International Journal of Medical Toxicology & Legal Medicine Volume 27, No. 1s, 2024
e-ISSN: 0974-4614
p-ISSN: 0972-0448

Article Submitted: 15-05-2024; Revised: 20-06-2024; Accepted: 02-07-2024

Comparative Study on Dental Autograft & Bone Autogenous Graft for Socket Preservation

[1]Dr. Seema Patil, [2]Dr. Pratap Mane, [3]Dr. Yusuf Ahammed Ronad, [4]Dr. Hansraj Patil, [5]Dr. Chinju Punnen[6]Dr Pankaj Patil

[1]Assistant Professor, seema6414@gmail.com
[2]Assistant Professor, drpratap@gmail.com
[3]Associate professor, dryusufar14@gmail.com
[1,2,3]Dept. of Orthodontics, School of Dental Sciences, School of Dental Sciences, Krishna Vishwa Vidyapeeth "Deemed to be University",Taluka-Karad, Dist-Satara, Pin-415 539, Maharashtra, India
[4]Assistant Professor dr.hansrajp@gmail.com
[5]Assistant Professor chinzcool92@gmail.com
[6]Associate professor pankaj.patil707@gmail.com
[4,5,6]Dept. Of Oral and Maxillofacial Surgery, School of Dental Sciences, Krishna Vishwa Vidyapeeth "Deemed to be University",Taluka-Karad, Dist-Satara, Pin-415 539, Maharashtra, India

ABSTRACT

Background: Autogenous bone grafts are regarded as the gold standard due to their osteoinductive, osteoconductive, and osteogenic qualities. Osteogenesis is the process by which graft cells that survive bone form new bone.
Aim: To compare & determine the EF of DA with ABG for POSD after removal of mandibular 3rd Molar clinically & radiographically.
Material & Method: 12 patiensy were inlcuded for the assessment of DA & ABG in 2 differents groups i.e. A & B.
Result: We have found highy significant differnce MO, pain, swelling, BD and BH respectively. While non- significant difference was seen for BOP & COG for both the groups.
Conclusion: When compared to the DA, there was a relatively smaller volume of ABG harvested, but it was sufficient to fill the socket up to the level of the CEJ. This resulted in a superior outcome after 6 months in terms of preserving the ridge BH, which was more pronounced on the side filled with DA.

Keywords: Osteoinductive, DA, BH, ABG,MO, pain, BOP, COG,BD,osteoconductive.

INTRODUCTION

After a tooth extraction, the alveolar ridge goes through a process of rapid resorption, which occurs within the first six months and accounts for about 50% of the total resorption[1]. Subsequently, the rate of resorption gradually decreases. When there is a pre-existing periodontal disease, traumatic extraction, or peri-apical lesion, the rate of alveolar ridge resorption is higher than usual. These challenges can arise when inserting implants, placing dentures, and addressing aesthetic concerns in the anterior region.Performing a tooth extraction requires careful handling and gentle application of force to minimize any potential trauma. Various tools can be utilized to aid in the gentle extraction of the tooth, such as sharp forceps, periotomes, and fine luxators. When it comes to teeth with multiple roots, a specialized procedure called coronectomy is carried out. This involves the careful removal of the tooth's crown, followed by the precise cutting of the roots into smaller sections. This method is employed to reduce harm to the adjacent bone [2].
There are five steps to the inclusion of bone grafts, whether they are allografts or autografts. Stage 1 consists of inflammation, which lasts for hours; stage 2 consists of pre-or osteoblasts, which last for days; stage 3 is osteoinduction, which happens in the weeks leading up to stage 4; stage 4 is osteoconduction, which lasts for months; and stage 5, mechanical support, is where the bone recovers its strength, which takes years[3]. A study comparing autogenous bone transplants and DFDBA was conducted by Becker et al. [4] The results showed that autogenous bone grafts produced much

more bone than DFDBA. In a study conducted by Nemcovsky & Serfaty[5], hydroxyapatite was utilized and demonstrated reliable ridge preservation. In a study conducted by Artzi et al.[6], Bio-oss was utilized and demonstrated an average bone fill of 82.3%. Guarnieri et al.[7] were the first to propose the use of calcium sulfate and achieved a remarkable 100% bone fill with this material.Thus, in our study we have tried to find the immediate preservation of the ridge via processing the non-functional tooth or harvesting bone graft from the region next to the extraction socket, also known as the external oblique ridge.

