Autogenous bone block in the treatment of teeth with hopeless prognosis

Nymphea Pandit, I. K. Pandit[1], Rajvir Malik, Deepika Bali, Shaifi Jindal

Abstract

Background: Autogenous bone graft, although considered as a gold standard, has been relegated to background because of limited quantity and donor site morbidity. Revival of interest in its use has been reflected by its tremendous capacity for regeneration in less than ideal situation. Bone blocks have been used for implant site augmentation, with varied success. **Aim:** Aim of the study was to evaluate the efficacy of autogenous bone block in the regeneration of bone, for saving teeth with a hopeless prognosis. **Settings and Design:** A total of six patients and 12 sites with grade II and III mobile teeth were treated with autogenous bone blocks and fiber splinting. **Subjects and Methods:** Attachment loss, probing depths, and radiographic bone loss were recorded at baseline and at 12 months interval. **Statistical Analysis Used:** The Student paired *t* test was used for evaluation of the changes from baseline to 12 months. **Results:** At 12 months post-operatively, there was a highly significant amount of bone gain as compared to the baseline. The mean amount of bone loss reduced from 9.41 ± 1.16 to 5.41 ± 1.01. The clinical attachment loss reduced from 7.37 ± 1.24 mm to 3.79 ± 0.89 mm and probing depth reduced from 7 ± 1.67 mm to 5.5 ± 0.63 mm. The grafted bone was observed to have been incorporated with the host bone in most of the sites as evidenced by radiographs. **Conclusions:** For teeth with hopeless prognosis, this method can be considered to be a very viable alternative to extraction and replacement by costly implants.

Keywords: Bone grafts, hopeless teeth, osseous defects, osseous surgery, periodontal regeneration, prognosis

Introduction

Since the inception of dental science, the specialties of periodontics, and restorative dentistry have worked diligently in saving the dentitions and providing the optimum level of health to the oral cavity. Periodontics focuses on preventive and corrective procedures for saving the natural teeth, affected by periodontitis.

Periodontitis causes loss of tooth supporting bone. The bone loss may be vertical, horizontal, or combined. The desired ideal outcome of course is the regeneration possible to some extent with the use of various kinds of bone grafting materials. These grafting materials are available in different forms.[1] Among the graft materials, autogenous bone grafts have been considered the gold standard[2-4] and can be harvested in either particulate or in the form of bone blocks.[2,5] Particulate graft material, though easy to procure, has its own limitation of the lack of immediate stability and it requires protection by biologic barriers or bony walls.[2,6,7] Thus, it is best suited for two, three, or more walled defect, as they usually provide adequate space for placing and retaining the bone graft material for a sufficient period of time.[2,6] Conversely, the one walled and the horizontal defects leave minimum options available and pose a considerable challenge.

Also, earlier it was believed that the teeth with advanced periodontitis have hopeless prognosis and the retention of these teeth may lead to aggravated destruction of the proximal periodontium of adjacent teeth, which has however been proved otherwise.[8] The use of bone block can be quite beneficial in treating such teeth, that are subject to possible masticatory forces, because they provide good stability and resistance to deformation.[5,6,9] Hegedus[10] was the pioneer (reported) in using the bone blocks for the regeneration of the horizontal bone loss in relation to upper and lower incisors using tibial bone. Although he tried to use the transplant from neighboring areas of involved teeth; but he found it much easier to use the tibial bone graft. The roentgenogram showed evidence of osteogenesis in the 4th week. However, this method was stuck, as it needed a second surgical site.

