

**ORIGINAL ARTICLE**

**POST EXTRACTION ALVEOLAR RIDGE PRESERVATION –  
TECHNIQUE USE AND WIDESPREAD**

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**Abstract:** Evaluation of the use of post extraction alveolar ridge preservation techniques by a group of dentists from the Oltenia region. The study was addressed to dentists with various specialties, who completed an online questionnaire, following which information such as the number of extractions usually performed, the clinical causes, paraclinical tests performed before extraction, the percentage of patients to whom alveolar ridge preservation therapies were proposed, the materials used, the experience in implantology, the specialty of the clinician, the percentage of patients who accept alveolar ridge preservation therapy, the benefits of the technique, but also possible complications was extracted. The questionnaire was launched online for a period of 4 weeks, and dentists from the Oltenia region were invited to participate. The statistical analysis was carried out with the help of the Google Docs program, the section dedicated to the "Google Forms" forms. 64 dentists participated in the study, of which 40.63% were general dentists, 28.13% dento-alveolar surgeons, and the rest from other specialties. The most common causes reported for dental extractions were: 35.94% dental caries complications, 25.00% periodontal causes, 21.88% vertical root fractures, 9.37% for orthodontic purposes, 7.81% trauma. Doctors use as materials for post extraction alveolar grafting: PRF (46.88%), xenogeneic materials (31.25%), synthetic bone grafts (9.38%), extracted tooth material (6.25%), hemostatic sponges (1.56%), and 4.68% of doctors does not perform alveolar ridge maintenance techniques. Alveolar ridge preservation is a technique that must be known and used by all dentists who perform tooth extractions.

**Keywords:** tooth extraction, alveolar ridge preservation, PRF, bone graft, collagen membrane.

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## 1. Introduction

Dental extraction is indicated when a tooth can no longer be saved or maintained in optimal conditions on the dental arch from the perspective of health, functionality and aesthetics [1]. Edentulism has a direct impact on the patient's quality of life, by affecting masticatory function, speech and in certain cases, affecting social life [1,2].

The alveolar process is a structure dependent on the teeth present on the arch, thus, the absence of teeth results in a marked reduction in bone size [3-6]. Dental extraction results in the loss of "bundle bone", which causes resorption of the alveolar ridge. Following alveolar bone resorption, soft tissue contraction occurs [1,7,8]. Even the most conservative tooth extraction can cause bone resorption and a bone augmentation procedure may be necessary, especially in the aesthetic area [9]. Following the resulting atrophy, it is obvious that resorption of the alveolar ridge is a complex process involving structural, functional and physiological components [10]. Post-extraction surgical traumas induce micro-traumas in the adjacent bone, which can accelerate bone remodeling [9].

Bone remodeling takes place throughout life, new bone permanently replacing old, degraded bone, so that every 10-year cycle there is a complete regeneration of bone tissue from the level of the entire human skeleton [10]. Bone remodeling takes place in two functional stages: bone resorption coordinated by osteoclasts and new bone formation produced under the effect of osteoblasts, both processes being functionally coordinated by

osteocytes [11]. Both osteoblasts and osteoclasts involved in a bone remodeling cycle are included in a structure called the bone multicellular unit (BMU) [11]. During a bone remodeling cycle, the process of bone resorption occurs first and proceeds more rapidly than the process of bone formation, so that increasing the rate of bone remodeling translates into an initial imbalance in favor of bone resorption [9, 10].

Age and gender are thought to influence the bone resorption process [11]. Changing the volume and shape of the post extraction alveolar bone is an important element from the medical point of view due to the possibility to prevent marked loss of bone volume and to rehabilitate the bone structure by insertion of implants and prosthetic restoration of the edentulous area with the help of guided bone regeneration techniques. In the presence of marginal bone pathology or traumatic extraction when a bony wall is absent, fibrous tissue will invade the post extraction alveolus and interfere with normal healing and bone regeneration [6]. Studies state that alveolar ridge preservation therapy decreases the process of vertical and horizontal bone resorption and favors better preservation of keratinized tissue [7].

Based on the experimental studies, in the case of dimensional changes, it can be suggested that the resorption of the bone walls of the post extraction alveoli occurred in two overlapping phases. In the first phase, the resorbed bone is replaced by cancellous bone, resulting in a vertical reduction of the alveolar ridge. In the second phase, resorption occurs

at the level of the outer surfaces of both bone walls [3,12]. This pattern of bone remodeling causes a horizontal resorption that can also induce a further vertical reduction of the buccal bone. These ridges often do not allow conventional fixed prosthodontics, nor placement of dental implants in a favorable prosthetic position [3,11,13].

