Intra-Oral Bone Harvesting for Oral and Maxillofacial Reconstruction

التطعيم الذاتي من عظام الفكين الاعلى والاسفل في اعادة بناء عيوب عظام الوجه والفكين

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Abstract

Background : bone grafts represent one of the earliest devised to reconstruct bony defects in oral and maxillofacial surgery .

Aim of study :the present study was focused on developing better bone harvesting technique which is simple, safe with less post- operative morbidity.

Patients and methods : this study was conducted on 15 patients with facial bone defects , due to physiological resorption of alveolar ridge (60% of patients), missile and road traffic accident (26%).

Bone was harvested from intra-oral donor sites , he symphyseal region (66.6 %) and retro-molar area (33.3 %). 53.3 % of patients were operated under local anesthesia and require no hospital admission, with little time consumption, while (46.6 %) patients were operated under general anesthesia. Both cortical and cancellous bone was harvested from intra- oral donor sites and fixed by mono- cortical screws.

Result : in this study , the complications of this technique for bone harvesting being minimal , donor site complications were occurred in three cases only (19.9 %) , which include hematoma formation and paraesthesia of the mental nerve , but there is no signs of teeth vitality loss in all patients , the degree of pain and swelling related to the donor sites being mild..

Conclusions: intra-oral bone graft harvesting simple, safe, less morbidity, little resorption , can be harvested under local anaesthesia with no or less time hospitalization period. Complication associated with this technique being minor, included paraesthesia, hematoma, teeth invitality.

Keywords: Oral Bone Harvesting, Oral and Maxillofacial Reconstruction.

الخلاصة:

ترقيع العظام تمثل واحده من اقدم الطرق لاعادة بناء العيوب العظمية في جراحة الوجه والفكين . هذه الدراسة عملت على تطوير طريقة لترميم فقدان العظام تكون امنة وبسيطة مع نسبة مضاعفات قليلة جدا .الدراسة اجريت على (15) حالة من حالات فقدان جزء من احد عظام الوجه نتيجة قلع الاسنان الذي ادى الى فقدان نسبي من العظم السنخي (60%) ،وكذالك اصابات الانفجار والحوادث المرورية (20%) .تمت عملية ترقيع العظام المفقودة بواسطة عظام اخذت من الفك الاسفل من داخل الفم ، حيث اخذ العظم من منطقة الحنك (66.6%) ومن منطقة الرحى (33.3%) تم اجراء العملية تحت التخدير الموضعي لي (53.3%) من المرضى ،الذين لم يتطلب التداخل الجراحي ادخالهم الى المستشفى ،في حين (46.6%) تمت العملية تحت التخدير العام .كانت مضاعفات عملية الترقيع العظمي خلال هذه الدراسة قليلة جدا حيث ظهرت في ثلاث حالات فقط (19.9%).

Introduction

Facial disfigurement can result from bone deficiency following trauma or surgery. To minimize the associated functional and cosmetic problems a number of reconstructive options are available to the surgeon including the use of autogenous .[1]

The transplantation of tissues and organs represents one of the most fascinating strategies to repair

or replace diseased or missing anatomical structures. Bone, by its character, differs substantially from solid organs and immediately revascularized tissues with respect to transplantation. Bone regenerates, and does so with autogenous resources including cells, cytokines and blood vessels, regardless of the source of graft material. Bone also shares, with other transplantable organs and tissues, the ability to induce a variety of immunological responses reflecting its nature .[2]Autogenous bone is still considered to be the "gold standard" in the realm of grafting materials as it is the only material that provides all three fundamental mechanisms of osteoconduction, osteoinduction, and osteogenesis. [3,4] The ideal bone graft should be osteoinductive and conductive, biomechanically stable , disease free and contain minimal antigenic factors. These features are all present with autograft bone.[5]

