

# Rehabilitation of Avulsed Teeth in Fractured Jaws via Bone Grafting and Implant Placement: Report of Two Cases

Anshul Jain<sup>1</sup>✉, Shridhar Baliga<sup>2</sup>

<sup>1</sup>Senior Resident, Department of Oral and Maxillofacial Surgery, Maulana Azad Institute of Dental Sciences, New Delhi, India

<sup>2</sup>Professor, Department of Oral and Maxillofacial surgery, KLE VK Institute of Dental Sciences, Belgaum, Karnataka, India

## Abstract

The maxillofacial region is one of the most injury-prone areas during road traffic accidents, personal violence, falls and sports. Maxillofacial trauma can lead to breakage or avulsion of upper anterior teeth, which may cause significant aesthetic and functional problems. There are many treatment options available for rehabilitation including removable partial dentures, fixed partial dentures, crown and bridges and implant-supported prostheses.

Herein, two cases are presented where implant placement was done for upper anterior teeth, which were traumatized or avulsed following maxillofacial trauma. Both patients demonstrated a history of maxillofacial trauma and had undergone open reduction and internal fixation. The first patient had a severe maxillary alveolar defect treated via autogenous bone grafting and a six-month period was given for proper integration of the bone graft. The second patient was a smoker with very poor oral hygiene and a deep bite. Thus, implant placement was not initially justified.

**Keywords:** Maxillofacial injuries; Dental implants; Tooth avulsion; Dental prosthesis

*Journal of Dentistry, Tehran University of Medical Sciences, Tehran, Iran (2015; Vol. 12, No. 7)*

✉ Corresponding author:

A. Jain, Department of Oral and Maxillofacial surgery, Maulana Azad Institute of Dental Sciences, New Delhi, India

dranshulkjain@gmail.com

Received: 7 February 2015

Accepted: 26 March 2015

## INTRODUCTION

The maxillofacial region is commonly injured during road traffic accidents, personal violence, falls and sports; which may lead to anatomical deficiencies in both soft and hard tissues of facial structures.

These defects often result in the loss of neural sensation, attached mucosa, bone, teeth and alveolar processes, which might require rehabilitation. Dental injuries are common in maxillofacial regions [1,2] and may or may not be associated with fractures of the temporomandibular joint, maxilla, mandible, teeth and supporting structures [1,3].

Maxillofacial trauma can lead to loss of upper anterior teeth, which are most likely to break or get avulsed along with alveolar bone, leading to significant aesthetic and functional problems [4-6].

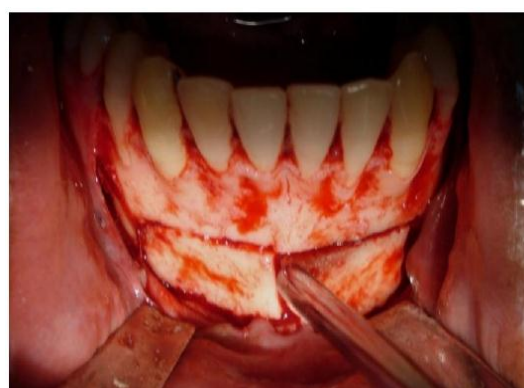
Facial fractures are usually treated by reduction, fixation and immobilization of the fractured segments, followed by occlusal adjustments and restoration of missing teeth and soft tissues where necessary [7]. There are several treatment options available for rehabilitation including removable partial dentures, fixed partial dentures, crown and bridges and implant-supported prostheses [8].



**Fig. 1.** Preoperative panoramic radiograph



**Fig. 2.** Incision at the donor site



**Fig. 3.** Bone graft from the mandibular chin region

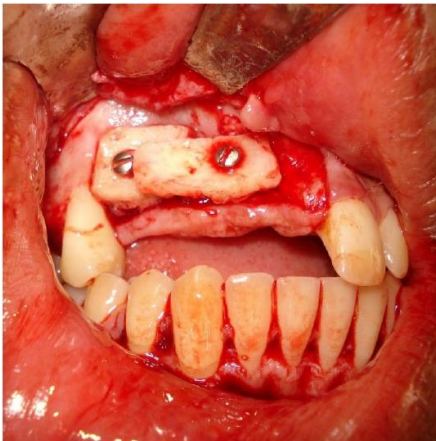
Herein, two cases are presented where implant placement was done for the upper anterior teeth, which were traumatized or avulsed following maxillofacial trauma.

