Evaluation of different modalities of intraorally harvested bone graft in oral and maxillofacial reconstructive surgery

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Abstract

Objectives: Although the iliac crest is most often used in major jaw reconstruction for dental implants and other maxillofacial reconstructive surgeries it has the disadvantages of higher costs, alteration of ambulation, and the need for hospitalization and general anesthesia. , bone grafts harvested from the maxilla and mandible offer several benefits. This study was conducted to the quality and the quantity of intraorally harvested bone graft from different sites, and assessing the suitability of each donor site for the selected recipient site.

Material and Method: Twenty-two patients (27 bone graft donor sites) (5 of them with bilateral alveolar reconstruction), of both sexes (9 males and 17 females), were operated on by harvesting intraoral bone grafts from different sites used in different reconstructive surgeries. Specific intraoral donor sites were used for specific type of surgery according to the feasibility and need. Preoperative and intraoperative evaluation of the recipient defect size and selecting proper intraoral donor sites was the paramount parameter in our study.

Results: The success rate was 96.2% in a follow-up period of 6-18 months, the patients were evaluated for bone graft stability, ability to insert the dental implant, stability of the implant, stability in orthognathic surgery, and the satisfactory aesthetic and functional results, all the patient had satisfactory results and only one case of particulates cortical bone had developed fibrous union ,

Conclusion: Intraoral bone graft can successfully be used for treating small and selected facial and alveolar defect with minimal complications in the donor sites, patients report minimal discomfort and morbidity and all complications were temporary. Types of fixation, prompt graft adaptation were the most important factors for success. Symphysis of the mandible has the advantage of easy access and visibility and can easily be done under local anesthesia. However, for reconstruction of a bigger bony defect, an extraoral bone grafting is recommended .

Keyword *Intra-oral donor site, bone graft, reconstructive surgery*

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Introduction

Resorption of alveolar bone is a common clinical problem, which can be a physiologic or a pathologic process. The deformities and defects may occur as a result of tooth loss by extraction, advanced periodontal diseases or trauma, long-term use of removable appliances, developmental defects/clefts, congenitally missing teeth, odontogenic cysts, and tumors[(1)]. It may result in an esthetically and functionally compromised prosthesis. The end goal of the therapy is to provide a functional restoration that is in harmony with the adjacent natural dentition. Thus, augmentation of bone is often necessary[(2)].

In the 1990s, implantology, distraction osteogenesis, and guided tissue regeneration significantly expanded the capabilities of today's reconstructive and preprosthetic surgeries[(3)]. History of the autogenously bone grafting goes back to the nineteenth century[(4)]. Until the present day, autogenous bone grafts are still considered as the gold standard in reconstructive oral and maxillofacial surgery[(5-8)]. The autograft is considered as osteogenic, osteoconductive and osteoinductive, it can be derived from extra oral source or intraoral source and can be used in block or particulate form[(2)]. They are highly advantageous but are associated with risks, such as donor site morbidity, limited bone availability, size mismatch, drooping of the

chin, nerve damage, tooth devitalization, gingival recession, increased postoperative discomfort, infection and blood loss[9]. An extraoral donor site often required for ridge augmentation in totally edentulous The surgical convenience of iliac grafts is negated, in part, by the additional requirements and patient morbidity; such procedures are, often require the use of general anesthesia, increased the likelihood of intra- and postoperative complications, and can result in considerable pain. Other external donor sites include calvarium, rib, and tibia[11]. Block bone grafts from the symphysis, ramus and buccal shelf offer advantages over iliac crest grafts, including close proximity to donor and recipient sites, convenient surgical access, decreased donor site morbidity and decreased cost[12]. This study was conducted to evaluate harvesting intraoral bone grafts and using it in reconstructing alveolar bone defects and other facial defects from quality and quantity point of view, suitability, and the related complications.

Intra-oral bone grafts have been used for alveolar augmentation to allow implant placement with good results[13, 14]. Bone harvested from the maxillofacial region appears to have inherent biologic benefits that may be attributed to the embryologic origin of the donor's bone. The majority of bones in the skeleton are of endochondral origin with the exception of alveolar bone, the maxilla, and body of the mandible that develop intramembranously while the condyle develops by endochondral bone formation [15]. There is substantial evidence that intramembranous bones (such as mandible) show less resorption and revascularize more rapidly than endochondral bone[16]. On the other hand, according to some studies resorption of on-lay grafts depends on the relative ratio of cortical to cancellous bone rather than the embryologic origin[17]. The use of cortico-cancellous bone grafts in implant dentistry was first reported by Breine and Branemark[18]. The healing of autogenous block grafts, described as “creeping substitution” where viable bone replaces the necrotic bone in the graft, is highly dependent on angiogenesis and revascularization[2].

