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Autogenous dentin graft - a novel chair side graft material preparation and placement for alveolar socket preservation- A clinical and radiographic study

[1]Dr. P. Bhuvaneswari, MDS, Professor, Department of Periodontology, Tamilnadu government dental college and hospital, Chennai, Tamil Nadu 600003

[2]Dr. T. Rajsundar, MDS, Department of Periodontology, Tamilnadu government dental college and hospital, Chennai, Tamil Nadu 600003

[3]Dr. G. D. Ram Kumar, MDS, Department of Periodontology, Tamilnadu government dental college and hospital, Chennai, Tamil Nadu 600003

[4]Dr. T. Gowri, BDS, PG Student, Department of Periodontology, Tamilnadu government dental college and hospital, Chennai, Tamil Nadu 600003

Corresponding Author: Dr .T. Rajsundar, MDS, Department of Periodontology, Tamilnadu government dental college and hospital, Chennai, Tamil Nadu 600003

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Abstract

Background: A randomized, prospective clinical, radio graphical, and histological study was conducted to evaluate the healing after alveolar socket preservation using autogenously dentine graft material (ADG).

Materials and Methods: A total of ten sites in ten patients undergoing extraction were selected in this study. Atraumatic extractions were performed. Sockets were grafted with ADG. Cone beam computed tomography scans were taken immediately after extraction and 6 months postoperatively to check the changes in alveolar crest height and width. Four implant placements was done after complete healing; bone samples were harvested using a 3 mm diameter trephine during osteotomy preparation from the socket preserved sites and studied histologically.

Results: All grafted site healed without any complication, neither graft site infection nor graft material rejection occurred. The soft tissue ridge width, radiographic socket width at the level of socket crest, 5mm from crest,10 mm from the crest and socket height between pre-operative and post-operative analysis were statistically significant.(p=0.000,p=0.000,p=0.000,p=0.003).

Histological analysis showed new bone formation at ADG-grafted socket sites.

Conclusion: socket preservation using Autogenous dentine graft leads to more predictable maintenance of alveolar ridge height and width with equal effectiveness as commercial bone grafts material available. Based on this, we conclude that ADG material can serve as a better alternative to conventional bone graft materials.

Keywords: Socket Preservation, Autogenous Dentine Graft, Histo-Pathology, Guided Tissue Sregeneration, Alveolar Ridge Preservation.

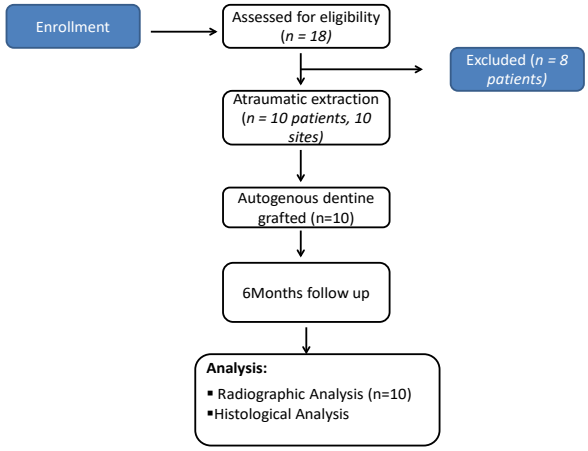
Introduction

After tooth extraction, dimensional change in the alveolar ridge is inevitable. The greatest amount of bone loss is in the horizontal dimension and occurs mainly on the facial aspect of the ridge. There is also loss of vertical ridge height, which has been described as to be most pronounced on the buccal aspect (Lekovic et al. 1997, 19981,2, Arau´jo & Lindhe 20053). This resorption process results in a narrower and shorter ridge (Pinho et al. 20064) and the effect of this resorptive pattern is the relocation of the ridge to a more palatal/lingual position.