#### **Case one:**

A 20 year-old male patient presented with missing upper anterior teeth needing to be replaced. The patient had a history of facial trauma four months prior to referral and avulsion of the right central incisor, lateral incisor, canine and first premolar teeth along with a LeFort I fracture for which he was operated.

The treatment plan included bone grafting of the defect in the maxillary alveolar region (Fig. 1) with two-stage implant placement.

The surgical procedure started with a crevicular incision (Fig. 2) in the mandible extending from the premolar of one side to the premolar of the opposite side for better visualization and accessibility of the symphysis. Then, by elevation of a full mucoperiosteal flap the mandibular symphysis region was exposed. Marking was done extending approximately 1.5 cm on either side from the mid-symphysis and two blocks of 1.5×1.0 cm monocortical bone were harvested (Fig. 3) using a rotary instrument and chisel; the incised wound was primarily sutured in layers and compression dressing was placed to prevent hematoma; the harvested bone was grafted in the region of the maxillary alveolar ridge defect (Fig. 4).



**Fig. 4.** Bone graft in situ



**Fig. 5.** Recipient site six months after bone grafting



**Fig. 6.** Completely healed donor site



**Fig. 7.** Postoperative panoramic radiograph

To attain desired alveolar height and thickness, the bone graft was secured with the help of stabilizing screws. Before securing the graft, decortication of the recipient site was done by drilling holes with the help of bur. This aids in regional acceleratory phenomenon. These holes provide access for trabecular bone blood vessels to the graft site, expedite revascularization and bring growth factors to the graft site. Periosteal undermining was done at the recipient site to acquire abundant tissue for closure. Watertight closure was achieved by horizontal mattress suturing using polyglactin suture material. After six months, screws were removed and bone morphology was evaluated at the recipient site (Fig. 5).

There was satisfactory healing both at the recipient site and at the donor site (Fig. 6). Four implants were inserted into the grafted bone to replace each missing tooth depending upon the height and width of the bone. First, with the help of diagnostic casts, a surgical stent was prepared and under local anesthesia with adrenaline, a crestal incision was made extending from the right central incisor to the right first premolar region. The site was exposed, desired marking was done with the help of the pilot drill, bony expansion was done with the help of bone taps to attain desired width so that the density of bone around the implant would increase; then implants were placed in the desired position and primary suturing of the mucosa was done.



**Fig. 8.** Final prosthesis in situ



**Fig. 9.** Preoperative panoramic radiograph



**Fig. 10.** Preoperative occlusion



**Fig. 11.** Diagnostic workup showing the marking up to which lower anterior teeth crown reductions had to be

A waiting period of six months was necessary for proper osseointegration of implants in the grafted bone (Fig. 7). After six months, all the implants were exposed and loaded (Fig. 8). There were no signs of inflammation with well-keratinized gingival tissue.

#### **Case two:**

A 30 year-old male patient presented with missing upper anterior teeth (Figs. 9 and 10) requiring to be replaced. The patient had a history of facial trauma nine months back with avulsion of both maxillary central and lateral incisors along with LeFort I fracture for which he was operated; the patient had undergone a second surgery for removal of miniplates after a gap of six months after the first surgery. The patient had a history of smoking and poor oral hygiene. He was referred to the department of periodontics for oral prophylaxis and was asked to quit smoking and advised to extract the maxillary right canine and first premolar teeth due to poor prognoses.

An impression was taken and a diagnostic cast was prepared to evaluate the occlusion and to prepare the surgical splint (Fig. 11). It was noticed that the lower anterior teeth were over-erupted and to maintain the proper overbite and occlusion the mandibular anterior teeth (mandibular left lateral incisor was congenitally missing) had to undergo intentional root canal treatment, crown height reduction and crown lengthening to achieve proper occlusion and esthetics. Six teeth were missing; therefore, four implants were placed according to the available height and width of bone for better anchorage and prosthetic stability. With the help of diagnostic casts, a surgical stent was prepared and under local anesthesia with adrenaline, a crestal incision was made extending from the right first premolar region to the left lateral incisor for exposure. The site was marked with the pilot drill; bone taps were used instead of drills to attain desired width (to increase the bone density of the fixture site).



**Fig. 12.** Postoperative panoramic radiograph



**Fig. 13.** Final prosthesis in situ.

The implants were placed in position (Fig. 12) and suturing of the mucosa was done. After waiting for a period of six months, all the implants were exposed and loaded (Fig. 13). There were no signs of inflammation with well-keratinized gingival tissue.