The morbidity associated with intraoral donor sites is usually low; the limited amount of bone is a prime disadvantage[19, 20].Complications include endodontic problems, neurosensory disturbances, infections and wound dehiscence can happen in low percent[21, 22].

Mandibular donor bone grafts exhibit little volume loss and show good incorporation at short healing times. Implant placement shortly after graft incorporation has a stimulating effect on the bone, maintaining the augmented bone volume and preventing further loss. Bone blocks from the symphysis have been used as on lay grafts for the alveolar process augmentation[19]. The major disadvantage with its use is the potential for the post-operative altered sensation of the teeth and chin area[23].

Interpositional autogenous bone grafting can be done in Inferior repositioning of the maxilla, or surgeries involving simultaneous mandibular advancement and anterior or posterior segmental alveolar osteotomies of maxilla or mandible[24]. The use of bone grafting during Lefort I maxillary osteotomy is to bridge the osteotomy gaps and to promote early consolidation, also to unload the vertical forces that tend to cause a vertical relapse[25].

The mandibular ramus and corpus are common sites for harvesting cortical bone. Bone can be taken from the buccal side in the molar area and distal to the molars.[22] and are associated with fewer complications[26, 27]. These donor sites have been used for reconstructing the resorbed alveolar ridge prior to dental implant placement[13, 22, 28, 29]. Wood and Moore were first to use coronoid process bone graft for sinus floor augmentation[30]. The coronoid process has also been used in orbital floor reconstruction after a blowout fracture[31],for nasal augmentation[32] and for paranasal augmentation in conjunction with orthognathic surgery[15] and with no functional limitations. The bone of maxillary tuberosity can be used to fill small local alveolar and sinus floor augmentation prior to dental implant placement[33]. The volume is rather limited, and the bone is mostly cancellous. The thicker soft tissue in the tuberosity region can mislead the assessment of this donor site[19]. The anatomic limitations of this area include the maxillary sinus, pterygoid plates[34]. This study was conducted to evaluate the use of intra-oral bone graft in the repair of a more localized alveolar defects.

Material and Method

This study included twenty-two patients with 27 intra, and extra oral bony defects were evaluated for the need for bone graft in the reconstructive surgery to improve function and aesthetic. The patients were collected in the maxillofacial surgery unit in Sulaimani teaching hospital. Informed consent was taken before doing any procedure or publishing the information of any patient. Those patients were operated on by augmentation of the intraoral or extraoral (facial) bony defect by bone graft harvested intra –orally. Preoperative, intraoperative, immediate postoperative radiographs were done in addition to photographs during the follow-up period for the patients.

All patients were in good oral hygiene and checked for plaque and calculus, scaling and polishing measures were done if needed, Instructions for chlorhexidine mouthwash (0.2%) twice daily for one week preoperatively. All smoker patients, Patients with systemic disease and those with periodontal diseases or those with bad oral hygiene habit were excluded from the study .

For patients with intra-oral alveolar bony defects (18 grafting sites), the surgical procedure was done under local anesthesia (Lidocaine 2% with adrenaline 1:80,000). While other patients who needed reconstruction of facial defect or needed orthognathic surgeries, operations were done under general anesthesia with local anesthesia infiltration to the surgical site to gain bloodless field .

Patients instructed to do mouthwash with chlorhexidine (0.2%) preoperatively, dexamethasone (8mg) was given intravenously before starting the operation. Prophylactic antibiotics; include amoxicillin 1000 mg by intravenous injection shortly before the surgery, or one hour orally, then half of this dose was given after 3 hours. Before starting harvesting intraoral bone grafts, evaluation of the amount of bone graft needed was done preoperatively and intraoperatively after flap elevation in the recipient site (figure 1&2). Bone was harvested in different amount and sizes intra–orally which includes symphysis of the mandible (figure 3), body and ramus of mandible (figure 7), coronoid of the mandible, and tuberosity of maxilla then used accordingly. For cortical block graft harvested, a sterilized ruler used to measure the length of the graft and if the graft needed as particulates form, the cortico-cancellous graft is milled by bone mill then inserting it inside a ten cc syringe. Collectively we used the following score according to the size of the bone collected for easy graft measurement; small means (0.5-1.0 mm) or (5-10 ml), moderate means (1.1-1.5 mm) or (1.1-1.5 ml) and large means (more than 1.5 mm) or (more than 1.5 ml).