The autologous bone harvesting requires a donor site surgery that may increase patient's

morbidity. This procedure can be associated with a number of complications according to the harvested site; intraoral sites can involve damage to the mental and lower dental nerves, increasing the risk of the mandibular ramus fracture and involvement of tooth apices. Extraoral sites harvesting may cause hemorrhage, pain, instability of the sacroiliac joint and gait disturbances. [6] Extra-oral bone graft of the iliac crest is most often used for major jaw reconstruction; it has the disadvantages of the need for general anaesthesia, altered ambulation, two surgical sites, the need for hospitalization and higher cost.**[7]** For the treatment of smaller defects, intra-oral harvest sites from the mandible and maxilla offer several benefits. The proximity of the donor sites can reduce anaesthesia and operative time, enabling outpatient treatment, no cutaneous scaring, minimal discomfort and a decreased morbidity from the graft harvest compared with extraoral locations. **[8]** Small bones used for such grafting are commonly obtained intra-oral sources, such as the mandibular ramus and retromolar area, It has been reported that use of intraoral donor sites has several advantages as compared to extraoral sites, including reduced operation and hospitalization time, and no cutaneous scarring.[9] There was no gold-standard treatment applicable to all patients[10].

Tthe present study focused on developing better bone harvesting technique which's simple ,safe, with less post-operative morbidity.

patients and methods.

Data was obtained in this study by reviewing the results of treatment 15 patients , 11(73.33%) patients were males , and 4 (26.67%) patients females. Their age range from 20-40) years old , all patients subjected to autogenous bone graft taken from mandibular bone to reconstruct facial defect .All patients in this study were treated in Maxillofacial Unit at Ghazi Al-hariri Teaching Hospital for Surgical Specialities at Medical City in Baghdad / Iraq from October 2014 to October 2015.pre-operative preparation for all patients included in this study ,a standardized record frame was made.

This protocol consists of four main topics , personal details, pre-operative evaluation , operative and post-operative evaluation .

Pre-operative orthopantomograph was done for all the cases pre and post-operatively to assess the intra-oral bony defect , and evaluate the location of the inferior alveolar neurovascular bundle , also helps in defining the relation between the maxillary sinus and the possible implant .Computed tomography and true lateral radiograph was done for selected cases .Intra-oral examination was performed to exclude any signs of infection. Pre-operative chlorohexidine mouth wash was instructed to be used by the patient for at least one week .The etiology of bony defects in this study was as follow, missile injuries in two cases , bony defects was of the nasal bridge in one of the cases

and anterior bony defect of the upper alveolar ridge in the second case, road traffic accident in two cases , bony defects were in the upper anterior alveolar ridges, implantology, sinus lift procedure in five cases, physiologic resorption in four cases ,alveolar ridge resorption due to dental extraction, residual deformity in two cases , one of the cases was zygomatic bony defect , and the second was mal-union of mandibular body fracture. the operation was done under local anaesthesia in eight (53.33%) patients. while the rest seven (46.67%0 patients was done under general anesthesia. those patients who treated under local anesthesia are five patients of the sinus lift procedure and three patients of physiologic resorption of the alveolar ridges.

Operative surgery.

Type of incision **,** vestibular incision is made in the alveolar mucosa 5 mm or more apical to the mucogingival junction between the premolars in symphyseal region while in ramus and retro-molar area the incision access to the ramus area for bone harvest begins in the buccal vestibule medial to the external oblique ridge and extends anteriorly and lateral to the retromolar pad. Starting the incision on the ascending ramus no higher than the level of the occlusal plane minimizes the possibility of cutting the buccal artery or exposing the buccal fat pad. The incision continues anteriorly into the buccal sulcus of the molar teeth. The mucoperiosteal flap is then reflected from the mandibular body on the lateral aspect of the ramus. With a notched ramus retractor, the flap is elevated superiorly along the external oblique ridge to the base of the coronoid process. After bone exposure , bone harvesting was done according to rules of 5 , which's 5 mm apical to the apices of the teeth .The technique of harvesting bone was by making holes on the outer cortex by surgical bur with irrigation by normal saline then connection between these holes was done to make a rectangular shape. Finally a small osteotome was used to harvest the bone. The type of bone graft fixation were mono-cortical bone screw fixation in 13 (86.66%) patients , mini-plate in one (6.67%) patient and no fixation in one (6.67%) patient. The types of bone grafts either cortico-cancellous bone blocks or cancellous bone chips, the blocks are monocortical. Inlay bone graft was used to reconstruct thirteen patients , onlay bone graft in one patient , while en-block reconstruction in only one patient . The bony defect that's reconstructed range from (1-2)cm in width , and (1)cm in height . bone harvesting from the symphyseal region in teen (66.67%) patients and five (33.33%) patient from external oblique ridges

