

Possible Intra-Oral Autogenous Bone Graft Donor Sites: A Review Article

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Abstract - There are several etiological factors related to the loss of intra oral bone (maxilla/mandible) they may be trauma, tumor and cysts surgeries, periodontal pathologies, or may be result of prolonged edentulism following dental extraction.^[1] Depending on the amount of bone loss/resorption that has occurred, there may be functional and/or aesthetic alterations that may lead to difficulty in the conventional rehabilitation. These problem can be solved by using autologous bone, allografts, xenografts, or alloplastic grafts with or without membrane.^[1] Among all previously mentioned alternatives, autogenous bone grafts are considered to be best because of their superior osteogenic, osteoinductive and osteoconductive properties as well as they constitute growth factors and are non immunogenic.^{[2][12]} Conventionally for the defects intra-orally, extra oral grafts were used but with changing time for small intra-oral defects intra-oral grafts are being considered for their advantages over others.^[12] Therefore the objective of this study is to review the various intra-oral bone grafts donor sites along with their indications, amount of graft generated, advantage, disadvantages and complications.

Key Words: Autogenous, Bone graft, Autologous, intra-oral bone graft site

1. INTRODUCTION

Intraoral bone loss is inevitable process following trauma, tumor or cyst surgeries and periodontal pathologies or may be result of prolonged edentulism following tooth extraction.^{[1][3]} For the purpose of esthetic and functional outcomes several bone reconstruction procedures have been developed. Bone augmentation procedures have been used to allow implant placements or the proper construction of dentures. Decision of if the bone augmentation procedure is to be carried out separately or simultaneously depends on the amount of bone loss.^[10]

Autogenous bone grafts have been considered to be gold standard among all graft materials, it fulfills all the regeneration triad (ie. Osteoconductive, osteoinductive and osteogenic properties).^{[2][12]} Intraoral bone grafting donor sites are being preferred over the years due to its easy harvesting techniques and less complications as compared to other extra oral bone graft donor sites. To enhance

peripheral volume gain bone graft block along with bone particulate can be used.^{[8][9]}

The main advantage of intraoral bone graft donor sites is their easy surgical access, as they are near to operating site, it reduces the operative and anesthesia time and are ideal for out patient surgery.^{[6][11]} The purpose of this study was to find out various intra-oral bone graft donor sites available along their advantages, disadvantages, indications and complication faced while using these grafts.

2. Various autogenous bone graft donor sites available intra-orally

2.1 Coronoid process^[15]

A triangular piece of bone graft can be harvested from the coronoid process of the mandible by an intraoral approach during many maxillofacial surgical procedures. It can be used in the reconstruction of various maxillofacial defects like orbital defects after extended maxillectomy, blowout fracture of orbit, temporomandibular joint ankylosis surgery, chin augmentation, defect in the anterior wall of maxilla due to trauma other mandibular defects like bone augmentation. It is intramembranous in origin, average amount of bone harvested is around 19X18X26 mm triangular area with 6mm thickness.

2.1.1 Indication

-Coronoid process bone graft can be used to repair small bone defects.

- it can be used as a block or particulate bone graft.

-it can be used for the replacement of condyle in cases of tmj ankylosis.

-it can be used for reconstruction of orbital floor, nasal deformation and mandibular reconstruction for implant and other defects.

2.1.2 Advantage and disadvantages

Advantages:

- low risk of morbidity
- good amount of bone volume.
- no damage to the teeth and other structures.

Disadvantages:

- Patient going under coronoidectomy needs to be hospitalized.

2.1.3 Technique

The osteotomy can be performed via intraoral approach with the help of rotary instruments, piezoelectric devices, or reciprocating saw.

2.1.4 Complications

Major complication that is being encountered is trismus and risk of injury to the temporomandibular joint.

2.2 Anterior maxillary sinus wall^[16]

Bone graft harvested from the anterior wall of the maxillary sinus is used in the reconstruction of several small bone defects but now being most commonly used in the closure of oro-antral fistula. It is intramembranous in origin, approximately 0.5ml to 2ml of total volume can be harvested.

2.2.1 Indication

- it can be used to repair small to medium bone defects like oro antral fistula.
- it can also be used as particulate or block bone graft.
- can be used for maxillary sinus floor elevation for the purpose of implant placement in deficient alveolar bone.

2.2.2 Advantages and disadvantages

Advantages :

- The recipient site is adjacent to donor site.
- It shows low rate of resorption.