Later on until mid-60s studies dwelt upon variously treated bone from heterogeneous origin.[11] Linghorne has published a detailed histologic analysis of an autogenous bone graft

Departments of Periodontology and Oral Implantology, and [1]Pedodontics and Preventive Dentistry, D.A.V. (C) Dental College and Hospital, Yamunanagar, Haryana, India

Correspondence: Dr. Nymphea Pandit, Department of Periodontology and Oral Implantology,
D.A.V. (C) Dental College and Hospital, Model Town,
Yamunanagar, Haryana - 135 001, India.
E-mail: drnymphea@yahoo.com

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in the periodontium of dogs. He observed enhanced bone repair in comparison to the non-grafted sites and insisted on major role for the cells.[12]

With the advancement in techniques and materials used for regeneration, there has been a renewed interest in the use of autogenous bone grafts. Although autogenous bone block has been used extensively for ridge augmentation of implant sites, to our knowledge, there is no reported study as yet, which has used autogenous bone block in periodontally involved teeth with hopeless prognosis. This clinical study describes a novel treatment option using bone block graft, from adjacent to the involved tooth, for saving the otherwise perceived to be the hopeless teeth, especially in the aesthetic zone of the mouth.

Subjects and Methods

A total of six patients (four males and two females) with 12 sites were selected for the study, from the patients attending the Out Patient Department of the college. All subjects were diagnosed with advanced chronic periodontal disease. The study was performed between January 2009 and March 2010. The study protocol was reviewed and approved by the Ethical Committee.

All subjects received phase I therapy, consisting of oral hygiene instructions and supra- and sub-gingival scaling and root planing. The data reported at baseline represented the clinical picture after the initial therapy. The age range of the patients included in this study was 25-55 years. The eligibility criteria included; an optimal oral hygiene; patient compliance with the maintenance program; teeth involved by severe periodontitis with clinical attachment loss (CAL) ≥8 mm; bone loss more than 50% as detected on radiographs and grade two or three mobility. Only patients with sufficient soft tissues to cover the harvested bone block were selected. Exclusion criteria were patients with any chronic systemic disease that could influence the outcome of the therapy, the pregnant and lactating females as well as current smokers.

The parameters recorded at the baseline and 12 months after the therapy included CAL and radiographic bone loss. All the measurements were made by the same examiner. The cement–enamel junction served as the reference point. An orthopantamograph and intraoral periapical (IOPA) radiographs of the area to be treated were taken. The pre- and post-operative IOPA radiographs were performed using the long cone parallel technique [Figures 1 and 2].

A complete comprehensive medical and dental history was recorded and an informed written consent was obtained. Non-vital teeth were root-canal treated and the test teeth were splinted with a fiber splint. Patients were instructed for maintaining an excellent oral hygiene throughout the therapy and thereafter. All the patients were scheduled for surgical phase after at least 1 month of the completion of phase I therapy to stabilize the tissues. Prophylactic antibiotic therapy with 500 mg of amoxicillin and 400 mg of metronidazole every 8 h was started orally a day prior to the surgery. On the day of surgery, 600 mg of ibuprofen every 8 h was added to the above regimen. Post-operatively, a single dose of 8 mg dexamethasone was injected intramuscularly. A pre-surgical rinse consisting of 0.2% chlorhexidine was used for 1 min. The antibiotic regimen was continued until 5 days post-surgically.

Surgical procedure

Intrasulcular incisions were placed in the involved area to preserve as much of the gingival tissue as possible. At least, two additional teeth on each side of the involved teeth were included, to provide enough coverage for the bone block. Vertical incisions were placed on either side of the sulcular incision, extending into the alveolar mucosa and full thickness (mucoperiosteal) flaps were raised [Figure 3] exposing the symphyseal region in five patients and external oblique ridge in one patient.

After exposing the symphysis and locating the mental foramina, a reciprocating saw was used to outline a rectangle of the size of the exposed defect. The superior border of the rectangle was at least 3-5 mm below the tooth apex. Due care was taken to preserve the integrity of the lower border of the mandible and minimize trauma to the graft [Figure 4]. Piezoelectric surgical units were used to detach the block from its bed. Bone scraper was used to harvest the cancellous bone from the bed itself. The graft was restored in sterile cold sodium chloride 0.9% solution and minimal time elapsed before placement in the recipient site. Pasetti stated that the harvesting should be as gentle as possible, and care should be taken to minimize the extracorporeal time of the graft.[13]

The bone block was used either as such or divided into smaller ones depending upon the defect and the sharp edges were smoothened to prevent the penetration into the overlying flap. The block was adapted in the interdental defects and the gaps were filled with the bone harvested by the scraper [Figure 5]. The periosteum at the base of the facial flap was carefully incised to allow stretching of mucosa and tension-free adaptation of the wound margins. The flap was sutured using 3-0 silk which were removed after 2 weeks.