Different methods were used for fixation on the recipient site, like titanium mesh, collagen membrane, and osteosynthesis screw. Titanium mesh needed molding it to the grafted area and small titanium screws (1-1.5 mm in diameter) used for optimal fixation (figure 4). Hydroxyapatite powder or particles added to some grafts in some patients with alveolar bone defects, especially those grafts that used as particulates form in a ratio of 1:3 (75% autogenous bone and 25% hydroxyapatite) .

Postoperatively, dexamethasone 8mg was given 12 hourly for the first day followed by 4mg 12 hourly for the next day. Antibiotics prescribed as one dose, half of the preoperative dose was given 3 hours after starting the surgery. Analgesics we used injectable diclofenac used 12 hourly for the first two days followed by oral mefenamic acid capsules for five days and chlorhexidine gluconate mouthwash (0.12%) 3 times daily prescribed for two weeks and all patients instructed for meticulous oral hygiene.

Regarding patients who needed a dental implant, the implants were placed either immediately in the same procedure of alveolar reconstruction, or after (6 months) of bone grafting and the non-resorb able fixative materials were removed at that visit. Dental implantation was done, prosthetic rehabilitation performed at the same implant center (figure 5-7)

Patients were grouped, according to the types of associated surgery essentially into three groups. The first group (18 patients) in whom bone graft was harvested to reconstruct alveolar bone defect, The second group (5 patients) include those whom bone graft was harvested to be used in orthognathic surgery as inter-positioning graft, and the third group was for those in need for facial bony reconstruction (4 patients). The first group can be further subgrouped into those patients in whom grafts were taken for sinus lifting augmentation (11 out of 18 grafting sites) and those taken to augment anterior maxillary alveolus (esthetic zone) and then subsequent implant placement (7 out of 18 grafting sites)

For post-operative follow-up and assessment, the patients were clinically examined in the same week; panoramic radiographs were taken after one week and suture removal performed (after 8-14 days). All patients were followed up for the success of the graft in one, three, six, nine, and twelve months by clinical examination and with 3-month intervals panoramic radiographs. Pain and neurosensory deficit at the donor site were evaluated as present or absent by patient reporting; this was evaluated every week

Results

At the end of the follow-up period, which was, at least six months, data were collected and transplanted into codes using a specially designed coding sheet, and then interred into a computerized database structure. An expert statistical device was sought for. Two types of tests used either Chi-square or ANOVAs tests .

Relation of bone quantity with each donor site

In almost all donor sites, the amount of bone harvested was moderate to large quantities, and it was sufficient to complete the procedure satisfactory, with exception of the site of tuberosity of maxilla in which the amount of bone harvested was small amount, and it was hardly sufficient to complete the procedure of reconstruction, and here the amount of the alloplastic material was increased to compensate for the deficiency in the bone graft. (Table 1)

Relation of bone quality regarding each donor site ,cortical bone was harvested from the coronoid, symphysis, body and ramus of mandible donor sites. Only pure cancellous bone could be taken from the tuberosity. Significantly, both cortical and cancellous bone type were harvested from the symphysis of mandible

Relation of bone quality and type of fixation, cortical bones grafts were fixated using titanium mesh and osteosynthetic screw a. Collagen membrane was used for cancellous graft fixation and in the case of cortico- cancellous particulated bone on lay graft (and in this case it was not successful), Titanium mesh with or without adding collagen was significantly needed in Cortico- cancellous grafts. (Table 2)

Relation between type of reconstruction and donor sites ,in this study , cases with alveolar bone defect were reconstructed mostly by grafts taken from symphysis of mandible , also by grafts taken from tuberosity of maxilla, while for orthognathic and facial reconstructive surgeries, body / ramus and coronoid process of mandible were significantly used as in (Table 3).

The relation between failure of graft union and type of fixation ,one case in which a particulated bone harvested from symphysis and used as on lay graft in alveolar reconstruction had developed fibrosis, and it is considered as a failure, in this case, titanium mesh was

used for fixation, (Table 4). All alveolar reconstructive surgeries were performed under local anesthesia, while the other two surgical modalities were performed under general anesthesia. Relation of donor sites with each type of postoperative complications,

Some complications were related to a particular donor site. Post-operative pain and edema were developed in 30% of patients in whom the bone graft was harvested from the symphysis, while. 20% of symphysis graft site had developed temporary neurosensory deficit. Body and Ramus of Mandible grafts had the least complications significantly. It has been noticed that post-operative pain and edema and small sinus perforations at the donor sites was significantly related to an older group of age (mean 43.5 years), the younger group didn't report any complication see (Table 5) and (figure 8).