AIM

To evaluate & compare the efficiacy(EF) of dentin autograft (DA) with autogenous bone graft(ABG) for preservation of socket defect(POSD) after removal of mandibular 3rd Molar clinically & radiographically.

INCLUSION CRITERIA

1. Age range was 18-40 years.
2. Individual heving bilaterally impacted 3rd Molar , with similar degree of difficulty.
3. Alveolar socket which all were free of any pre-existing periapical pathology based on OPG.
4. Patients who give inform consent.

EXCLUSION CRITERIA

1. Pregnant or lactating.
2. Any local or systemic medication or disease, which will interfere with bone remodeling & bone metabolism.
3. Impacted 3rd molar, which are grossly carious or are associated with any pathology.
4. Individual underwent radiation therapy.
5. Patient not giving consent.

MATERIAL & METHOD

We have conducted a prospective, comparative and clinical type of study with total of 12 patients in the department of oral maxillofacial surgery, KIMSDU, Karad after due approval of institutional ethical committee from 1st January 2020 to June 2021.

Material

1. Autogenous dentin graft (harvest & processed)
2. Sieve (VTS test sieve- ATSM Mesh 300 micron)
3. Domestic grinder (Viedem vtron pro 900 watts with 1000 rpm)
4. Carbide straight fissure bur (SSW HP702)
5. Collagen membrane (Healiguide® 15 × 20 mm; Advanced Biotec Products (P) Ltd., India).
6. Basic alcohol solution (0.5M NaOH & 30% alcohol)
7. Smartscraper (Geistlich Pharma India Pvt.ltd)
8. 3-black braided silk suture (Healthium MedTech Private Ltd.)

Methodology

Patient require bilaterally impacted 3rd molar extraction with similar grade of difficulty according to Pederson difficulty index were selected as shown in figure 1.

FIGURE.1. OPG SHOWING BILATERALLY IMPACTED MANDIBULAR 3RD MOLARS WITH SIMILAR DIFFICULTY INDEX.

Intra-oral & extra-oral examination was done. Patient mouth opening (MO) was evaluated pre-operatvely as shown in figure 2.

FIGURE 2. MOUTH OPENING IS CHECKED USING A STAINLESS-STEEL SCALE

Surgical steps for extraction of 3rd molar

In the beginning, a standard stepwise extraction of the third molar on the left side of the mouth (Group A) was performed while maintaining a sterile environment. The socket was then irrigated using a saline line and betadine solution. The procedures for preparing the tooth that had been taken for a transplant were also going on simultaneously.

GRAFT PREPARATION

Autogenous dentin graft (ADG)

The removed tooth was sterilized with saline solution and thoroughly cleaned to remove any dental plaque or soft tissue using a carbide straight fissure bur (SSW HP702). The whole tooth, including the enamel and cementum, was ground using a high-speed sterile household grinder (Viedem vtron pro) with a power of 1500 watts and a speed of 700 rpm as shown in figure 3.

FIGURE 3. (A) DOMESTIC GRINDER OF 1500WATTS WITH 700RPM, (B) EXTRACTED 38 TOOTH (C) PARTICULATE OF THE GRINDED TOOTH.

The dentin particulate was separated using a filter (VTS test sieve) to keep particles between 500 and 1200 m as shown in figure 4. This small particulate (less than 300 μm) is considered inefficient for grafting.

FIGURE.4 SIEVE USED TO SEPARATE PARTICULATE SIZE OF < 300 MICRONS.

The dentin was soaked in basic alcohol for 10 minutes, as shown in Figure 5, using a small sterile glass container. The standard alcohol cleanser is made up of a solution containing 0.5 M of NaOH and 30% alcohol (v/v). This mixture effectively removes fat, dissolves organic debris, bacteria, and toxins from the dentin particulate. The particulate underwent two rounds of washing using sterile phosphate-buffered saline (PBS). The duration of the tooth extraction and grafting procedure is typically around 15–20 minutes.