Statistical analysis

Results were averaged (mean ± standard error) for each parameter [Table 1]. The net difference between each pair of measurements was then calculated (pre- and post-operative). The statistical analysis was performed by a professional bio-statistician. Radiographic bone levels and CAL were the primary outcome variable. The Student paired t-test was used for evaluation of the changes from baseline to 12 months [Table 2].

Results

The post-operative healing was uneventful at all sites except in one case where there was exposure of the block. All the parameters were evaluated at baseline and 12 months post-surgically. Table 1 illustrates the measurements of CAL and radiographic alveolar bone loss, of all the sites and their mean at the baseline and at 12 months. Mean radiographic alveolar bone loss at baseline was 9.41 ± 1.16 mm

Figure 1: Pre-operative radiograph

Figure 2: Post-operative radiograph

Figure 3: Pre-operative photograph showing teeth splinted with reinforced fiber

Figure 4: Bone defect in relation to 41, 31, 32 and delineation of block in the symphysis region using piezoelectric surgical unit

Figure 5: Particulate bone graft placed to fill the gaps between chunks of bone block

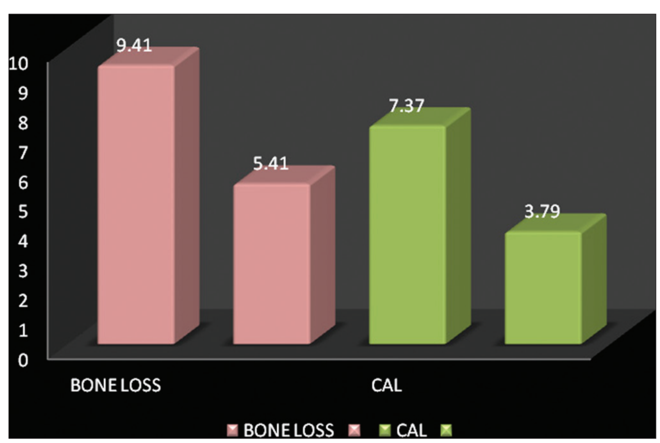

Figure 6: Bone loss and clinical attachment loss at baseline and 12 months

Table 1: Preoperative and postoperative values

Defect no.	Bone loss		CAL	
	Pre-operative	Post-operative	Pre-operative	Post-operative
1	9.0	4.5	7.0	3.5
2	10	4.0	8.0	2.5
3	10	8.0	8.0	6.0
4	8.0	6.0	6.0	3.5
5	7.0	5.5	5.0	4.0
6	10	5.5	7.0	4.0
7	10	5.5	7.0	4.0
8	8.0	5.0	6.0	3.5
9	10	6.0	8.5	4.5
10	11	5.5	9.0	4.0
11	10	4.5	8.5	3.0
12	10	5.0	8.5	3.0
Mean	9.41	5.41	7.37	3.79

CAL-Clinical attachment loss

Table 2: Paired *t* test

Parameters	Pre-operative	Post-operative	*P* values
Bone loss	9.41±1.16	5.41±1.01	0.00
CAL	7.37±1.24	3.79±0.89	0.00

CAL-Clinical attachment loss

whereas at 12-month post-operatively, it was recorded to be 5.41 ± 1.01 mm. The mean CAL values decreased from 7.37 ± 1.24 mm to 3.79 ± 0.89 mm. Both CAL and radiographic alveolar bone loss changes were statistically highly significant [Figure 6].