The bone loss in the horizontal direction of the post extraction alveolar ridge is more extensive compared to the bone loss in the vertical direction and it tends to be greater in the buccal area [12]. Resorption of the alveolus is intense during the first six months after tooth extraction, but it will continue throughout the patient's life. Studies have also reported 35% to 50% loss of ridge dimensions following tooth extraction [12]. After extraction any alveolar site involves important anatomical changes, this aspect being proven by numerous studies in the specialized literature, it is necessary to apply "Socket Preservation" or "Ridge Preservation" techniques (preservation of the alveolar ridge), to block the post-extraction alveolar site change [13]. The clinical need is to maintain sufficient alveolar dimensions and to encourage bone augmentation following tooth extraction to support implants in ideal positions. To limit the effects of the resorptive healing process, alveolar ridge preservation techniques were used at the time of surgery [1]. Thus, to carry out this procedure, a grafting material is placed in the alveolus, with the aim of limiting dimensional change and providing enough bone to achieve optimal aesthetics and function [3,13].

Advances in the field of bone substitute materials have brought to the area of alveolar regeneration an increasing number of products that can cause confusion and uncertainty regarding their biological valence [8]. Current methods used to prevent ridge resorption include the placement of autografts, allografts, xenografts, and alloplasts. These biomaterials present both advantages and disadvantages, depending on their structure and biochemical composition, being resorbable or non-resorbable [1,8,10]. Over the past two decades, multiple studies have evaluated the effectiveness of different alveolar ridge preservation techniques [8]. In these studies, a variety of biocompatible materials have been used, including autologous bone, human bone substitute materials (autologous transplant, heterologous transplant, and allograft), autologous blood derivatives, and bioactive agents [3,8,14].

In the past, the absence of standardized protocols and long-term data on alveolar ridge preservation materials prevented some specialists from routinely performing this procedure [2,15]. According to published studies, the post-extraction alveolar ridge preservation operation is not widely used, most tooth extractions being performed using the traditional method [16,17]. Alveolar ridge preservation therapy should be considered in conjunction with minimally traumatic tooth extraction to minimize post extraction bone loss [17].

Post extraction alveolar ridge preservation therapies are now widely indicated in contemporary dental practice and there is

solid evidence supporting their effectiveness [1,13,17- 20].

The purpose of this study is to present the experience and knowledge about alveolar ridge preservation techniques in a group of dentists from Oltenia region.

## 2. Materials and method

This retrospective study aimed to evaluate and to determine the use of postextraction alveolar ridge preservation techniques by a group of dentists. The study highlighted the way in which dentists apply post extraction bone ridge preservation therapy, the clinical advantages, patient compliance, the type of recommended therapeutic method, the clinician's experience in implantology, the materials used, but also the reasons why post extraction alveolar ridge maintenance was not achieved in certain clinical cases. Possible complications arising from bone preservation surgeries were also presented. The data obtained from the study were corroborated and used to understand if the alveolar ridge preservation is a standard of care at this time in dental clinics in Romania.

This study included data on patients who underwent dental extractions and on whom were proposed alveolar ridge preservation by various techniques and using different biomaterials. The data were obtained from dentists with various specializations, from the region of Oltenia, Romania, using as an investigation method an online questionnaire, consisting of 15 questions, which contained both single-choice and multiple-choice questions. The questionnaire was launched for

a period of 4 weeks, and a number of 64 dentists, who were assured of anonymity and confidentiality of the research data, answered it voluntarily.

Information was collected such as: the number of dental extractions usually performed in the clinic, the causes that led to the extraction (periodontal causes, severe caries, orthodontic causes, fractures, trauma), the paraclinical tests and complementary examinations performed before the extraction, the percentage of patients on whom were proposed alveolar ridge preservation therapies, the materials used for alveolar ridge preservation, experience in implantology, the specialty of the clinician, the percentage of patients who usually accept alveolar ridge preservation therapy, the benefits of the technique and possible complications.