FIGURE.5 DENTIN PARTICULATE SOAKED IN BASIC ALCOHOL SOLUTION.

For the extraction socket of tooth 38 (also known as group A), we utilized processed dentin and an absorbable collagen membrane to ensure the graft was securely placed. Following the procedure, the extraction site was carefully closed using a 3-0 black braided silk suture as shown in figure 6.

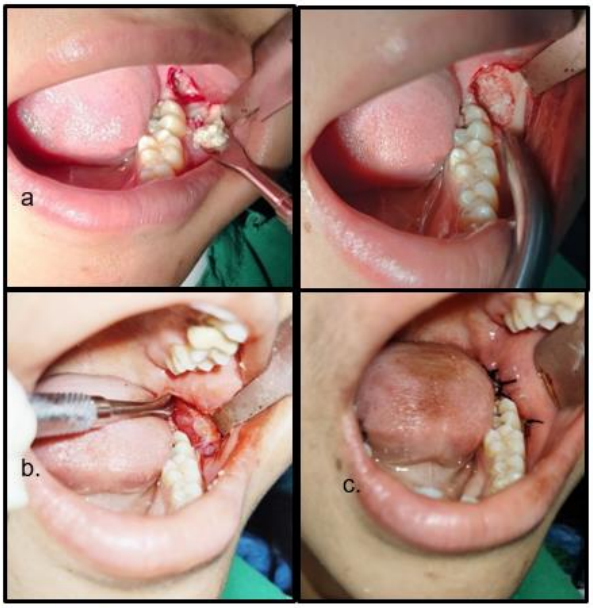

FIGURE 6. (A)FILLING THE EXTRACTION SOCKET WITH DENTIN GRAFT. (B)COLLAGEN MEMBRANE PLACED. (C) CLOSURE DONE WITH 3-0 BRAIDED SILK SUTURE.

Furthermore, the surgical removal of tooth 48 (Group B) was performed within 1-2 weeks. The resulting socket was then filled with autogenous bone graft and fixed using a collagen membrane. (figure 7)

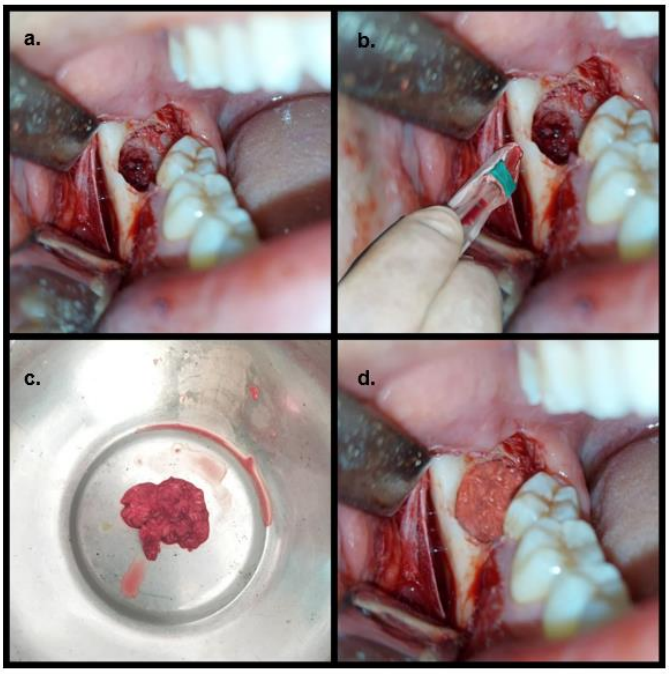

FIGURE 7. A.48 SOCKET B. SMARTSCRAPER USED FOR BONE HARVESTING C.BONE CHIPS COLLECTED D. SOCKET FILLED WITH AUTOGENOUS BONE GRAFT.

