotransplantation.

Ray Lescure et al.[17] state that the recipient bed must be free of any infections and with a sufficient amount of bone that will provide good support and stabilization for the transplanted tooth. Regarding the donor tooth, the ideal candidate is the teeth with incomplete root growth, because they have the potential to form the root and preserve the

vitality of the pulp. Some other prognostic factors that may influence the success rate are: atraumatic tooth extraction, limited root injury and PDL, minimal root manipulation, and reduced extraoral time. All of the above factors are associated with a reduction in the risk of PDL damage, which would lead to the most common complications of the autotransplanted tooth, such as internal/external root resorption and ankylosis[17].

The criteria for successful autotransplantation are similarly described and divided in a number of papers, but as the most appropriate we will take the division of Andreasen et al. (18). Regarding the clinical examination, it is managed according to the following criteria: 1) physiological mobility; 2) no pain on percussion; 3) probing depth <3mm; 4) no signs of inflammation; 5) normal chewing function. Regarding the radiological criteria, they take into account the following: 1) normal spatiumperiodontale; 2) there is no progressive resorption of the root; 3) presence of lamina dura. ATT is considered unsuccessful when there is prolonged inflammation of the recipient cavity or when the transplanted tooth appears clinically unhealthy with persistent grade 3 mobility, ankylosis, or progressive root or bone resorption[18].

Keranmu et al.[19] in their study of 52 patients with ATT, divided the patients into two groups of 26 subjects, one of which performed the interventions in a classical way, and the other with the use of PRF. The initial stability of the graft in the PRF group is better immediately after the intervention. Periapical lesions in 23 of 26 subjects with PRF healed completely with new alveolar bone within 3 months, whereas in the control group, only 9 cases showed complete lesion healing after three months. In the PRF group, all patients showed satisfactory mastication, no abnormal mobility, periodontal pockets, and root resorption or ankylosis. In the control group, deep periodontal pockets were observed in some of the subjects[19].

Jorge González et al.[20] in their study presented 10 cases of ATT using PRF. All 10 patients have a functional and asymptomatic transplanted tooth with physiological mobility even after 1 year. All 10 have a positive test for vitality and all transplants show positive root growth (on average 2.01mm per year). The probing depth is not greater than 4 mm during the first year[20].

The use of A-PRF is thought to be a promoter of wound healing and angiogenesis processes. Use in autotransplantation cases is thought to possibly enhance the natural revascularization process of the transplanted tooth. Also, keeping the donor tooth in a PRF exudate while outside the alveolus may have an effect in preserving the vitality of cells from both the pulp and the PDL, thus improving the clinical outcome[21,22].

PRF stimulates angiogenesis through migration, division and phenotypic switching of endothelial cells. It also stimulates cell mitosis and induces osteogenesis without an inflammatory reaction. These effects work through a slow process that lasts at least a week[23] and up to 4 weeks[24].

PRF can induce strong and prolonged differentiation and stimulation of osteoblasts together with fibroblasts within 14 days[25].

After 12 months of follow-up, Bakhtiar et al. showed radiological evidence of prolonged root loom and closure of the apex in 4 teeth with incomplete growth and necrotic pulp[26].

These "miraculous" powers of PRF are described and explained by various authors in literature. Thus Alkofahi et al.[27] state that this is due to the fact that PRF contains a dense network of fibrin network and a concentration of many growth factors such as platelet-derived growth factor and vascular endothelial growth factor. An important factor is transforming growth factor b1 (TGFb1), which is simultaneously secreted by Hertwig's coat and positively affects the differentiation of dental papilla cells to transform into odontoblasts, providing a suitable environment for PDL cell proliferation and extracellular matrix synthesis. Finally, the authors conclude that the benefit of using PRF in autotransplantation of teeth with incomplete root growth is great in the early and late stages of the regenerative process[27].