Therefore, preserving the alveolar dimension of the socket after extraction aid in successful accomplishment of future rehabilitation such as fixed partial denture, dental implants. There are many material, like using autogenous, allogeneic, xenograft, and alloplastic materials, to guide and assist specialized cellular components of the periodontium to participate in the regenerative process to preserve bone width and height of the alveolus. Among various graft materials, autogenous bone is considered as the gold standard material for its osteogenic potential. However, due to added morbidity and risk of complications from donor site, clinicians prefer commercially available non-autogenous graft materials. Teeth and bones share many similarities. Teeth, cartilages, nerves, and maxillofacial bones all embryologically originated in the neural crest, sharing identical origin. Based on the potentials of osteoconduction, osteoinduction, and osteogenesis through growth factors in tooth and similar histogenesis between tooth and bone, a novel bone graft material can be developed utilizing the inorganic and organic components of an extracted tooth. This prospective clinical study was designed to evaluate the clinical efficacy and histological characteristics of the Autogenous dentine graft in post-extraction alveolar socket preservation.

Materials and methods

This clinical trial was conducted at Tamil Nadu Government Dental College and Hospital and was approved by the Institutional Ethical Committee vide Ref no:R.C.NO:0420/DE/2017.In this study a total of 10 patients, who had hopeless vital tooth, to undergo extraction were selected. 10 patients who reported to the Department of Periodontology, Tamil Nadu Government Dental college & Hospital, Chennai agreed for the study with informed consent obtained from all and extracted their hopeless teeth.



Inclusion criteria

1. Age between 20 and 50 years.
2. Systemically healthy patients.
3. Patients who have not undergone any type of regenerative periodontal therapy for a period of 1 year prior to the initial examination.

4. Patients having a vital tooth indicated for extraction which could be used for auto graft.

Exclusion criteria

1. Patients who have received periodontal flap / regenerative therapy within the past 1 year
2. Pregnant and lactating patients
3. Alcoholics and Smokers.
4. Patient who has received radiation therapy.
5. Systemic illness such as diabetes mellitus, cardiac diseases, immune-compromised (e.g. HIV individuals, under radiotherapy) known to affect the outcome of periodontal therapy, patients taking medications such as corticosteroids, calcium channel blocker or bisphosphonates which are known to interfere with the outcome.
6. Patients with any known allergy to drugs
7. Patient who has acute infections.

Surgical procedure

Following screening, all patients were consented to the planned treatment strategy. Atraumatic extraction of the compromised tooth done carefully to avoid damage to the surrounding alveolar bone. Periotome is used to release the periodontal ligament. Once the tooth was removed, the socket is carefully derided with curette and irrigated with saline.

Fig. 1: Preoperative buccal view

Fig.2: Pre opclinical measurement with boley gauge

Fig. 3: Extracted socket buccal view

Fig.4: Extracted tooth

Preparation of Autogenous Dentin Graft

Enamel in toto, discolored dentin, cementum or remnants of Periodontal ligament (PDL) and calculus if any are reduced by tungsten bur. Clean teeth including crown and root dentin are put into a grinding sterile chamber of a

high speed dentin grinder. The 'High speed sterile dentin grinder' conventional domestic mixer grinder with 150W with speed of >700RPM is capable to grind the roots into particles of less than 1200 µm . These particles are separated through a sieve that keeps particles between 500-1200 µm. This fine particulate (less than 300 µm) is considered as a non-efficient particulate size for bone grafting. This grinding and sorting protocol is repeated to grind the remaining teeth particles left in grinding chamber.