The bone graft was obtained from the external oblique ridge of the mandible using a bone scraper. (figure 8)

FIGURE 8. BONE SCRAPER

POST-SURGICAL CARE

1. After finishing the procedure, patients were made to take analgesic medication within 30 minutes before local anaesthetic effects wear off.
2. Avoid the surgical site while brushing and eating.
3. Betadine mouthwash two times a day for 2 weeks,
4. post-operative antibiotic and analgesics:

a) Cap. Amoxycillin 500mg twice a day for 5 days.
b) Tab Enzoflam twice a day for 5 days.

5. Patient was called for suture removal after 7 days.

EVALUATION OF OUTCOME

Pre-Operative Variable

12 patients were chosen according to the indicated inclusion criteria. During the first consultation, many factors were recorded, such as the patient's age, gender, and medical and dental history. In addition, the study evaluated the precise placement and orientation of the third molar, as well as its probable relationship with the inferior alveolar nerve, which was seen using a panoramic radiograph. Before the procedure, the patient's capacity to open their mouth was assessed. Patients with impacted mandibular third molars on both sides were selected based on their difficulty index, which was assessed using Pederson's index on an OPG.

Facial patterns and mouth opening (MO) were measured:
Using Amin and Laskins' modified criteria for evaluating post-operative inflammation, facial measurements were conducted using silk thread to measure the distance from the trago-pogonion, the external labial commissure to the tragus, and the gonion to the external canthus of the eye. The interincisal distance for mouth opening was measured using a stainless steel scale on both the first and seventh days after extraction.

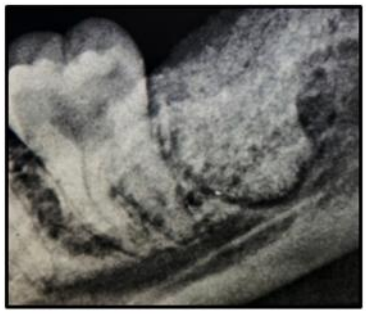

FIGURE. 9. RVG SHOWING 38 SOCKET FILLED WITH AUTOGENOUS DENTIN GRAFT.

FIGURE. 10. RVG SHOWING 48 SOCKET FILLED WITH AUTOGENOUS BONE GRAFT.

Pre-Operative Variable

The post-operative parameters were assessed on day 1 and day 7 after the surgery. These parameters included pain, swelling, mouth opening, tissue redness, surgical incision margin, granulation tissue, and suppuration. The study examined the hard tissue parameters, specifically bone density and alveolar ridge height. In group A, the socket was filled with a dentin graft, while in group B, the socket was left to fill naturally. The evaluation of the hard tissue parameters was conducted on day 1 (fig 9. And fig. 10) and again after 6 months post-operatively. The level of pain was evaluated using the visual analogue scale (VAS), which utilizes a scoring system ranging from 1 to 10. On a scale of 1 to 10, with 1 indicating minimal pain and 10 indicating severe pain.

RESULT

	Group	N	Mean	Std. Deviation	t test p value
Pederson's difficulty index	Group A	12	5.80	1.265	**NS**
	Group B	12	5.80	1.265	**NS**

TABLE 1: INTER-GROUP COMPARISON (PEDERSON DIFFICULTY INDEX)

Table 1 showed that , we can see that the mean difficulty of extraction for 12 patients was 5.8, i.e., moderately difficult. Since the patients having a similar degree of impaction bilaterally were chosen for the study, the p value, or the difference between the two groups using the student t test, was found to be clinically insignificant.

Mouth opening(MO)	**Group**	**Mean difference**	**Bonferroni test p value**	
Mouth-opening pre-operatively	Group A	4.45	0.678	**NS**
	Group B	4.45		
Mouth-opening post-operative day 1	Group A	2.80	0.021	**HS**

	Group B	2.48		
Mouth-opening post -operative 7th day	Group A	4.18	0.768	**HS**
	Group B	3.80		

TABLE 2: COMPARING MO IN GROUPS

Table 2 showed that , MO measurements averaged 4.45 for both groups A and B. A p-value of 0.678 was found before surgery after the Bonferroni test. There does not seem to be a statistically significant difference, according to this finding. On the first day after surgery, group A had a mean mouth opening value of 2.87, while group B had a value of 2.48. A highly significant result is shown by the computed p-value of 0.917. The average mouth openness for group A was 4.18 on the seventh day following surgery, whereas for group B it was 3.8. With a p-value of 0.768, the statistical analysis using the Bonferroni test showed that there was a significant difference between the two groups on day 7.