## DISCUSSION

Maxillofacial trauma may lead to defects, which may create functional and esthetic problems [5]. The loss of maxillary anterior teeth leads to resorption and remodeling of the alveolar bone. Eventually an atrophic alveolar ridge develops [9]. Various treatment options are available for patients having maxillary defects [1,3,5,9-11]. Prosthetic rehabilitation by dental implants aims to restore the anatomy, function and esthetics.

Autogenous bone is highly efficient for reconstructing the jaw anatomy [12,13], restoring esthetics [14,15] and providing biomechanical support for the placement of dental implants [16].

Autogenous bone can be harvested from the calvarium [17,18], iliac crest [19-22], tibia [23,24], fibula [25], scapula [26], symphysis [16,27-33] and buccal shelf of the ramus [16,34-45]. Every donor site varies in the quality and quantity of available bone that can be harvested [46]. Graft resorption and donor site morbidity are the main drawbacks associated with autogenous bone grafting. It is documented that membranous grafts show less resorption than endochondral bone grafts [47,48]. Intraoral donor sites are best for harvesting bone.

An average increase in bone width of 4 or 5 mm (maximum of 6 or 7 mm)[48] and 2 mm (maximum of 3 mm) increase of vertical ridge height [49] is desired in intraoral block grafting procedures. Complications of harvesting block autografts from the chin include the risk of inferior alveolar nerve paresthesia, infection, loss of tooth vitality and the postoperative sagging of the chin. Careful incision design and proper osteotomy location can prevent these complications [14,50].

Use of implant-supported or implant-retained prosthesis in severely resorbed ridges usually requires bone grafting to provide adequate support and restoration of oral functions [51]. Proper planning, modifications and different treatment plans are required to determine conditions for rehabilitation of function and esthetics in maxillofacial defects. This includes provision of health of both soft and hard tissues [52].

As was seen in the radiological and clinical examinations of both patients, the desired result in the anterior maxilla was obtained. Difficulty of prosthetic rehabilitation in maxillary defects can be minimized by proper pre-surgical planning and evaluation of every case individually. It is emphasized that prosthodontists and oral and maxillofacial surgeons should work in tandem when planning treatment of patients with maxillofacial trauma.

## CONCLUSION

In alveolar ridge defects, careful pre-surgical planning and evaluation should be carried out for proper prosthetic rehabilitation. The involvement of various disciplines is required in rehabilitation of maxillofacial trauma patients.

## REFERENCES

1- Wiens JP. Acquired maxillofacial defects from motor vehicle accidents: statistics and prosthodontic considerations. *J Prosthet Dent.* 1990 Feb;63(2):172-81.

2- Lindqvist C, Sorsa S, Hyrkäs T, Santavirta S. Maxillofacial fractures sustained in bicycle accidents. *Int J Oral Maxillofac Surg.* 1986 Feb;15(1):12-8.

3- Sykes LM, Wolfaardt JF, Sukha A. Prosthodontic rehabilitation of a patient with total avulsion of the maxilla: a clinical report. *J Prosthet Dent.* 2002 Oct;88(4):362-6.

4- Cvek M, Tsilingaridis G, Andreasen JO. Survival of 534 incisors after intra-alveolar root fracture in patients aged 7-17 years. *Dent Traumatol.* 2008 Aug;24(4):379-87.

5- Zerman N, Cavalleri G. Traumatic injuries to permanent incisors. *Endod Dent Traumatol.* 1993 Apr;9(2):61-4.

6- Al-Omiri MK, Karasneh JA, Lynch E, Lamey PJ, Clifford TJ. Impacts of missing upper anterior teeth on daily living. *Int Dent J.* 2009 Jun;59(3):127-32.

7- Riden K, Wilson P. Key topics in oral and maxillofacial surgery. 1st ed., Oxford, Bios Scientific Publications, 1998:147-51.

8- Uğurlu K, Sacak B, Hüthüt I, Karsidag S, Sakiz D, Baş L. Reconstructing wide palatomaxillary defects using free flaps combining bare serratus anterior muscle fascia and scapular bone. *J Oral Maxillofac Surg.* 2007 Apr;65(4):621-9.

9- de Freitas R, Kaizer OB, Hamata MM, de Resende DR, de Oliveira Fortes Kaizer R. Prosthetic rehabilitation of a bone defect with a teeth-implant supported, removable partial denture. *Implant Dent.* 2006 Sep;15(3):241-7.