Fig. 5: Sectioned tooth placed in grinder

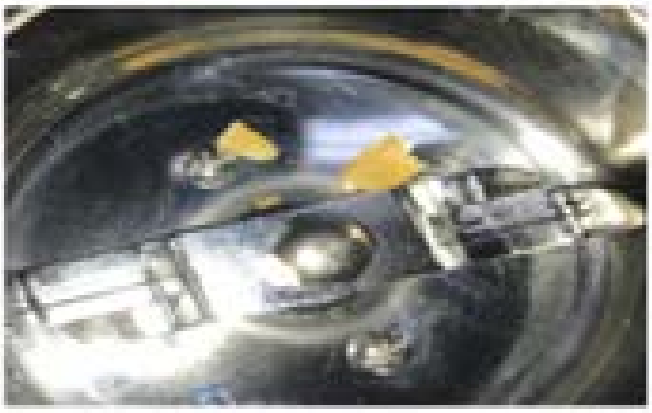


Fig. 6: Autogenous dentine graft prepared

Fig 7: graft particle passing through 1200µm sieve

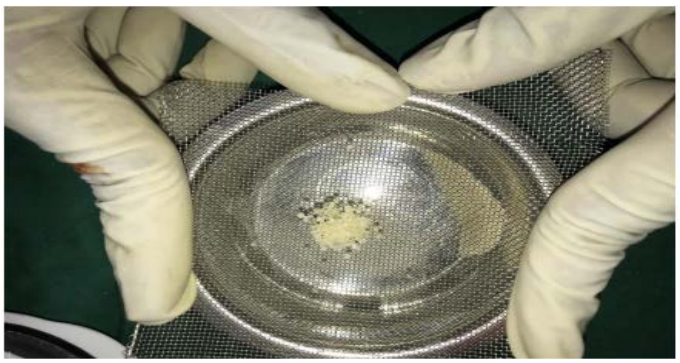


Fig. 8: graft particle passing through 300µm sieve

The graft particles were immersed in 1N lactic acid for 15 – 20 min which also partially decalcified them. Later using sterile normal saline, graft particles were thoroughly washed for 60 sec to remove any residual traces of lactic acid. The material is then placed in the socket and primary wound closure with interrupted, non-absorbable braided black silk 3-0 sutures (Mersilk (Ethicon) – Johnson &Johnson pvt Ltd, India) was done and periodontal dressing placed.

Fig 9: Graft particle placed in lacticacid

Fig. 10: graft particle placed in saline

Fig. 11: Final Autogenous graft obtained

Fig. 12: Graft placed

Fig. 13: Sutured

All the grafted sites were covered with a collagen membrane (Heli guide).Postoperative instructions were given and Cap.Amoxycillin 500mg, thrice a day, for 5 days & Tab. Ibuprofen 400 mg, twice a day, for 3 days was prescribed. Periodontal dressing and sutures were removed 7-10 days postoperatively.

Fig. 14: Post op 6 months

Fig. 15: Post op clinical measurement using boley gauge

Assessment

The study period is 6 months. Clinical evaluation was done at all visits and CBCT scans and IOPA X-ray were obtained immedietly after extraction, and at the end of 6 months. Three dimensional radiographic crestal bone changes in height and width after 6 months were selected as the primary outcome and histological new bone formation as secondary outcome