Discussion

The rationale behind the use of bone grafts or allogenic materials is the assumption that the material may contain bone-forming cells (osteogenesis), serve as a scaffold for bone formation (osteoconduction), or that the matrix of the bone grafts contains bone-inducing substances (osteoinduction) that would stimulate both the regrowth of alveolar bone and the formation of new attachment.[14] Bone graft particles hypothetically present osteoinductive activity and act as centers of ossification in the surrounding mineralized matrix, promoting new bone formation.[15,16] With respect to histological parameters, there is ample evidence that autogenous and demineralized allogenic bone grafts shore up the formation of new attachment.[17]

Utilization of autogenous bone is justified by the fact that this material has a high osteogenic potential and no immunological reaction.[18] Autogenous bone has been used in the form of blocks[19-22] or particulates.[22-26] Bone blocks have the inherent advantage of stability and resistance to deformation.[5,6,9] Autogenous bone blocks can be harvested from various extraoral as well as intraoral sites. Although iliac crest is one of the most preferred site, it is not always recommended due to its associated problems, such as post-operative infection; exfoliation and sequestration; varying rates of healing; root resorption and rapid recurrence of the defect, in addition to increased patient expense; patient morbidity; altered ambulation; difficulty in procuring the donor material and need for hospitalization.[27] These disadvantages together with the fact that alveolar defects do not demand large amounts of bone, led to the growing use of intraoral block bone grafts from intraoral sources, especially from the mandibular symphysis[28-33] and ramus.[28,34] The intraoral donor sites also have the benefit of conventional surgical access; proximity of donor and recipient sites which reduces operative and anesthesia time; making it ideal for outpatient periodontal surgery; no scar; minimal discomfort to the patients and less morbidity compared to extraoral locations making it ideal for outpatient periodontal surgery. [30-32]

Autogenous bone block can be procured either by bone mill or by osteotomy procedures.[35] However, cell viability seemed to be significantly influenced by the harvesting technique.[36] Conventional osteotomy or milling procedures has some limitations like overheating of bone when water cooling is insufficient, possible damage of adjacent soft tissues and metallic contamination of bone, which leads to possible structural bone changes and toxic effect on living cells.[37-39] In order to overcome some of these problems, a newly developed piezoelectric device has been used for harvesting the autogenous bone block. Piezoelectric bone surgical technique has an advantage of low surgical trauma, exceptional control during surgery and fast healing response of tissues.[40]

Teeth taken in this study were either grade II or grade III mobile. Moreira *et al*.,[42] have stated that reasons for extraction are tooth mobility, severity of attachment loss and radiographic bone loss greater than 50% in this order. The resultant site demands either the replacement by an implant or a fixed or removable prosthesis, which adds up to the treatment cost and the patient may not be able to afford it. The proposed technique offers cost effectiveness along with the above mentioned advantages. Moreover, bone harvested from mandibular symphysis is mainly cortical in nature and thus provides good stability.[43] Kooley proposed that the volume maintenance of mandibular symphiseal bone grafts is related to a more rapid vascularization. This observation may be explained by a similar embryonic origin of the donor and the recipient site.[44] These grafts can be easily carved to intimately fill in the defects.[41] They also exhibit better potential for incorporation in the maxillofacial region because of a biochemical similarity in the protocollagen, and greater inductive capacity and an inherent higher concentration of bone morphogenic proteins and growth factors.[28,30,34]

Literature also shows different views regarding the preferred donor site for intraoral autogenous grafts depending upon the different procedural requirements.[27,41] In this study, the area adjacent to the involved site was preferred for harvesting the graft, to minimize the operating time as well as patient discomfort and morbidity.

The healing of autogenous bone block graft has been described as creeping substitution where viable bone replaces the necrotic bone within the graft and is highly dependent on the graft angiogenesis and revascularization.[45] In the 1st week, there is inflammatory reaction followed by granulation phase.[46] Also these grafts contain undifferentiated cells or osteoblasts capable of inducing bone formation. In addition, as the graft material necroses, it releases substances that may stimulate further bone formation and the non-viable cellular elements within the graft may act as a scaffold for ingrowth of vessels and accumulation of osteoblasts.[47] Revascularization of a bone block is critical for cell survival and graft incorporation[3,48-50] and can vary depending upon the receptor site, type of fixation, orientation of grafted bone or even presence or absence of the periosteum, and patient's age, as well.[51,52] Perforation of cortical bone at donor site has been suggested to improve vascularity but the results are yet to be substantiated (about cortical perforation).[3,47,50] In the following month, calcification progresses and within a year the newly formed bone develops the normal physical strength.[46]