The questionnaire was made up of the following questions:

1. What is the number of dental extractions performed per week in your clinic?
2. What are the most common reasons for which you perform dental extractions?
3. What are the paraclinical assessments you use before performing the tooth extraction?
4. Have you often proposed therapeutic methods to patients in order to preserve the post-extraction alveolar ridge?
5. What biomaterial do you use in your clinic for grafting the post-extraction alveolus?
6. What type of xenograft do you use?
7. What synthetic material do you use?

8. In which area of the dental arches do you consider it is useful to preserve the alveolar ridge?

9. What is the percentage of patients who accept alveolar ridge preservation therapy after extraction?

10. If, after extraction you did not propose the alveolar ridge preservation technique to the patient, what are the reasons?

11. What do you consider to be the benefits of preserving the postextraction alveolar ridge?

12. In how many cases have you applied alveolar ridge preservation therapy, followed by implant insertion?

13. What is your specialty?

14. What is your clinical experience in the field of implantology?

15. What complications of alveolar ridge preservation procedures have you encountered in your clinical experience?

Following the results obtained from this study, different graphs were made, which were processed statistically, and which were later exemplified individually, in the chapter dedicated to the results and discussions. The statistical analysis was carried out with the help of the Google Docs program, the section dedicated to the "Google Forms" forms.

The study was approved by the Scientific Ethics and Deontology Commission of the University of Medicine and Pharmacy in Craiova (Approval Number 52/29.01.2024) and was carried out in accordance with the ethical principles of the Declaration of Helsinki (version 2013).

### 3. Results

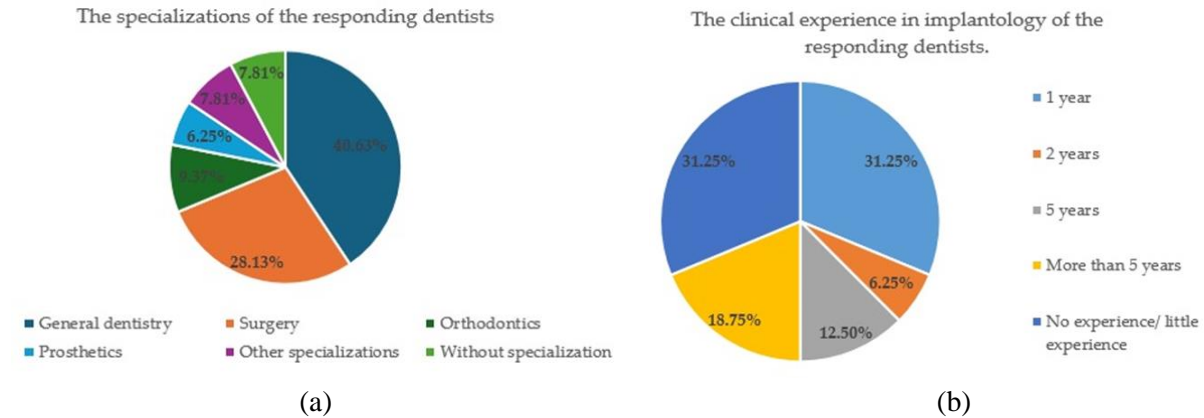
The study included the analysis of data obtained from a group of 64 dentists with various specializations, from Oltenia, Romania. 26 (40.63%) are general dentists, 18 (28.13%) are specialists in dento-alveolar surgery, 6 (9.37%) work as specialists in orthodontics and dento-facial orthopedics, 4 (6.25%) in dental prosthetics, 3 (4.68%) are specialists in periodontology and pedodontics, 2 (3.12%) in endodontics and 5 (7.81%) without specialty. The results obtained from the answers received were recorded and centralized and will be presented in the following.

Regarding the clinical experience in implantology, 20 (31.25%) doctors answered that they have one year of experience, 20 (31.25%) doctors stated that they have no experience in implantology or have little expertise, 12 (18.75%) are medical specialists with more than 5 years of clinical implantology experience, 8 (12.5%) have been active in the field of implantology for 5 years, and 4 (6.25%) have 2 years of experience in this field.

It is a great diversity caused by clinical experience and the specialty in which dentists work. 10 (15.63%) of the surveyed doctors reported 5 extractions per week, another 9 (14.06%) doctors reported 10 weekly extractions, 9 (14.06%) answered that they perform 2 tooth extractions every week, 6 (9.38%) perform only one extraction weekly, 5 (7.81%) do not perform any extractions, 3 (4.69%) physicians said they perform 6 extractions per week, and 2 (3.12%) reported

30 extractions each week. Other single responses, representing a percentage of 31.25%, reported a varied number of tooth

extractions. The maximum was 30 tooth extractions per week, and the minimum was 2 extractions.