Cone beam computed tomography analysis

Fig. 16: Pre op CBCT

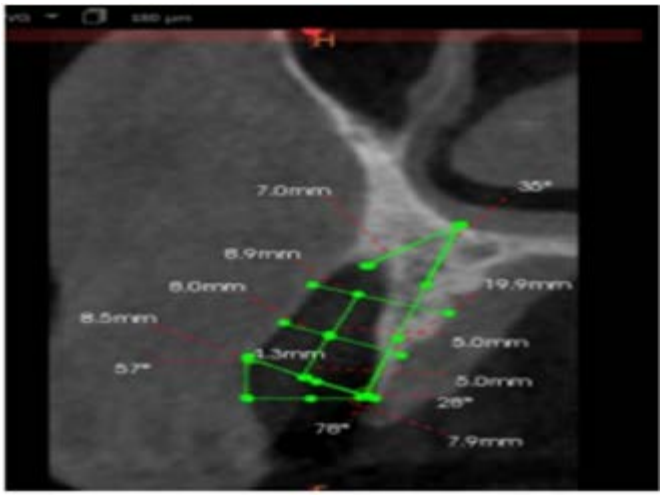


Fig. 17: Post op CBCT

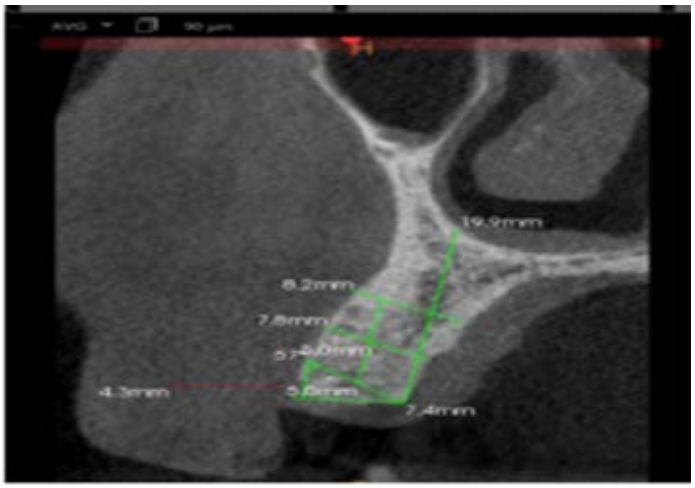


Fig. 18: pre op study model

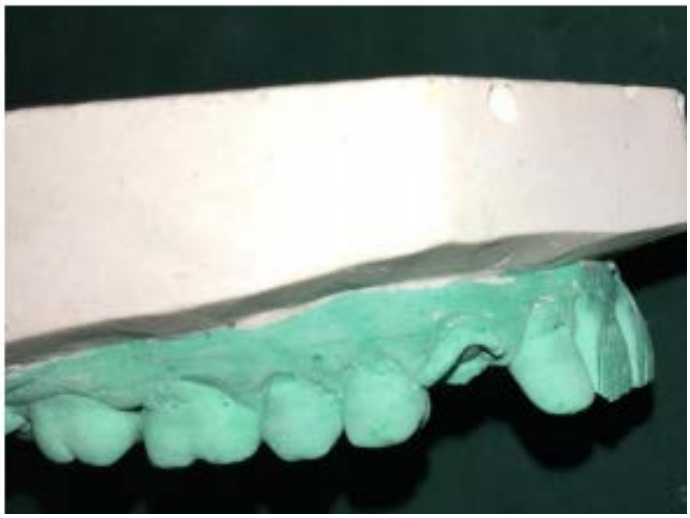
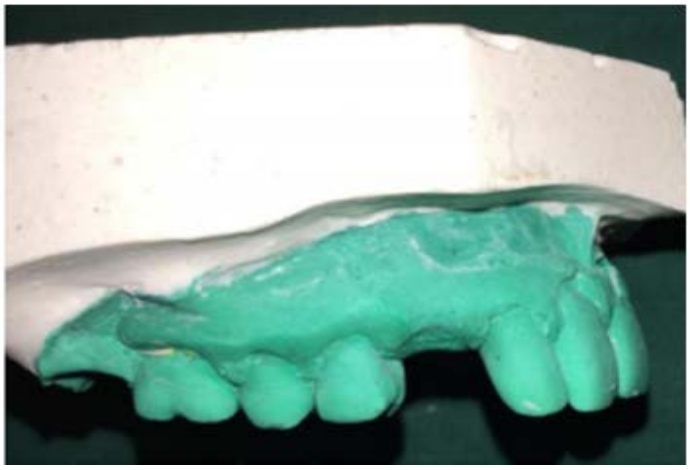


Fig 19: Post op study model

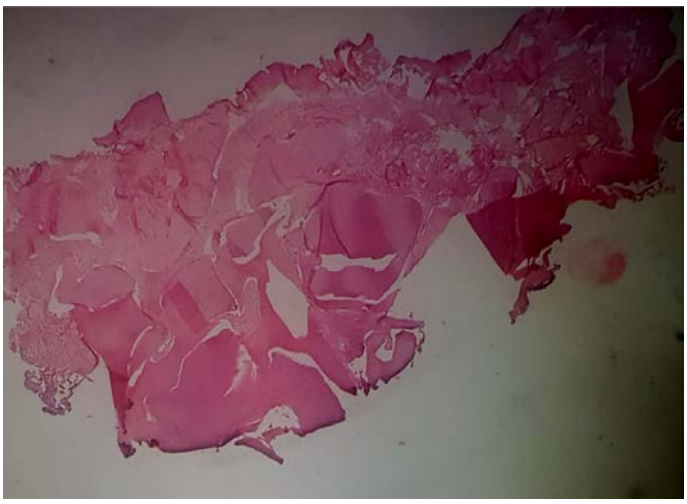


Labio palatal width of the alveolar ridge were measured horizontally at crest level, 5 mm from crest level and 10 mm from crest level values respectively. Vertical height measurements were done from the most coronal aspect of cortical bone of the alveolar socket to the fixed anatomical point apically.