Discussion

In this study, all the patients were satisfied with the result of the reconstructive surgeries done. The success rate was 96.2% (26 out of 27 cases). The ends were bone graft stability, the ability to insert the dental implant, stability of the implant, stability in orthognathic surgery, and the satisfactory aesthetic and functional results. 96% percent of cases treated with such grafts had satisfactory, and only one case of particulated cortical bone used as on-lay, harvested from the symphysis of mandible in a patient with huge intraoral defect resulted in fibrous union, and the cause was blamed on inadequate fixation , the quality of body/ramus of the mandible bone grafts was cortical and here it is not recommended to take cancellous component beyond the outer cortex in order not cause damage to the inferior alveolar nerve, this was also recommended in Bedrossian et al. studies, Picko, Davis et al, Schwartz et al. studies[12, 35-37]. The quality of coronoid process grafts was cortical involving a two layer of dense cortical bone surrounding a thin layer of cancellous bone, and this was also described by many studies[15, 38]. Both cortical and cancellous components were involved in the symphysis of mandible., and was significantly used in alveolar reconstructive surgeries, and this agrees with many studies[12, 17, 36, 39]. This can be justified by its easy accessibility, cortical and cancellous nature of the graft, and moderate to large quantities that were gained, this agrees with Pikos, and McCarthy C. [12, 40]. Only cancellous type of bone was harvested from the tuberosity of maxilla, and This was also recorded by Misch and Patrick J studies [19, 41].

Filling of sinus cavity with good prognosis was practiced by either cancellous or cortico- cancellous quality in which the bone transformed to particulated type by a means of Mill with favorable particle size, this was recorded by some studies[21, 33]. The bone grafts harvested to be used for in orthognathic, and facial reconstructive surgeries were taken from the body/ramus and coronoid process, of the mandible because of the cortical nature of these grafts which has the least resorption rate and the shape and size of the graft that is suitable for such types of surgeries. The coronoid process used for facial reconstruction was also reported by many studies[31, 38, 42].

Moderate to a large amount of bone was possible to be taken in 88.8 % of cases involved in the study, the amount of bone harvested from symphysis was moderate to large in 90 % of cases, and in 100% of bone taken from the body and ramus of the mandible. The amount taken from the coronoid process of the mandible was considered as large quantities (11 mm-more than 15mm length) .these results agree with the results of Hernández-Alfaro F et al., yates D. et al., and Sabhlok et al.[23, 36, 38] and was recorded in these studies[14, 17, 19, 22]. However, The amount of bone harvested from the tuberosity of maxilla was of small to moderate quantities (0.5- 1.5 ml), and it was not possible to take more because of danger of perforation, this was also mentioned by many studies that harvested bone from the tuberosity usually scarce that mostly used to restore small vertical or horizontal defects and to fill small cavities[33, 43].

Complications like postoperative pain and edema, small sinus perforations occurred mostly at older age group (Mean 43.5 years). While the younger age group did not report any complication, the relation between the age and the complication was significant. In spite of using all possible preventive measures done for the patients involved in the study to minimize postoperative pain and edema, still many patients had experienced some pain. The measures that used involved pressure dressings, topical ice packs, pre and postoperative steroidal anti-inflammatory drugs, analgesics, and meticulous oral hygiene instructions. The occurrence of complications was minimum when bone is harvested from the body, ramus and coronoid process of the mandible; this agrees with *Silva et.al* [44]. Proper preoperative radiographic evaluation of the inferior neurovascular bundle and harvesting grafts from the body/ramus of the mandible only to the mesial of the first molar tooth in order not injuring inferior alveolar nerve were helpful in preventing the complication in theses donor sites .

In 30% of patients in whom bone grafts were harvested from symphysis had developed marked postoperative pain and edema. We think that the cause is related to the design of flap, which was vestibular incision necessitated dissection of mentalis muscle and periosteum. According to Pickos[12] and Khojasteh[45], the pain that developed after harvesting symphyseal bone graft was not significant. However, according to a study done by Nkenke E, Neukam FW[40], Patients' acceptance of chin bone harvesting was low, and that it led to a considerable morbidity like pain, skin sensitivity and wound healing problems at the donor site. Patients even preferred iliac crest bone harvesting over bone harvesting from the chin, although this distant donor site required general anesthesia and a hospital stay.