Results.

the age of the patients on this study was ranged from (20-40) years old, 6 patients rang between (20-29)years and 7 patients ranged between (30 -39)years which was greatest age group in our study and 2 patients ranged between (40 -49) years old , 11 (73.33%) patients were males , and 4 (26.67%) patients females.

etiology for harvesting bone graft.

Intra-oral bone graft was used for small bony defects that was caused by either missile injury ,road traffic accident ,resorption , or for implant placement on the upper jaw in which the maxillary sinus extended close the apices of upper ridges that prevent implant placement .

	Missile injury	Road traffic accident	Sinus lift procedure (implantology)	Physiologic resorption	Residual deformity
No. of patients	2	2	5	4	2

Table(1) etiology of bony defect.

The anatomical region of bone graft placement our results revealed that on the upper anterior region in four patients , sex patients for upper posterior region (premolar-molar region) , three patients for mandibular reconstruction ,one patient used for nasal bone reconstruction and one patient for zygomatic bone defect.

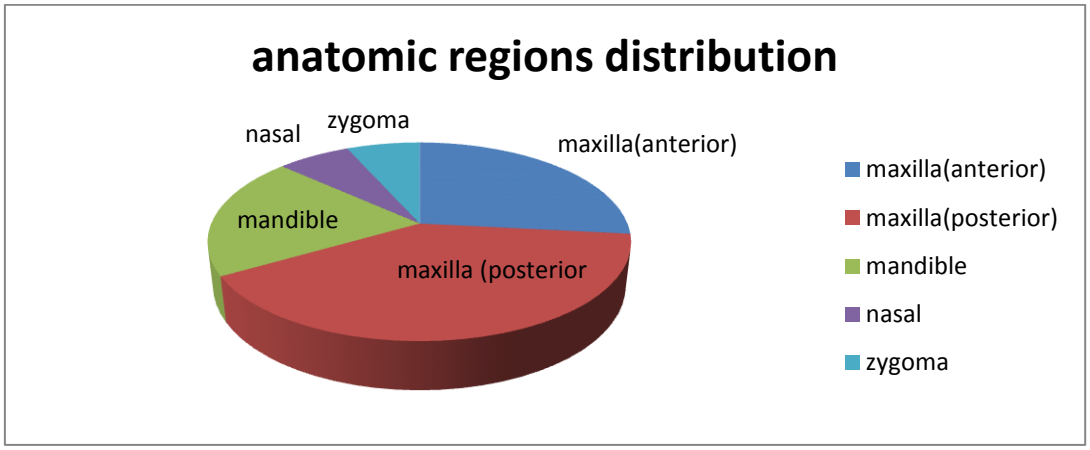
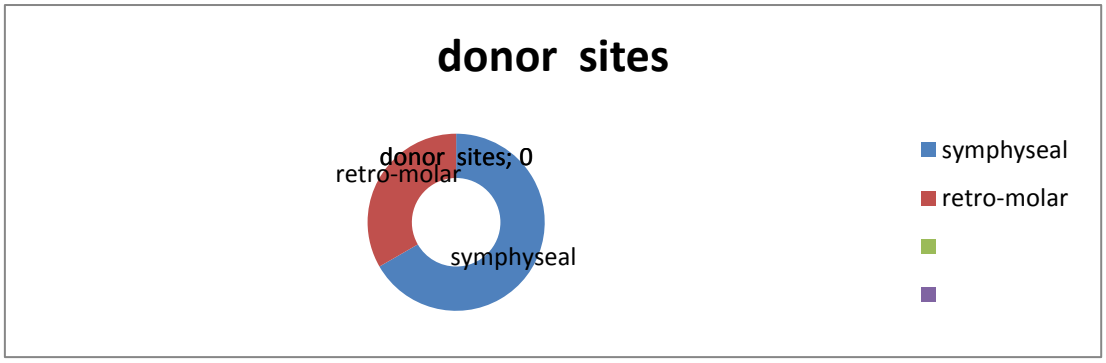