Histological assessment

Bone tissue was harvested using trephine bur of 3mm diameter in patients where implant placement was done at the end of 6 months post operatively. The harvested specimens were sent to Department of Oral Pathology for histological evaluation of new bone formation.

Fig 20: after 6 month new bone formation



Statistical analysis

The statistical analysis was done using the computer software program SPSS version 16 (IBM CORP, CHICAGO, IL, USA). Data analysis was performed using the patient as the experimental unit. The changes over time of these variables were examined by means of paired t test'. Descriptive data are presented as mean ± SD and range values. For all tests, $P < 0.05$ was considered significant. The obtained results were described and plotted.

Table: 1 Descriptive Statistics

*	N	Minimum	Maximum	Mean		Std.Dev
		Statistic	Statistic	Statistic	Std Err	Statistic
Crest Width Preoperative	10	7.3	15.2	10.840	.9451	2.9886
Crest Width Postoperative	10	6.5	14.3	9.830	.9354	2.9579
At 5mm From Crest Preoperative	10	8.0	15.5	11.360	.8429	2.6655
At 5mm From Crest Postoperative	10	7.8	15.1	10.990	.8287	2.6206
At 10mm From Crest Preoperative	10	8.9	15.9	12.590	.79091	2.2422
At 10mm From Crest	10	8.2	15.3	11.960	.7290	2.3052

Postoperative						
Height (Fixed Anatomical Landmark To Crest) Preoperative	10	10.0	19.9	15.160	.9890	3.1274
Height (Fixed Anatomical Landmark To Crest) Postoperative	10	9.8	19.9	14.920	.9924	3.1382
Soft Tissue Width Preoperative	10	9.9	18.1	13.510	.9878	3.1235
Soft Tissue Width Postoperative	10	9.1	17.3	12.500	.9778	3.0919

Result

10 sites were treated with minimally traumatic extraction followed by placement of Autogenous dentin graft in the extracted socket area. All patients showed uneventful healing without any sign of infection or graft rejection. At the end of 6 months, a satisfactory clinical healing was observed in all the patients.

Radiographic parameters

Table 2: Paired T Test to compare preoperative and postoperative crest width

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
CREST WIDTH PREOPERATIVE – CREST WIDTH POSTOPERATIVE	1.0100	.2998	.0948	.7955	1.2245	10.653	9	.000*

Table 3: Paired T Test to compare preoperative and postoperative at 5mm from crest

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
AT 5mm FROM CREST PREOPERATIVE – AT 5mm FROM CREST POSTOPERATIVE	.3700	.1059	.0335	.2942	.4458	11.045	9	.000*

Table 4: Paired T Test to compare preoperative and postoperative at 10mm from crest

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
AT 10mm FROM CREST PREOPERATIVE – AT 10mm FROM CREST POSTOPERATIVE	.6300	.2003	.0633	.4867	.7733	9.947	9	.000*

Table 5: Paired T Test to compare preoperative and postoperative height (fixed anatomical landmark to crest)

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
HEIGHT (FIXED ANATOMICAL LANDMARK TO CREST) PREOPERATIVE – HEIGHT (FIXED ANATOMICAL LANDMARK TO CREST) POSTOPERATIVE	.2400	.1897	.0600	.1043	.3757	4.000	9	.003*

Table 6 : Paired T Test to compare preoperative and postoperative soft tissue width

	Paired Differences					t	df	P Value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SOFT TISSUE WIDTH PREOPERATIVE – SOFT TISSUE WIDTH POSTOPERATIVE	1.0100	.2998	.0948	.7955	1.2245	10.653	9	.000*

Note: the difference between the preoperative and postoperative values are statistically significant ($p<0.05$)

Changes in radiographic (CBCT) socket width

The mean ridge width was assessed at crest level, 5mm from the crest level and 10mm from the crest level. The mean difference of pre-operative and post-operative crest width was1.01±0.29mm ; at 5mm from crest was 0.37±0.10mm ; at 10mm from crest was 0.63±0.20mm and that was found to be statistically significant with a p value of $p=0.000(p<0.05)$.