Garg AK[46], and Pikos M A[12] reported that postoperative pain at the donor sites was minimal to moderate and can be controlled by non-steroidal anti-inflammatory drugs. And regarding deciding the type of

flap used, vestibular versus intra sulcular, in harvesting symphysis graft, the flap design depends on mandible musculature and periodontal status of the mandibular anterior teeth[21, 47, 48], they stated that vestibular incision design indicated when there is alveolar bone loss around the lower incisors or scalloped gingiva. Intramuscular incision design is a straightforward method indicated for patients with low vestibule, tense mentalis posture, and absence of abnormal periodontal status. Advantages of this incision method include minimized bleeding and trauma and facilitated flap retraction[21]. According to "Hindy and Smith", the intensity and duration of post-operative pain seemed to be more pronounced in patients receiving bone from the symphysis area compared with body and ramus. Their need for analgesics was also high and that the functional limitations in speaking, eating, and drinking was experienced equally by both groups "symphysis and ramus" but mouth opening and chewing were reported to be more difficult for patients whose grafts were harvested from the ramus[49].

During harvesting the bone graft, we followed the "5s" rule; here the cut is 5mm away from root apices, mental foramen, and inferior border of mandible respectively. Alfaro FH[50] also recommended this rule. However, still we had 20% (two patients) in whom bone was harvested from the symphysis developed temporary neurosensory of lower lips, which resolved after 2-4 months, and no permanent deficits were recorded. The altered sensation was reported in much more frequently (22 patients) in those receiving grafts from the chin area, appeared " as altered sensation in the lip" than in patients who received a ramus graft (5 of 24). Few patients in the ramus group experienced altered sensation localized in the region of the buccal nerve terminal branch. Anatomic variations of the buccal nerve have been reported and might explain the impaired function of the buccal nerve after surgery. Hendy and Smith[49], Raghoebar et al. reported 43% of patients had developed decreased sensibility of the symphysis region.[21] In the literature, many patients do experience reduced sensitivity in the chin or inferior mandibular teeth following bone graft procurement from the mandibular symphysis. These are typically minimal and eventually disappear, but patients must be informed about this possibility[47]. According to Silva, temporary sensory disturbances were the most common complications noted in both symphysis and ramus areas[44]. For Pikos, few patients had developed neurosensory deficit after harvesting bone from the symphysis. And according to his study, permanent neurosensory deficits include altered sensation of the lower lip and chin had occurred in 1%, but the patients may develop the complication of transient dysesthesia of the anterior mandibular dentition up to 53%[12].

In our study, one case of grafts harvested from maxillary tuberosity had developed postoperative pain and edema, most likely due to vertical relieving incisions did during graft harvesting done to increase access, or due to releasing incisions done at the base of the flap during sinus lifting and augmentation procedures to gain passive flap closure, this agrees with the finding of Yates D et al., and Alfaro FH et al. [36, 50], It worth to mention here that forceful retraction causes pain and edema, especially in the posterior region. Small sinus perforation had occurred in one case during bone harvesting from the tuberosity; the patient was 43-year old. However, the perforation was small and was treated by meticulous suturing of the flap during the closure, and postoperative medical measures like anti-inflammatory and nasal decongestant did. Sinus perforation was explained by the prolonged period for posterior maxillary ridge being edentulous resulted in increased sinus pneumatization. Anon JB et al. studies showed that maxillary sinus expansion occurs with the loss of upper posterior teeth, in which the antrum expands in inferior, lateral, and posterior directions. [51] The same type of postoperative complication was also reported in other studies [19, 33].

In general, the success rate in this study was 96.2% (26 out of 27 cases) with one failure case. In this case, bone was harvested from the symphysis of mandible and was used as particulated on-lay graft for horizontal ridge augmentation over an implant in a patient with huge intraoral defect resulted in fibrous union a, the cause was blamed on inadequate fixation .such complication was also reported by Procacci P et al.[52]. Rigid fixation is the method of choice in all circumstances where on-lay block bone grafts are exposed to motion and torsional forces[13]. Cortical and cortical and cancellous grafts need more rigid fixation and adaptation to prevent micro movement, osteosynthetic screws and titanium mesh with or without collagen barrier were used for fixation in all patients enrolled in this study. Stevenson studies showed that stability of the construct and contact between host bone and the graft determine the incidence and speed of the union between the block bone grafts and adjacent host bone more than the characteristics of the grafts themselves[13, 53]. We agree with Fu and Wang, who concluded that block graft should be stabilized using titanium screws to avoid movement. The key to success is the elimination of graft mobility and dead space between the graft and host bone[8].