Disadvantages:

- Compact bone is available.

2.2.3 Technique

The upper limit of the maxillary sinus is approximately 5mm below the infraorbital foramen. Osteotomy can be carried out with the help of rotary instruments or piezoelectric device, to better avoid complications like schneiderian

membrane perforation the use of piezoelectric devices is encouraged.

2.2.4 Complications

- schneiderian membrane perforation.

2.3 Zygomatic body^[16]

It is a preferred donor site for reconstruction of bone defect 1 or 2 implant sites, covering exposed surfaces of implants. Using the local anesthetic agent graft can be harvested intraorally. It is intramembranous in origin, total amount of bone harvested in this procedure is around 0.5ml to 1ml.

2.3.1 Indications

- it can be used to repair small or medium bone defects.
- it can be used in maxillary sinus floor elevation in case of implant surgeries.
- can be used in alveolar bone reconstruction or preservation.
- it can be used as block or particulate bone graft.

2.3.2 Advantages and disadvantages

Advantages :

- Access is easy to achieve.
- Both cortical and cancellous bone is available.
- Prevalence of complication is less.

Disadvantages:

- Ocular complication can occur.
- Amount of bone harvested is less.

2.3.3 Technique

Actual site for the graft harvesting used to be 5mm inferior to lower orbital rim and 3 mm above the inferior border of zygomatic bone. The bone is harvested with the help of trephine with the blade angled 45 degrees to the occlusal plane and it should be parallel to the lateral wall of maxillary sinus, the cut should not exceed beyond 12-14mm.

3.3.4 Complications

- infratemporal fossa perforation
- perforation of the schneiderian membrane.
- alteration in the sensitivity of the infraorbital and zygomaticofacial nerve.

2.4 Zygomatic alveolar buttress^[16]

Limited maxillary defects are commonly grafted with bone blocks harvested from the symphysis or the ramus;

harvesting a second surgical site in the mandible increases both operative time and patient's postoperative morbidity. To overcome these disadvantages, the zygomatic buttress was suggested as an alternative maxillary source of autogenous bone. This intraoral donor site has a natural convex shape and can be accessed along with the recipient site through the same flap design. It is intramembranous in origin in which approximately 1.5cm * 2cm bone can be harvested.

2.4.1 Indication

- it can be used for the reconstruction of bone defects and guided bone regeneration.
- it can be used as block or particulate bone graft.

2.4.2 Advantages and disadvantages

Advantages:

- Access and visibility in this procedure is very good.
- it is adjacent to the recipient site.
- resorption rate is low.

2.4.3 Technique

Rotary instruments or trephine or piezoelectric device can be used to harvest the bone graft in which the piezoelectric device is considered.

2.4.4 Complications

- there may be changes in sensation in the area supplied by infraorbital nerve.
- if not done with experienced hands there may be probability of maxillary sinus membrane perforation.

2.5 Incisive fossa^[17]

2.5.1 Indications

It is mainly used for the repair of small bone defects. Bone graft harvested from the incisive fossa can be used as bone block or as a particulate.

2.5.2 Advantages and Disadvantages

Advantages:

- it is a very simple procedure, in which cortico-cancellous graft can be harvested.
- it has high quantity of osteoprogenitor cells.
- it has less complications as compared to other sites.

Disadvantages:

- Bone grafts harvested from incisive fossa are of type IV bone.

2.5.3 Techniques

- Bone graft is harvested 3mm apical from the root tip of the central incisor, and its upper limit is anterior nasal aperture. Trephine drill or piezoelectric device can be used to obtain bone graft.

2.5.4 Complication

- tooth injury
- basal membrane perforation.

2.6 Anterior nasal spine^{[4][18]}

Bone graft from the anterior nasal spine is harvested frequently to correct peri-implant bone defects, specially during implant placement in the anterior maxillary region. It is intramembranous in origin, average amount of bone that can be harvested is in between 0.25 to 0.5 ml.

2.6.1 Indication

- used to repair small bone defects.
- used to cover fenestrations.
- used to repair peri-implant bone defects.

2.6.2 Advantages and disadvantages

Advantages:

- It is easily accessible, with low morbidity.

Disadvantages:

- Bone harvested is limited in quantity and are too compact.

2.6.3 Technique

A notch is made in the base of the anterior nasal spine, and then the spine is detached with the help of chisel.

2.6.4 Complications

Aesthetics may be hampered.