10- Sykes LM, Essop RM. Combination intraoral and extraoral prosthesis used for rehabilitation of a patient treated for cancerum oris: a clinical report. *J Prosthet Dent.* 2000 Jun;83(6):613-6.

11- Wiens JP. The use of osseointegrated implants in the treatment of patients with trauma. *J Prosthet Dent.* 1992 May;67(5):670-8.

12- Burchardt H. Biology of bone transplantation. *Orthop Clin North Am.* 1987 Apr;18(2):187-96.

13- Marx RE. Biology of bone grafts. *OMS Knowledge Update.* Vol. 1. Rosemont, IL:

- American Association of Oral and Maxillofacial Surgeons; 1994: RCN3-17.
- 14- Schultze-Mosgau S, Schliephake H, Schultze-Mosgau S, Neukam FW. Soft tissue profile changes after autogenous iliac crest onlay grafting for the extremely atrophic maxilla. *J Oral Maxillofac Surg.* 2000 Sep;58(9):971-5; discussion 975-7.
- 15- Sullivan D, Kay H, Schwarz M, Gelb D. Esthetic problems in the anterior maxilla. *Int J Oral Maxillofac Implants.* 1994;9(suppl):64-74.
- 16- 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 Fall;7(3):360-6.
- 17- Gary JJ, Donovan M, Garner FT, Faulk JE. Rehabilitation with calvarial bone grafts and osseointegrated implants after partial maxillary resection: a clinical report. *J Prosthet Dent.* 1992 Jun;67(6):743-6.
- 18- Donovan MG, Dickerson NC, Hanson LJ, Gustafson RB. Maxillary and mandibular reconstruction using calvarial bone grafts and Branemark implants: a preliminary report. *J Oral Maxillofac Surg.* 1994 Jun;52(6):588-94.
- 19- Listrom RD, Symington JM. Osseointegrated dental implants in conjunction with bone grafts. *Int J Oral Maxillofac Surg.* 1988 Apr;17(2):116-8.
- 20- Brånemark PI, Zarb GA, Albrektsson T. Tissue-integrated prostheses. Osseointegration in clinical dentistry. Quintessence Publication; 1985:47-50.
- 21- Keller EE, Van Roekel NB, Desjardins RP, Tolman DE. Prosthetic-surgical reconstruction of the severely resorbed maxilla with iliac bone grafting and tissue-integrated prostheses. *Int J Oral Maxillofac Implants.* 1987 Summer;2(3):155-65.
- 22- Kahnberg KE, Nystrom E, Bartholdsson L. Combined use of bone grafts and Brånemark fixtures in the treatment of severely resorbed maxillae. *Int J Oral Maxillofac Implants.* 1989 Winter;4(4):297-304.
- 23- Breine U, Brånemark PI. Reconstruction of alveolar jaw bone. An experimental and clinical study of immediate and preformed autologous bone grafts in combination with osseointegrated implants. *Scand J Plast Reconstr Surg.* 1980;14(1):23-48.
- 24- Catone GA, Reimer BL, McNeir D, Ray R. Tibial autogenous cancellous bone as an alternative donor site in maxillofacial surgery: a preliminary report. *J Oral Maxillofac Surg.* 1992 Dec;50(12):1258-63.
- 25- Zlotolow IM, Huryn JM, Piro JD, Lenchewski E, Hidalgo DA. Osseointegrated implants and functional prosthetic rehabilitation in microvascular fibula free flap reconstructed mandibles. *Am J Surg.* 1992 Dec;164(6):677-81.
- 26- Buchbinder D, Urken ML, Vickery C, Weinberg H, Sheiner A, Biller H. Functional mandibular reconstruction of patients with oral cancer. *Oral Surg Oral Med Oral Pathol.* 1989 Oct;68(4 Pt 2):499-503
- 27- Collins TA, Scand J. Onlay bone grafting in combination with Brånemark implants. *Oral and maxillofacial surgery clinics of North America.* WB Saunders; 1991:893-902.
- 28- 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 Dec;49(12):1277-87.
- 29- Misch CM. Enhance maxillary implant sites through symphysis bone graft. *Dent Implantol Update.* 1991;2:101-4.
- 30- Pikos MA. Buccolingual expansion of the maxillary ridge. *Dent Implantol Update.* 1992 Nov;3(11):85-7.
- 31- Jensen J1, Sindet-Pedersen S, Oliver AJ. Varying treatment strategies for reconstruction of maxillary atrophy with implants: results in 98 patients. *J Oral Maxillofac Surg.* 1994 Mar;52(3):210-6; discussion 216-8.
- 32- Misch CM, Misch CE. The repair of localized severe ridge defects for implant