Figure 2. anatomic regions distribution of bone graft placement.

Donor site, Intra-oral bone graft in this study was harvested from the symphyseal area in ten (66.67%) patients and from external oblique ridge in five (33.33%) patients.



Fig(4) donor sites distribution.

type of fixation, The type of bone graft fixation were mono-cortical bone screw fixation in 13 (86.66%) patients, mini-plate in one (6.67%) patient and no fixation in one (6.67%) patient.

the time of operation and hospitalization,the operative time for harvesting bone takes about (30-60) minutes, in which 8 (53.33%) patients take 30minutes and 7 (46.67%) patients take about (60) minutes .The hospitalization period for patient that require admission to the hospital range from (1-3)days , only seven patients require admission to hospital (five patients admitted for three days and two patients for two days only. . post-operative care, extra-oral pressure dressing was applied on the chin area to aid in mentalis muscle adaptation and prevent post-operative hematoma, antibiotic administration for 5 days post-operatively, Chlorohexidine mouth wash twice daily is instructed to all patient, Suture removal after one week .

complications of intra-oral bone graft The complication of the donor and recipient sites following intra-oral bone graft harvesting being minimal. In this study the complication were uncommon , among (15) patients , the recipient site complication occur in two patients, in which wound dehiscence occur and exposure of the bone graft and subsequent sequestration and failure of bone graft, The donor site complications was occurred in three patients , paraesthesia of the mental nerve

occur in one patient and hematoma formation occur in two patients which treated immediately by evacuation through one stitch removal and extra-oral pressure dressing on chin area.