**Figure 1.** Responding dentists’ characteristics. (a) specialization; (b) clinical experience in implantology.

**Table 1.** Characteristics of the responding dentists.

Characteristics	Number	Percentage (%)
<b>Specialization</b>		
General dentistry	26	40.63%
Surgery	18	28.13%
Orthodontics	6	9.37%
Prosthetic	4	6.25%
Other specializations	5	7.81%
No specialization	5	7.81%
<b>Experience in implantology</b>		
No experience/ little experience	20	31.25%
1 year	20	31.25%
2 years	4	6.25%
5 years	8	12.50%
More than 5 years of experience	12	18.75%

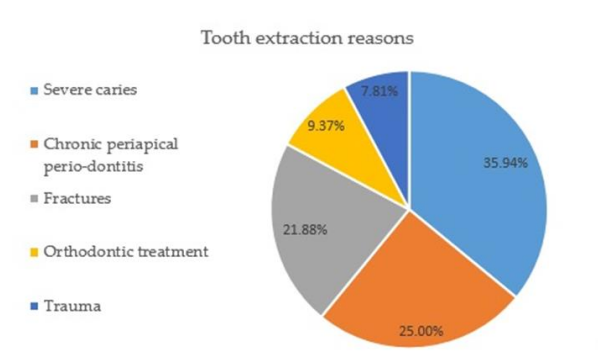
The most common reasons for dental extractions, which the dentists included in the study presented, are: 23 (35.94%) mentioned severe caries, 16 (25.00%) indicated periodontal causes, 14 (21.88%) answered the

fact that coronal-radicular fractures are frequent causes for tooth extractions, 6 (9.37%) performed extractions for orthodontic purposes, and 5 (7.81%) reported extractions caused by trauma.

**Table 2.** Causes of tooth extraction.

Tooth extraction causes	Number	Percentage (%)
Severe caries	23	35.94%
Periodontal causes	16	25.00%
Vertical Root Fractures	14	21.88%
Orthodontic purposes	6	9.37%
Trauma	5	7.81%

Before performing extraction procedures, complementary examinations are necessary to avoid the risks and complications associated with tooth extraction.

**Figure 2.** Causes of tooth extraction.

According to the study, the most used paraclinical evaluations are orthopantomography (OPG), indicated by 35 (54.69%) of the responding dentists, cone beam computed tomography (CBCT) indicated by 20 (31.25%) of the dentists and intraoral radiography (RIO) indicated by 9 (14.06%) of the respondents.

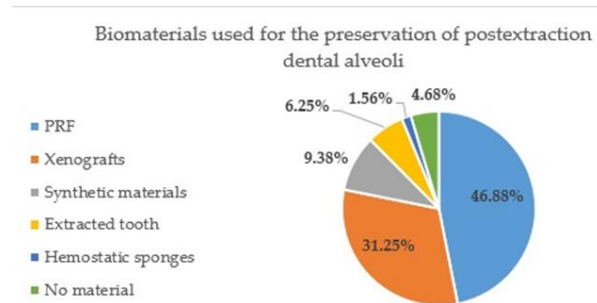
The doctors included in the study indicated these materials for post-extraction alveolar grafting as being the most used by them: 30 (46.88%) mentioned PRF and variants, 20 (31.25%) use xenogeneic materials, 6 (9.38%) synthetic preparations, 4 (6.25%) use the extracted tooth, 1 (1.56%) use hemostatic sponges, and 3 (4.68%) doctors do

not perform alveolar ridge maintenance techniques. Among the doctors who use xenografts for dental alveolus grafting, they indicated that they prefer: bovine-derived xenografts in proportion 56.67%, porcine-derived xenografts in proportion 30% and equine xenografts in proportion 13.33%. Among the doctors who use synthetic materials for dental socket grafting, they indicated: synthetic hydroxyapatite, tricalcium phosphate, bioactive glass and calcium sulfate.

Alveolar ridge preservation therapy is considered useful by the study participants both in the lateral and anterior area of the dental arches by 49 (76.56%) of the dentists, 9 (14.06%) believe that the preservation technique ridge is more useful for the posterior area of the dental arches, and 6 (9.38%) participants indicated the anterior area of the dental arch as priority.