1. New trends in science

The goal of modern science is to discover new innovations, to introduce new methods and techniques of work, but also to improve the existing ones, in a way that will enable the removal of the negative aspects of a procedure, improvement of epidemiological data in terms of improving the performance of one technique, as well as reducing the rate of complications. As in every field, in this field as well, modern science is trying to improve these parameters. In recent years, new work methods have been researched, implemented and introduced, and work protocols have been modified. In the following, some of those novelties will be briefly described.

1.1. Use of 3D technology in planning and performing autotransplantation of teeth

The introduction and daily use of CBCT in oral surgery greatly facilitates the process of diagnosis and therapy planning. Combining this diagnostic technology with various software that offers 3D design, planning, transfer of files, as well as their 3D printing has led to completely new views in the therapeutic plan, and thus in increasing the success of surgical techniques. These technologies, used in the planning process of autotransplantation of teeth, find application in several places.

Park S. et al.[28] in their paper give a simple explanation of the procedure. Namely, the width and length of the donor tooth can be predicted according to a digital image obtained

during CBCT 3D recording in the form of DICOM files. With the help of advanced software systems, a virtual reconstruction of the donor tooth is made and as an STL file it can be transferred, manipulated, and thus can be printed on a 3D printer, which results in a computer-guided prototype of the tooth that needs to be transplanted, made of artificial material (resin). Such a tooth model can be used to adjust and prepare the alveolus that will be the bed for the transplant, without having to manipulate the real tooth at all. The very fact that the donor tooth can be extracted after the recipient alveolus is prepared is an extremely important step forward and a revolutionary moment in the autotransplantation protocol, because it allows minimizing the possibility of damaging and drying the cells of the periodontal ligament of the donor tooth.

On the other hand, imitating the use of a surgical-prosthetic guide during implant surgery, the same procedure is successfully transferred to the autotransplantation procedure. Namely, in implantology, with the help of CAD/CAM technology, a surgical guide that determines the exact depth, direction and angulation of the implantis often created. Considering the fact that when transplanting, it is best to have 1-2 mm of free space between the root of the tooth and the walls of the alveolus to be filled with blood, it is extremely important to place the donor tooth without pressure on the walls of the alveolus so that the cells of the PDL would not be damaged, but so that the revascularization of the pulp would be promoted. For this purpose, surgical guides are created that are virtually planned, 3D printed and which determine the extent of the osteotomy during alveolar bed preparation. This method provides atraumatic work and a precise surgical approach during autotransplantation[6,28].

1.2. Guided block autotransplantation

Krasny et al.[29] introduce a new technique of tooth transplantation which they call "en bloc autotransplantation". This surgical technique involves dissecting a block of bone that contains the bottom tooth and then transplanting the bone and tooth in one block into the recipient socket. This method is introduced in order to preserve the PDL and the bone, which enables easier and faster revascularization and continuation of the growth of the transplanted tooth. Surgical osteotomy of the bone is recommended to be done with a piezo device, in order to minimize potential complications, considering that this is a more complex intervention compared to the classical transalveolarautotransplantation[29].

1.3. Use of platelet-rich fibrin (PRF) in autotransplantation

Literature data indicate numerous case reports, but a lack of systematic research on this topic. Robindro Singh et al. used PRF in ATT of an impacted central incisor after odontoma removal. They wrapped the membrane around the root of the transplanted tooth, and a 6-month follow-up indicated successful regrowth of the root. Devi et al. They indicate positive radiological and clinical results at 2 and 3 year follow-up after the use of PRF in ATT of an impacted third molar with incomplete root growth in a fresh extraction alveolus[19,27,30,31].

Conclusions

Autotransplantaton is a reliable treatment option in patients that need tooth replacement due to tooth loss or partial edentulism, especially in young patients where the processes of bone growth are still active and it is an accepted and predictable procedure for replacing an irreparable tooth. Following the strict criteria for patient selection and following the steps of the therapeutic protocol, greatly improves the outcome of the therapyand increases the percent of survival and success rate of the transplanted tooth. Also, including the latest therapy modalities can make a positive impact on the therapy outcome.

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