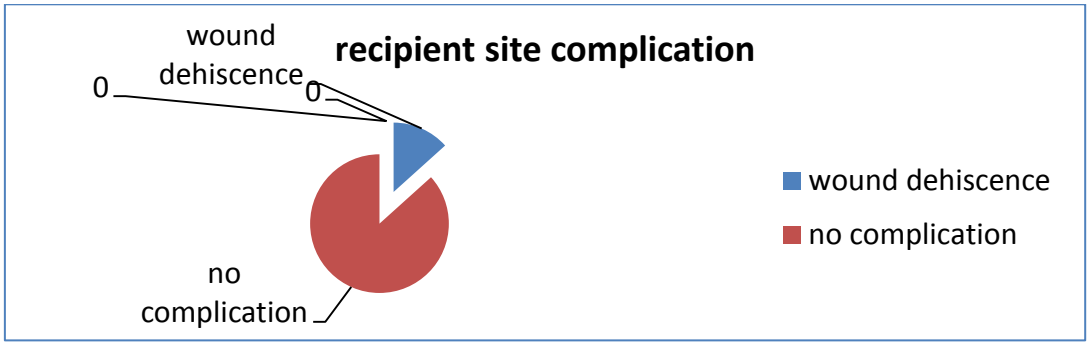


Figure 5. recipient site complication

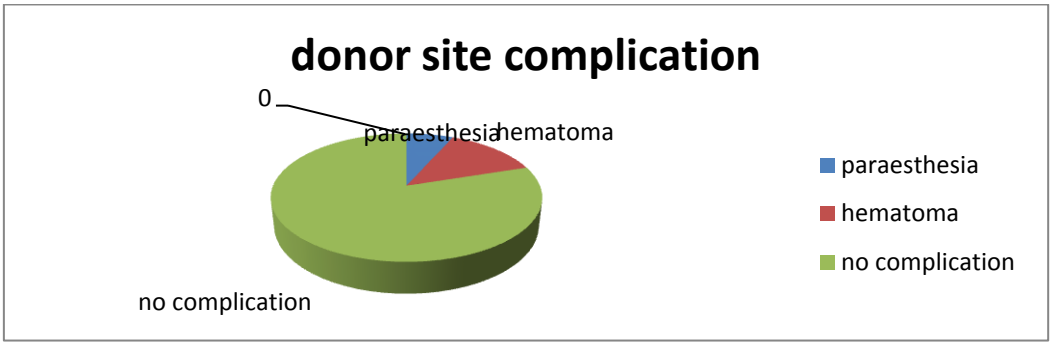


Figure 6. complication associated with donor site harvesting

Photograph 1. patient present with history of missile injury , complaining of comminuted nasal bone fracture.

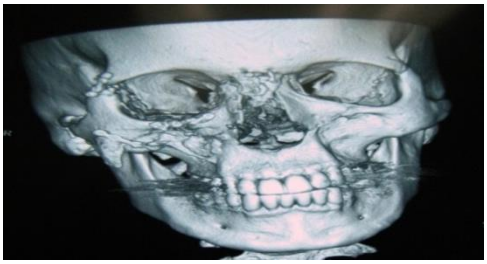


photo 2.3D C.T. showing the comminution of the nasal bridge.

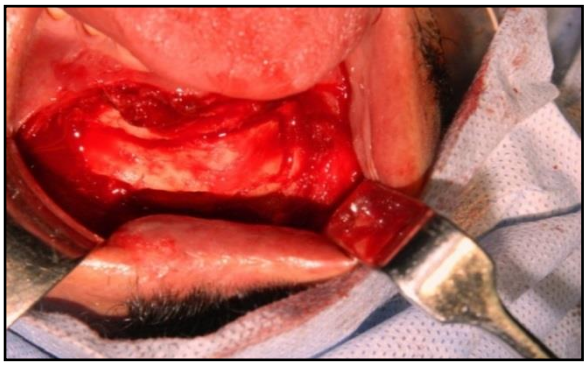


Photo 3..Symphyseal donor site for bone harvesting.

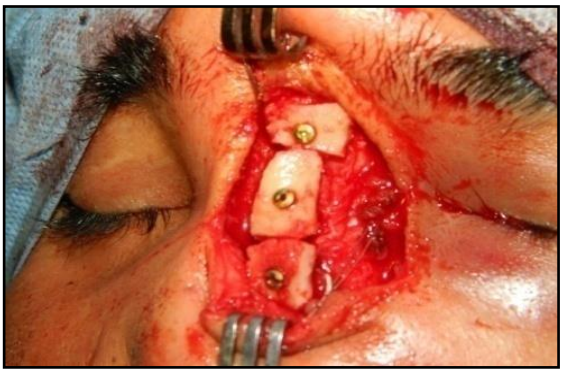


Photo 4. Nasal bridge reconstruction by bone graft harvested from chin area and fixated by mono-cortical screw.

Photo 5 .Post-operative profile view for nasal bone.

Discussion

Over the years the use of autogenous block bone grafts harvested from intraoral sites has increased.The fact that endosseous implant placement requires smaller size of bone block grafts has brought about the transition from utilization of calvarial and tibial grafts to suitable intraoral sites [11].

Block grafts obtained from mandibular symphysis, retromolar area, mandibular ramus and the maxillary tuberosity have been reported a high success rate in providing ridge augmentation and bone reconstruction [12]. Our results revealed that the age of the patients of our study was ranged from (20-49) years old , six patients at age of (20-29) years and seven of them was at (30-39) years which was the greatest one and two patients were at (40-49) years old , 11 (73.33%) patients were males , and 4 (26.67%) patients females ,our results was in agreement with Mazess RB , 1982 he reported and explained that bone mass reaches its maximum level approximately 10 years after the end of linear growth. This level normally remains fairly constant as bone is continually deposited and absorbed throughout the skeleton until sometime in the fourth decade of life, when bone mass begins to gradually decrease, Humans reach peak bone mineral density in their 30s, although it is lower in women than in men. Women lose an estimated 35% of their cortical bone and 50% of cancellous bone as they age, while men lose only two-thirds of these amounts [13] .