		N	**Mean**	**Std. Deviation**	**t test p value**	
1st day	Group A	12	7.00	1.31	0.000	**HS**
	Group B	12	7.73	1.90		
7th day	Group A	12	3.67	0.90	0.00	**HS**
	Group B	12	4.07	0.59		

TABLE 3: COMPARING PAIN IN GROUPS

Table 3 showed that , pain was assessed by VAS scale in the two groups. On day 1 the mean value of group A was found out to be 7 and for group B the mean value was 7.73. The p value for day 1 was 0.00 which is clinically significant. It is obvious that on immediate post operative day 1 the patient is bound to experience immense pain when the region was elicited. Due analgesics which were prescribed till day 5 there was significant reduction in pain till day 7. The mean value for group A was 3.67 and for group B was 4.07, the p value was 0.00 which is clinically significant.

	Swelling on day 1	Swelling on day 7	Mann Whitney test p value	
GROUP A	13.67	1.4	0.008	**HS**
GROUP B	17.2	3.7	0.003	**HS**

TABLE 4: SWELLING (GROUP)

Table 4 showed that swelling was assessed in groups A and B using Amin and Laskins' modified criteria. A comparison of the swelling between the two groups was done using the Mann-Whitney U test. The mean value of group A on postoperative Day 1 was 13.67, and that of group B was 17.07. The value of p on day 1 was 0.008, which is clinically significant. The mean value of group A on day 7 was 1.40 and of group B was 3.70. The value of p was found to be 0.003, which is clinically significant.

	Group A	**Group B**	**Mann Whitney test p value**	
Day 1	2	4.27	1.000	**NS**
Day 7	2	4.2	1.000	**NS**

TABLE 5 : BLEEDING ON PROBING (BOP)

Table 5 showed that using the Landry, Turnbull, and Howley healing index, soft tissue healing was evaluated. The mean value for both groups on day 1 was 2.00, and postoperative bleeding was found in both groups. A p value of 1.00 was found

between the two groups, which means that there was no clinically significant difference. The bleeding was checked again on day 7, when the sutures were removed. The mean of groups A and B on day 7 was 0.655, and the p value of the two groups was found to be 0.814, which is not clinically significant.

	Group A	**Group B**	**Mann Whitney test p value**	
Day 1	1.8	1.67	0.814	**NS**
Day 7	3.67	3.8	0.242	**NS**

TABLE 6 : COLOUR OF GINGIVA (COG)

Table 6 showed that , after the extraction, on the first day, the gingiva appeared to be more than 50% red. The average value for group A was 1.80, while for group B it was 1.67. Based on the soft tissue healing index, if the gingiva appears more than 50% red, it is considered to have a score between 1 and 2, indicating poor or very poor healing. The p value on day 1 was determined to be 0.84 using the Mann-Whitney test. By the seventh day after the extraction, the color of the gingiva was measured to be 3.67 for group A and 3.80 for group B. This
indicates excellent healing for both groups. The p value for the change of color of the gingiva on day 7 was determined to be 0.242, indicating that the observed difference is not considered clinically significant.

	Group A	**Group B**	**Students paired t test -p value**	
Day 1	136.4	120.80	0.00	**HS**
6^{th} Month	146.80	140.00	0.00	**HS**

TABLE 7: BONE DENSITY(BD)

Table 7 showed that, the paired t test yielded a clinically significant value of 0.00, which was found by the test. When compared, dentin fill density, or group A, was seen to be greater. The mean density of group A on the sixth day was 146.80 and group B was 140; both groups showed an increase in red density when compared to the first result; however, when an intergroup comparison was performed, group A showed a higher density than group B. By the sixth month, the p-value had dropped to 0.00, indicating a clinically significant outcome.