Although the changes in probing depth and CAL were not dramatic, the osseous component enhancement can be expected to provide optimum support in such situations. The patients were followed upto 1 year and stability of the clinical findings with respect to decreased mobility was observed. The radiographic findings showed an increasing incorporation of the donor bone with that of the recipient area. In one patient, there was exposure of bone block, which continued even after trying to cover with a coronally advanced flap. The reason for this could be that the overlying gingival tissue was deficient, which compromised the vascularity from that end.

The patients were followed for 1 year. The long-term stability could not be evaluated and as the splint was not removed, therefore, the actual gain in terms of stability was not measured, although the radiographic gain was appreciable.

Conclusion

Within the limitations of the study, the results of this study demonstrated significant amount of bone fill in teeth with questionable prognosis. An intraoral bone block graft provides structural support, all elements of regeneration, minimal complications and low failure rate. Hence, it can be considered as a predictable treatment modality for management of teeth with severe bone loss.

References

1. Trombelli L, Heitz-Mayfield LJ, Needleman I, Moles D, Scabbia A. A systematic review of graft materials and biological agents for periodontal intraosseous defects. J Clin Periodontol 2002;29:117-35.
2. Coradazzi LF, Garcia IR Jr, Manfrin TM. Evaluation of autogenous bone grafts, particulate or collected during osteotomy with implant burs: Histologic and histomorphometric analysis in rabbits. Int J Oral Maxillofac Implants 2007;22:201-7.
3. Faria PE, Okamoto R, Bonilha-Neto RM, Xavier SP, Santos AC, Salata LA. Immunohistochemical, tomographic and histological study on onlay iliac grafts remodeling. Clin Oral Implants Res 2008;19:393-401.
4. Sàndor GK, Rittenberg BN, Clokie CM, Caminiti MF. Clinical success in harvesting autogenous bone using a minimally invasive trephine. J Oral Maxillofac Surg 2003;61:164-8.
5. Sandor GK. The minimization of morbidity in cranio-maxillofacial osseous reconstruction. Bone graft and coral-derived granules as a bone substitute [thesis dissertation]. Institute of Dentistry, Department of Oral and maxillofacial Surgery, University of Oulu, Finland; 2003. Available from: http://hercules.oulu.fi/isbn9514269640/. [Last accessed on 2012 May 23]
6. Finkemeier CG. Bone-grafting and bone-graft substitutes. J Bone Joint Surg Am 2002;3:454-64.
7. Rissolo AR, Bennett J. Bone grafting and its essential role in implant dentistry. Dent Clin North Am 1998;42:91-116.
8. DeVore CH, Beck FM, Horton JE. Retained «hopeless» teeth. Effects on the proximal periodontium of adjacent teeth. J Periodontol 1988;59:647-51.
9. Zerbo IR, de Lange GL, Joldersma M, Bronckers AL, Burger EH. Fate of monocortical bone blocks grafted in the human maxilla: A histological and histomorphometric study. Clin Oral Implants Res 2003;14:759-66.
10. Hegedus Z. The rebuilding of the alveolar processes by bone transplantation. Dent Cosmos 1923;65:736.
11. Rivault AF, Toto PD, Levy S, Gargiulo AW. Autogenous bone grafts: Osseous coagulum and osseous retrograde procedures in primates. J Periodontol 1971;42:787-96.
12. Linghorne WJ, O›connell DC. Studies in the regeneration and reattachment of supporting structures of the teeth. II. Regeneration of alveolar process. J Dent Res 1951;30:604-14.
13. Pasetti P. Bone harvesting from the oral cavity. Int J Dent Symp 1994;2:46-51.
14. Karring T, Lindhe J, Cortellini P. Regenerative periodontal therapy. In: Lindhe J, editor. Clinical Periodontology and Implant Dentistry. Copenhagen: Munskgaard; 1998. p. 597-638.
15. Ham A, Gordon S. The origin of bone that forms in association with cancellous chips transplanted into muscle. Br J Plast Surg 1952;5:154-60.
16. Bassett CA. Clinical implications of cell function in bone grafting. Clin Orthop Relat Res 1972;87:49-59.
17. Reynolds MA, Aichelmann-Reidy ME, Branch-Mays GL, Gunsolley JC. The efficacy of bone replacement grafts in the treatment of periodontal osseous defects. A systematic review. Ann Periodontol 2003;8:227-65.
18. Moy PK, Lundgren S, Holmes RE. Maxillary sinus augmentation: Histomorphometric analysis of graft materials for maxillary sinus floor augmentation. J Oral Maxillofac Surg 1993;51:857-62.
19. Jensen J, Sindet-Pedersen S. Autogenous mandibular bone grafts and osseointegrated implants for reconstruction of the severely atrophied maxilla: A preliminary report. J Oral Maxillofac Surg 1991;49:1277-87.
20. Misch CM, Misch CE, Resnik RR, Ismail YH. Reconstruction of maxillary alveolar defects with mandibular symphysis grafts for dental implants: A preliminary procedural report. Int J Oral Maxillofac Implants 1992;7:360-6.
21. Sethi A, Kaus T. Ridge augmentation using mandibular block bone grafts: Preliminary results of an ongoing prospective study. Int J