Titanium mesh is a good system used for fixation, it tolerates exposure very well and gives predictable results [54, 55]. In our study the combination of particulated bone graft and mesh fixation was used successfully to augment alveolar ridge during implant placement, this was also recommended by Deshpande S et al.[54], and To reduce the amount of on-lay graft bone resorption, it is advisable to fix the cortical graft securely in place with osteosynthesis. Collagen membrane was sometimes used with the titanium mesh during grafting and also in the filling of the cavity to prevent fibrous tissue ingrowth into the graft. Collagen membrane proved to enhance bone regeneration[56]. Although fixation by using only collagen membrane alone was tried by many authors, still with some complications and considerable failure rate. Esposito's

systematic review concluded that there is early evidence that GBR can be used as a staged approach to allow for vertical bone augmentation and the randomized controlled trials included in his Cochrane review confirmed this proposition[59]. The evaluated techniques, however, were associated with high complication rates ranging from 60%[57] to 20%[58]. Chen et al. clarified that "horizontal ridge augmentation often requires the use of autogenous bone block which may be combined with a membrane and a particulate autograft, allograft, or xenograft [59] However, for other authors, GBR seems to give a comparable result to autogenous bone block which is considered the gold standard in bone reconstruction[60]. In our study, the cancellous bone grafts which were used for filling the sinus cavity was fixated only by collagen barrier membrane, and this was not due to the type of bone quality, but these grafts were used in filling of maxillary sinus cavities (during sinus lifting), and these cavities have at least two walls. Thus, resorbable collagen membranes were sufficient for their fixation. This regimen was used with[61]. Graft stabilization is paramount to obtain a predictable bone augmentation; this ensures initial blood clot adhesion with its associated growth factors[62]. Barrier membranes prevent soft tissue from invading the bone graft site for at least several weeks or months. If particulate or block bone grafts are mobile, they cannot develop a blood supply for new bone formation. Instead, the graft becomes encapsulated in fibrous tissue and often sequestrates[63-66].

In our study, inlay or interpositional bone grafts were used to close the gap created after superior positioning of the maxilla in Lefort I or maxillary segmental osteotomies to increase the stability and decrease relapse rate. This was recorded by Epkar BN[25], and the Fixation of inlay bone grafts was not needed because the maxillary segments fixated either by bone plated or intraosseous wires and the grafts were stable in between the segments. The technique of "no fixation" of the repositioned maxilla may be allowed in certain cases when a good amount of bone graft is used, and the graft is stable. When the bone graft is unstable, it can be fixated using bone plates [24, 25].

Local anesthesia was the method of choice for all patients of alveolar reconstructive surgeries (100%). In16 patients % of those patients, bone grafts were taken from the symphysis of mandible and tuberosity of maxilla because of easy access and visibility. On the other hand, all bone grafts used in orthognathic and facial reconstructive surgeries were done under general anesthesia, and 100% of these grafts were taken from ramus and body of the mandible and the coronoid process. It is logical here that bone grafting is performed under general anesthesia as far as surgeries are already done under general anesthesia, and to a less degree is due to the site of bone graft harvested. This agreed with patients, and a popular and reasonably safe extra oral site is the posterior iliac crest, which can yield relatively large bone volumes[10].

Mintz et al.[31]. and-Sabhlok S[38] who showed that harvesting coronoid process is difficult and requires general anesthesia .

All patients in the study were satisfied that they had avoided the need for general anesthesia for two reasons. First, the procedure of harvesting the intraoral bone graft didn't add a considerable time to the original procedure of augmentation, and the patients were happy that the surgery didn't affect their daily life. On the other hand , some authors believe that shifting to prefer the intraoral bone graft to avoid general anaesthesia is not justified , and it would appear that short-term morbidity following these procedures is frequently overstated and is in itself not a valid reason to change to calvarial or mandibular donor sites[67], and according to Dawson K H study, the intra-oral harvested bone graft led to a considerable morbidity included pain and wound healing problems at the donor site. Patients even preferred iliac crest bone, although this distant donor site required general anesthesia and a hospital stay[67].

Conclusion

Harvesting Intraoral Bone graft is a reliable reconstructive technique and can be used successfully for treating small, selected facial and alveolar defect with minimal complications in the donor sites. The success rate of intraoral bone grafts was 96.2% in a follow-up period.The intraoral bone graft can be done with few complications if accurate preoperative evaluation was practiced ,with careful selection of intraoral bone graft sites for each defect regarding the size (small ,moderate ,and large), the quality (cortical, cancellous or both of them), type of application, and type of surgery. In this study, all complications were temporary and treatable with the exception of one case in which the graft was repeated. The body/ramus and coronoid process of mandible donor sites had the least complications, Type of the fixation and prompt graft adaptation were the two important factors in the success rate of our study.