- placement using mandibular bone grafts. *Implant Dent.* 1995 Winter;4(4):261-7.
- 33- Bernhart T, Weber R, Mailath G, Ulm C, Dörtbudak O, Watzek G. Use of crestal bone for augmentation of extremely knife-edged alveolar ridges prior to implant placement: report of 3 cases. *Int J Oral Maxillofac Implants.* 1999 May-Jun;14(3):424-7.
- 34- Brånemark PI, Lindström J, Hallén O, Breine U, Jeppson PH, Ohman A. Reconstruction of the defective mandible. *Scand J Plast Reconstr Surg.* 1975;9(2):116-28.
- 35- Sindet-Pedersen S1, Enemark H. Reconstruction of alveolar clefts with mandibular or iliac crest bone grafts: a comparative study. *J Oral Maxillofac Surg.* 1990 Jun;48(6):554-8; discussion 559-60.
- 36- Braun TW, Sotereanos GC. Autogenous regional bone grafting as an adjunct in orthognathic surgery. *J Oral Maxillofac Surg.* 1984 Jan;42(1):43-8.
- 37- Misch CM, Misch CE. The repair of localized severe ridge defects for implant placement using mandibular bone grafts. *Implant Dent.* 1995 Winter;4(4):261-7.
- 38- Misch CM Comparison of intraoral donor sites for onlay grafting prior to implant placement. *Int J Oral Maxillofac Implants.* 1997 Nov-Dec;12(6):767-76.
- 39- Collins TA, Nunn W. Autogenous veneer grafting for improved esthetics with dental implants. *Compendium.* 1994 Mar;15(3):370, 372-4, 376.
- 40- Pikos MA. Buccolingual expansion of the maxillary ridge. *Dent Implantol Update.* 1992 Nov;3(11):85-7.
- 41- Pikos MA. Facilitating implant placement with chin grafts as donor sites for maxillary bone augmentation--Part I. *Dent Implantol Update.* 1995 Dec;6(12):89-92.
- 42- Pikos MA. Chin grafts as donor sites for maxillary bone augmentation--Part II. *Dent Implantol Update.* 1996 Jan;7(1):1-4.
- 43- Pikos MA. Alveolar ridge augmentation with ramus buccal shelf autografts and impacted third molar removal. *Dent Implantol Update.* 1999 Apr;10(4):27-31.
- 44- Misch CM. Ridge augmentation using mandibular ramus bone grafts for the placement of dental implants: presentation of a technique. *Pract Periodontics Aesthet Dent.* 1996 Mar;8(2):127-35.
- 45- Perry RT. Ascending ramus offered as alternate harvest site for onlay bone grafting. *Dent Implantol Update.* 1997 Mar;8(3):21-4.
- 46- Nicolucci B. Autogenous bone grafts. *Oral Health.* 1998 Jul;88(7):37-42.
- 47- Smith JD, Abramson M. Membranous vs endochondrial bone autografts. *Arch Otolaryngol.* 1974 Mar;99(3):203-5.
- 48- Zins JE, Whitaker LA. Membranous versus endochondral bone: implications for craniofacial reconstruction. *Plast Reconstr Surg.* 1983 Dec;72(6):778-85.
- 49- Urist MR. Surface-decalcified allogeneic bone (SDAB) implants. A preliminary report of 10 cases and 25 comparable operations with undecalcified lyophilized bone implants. *Clin Orthop Relat Res.* 1968 Jan-Feb;56:37-50.
- 50- Rubens BC, West RA. Ptosis of the chin and lip incompetence: consequences of lost mentalis muscle support. *J Oral Maxillofac Surg.* 1989 Apr;47(4):359-66.
- 51- Cakan U, Anil N, Aslan Y. Prosthetic rehabilitation of a mandibular gunshot defect with an implant-supported fixed partial denture: a clinical report. *J Prosthet Dent.* 2006 Apr;95(4):274-9.
- 52- Morton D, Fridrich K, Aquilino SA, Fridrich TA. Interdisciplinary treatment of severe maxillofacial trauma: a clinical report. *J Prosthet Dent.* 2000 Aug;84(2):133-5.