	Group A	**Group B**	**Students paired t test -p value**	
Day 1	12.43	9.79	0.00	**HS**
6^{th} Month	12.88	9.98	0.00	**HS**

TABLE 8: BONE HEIGHT(BH)

Table 8 showed that , the height was measured on the RVG using a calibrated scale in millimeters. On day one, the mean height of group A was 12.43 mm, whereas group B's mean height was 9.79 mm. On day one, the p-value was found to be 0.00, suggesting high statistical significance. After 6 months, the average height in group A was 12.88, whereas group B had an average height of 9.87. The p-value for the sixth month was 0.000, suggesting a high degree of clinical significance.

DISCUSSION

Alveolar ridge height loss is an undesirable occurrence after tooth extraction. Natural healing after extraction results in decreases in width ranging from 2.6 to 4.6 mm and in height ranging from 0.4 to 3.9 mm. In the study found that this led to a reduction in the size and length of the remaining bone [8]. To comprehend the utilization of tooth material as a bone transplant, we must first study the chemical makeup of human teeth and alveolar bone. The ratio of inorganic/organic/water from different components of teeth is as follows: enamel (95%/0.6%/4%), dentin (70-75%/20%/10%), and cement (45-55%/50-55%)[9,10]. When the components are compared to bone, the ratio is seen to be (65%/35%/0%), indicating a resemblance between bone and dentin. Given these possibilities, researchers started looking for other hard tissues in the teeth. Yemen and Urist's pioneering work demonstrating dentin's bone-inducing capacity paved the way for novel implant applications [11]. Furthermore, there are additional growth factors such as bone morphogenetic proteins (BMPs), the

mineral protein LIM 1, and growth factor-β changes [9,12]. Bessho et al. conducted a comparison between BMP for the dentin matrix and BMP for the bone matrix and determined that they are not equivalent. However, both of them have the ability to stimulate bone development [13].

Koga et al., in their in vitro study, concluded that partially demineralized dentin of approximately 1000 µm showed better osteoconductive activity when compared to under-demineralized dentin. He had further explained that demineralization increases the osteoconductive capacity of the dentin autograft as it exposes the organic substance of the tooth and also increases the porosity and surface area, thereby decreasing the crystallinity [14]. Data on soft tissue sutures was obtained on the day after suture removal on the control side, and the patient was contacted for a follow-up after 6 months. The recall period in our study was six months because bone remodeling and resorption occur more quickly during this time, followed by an average loss of 0.5%–1.0% every year for the rest of life [15]. Another study conducted a histological study of healing in an extraction socket filled with PRF (platelet-rich fibrin) and found that new bone growth had taken place [16].

CONCLUSION

It has been observed that patients experienced more discomfort after undergoing surgical extraction on the 48 side, with increased post-operative pain, swelling, and limited mouth opening. However, when the dentin grafting procedure was performed instead, there was a noticeable improvement in the results.

When compared to the DA, there was a relatively smaller volume of ABG harvested, but it was sufficient to fill the socket up to the level of the CEJ. This resulted in a superior outcome after 6 months in terms of preserving the ridge BH, which was more pronounced on the side filled with DA. Additionally, the side was seen to be larger when compared to the side filled with ABG.