According to study, the amount of bone harvested from symphysis, body, ramus, and coronoid process of the mandible was moderate to large quantities. The amount of bone harvested from the tuberosity of maxilla was small to moderate. In addition, these areas offer a decreased morbidity compared with extraoral donor sites reviewed in the literature. Symphysis of the mandible has the advantage of easy access and visibility and can be easily done under local anesthesia, however for reconstruction of a bigger bony defect, an extraoral bone grafting sources are recommended. Mixing alloplastic bone graft materials in low ratio with autogenous bone grafts to decrease the graft resorption, donor site complications, and increase the amount of bone graft that applied to the defect.

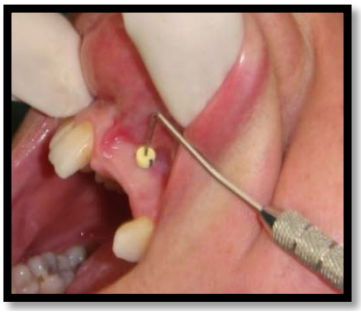


Figure 1: Clinical evaluation of the defect

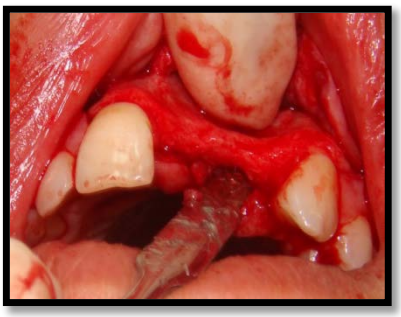


Figure 2: Intra operative evaluation of the alveolar bone defect at the maxillary anterior segment

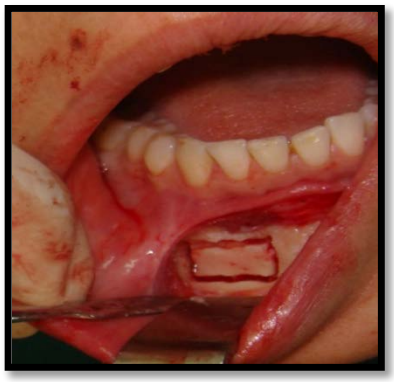


Figure 3: A block cortical bone graft harvesting from the right side of symphysis of mandible by using small fissure and round burs.

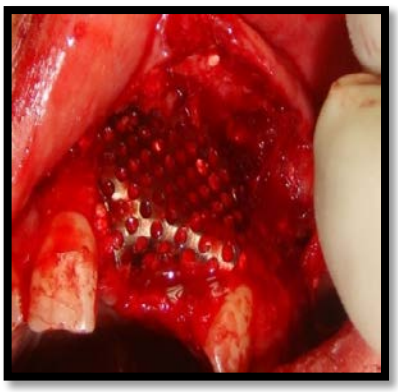


Figure 4: After insertion of 2 dental implant , and the bone graft , titanium mesh is adapted to the surface , and fixed with titanium screws

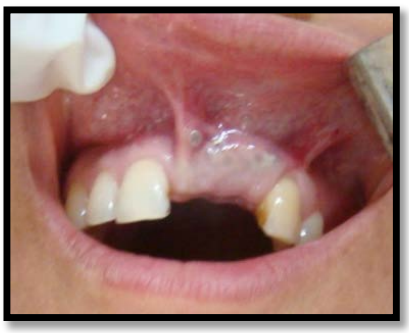


Figure 5: The same patient at presented after 6 months of the defect augmentation, titanium mesh and screws is at situ. The screws and the mesh removed with and implants inserted

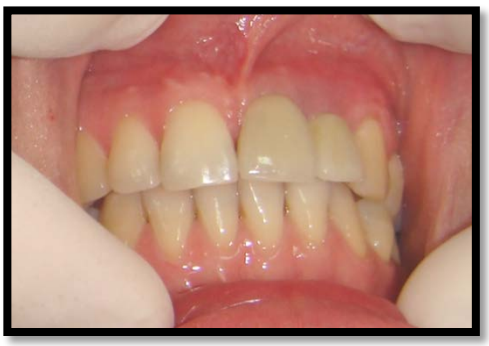


Figure 6: Patient , with the final prosthesis , implant of upper left central and lateral incisor .