Oral Maxillofac Implants 2001;16:378-88.
22. Zerbo IR, de Lange GL, Joldersma M, Bronckers AL, Burger EH. Fate of monocortical bone blocks grafted in the human maxilla: A histological and histomorphometric study. Clin Oral Implants Res 2003;14:759-66.
23. Missori P, Rastelli E, Polli FM, Tarantino R, Rocchi G, Delfini R. Reconstruction of suboccipital craniectomy with autologous bone chips. Acta Neurochir (Wien) 2002;144:917-20.
24. Schlegel KA, Fichtner G, Schultze-Mosgau S, Wiltfang J. Histologic findings in sinus augmentation with autogenous bone chips versus a bovine bone substitute. Int J Oral Maxillofac Implants 2003;18:53-8.
25. Artzi Z, Kozlovsky A, Nemcovsky CE, Weinreb M. The amount of newly formed bone in sinus grafting procedures depends on tissue depth as well as the type and residual amount of the grafted material. J Clin Periodontol 2005;32:193-9.
26. Le Lorc'h-Bukiet I, Tulasne JF, Llorens A, Lesclous P. Parietal bone as graft material for maxillary sinus floor elevation: Structure and remodeling of the donor and of recipient sites. Clin Oral Implants Res 2005;16:244-9.
27. Schwartz-Arad D, Levin L. Intraoral autogenous block onlay bone grafting for extensive reconstruction of atrophic maxillary alveolar ridges. J Periodontol 2005;76:636-41.
28. Misch CM. Comparison of intraoral donor sites for onlay grafting prior to implant placement. Int J Oral Maxillofac Implants 1997;12:767-76.
29. Misch CM, Misch CE, Resnik RR, Ismail YH. Reconstruction of maxillary alveolar defects with mandibular symphysis grafts for dental implants: A preliminary procedural report. Int J Oral Maxillofac Implants 1992;7:360-6.
30. Misch CM, Misch CE. The repair of localized severe ridge defects for implant placement using mandibular bone grafts. Implant Dent 1995;4:261-7.
31. Güngörmüş M, Yavuz MS. The ascending ramus of the mandible as a donor site in maxillofacial bone grafting. J Oral Maxillofac Surg 2002;60:1316-8.
32. Montazem A, Valauri DV, St-Hilaire H, Buchbinder D. The mandibular symphysis as a donor site in maxillofacial bone grafting: A quantitative anatomic study. J Oral Maxillofac Surg 2000;58:1368-71.
33. Proussaefs P, Lozada J, Kleinman A, Rohrer MD. The use of ramus autogenous block grafts for vertical alveolar ridge augmentation and implant placement: A pilot study. Int J Oral Maxillofac Implants 2002;17:238-48.
34. Misch CM. Ridge augmentation using mandibular ramus bone grafts for the placement of dental implants: Presentation of a technique. Pract Periodontics Aesthet Dent 1996;8:127-35.
35. Young MP, Worthington HV, Lloyd RE, Drucker DB, Sloan P, Carter DH. Bone collected during dental implant surgery: A clinical and histological study. Clin Oral Implants Res 2002;13:298-303.
36. Springer IN, Terheyden H, Geiss S, Härle F, Hedderich J, Açil Y. Particulated bone grafts – Effectiveness of bone cell supply. Clin Oral Implants Res 2004;15:205-12.