In postextraction alveolar ridge preservation therapy, patient compliance is one of the most important factors that determine the success of the intervention. Among the study participants, 23 (35.94%) indicated that only 2 out of 10 patients accept post extraction alveolar ridge preservation therapy, 17 (26.56%) indicated a ratio of 1 out of 10 patients, 10 (15.62%) of the doctors

answered that 4 out of 10 patients accept the bone preservation therapy, 9 (14.06%) indicated a percentage of 5 out of 10 compliant patients, only one respondent (1.56%) indicated a ratio of 9 out of 10 patients accepting the preservation technique of the alveolar ridge, and 4 (6.26%) of the doctors reported that no patient accepted post extraction alveolar ridge preservation therapy.



**Figure 3.** Biomaterials used for postextraction alveolar grafting.

Respondents indicated three major benefits of alveolar ridge preservation in their clinical experience. 31 (48.44%) answered that bone preservation therapy increases the efficiency of implant insertion following extraction, 17 (26.56%) believe that quantitative and qualitative bone preservation is the main clinical benefit, and 16 (25%) of the dentists included in the study have answer the fact that bone loss is greatly reduced post-extraction in patients who accept post-extraction alveolar ridge preservation therapy. One of the advantages of the bone preservation technique is precisely that of increasing the efficiency of post-extraction implant placement. 20 (31.25%) of the dentists inserted implants following ridge preservation therapy in 2 out of 10 patients, 16 (25%) indicated a ratio of 1

out of 10 patients, 10 (15.63%) reported a number of 5 out of 10 patients, 7 (10.94%) indicated a ratio of 4 out of 10 patients in whom the insertion of implants was performed following postextraction alveolar ridge preservation therapy, 3 (4.69%) dentists indicated the percentage of 10 out of 10 patients, however, 8 (12.4%) of the study participants did not insert implants following the ridge preservation technique.

Alveolar ridge preservation procedures can also cause complications. Dentists have exposed a number of these complications encountered in the dental office. 26 (40.63%) indicated pain and edema, 10 (15.63%) post extraction alveolitis, 6 (9.38%) wound dehiscence, 7 (10.94%) ecchymosis and hematoma, 6 (9.37%) post extraction bleeding, 4 (6.25%) have reported healing disorders. Less common complications include bone necrosis indicated by 3 (4.68%) dentists, maxillary sinus pneumatization and fascial infections by 2 (3.12%) study participants.

Post extraction alveolar ridge preservation therapy is not yet widely used in dental clinics, although numerous specialized studies reveal important benefits for patients who have undergone bone preservation interventions. The reasons why some of the doctors included in the study did not propose such techniques to the patients in the office were: financial problems, the complexity of the technique and the lack of experience of the practitioner, difficult patients or with health problems, the advanced age of the patients and the time limited for treatment.



**Table 3.** Biomaterials used for postextraction alveolar grafting.

Biomaterials	Number	Percentage (%)
PRF	30	46.88%
Xenografts	20	31.25%
Synthetic materials	6	9.38%
Extracted tooth	4	6.25%
Hemostatic sponges	1	1.56%
No preservation	3	4.68%

#### 4. Discussions

The present study was conducted to understand whether alveolar ridge preservation therapy after tooth extraction represents a standard of care used and accepted as beneficial by dentists of different specialties with varied clinical experience. The obtained results reveal that dentists understand the importance and benefits of the bone preservation technique. The advantages indicated by the dentists were: increasing the efficiency of implant insertion after tooth extraction, limiting post extraction alveolar bone resorption and maintaining an optimal quantitative and qualitative bone level. In the literature, numerous studies have confirmed that bone resorption is greatly reduced in dental alveoli grafted with a collagen membrane compared to non-grafted alveolar sites [9-11]. In the study conducted by Ucer and the use of PRF platelet concentrates during ARP include reduced healing time, improved angiogenesis and bone regeneration, sealing of the alveolus by the fibrin matrix, antibacterial properties and decreased post-extraction pain and risk of infection. [21].