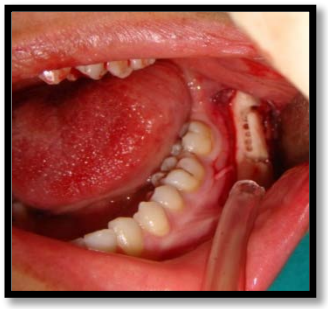
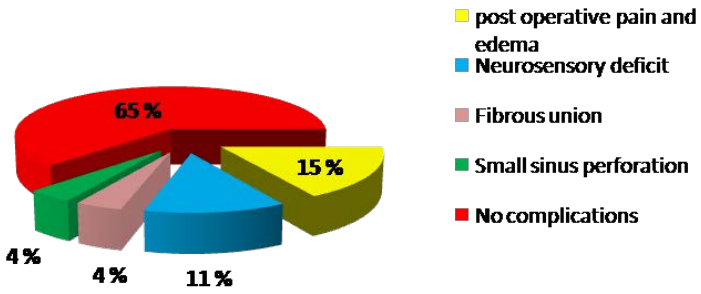


Figure 7: A block graft harvesting from the left body of mandible by using small round bur.



(Figure 8) shows the percentage of occurrence of each complication

Table 1 Relation of bone quantity with each donor site

BONE QUANTITY	DONOR SITES			
	Symphysis of mandible N (%)	Body of mandible N (%)	Tuberosity of maxilla N (%)	CORONOID OF MANDIBLE N (%)
	P VALUE = 0.279	P VALUE = 0.071	P VALUE = 0.073	P VALUE = 0.332
SMALL (0.5-1.0 ML)				
MODERATE(1.1-1.5ML)	1(33.3)	0(0.0)	2(66.7)	0(0.0)
LARGE (MORE THAN 1.5	6(54.5)	2(18.2)	3(27.3)	0(00)
ML)	3(23.1)	7(53.8)	1(7.7)	2(15.4)

Table 2 Relation of bone quality and type of fixation.

QUALITY OF BONE	TYPE OF FIXATION			
	Titanium m with or without collagen N(%)	Collagen only N(%)	Osteosynthetic screw N(%)	NOT USED N(%)
	P= 0.143	P= 0.000	P= 0.053	P= 0.000
CORTICAL	1(8.3)	0(0.0)	4(33.3)	7(58.33)
CANCELLOUS	0(0.0)	6 (100)	0(0.0)	0(00)
CORTICAL AND CANCELLOUS	3(33.3)	6(66.7)	0(0.0)	0(0.0)

Table 3 Relation between type of reconstruction and donor sites

TYPE OF SURGERY	DONOR SITES			
	Coronoid of mandible	Tuberosity of maxilla	Body / ramus of mandible	SYMPHYSIS OF MANDIBLE
	N (%)	N (%)	N (%)	N (%)
	P=0.003	P=0.141	P=0.001	P=0.019
ALVEOLAR BONE RECONSTRUCTION				
ORTHOGNATHIC SURGERY	0(0.0)	6(33.3)	2(11.1)	10(55.6)
FACIAL RECONSTRUCTION	0(0.0)	0(0.0)	5(100.0)	0(0.0)
	2(50.0)	0(0.0)	2(50.0)	0(0.0)

Table 4 Relation between failure of graft union and type of fixation

TYPE OF FIXATION	GRAFT UNION	
	Bony union	FIBROUS UNION
	N (%)	N (%)
TITANIUM MESH	3(75.0)	1(25.0)
COLLAGEN	11(91.66)	1(8.33)
OSTEOSYNTHETIC	4(100.0)	0(0.0)
NOT USED	7(100)	00

Table 5 Relation of donor sites with each type of postoperative complications

DONOR SITES	POST OPERATIVE PAIN AND EDEMA N (%)	SMALL SINUS PERFORATION N (%)	TEMPORARY NEUROSENSORY DEFICIT N (%)	NO COMPLICATION N (%)
	P VALUE=0.25	P VALUE=0.536	PVALUE=0.615	P VALUE=0.031
SYMPHYSIS OF	3(30.0)	0.(0.0)	2(20.0)	5(50.0)
MAN.*	0(0.0)	0(0.0)	1(11.1)	8(88.9)
BODY/RAMUS OF	1(16.66)	1(16.66)	0(0.0)	4(66.66)
MAN*	0(0.00)	0(0.0)	0(0.0)	2(100.0)
TUBEROSITY OF MAX.*				
CORONOID OF MAN.*				

*man. = mandible ** max. =maxilla

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