37. Danckwardt-Lillieström G, Lorenzi GL, Olerud S. Intramedullary nailing after reaming. An investigation on the healing process in osteotomized rabbit tibias. Acta Orthop Scand 1970;134:1-78.
38. Ercoli C, Funkenbusch PD, Lee HJ, Moss ME, Graser GN. The influence of drill wear on cutting efficiency and heat production during osteotomy preparation for dental implants: A study of drill durability. Int J Oral Maxillofac Implants 2004;19:335-49.
39. Hobkirk JA, Rusiniak K. Metallic contamination of bone during drilling procedures. J Oral Surg 1978;36:356-60
40. Vercellotti T, Nevins ML, Kim DM, Nevins M, Wada K, Schenk RK, *et al*. Osseous response following resective therapy with piezosurgery. Int J Periodontics Restorative Dent 2005;25:543-9.
41. Montazem A, Valauri DV, St-Hilaire H, Buchbinder D. The mandibular symphysis as a donor site in maxillofacial bone grafting: A quantitative anatomic study. J Oral Maxillofac Surg 2000;58:1368-71.
42. Moreira CH, Zanatta FB, Antoniazzi R, Meneguetti PC, Rösing CK. Criteria adopted by dentists to indicate the extraction of periodontally involved teeth. J Appl Oral Sci 2007;15:437-41.
43. Widmark G, Andersson B, Ivanoff CJ. Mandibular bone graft in the anterior maxilla for single-tooth implants. Presentation of surgical method. Int J Oral Maxillofac Surg 1997;26:106-9.
44. Koole R. Ectomesenchymal mandibular symphysis bone graft: An improvement in alveolar cleft grafting? Cleft Palate Craniofac J 1994;31:217-23.
45. McAllister BS, Haghighat K. Bone augmentation techniques. J Periodontol 2007;78:377-96.
46. Burchardt H, Enneking WF. Transplantation of bone. Surg Clin North Am 1978;58:403-27.
47. Minsk L. Bone replacement grafts for periodontal regeneration. Compend Contin Educ Dent 2005;26:676, 678, 680 passim.
48. De Marco AC, Jardini MA, Lima LP. Revascularization of autogenous block grafts with or without an e-PTFE membrane. Int J Oral Maxillofac Implants 2005;20:867-74.
49. Delloye C, Simon P, Nyssen-Behets C, Banse X, Bresler F, Schmitt D. Perforations of cortical bone allografts improve their incorporation. Clin Orthop Relat Res 2002;396:240-7.
50. Rompen EH, Biewer R, Vanheusden A, Zahedi S, Nusgens B. The influence of cortical perforations and of space filling with peripheral blood on the kinetics of guided bone generation. A comparative histometric study in the rat. Clin Oral Implants Res 1999;10:85-94.
51. Khan SN, Cammisa FP Jr, Sandhu HS, Diwan AD, Girardi FP, Lane JM. The biology of bone grafting. J Am Acad Orthop Surg 2005;13:77-86.
52. Cho BC, Chung HY, Shin DP, Park JW, Baik BS. Early revascularization of membranous inlay bone graft in canine mandible model. J Craniofac Surg 2002;13:251-7

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