The dentists included in the study perform extractions in the usual way in the dental office. They reported a varied number of weekly extractions, the maximum being 30 extractions per week, and the minimum 2 weekly extractions. According to the study by Passarelli et al., dental caries complications and periodontal diseases are the most common reasons for tooth extractions [22]. The study conducted by Aljafar et al, supports the same scientifically proven fact [23]. Tooth extraction is largely caused by complicated carious lesions and progression of periodontal pathology [23]. In this study, it was found from the answers received that the main causes of dental extractions were dental caries complications and periodontal causes. In the study conducted by Fayaz et al, the main cause of extraction was complicated caries, and other causes were periodontal reasons, failed root canal therapy (RCT), tooth mobility, and root fractures [24].

The study by Shabaninejad et al. exposed the fact that CBCT (Cone Beam Computer Tomography) is the most effective diagnostic method for obtaining information about oral health status and guides the dentist in choosing an effective diagnosis compared to

intraoral radiography or OPG [25]. However, the study by Hassan et al concluded that although multislice computed tomography is the gold standard from the authors' perspective, not every implant situation can justify such a test [26]. The present study indicated that among the responding doctors, the majority prefer OPG, followed by those who prefer CBCT and in a small number prefer RIO as an elective diagnostic method.

The use of grafts is determined by the clinical case and the prosthetic treatment plan. Following the answers received, the most used biomaterials for grafting post-extraction alveoli are: PRF and xenografts. Among the xenografts, the most used are bovine xenografts. The synthetic materials most used by the dentists included in the study are synthetic hydroxyapatite and tricalcium phosphate.

The literature reveals numerous scientific evidence that encourage the implementation of post extraction alveolar ridge preservation therapy [1, 11, 13-18, 25-28]. In contrast, the study conducted showed that patients are refractory to bone-preserving surgery. The reasons why patients are still reserved towards bone preservation surgery are: advanced age, general status, lack of surgical expertise of the dentist, financial problems, clinical complexity of the treatment and lack of effective information about the benefits of alveolar ridge preservation therapy post extraction.

The study carried out by Darby et al. [14] claims that prosthetics on implants has an increased efficiency in the case of post

extraction alveolar site grafting. Maintaining a quantitatively and qualitatively optimal bone level is a key factor in implant therapy. Due to the scientifically proven benefits, the authors of the study believe that the dentist should consider performing bone preservation interventions in the case of every tooth extraction [14]. According to the cited study, the most common complications of alveolar preservation techniques are postoperative pain and edema, as well as fascial infections [14].

The responses received indicated a series of complications of alveolar ridge preservation therapy, including postoperative pain and edema, post extraction alveolitis, wound dehiscence, ecchymosis and hematoma, and post extraction bleeding. Postoperative discomfort, severity and duration of pain and swelling, spontaneous bleeding and persistent swelling, implant stability, and treatment modalities were evaluated in the study by Lee et al, and the conclusions were that there were no serious or adverse complications in any of the cases and none of the measured parameters differed significantly between groups [29]. To avoid complications and to ensure the long-term success of the treatment plan, post extraction alveolar ridge preservation therapy must be performed in association with minimally invasive extraction procedures [29-33].

Various trends were identified for alveolar ridge preservation techniques performed and biomaterials used [34]. Autologous materials like A-PRF are preferred, with a good performance for maintaining of the ridge dimensions but also with good healing

properties [35, 36]. Whenever possible, the alveolus will receive immediately the dental implant [37], and only in compromised cases the alveolar ridge preservation will be chosen, delaying implantation [34]. Sealing materials for socket have received particular attention lately, become important for ridge preservation [38-40]. Alveolar ridge preservation is a technique that conserves the ridge but also the clinical attachment of the adjacent teeth [41].

## 5. Conclusions

The benefits obtained by patients who accept bone preservation interventions considerably improve the therapeutic act performed by the dentist. Reducing the alveolar resorption process, maintaining a qualitatively and quantitatively optimal bone

level, making post extraction implant insertion more efficient and maintaining an alveolar anatomy as close as possible to the physiological state are proven benefits of post extraction alveolar ridge preservation techniques. Alveolar ridge preservation therapy is not a secondary intervention, and studies now provide us with concrete data on the effectiveness of modern diagnostic methods (CBCT), the materials we can use for grafting alveolar sites, minimally invasive extraction techniques and flapless surgery (flapless). In Romanian dental clinics, post-extraction alveolar ridge preservation techniques are currently not routinely performed. Conventional tooth extraction is preferred by some patients and in some cases by medical staff.

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*Will be provided on request.*

#### **Ethics statement**

*Approved by the Scientific Ethics and Deontology Commission of UMF Craiova (no. 52/29.01.2024).*

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