Changes in radiographic (CBCT) socket height

Pre-operative CBCT assessment showed a mean height of 15.16 ± 3.12mm.

Post-operative assessment was done at the end of 6 months which showed a mean height of 14.92 ± 3.13mm. The mean difference of pre-operative and post-operative height was 0.24±0.19mm and that was found to be statistically significant with a p value of $p=0.003(p<0.05)$.

Histological result

Hard tissue specimens were obtained from four patients where implant placement was done 6months postoperatively. Histological section showed trabaculae of bone surrounding the dentine graft material with areas of dentinal fragments merging with vital bone and areas of osteoid formation.

Discussion

Whether due to caries, trauma or advanced periodontal disease, tooth extraction and subsequent healing of the socket commonly result in osseous deformities of the alveolar ridge, including reduced height and reduced width of the residual alveolar ridge. Tooth extraction is invariably followed by loss of height and width of the alveolar process. During natural healing after extraction, reductions in width of between 2.6 and 4.6 mm and in height of between 0.4 and 3.9 mm are observed BY Ten Heggeler JMAG, 2011, Pinho MN et al.. 20064 in the same study stated that it resulted in narrowing and shortening of the residual ridge.

It is possible to minimize such problems by simply carrying out ridg preservation procedures in extraction sockets using grafting materials with or without barrier membranes.

Though the gold standard Autogenous bone graft has the advantage of increased bone formation, osteoconduction and osteoinduction with no graft rejection or reaction it carries its own shortcoming of limited harvested amount and secondary defect.

Extracted tooth which has so far occupied space only in bio medical waste has now been started to process and replace commercial bone graft material. autogenous tooth

graft material contains both inorganic and organic substances, promotes better bone healing, and exhibits excellent osteoinduction and osteoconduction properties. In histological tests, healing adjacent to autologous bone grafts has been observed; thus confirming the safety of Autogenous tooth bone graft material. Kim 20115.

This is a prospective clinical and radiographic study having 6 months follow up period assessing the change in mean width and height of alveolar ridge, as well as histological healing pattern. CBCT scans were taken immediately after extraction and six months after grafting procedure. CBCT scan being three dimensional helped us to evaluate changes in alveolar bone in all possible dimensions and measure them accurately.

The results of 6month postoperative evaluation in alveolar socket width and height were statistically significant with $p<0.05$.

Hardtissue specimens were obtained from four patients where implant placement was done 6months postoperatively. Good Primary stability were achieved during implant placement in autogenous dentine graft site which itself is a positive result.

Histological section showed trabeculae of bone surrounding the dentine graft material with areas of dentinal fragments merging with vital bone and areas of osteoid formation.

According to Urist in 1965, demineralized dentin matrix and demineralized bone matrix contain mainly type-I collagen with growth factors such as bone morphogenetic proteins 2 and fibroblast growth factors. These bioactive molecules are thought to contribute to osteoinduction and osteoconductive property of human tooth as a graft material.[10 The possible explanation for better results with ADG is validated by various *in vitro* and animal studies which have demonstrated its biocompatibility, osteoinductive, and osteoconductive potential.[10,20,21

Limitations

Additional studies are needed to validate these findings using larger sample size. Research needs to be conducted to differentiate osseo-remodeling properties of dentin, cementum, and enamel. Longer duration of evaluation will give more predictable results. In addition, more studies are needed to evaluate the effect on implants placed in ADG-grafted alveolar ridge preservation sites in terms of implant osseointegration , implant stability and implant survival rate.

Conclusion

The aim of the study was to evaluate the effectiveness of autogenous dentine graft prepared at chairside immediately after extraction as a material in the preservation of extracted socket dimension. Rather than disposing extracted teeth as biomedical waste, they can be used as an autogenous graft material and serve as a better alternative to most of the conventional graft materials It has been clearly established radiographically as well as histologically,that socket preservation using autogenous dentine graft results in good bone formation as well as minimize the residual ridge resorbtion in terms of socket height and width. Since the autogenous graft is being produced chair side ,it eliminates the second surgical intervention which was previously possible only by sending the tooth to the commercially available tooth banks around the world (AUTO BT korea)Further randomized clinical trials are needed to moniter soft tissue dynamics, hard tissue changes and histological observations required to establish its regenerative potential in various field of applications.