REFERENCE

1. Lekovic, V., Kenney, E. B., Weinlaender, M., Han, T., Klokkevold, P., Nedic, M., & Orsini, M. (1997). A bone regenerative approach to alveolar ridge maintenance following tooth extraction. Report of 10 cases. Journal of periodontology, 68(6), 563-570. https://doi.org/10.1902/jop.1997.68.6.563
2. Araújo, M. G., & Lindhe, J. (2005). Dimensional ridge alterations following tooth extraction. An experimental study in the dog. Journal of clinical periodontology, 32(2), 212-218. https://doi.org/10.1111/j.1600-051X.2005.00642.x
3. Jeong, K. I., Kim, S. G., Kim, Y. K., Oh, J. S., Jeong, M. A., & Park, J. J. (2011). Clinical study of graft materials using autogenous teeth in maxillary sinus augmentation. Implant dentistry, 20(6), 471-475. DOI: 10.1097/ID.0b013e3182386d74
4. Becker, W., Becker, B. E., & Caffesse, R. (1994). A comparison of demineralized freeze-dried bone and autologous bone to induce bone formation in human extraction sockets. Journal of periodontology, 65(12), 1128-1133. https://doi.org/10.1902/jop.1994.65.12.1128
5. Nemcovsky, C. E., & Serfaty, V. (1996). Alveolar ridge preservation following extraction of maxillary anterior teeth. Report on 23 consecutive cases. Journal of periodontology, 67(4), 390-395. https://doi.org/10.1902/jop.1996.67.4.390
6. Avila-Ortiz, G., Elangovan, S., Kramer, K. W. O., Blanchette, D., & Dawson, D. (2014). Effect of alveolar ridge preservation after tooth extraction: a systematic review and meta-analysis. Journal of dental research, 93(10), 950-958. https://doi.org/10.1177/0022034514541127
7. Guarnieri, R., Pecora, G., Fini, M., Aldini, N. N., Giardino, R., Orsini, G., & Piattelli, A. (2004). Medical grade calcium sulfate hemihydrate in healing of human extraction sockets: clinical and histological observations at 3 months. Journal of periodontology, 75(6), 902-908. https://doi.org/10.1902/jop.2004.75.6.902
8. Cornu, O., Banse, X., Docquier, P. L., Luyckx, S., & Delloye, C. (2000). Effect of freeze-drying and gamma irradiation on the mechanical properties of human cancellous bone. Journal of Orthopaedic Research, 18(3), 426-431. https://doi.org/10.1002/jor.1100180314
9. Dimitriou, R., Jones, E., McGonagle, D., & Giannoudis, P. V. (2011). Bone regeneration: current concepts and future directions. BMC medicine, 9, 1-10. https://doi.org/10.1186/1741-7015-9-66
10. Johnson, K. (1969). A study of the dimensional changes occurring in the maxilla following tooth extraction. Australian dental journal, 14(4), 241-244. https://doi.org/10.1111/j.1834-7819.1969.tb06001.x
11. Han, B., Yang, Z., & Nimni, M. (2008). Effects of gamma irradiation on osteoinduction associated with demineralized bone matrix. Journal of Orthopaedic Research, 26(1), 75-82. https://doi.org/10.1002/jor.20478

12. Schropp, L., Wenzel, A., Kostopoulos, L., & Karring, T. (2003). Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. International Journal of Periodontics & Restorative Dentistry, 23(4). https://www.researchgate.net/profile/Lars-Schropp/publication/10582943_Bone_healing_and_soft_tissue_contour_changes_following_single-tooth_extraction_A_clinical_and_radiographic_12-month_prospective_study/links/0c960524091097509f000000/Bone-healing-and-soft-tissue-contour-changes-following-single-tooth-extraction-A-clinical-and-radiographic-12-month-prospective-study.pdf
13. Shigeyama, Y., D'Errico, J. A., Stone, R., & Somerman, M. J. (1995). Commercially-prepared allograft material has biological activity in vitro. Journal of periodontology, 66(6), 478-487. https://doi.org/10.1902/jop.1995.66.6.478
14. Aspenberg, P., Kälebo, P., & Albrektsson, T. (1988). Rapid Bone Healing Delayed by Bone Matrix Implantation. International Journal of Oral & Maxillofacial Implants, 3(2). https://openurl.ebsco.com/EPDB%3Agcd%3A10%3A22569178/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A37793339&crl=c
15. Amler, M. H., Johnson, P. L., & Salman, I. (1960). Histological and histochemical investigation of human alveolar socket healing in undisturbed extraction wounds. The journal of the american dental association, 61(1), 32-44. https://doi.org/10.14219/jada.archive.1960.0152
16. Goldberg, M., Kulkarni, A. B., Young, M., & Boskey, A. (2011). Dentin: Structure, Composition and Mineralization: The role of dentin ECM in dentin formation and mineralization. Frontiers in bioscience (Elite edition), 3, 711. https://doi.org/10.2741%2Fe281