Etiology for harvesting bone graft our study revealed that the physiological resorption of alveolar ridge (60% of patients) was the most common etiology for intra-oral bone graft harvesting , and this was related to the amount of bone than can be harvested from intra-oral donor sites .Predictable increase averaging 4 or 5 mm (maximum, 6 or 7 mm) in ridge width and 2 mm (maximum 3 mm) in vertical ridge height have been documented with intraoral block grafting procedures . [14] So in our study bone defect because of missile and road traffic accident (26.66 %) will be bigger and beyond the amount of bone that can be harvested by this method .

anatomical region of bone graft placement**,** The several advantages of intra-oral bone graft make their indications increase , in this study we used this technique to reconstruct the alveolar ridge of the upper and lower jaw , nasal bridge and zygomatic bone reconstruction. After tooth loss, the maxillary alveolar process undergoes progressive, irreversible resorption that results in a massive loss of substance, both vertically and horizontally. Atrophy-related bone resorption markedly reduces the local host bone available for implant placement over the years [15] , and this is similar to what we found because the most anatomical regions that's reconstructed was the alveolar ridge of the upper jaw (sinus lift 33.3%) for implantation ,due to resorption of the alveolar ridge that occur following teeth extraction.

donor site , the bone graft was harvested in this research from two intra-oral sites , from the symphyseal and retro-molar ridges. In our study the symphyseal donor site was used more than the retro-molar area , the preference of the symphyseal region over the retro-molar area related to simple surgical access of the chin area, and the amount of cancellous cellular density that provide from the chin area compared to the mostly cortical nature of ramus area which in agreement with Cranin et al 2001which reported that the chin graft provides both cortical and medullary bone necessary for osteoinduction and osteoconduction[16,17].

time of operation and hospitalization, Intra-oral bone graft harvesting can be performed under local anesthesia and complications and postoperative discomfort as seen after harvesting from distant sites such as the iliac crest do not occur [18,19]. No hospitalization is needed after surgery and the operation can be performed under local anaesthesia ,so we found that (53.4 %) of the patients (was operated under local anaesthesia and require no hospital admission , with little time consumption . Those patients(46.6%) who operated under general anaesthesia require from (1-2) days of hospitalization that's small period when compared with other bone harvesting technique .

complications of intra-oral bone graft,

our study revealed that the complications of this technique for bone harvesting being minimal , donor site complications occurred in three cases only (19.9%) , which include two patients complant of hematoma formation and one patient complant paraesthesia of the mental nerve , but there's no signs of teeth vitality loss in all patients , the degree of pain and swelling related to the donor sites being mild. The mental nerve paraesthesia occur in only one patient (6.6%) and may be related to retraction , and this may be related to rule of 5 (5mm away from the mental foramen) , that depend on it during operation .While, In a retrospective study, Raghoebar G M et al 2001 found that after 3 years of harvesting bone from the chin, half of the 20 patients reported decreased sensibility in the donor area [20,21]. And this can be explained by that all patients were treated by the same surgeon and duration of harvesting and fixation was less than 30 minutes,

Conclusion.

autogenously bone graft being the gold standard for maxillofacial defect reconstruction, intra-oral bone graft harvesting being simple , safe , less morbidity , with little resorption, can operated under local anesthesia with no or less time hospitalization period. Symphyseal and retro-molar area can be used for reconstruction of small bony defect , mostly used for alveolar ridge resorption (for implant placement), with little morbidity post operatively like hematoma formation and transient paraesthesia of the mental nerve.

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