2.7 Palate^{[10][17][18]}

Anterior region of the palate can be reliably selected as the donor site in the oral and maxillofacial reconstructive, implantology, and periodontal regeneration procedure. It is intramembranous in origin.

2.7.1 Indication

- It can be used as particulate or bone block to repair small bone defects.
- it can be used in maxillary sinus lift procedures in cases of deficient bone for implant placement.

2.7.2 Advantages and Disadvantages

Advantages:

- it has high acceptance rate with less morbidity.

Disadvantages:

- Access to the donor site is difficult.
- Bone is compact and amount of graft harvested is also low.

2.7.3 Technique

Graft is harvested with the help of trephine or piezoelectric units, nasal floor use to be its upper limit.

2.7.4 Complications

- excess bleeding
- injury to the adjacent tooth structure
- communication with nasal cavity.

2.8 Tuberosity^{[3][19]}

Bone graft either in form of particulate or block can be harvested from the maxillary tuberosity to repair or reconstruct the bone defects in the oral cavity. It is intramembranous in origin.

2.8.1 Indication

- it can be used in periodontal defects.
- it can be used in the procedure of sinus lift surgeries.
- it can be used to repair small bone defects.

2.8.2 Advantages and Disadvantages

Advantages:

- High quantity of osteoprogenitor cells are present in the harvested graft.
- Procedure is simple to execute.
- It is cortico-cancellous in nature.
- Complication rate is low as compared to other intra-oral bone graft donor sites.

Disadvantages:

- Bone harvested is of poor quality (type IV).

2.8.3 Technique

- The bone harvesting can be done with the help of rotary/ trephine or piezoelectric unit, graft will be harvested distal to the second molar with schneiderian membrane as upper limit.

2.8.4 Complication

- maxillary sinus membrane perforation.

2.9. Mandibular torus^{[7][20]}

Mandibular tori are usually symmetrical and bilateral, but can also be unilateral, located on the lingual side of the mandible, above the mylohyoid line, and at the level of premolars, but it may extend distally to the third molar and mesially to the lateral incisor. It is intramembranous in origin.

2.9.1 Indication

- it can be used as a particulate or bone block to repair small bone defects as well as for other minor procedures like sinus lift.

2.9.2 Advantages and Disadvantages

Advantages:

- It is a simple procedure with low incidence of complications.

Disadvantages:

- Bone harvested is too compact as well as it depends on the size of the torus present.

2.9.3 Technique

It can be harvested with the help of piezoelectric unit or chisel and mallet.

2.9.4 Complications

- excessive bleeding
- alternation in the sensitivity of the lingual nerve.

2.10 Torus Palatinus^{[14][21]}

Torus palatinus are the exostoses present mostly in the midline of hard palate, it can be used as a bone graft donor site to reconstruct the minor bone defect intra-orally. It is intramembranous in origin.

2.10.1 Indications

- it can be used as a particulate or bone block to repair small bone defects as well as for other minor procedures like sinus lift.

2.10.2 Advantages and Disadvantages

Advantages:

- Simple procedure
- Low incidence of complication

Disadvantages:

- Amount of bone graft harvested is directly proportional to the torus size.

2.10.3 Technique

- The procedure to harvest bone graft from torus palatinus is similar to the process involved in the graft harvesting from the mandibular torus.

2.10.4 Complications

- excessive bleeding
- oro-nasal communication

2.11 Mandibular symphysis^{[11][13][14]}

Mandibular symphysis region act as a potential bone graft donor site which is intramembranous in origin.

2.11.1 Indications

- it can be used as bone block or particulate form.
- used to reconstruct/repair small to medium sized bone defects.

2.11.2 Advantages and Disadvantages

Advantages:

- Good amount of bone is harvested from the site.

Disadvantages:

- Chances of complications are high as compared to other sites.
- Facial disfigurement may occur.

2.11.3 Technique

- Rotary instrument or bone saw or piezoelectric unit may be used after giving intraoral vestibular incision and bone is harvested from the symphysis region.

2.11.4 Complication

- excessive bleeding.
- facial disfigurement may occur.

3. Conclusions

Autogenous bone grafts continues to be gold standard in the field of reconstruction surgery, be it in maxillofacial, spinal areas or trauma and treatment of malunions, nonunions, or tumors. There are various donor sites available in the body from which we can harvest the graft, each having their own advantages and disadvantages which include their anatomic location which makes one site preferable over the other.

Maximum autogenous bone grafts donor sites options available intra-orally can be used as particulate as well as bone block form to repair small bone defects in maxillofacial region.

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