References

1. Lekovic V, Kenney EB, Weinlaender M, et al. A bone regenerative approach to alveolar ridge maintenance following tooth extraction. Report of 10 cases. J Periodontol 1997;68:563–570.

2. Lekovic V, Camargo PM, Klokkevold P, et al. Preservation of alveolar bone in extraction sockets using bioabsorbable membranes. J Periodontol 1998;69:1044–1049.
3. Araujo MG, Lindhe J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. J Clin Periodontol. 2005; 32(2): 212-8.
4. P Pinho MN, Roriz VL, Novaes AB, Jr., Taba M, Jr., Grisi MF, de Souza SL, et al. Titanium membranes in prevention of alveolar collapse after tooth extraction. Implant Dent. 2006; 15(1): 53-61.
5. Jeong KI, Kim SG, Kim YK, Oh JS, Jeong MA, Park JJ. Clinical study of graft materials using autogenously teeth in maxillary sinus augmentation. Implant Dent. 2011; 20(6): 471-5.
6. Lam RV. Contour changes of the alveolar processes following extractions. J Prosthet Dent. 1960; 10(1): 25-32. 7.2. Pietrokovski J, Massler M. Alveolar ridge resorption following tooth extraction. J Prosthet Dent. 1967; 17(1): 21-7
7. Rosenberg E, Rose LF. Biologic and clinical considerations for autografts and allografts in periodontal regeneration therapy. Dent Clin North Am. 1998; 42(3): 467-90.
8. Iasella JM, Greenwell H, Miller RL, Hill M, Drisko C, Bohra AA, et al. Ridge preservation with freeze-dried bone allograft and a collagen membrane Bibliography 74 compared to extraction alone for implant site development: a clinical and histologic study in humans. J Periodontol. 2003; 74(7): 990-9
9. Barone A, Aldini NN, Fini M, Giardino R, Calvo Guirado JL, Covani U. Xenograft Versus Extraction Alone for Ridge Preservation After Tooth Removal: A Clinical and Histomorphometric Study. J Periodontol. 2008; 79(8): 1370-7.
10. Brydone AS, Meek D, Maclaine S. Bone grafting, orthopaedic biomaterials, and the clinical need for bone engineering. Proc Inst Mech Eng H. 2010; 224(12): 1329-43
11. Dimitriou R, Jones E, McGonagle D, Giannoudis PV. Bone regeneration: current concepts and future directions. BMC Med. 2011; 9: 66.
12. Keskin D, Gundogdu C, Atac AC. Experimental comparison of bovinederived xenograft, xenograft-autologous bone marrow and autogenous bone graft for the treatment of bony defects in the rabbit ulna. Med Princ Pract. 2007; 16(4): 299-305
13. Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing changes and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. Int J Periodontics Restorative Dent 2003;23:313–323
14. Amler MH, Johnson PL, Salman I. Histological and histochemical investigation of human alveolar socket healing in undisturbed extraction wounds. J Am Dent Assoc 1960;61:31–34.
15. Johnson K. A study of the dimensional changes occurring in the maxilla following tooth extraction. Aust Dent J 1969;14:241– 244.
16. Atwood DA. Post-extraction changes in adult mandible as illustrated by microradiograph of midsagittal section and serial cephalometric roentogenograms. J Prosthet Dent 1963;13:810– 824.
17. Pietrokovski J. The bony residual ridge in man. J Prosthet Dent 1975;34:456– 462.
18. Jahangiri L, Devlin H, Ting K, Nishimura I. Current perspectives in residual ridge remodeling and its clinical implications: a review. J Prosthet Dent 1998;80:224–237.

19. Tallgren A. Positional changes of complete dentures. A 7-year longitudinal study. Acta Odontol Scand 1969;27:539–561.
20. Atwood DA, Coy WA. Clinical, cephalometric and densitometric study of reduction of residual ridges. J Prosthet Dent 1971;26:280–295
21. Tan WL, Wong TL, Wong MC, Lang NP. A systematic review of postextractional alveolar hard and soft tissue dimensional changes in humans. Clin Oral Implants Res. 2012;
22. Suppl 5: 1-21. 23. Artzi Z, Tal H, Dayan D. Porous bovine bone mineral in healing of human extraction sockets. Part 1: Histomorphometric evaluations at 9 months. J Periodontol 2000 (2016);71:1015–1023.
23. Allen EP, Gainza CS, Farthing GG, Newbold DA. Improved technique for localized ridge augmentation. A report of 21 cases. J Periodontol. 1985; 56(4): 195-9.
24. Claflin RS. Healing of Disturbed and Undisturbed Extraction Wounds. J Am Dent Assoc. 1936; 23(6): 945 59.
25. Guglielmotti MB, Cabrini RL. Alveolar wound healing and ridge remodeling after tooth extraction in the rat: A histologic, radiographic, and histometric study. J Oral Maxillofac Surg. 1985; 43(5): 359-64.
26. Iizuka T, Miller SC, Marks SC. Alveolar bone remodeling after tooth extraction in normal and osteopetrotic (ia) rats. J Oral Pathol Med. 1992; 21(4): 150-5.
27. Trombelli L, Farina R, Marzola A, Bozzi L, Liljenberg B, Lindhe J. Modeling and remodeling of human extraction sockets. J Clin Periodontol. 2008; 35(7): 630-9.
28. Hoffmann O, Bartee BK, Beaumont C, Kasaj A, Deli G, Zafiropoulos GG. Alveolar bone preservation in extraction sockets using non-resorbable dPTFE membranes: a retrospective non-randomized study. J Periodontol. 2008; 79(8): 1355-69.
29. Neiva R, Pagni G, Duarte F, Park CH, Yi E, Holman LA, et al. Analysis of tissue neogenesis in extraction sockets treated with guided bone regeneration: clinical, histologic, and micro-CT results. Int J Periodontics Restorative Dent. 2011; 31(5): 457-69.
30. Luczyszyn SM, Papalexiou V, Novaes AB, Jr., Grisi MF, Souza SL, Taba M, Jr. Acellular dermal matrix and hydroxyapatite in prevention of ridge deformities after tooth extraction. Implant Dent. 2005; 14(2): 176-84.
31. Landsberg CJ, Bichacho N. A modified surgical/prosthetic approach for optimal single implant supported crown. Part I--The socket seal surgery. Pract Periodontics Aesthet Dent. 1994; 6(2): 11-7; quiz 9
32. Stimmelmayr M, Allen EP, Reichert TE, Iglhaut G. Use of a combination epithelized-subepithelial connective tissue graft for closure and soft tissue augmentation of an extraction site following ridge preservation or implant placement: description of a technique. Int J Periodontics Restorative Dent. 2010; 30(4): 375-81.
33. Thalmair T, Hinze M, Bolz W, Wachtel H. The Healing of Free Gingival Autografts for Socket-seal Surgery: a Case Report. The European journal of esthetic dentistry: official journal of the European Academy of Esthetic Dentistry. 2010; 5(4): 358-68
34. Tal H. Autogenous masticatory mucosal grafts in extraction socket seal procedures: a comparison between sockets grafted with demineralized freezedried bone and deproteinized bovine bone mineral. Clin Oral Implants Res. 1999; 10(4): 289-96.
35. Becker W, Becker BE, Caffesse R. A comparison of demineralized freezedried bone and autologous bone

to induce bone formation in human extraction sockets. J Periodontol 1994;65:1128–1133

36. Clementini M., Morlupi A., Agrestini C., Ottria L (2011). Success Rate of Dental Implants Inserted in Autologous Bone Graft Regenerated Areas: A Systematic Review. Oral Implantol, 4(3-4), pp. 3-10
37. Clementini M., Morlupi A., Agrestini C., Ottria L (2011). Success Rate of Dental Implants Inserted in Autologous Bone Graft Regenerated Areas: A Systematic Review. Oral Implantol, 4(3-4), pp. 3-10