

Dental Implant Site Preparation – A Review

C.J.VENKATAKRISHNAN¹, S.BHUMINATHAN² and CHITRAA.R.CHANDRAN³

¹Research Scholar Bharath University, Department of Prosthodontics, Tagore Dental College, Melakkottaiyur Post, Rathinamangalam, Tamil Nadu 600127, India.

²Department of Prosthodontics, Sree Balaji Dental College, Velachery Main Road, Pallikaranai, Chennai, Tamil Nadu 600100, India.

³Department of Periodontics, Tagore Dental College, Melakkottaiyur Post, Rathinamangalam, Tamil Nadu 600127, India.

*Corresponding author E-mail: venkatmds9@gmail.com

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ABSTRACT

In the current scenario for dental practice we face patients who are much more aware of dental implants and its benefits. Restoring patient's teeth with implants improves the quality of life of the individual and helps him lead a healthy life. Patient selection and implant site preparation is as important as other factors that determine the success or failure of dental implants.

Keywords: Dental implants, site preparation, Bone augmentation, Osseointegration, Implant stability.

INTRODUCTION

The use of implants has increased owing to the increase in aged population, increased tooth loss in aged population, inability of patients to use removable dentures, improved implant systems and predictability and benefits of implant supported prostheses.(1)

Criteria for implant success: (2)

1. On clinical examination implant should be immobile
2. Should not have periimplant radiolucency
3. Bone loss not more than 0.2mm vertically every year following placement
4. No pain, infection or nerve paresthesia

The surgical procedures for the implant placement of almost all the endosseous dental implants currently used are based on the original work of Professor Per-Ingvar Branemark and

colleagues. Regardless of which implant system is used, the same fundamental principles of atraumatic, precise implant site preparation apply. This involves gentle surgical techniques and progressive, incremental preparation of the bone for a precise fit of the implant.

General principles of implant surgery

Patient Preparation

Risks and benefits of implant surgery specific to the patient's need should be thoroughly explained at the appointment before the day of surgery.

Implant site preparation

Basic principles must be followed to achieve a successful osseointegration.

The surgical site should be kept aseptic and the patient appropriately prepared and draped for an intraoral surgical procedure. It is recommended

that the patient rinse with chlorhexidine gluconate for 30 seconds immediately before surgery. A sterile field has to be maintained at all times to avoid contamination of the implant surface.

Implant sites should be prepared using gentle, atraumatic surgical techniques with a constant reminder to avoid overheating the bone. Finally, implants should be stable and allowed to heal. Regardless of the type of surgical approach, the implant must be placed in healthy bone to achieve osseointegration and an atraumatic technique must be followed to avoid damage to bone or vital structures. Bone quality at the recipient site influences the interface between bone and implant. Compact bone offers a much greater surface area for mineralised tissue-to implant contact than the cancellous bone. Surgical preparation of the tissues at the recipient site may also greatly affect healing. Drilling of the bone without proper cooling generates increased temperatures that can injure the bone and increase the risk of implant failure.

One-stage versus Two-Stage Implant Surgeries

Most of the threaded implants can be either placed in one-stage or a two stage protocol.

In the one-stage approach the implant or the abutment emerges through the mucoperiosteum at the time of implant placement, whereas in the two-stage approach the top of the implant and cover screw is completely covered with flap closure. Here implant is allowed to heal, without loading or micro movement, for a time. In two-stage implant surgery the implant must be surgically exposed following an undisturbed healing period.

Advantages of one stage-implant

1. Easier mucogingival management around the implant
2. Patient management may be simplified because a second stage exposure surgery is not necessary.

Advantages of a two-stage implant

1. For situations which require simultaneous bone augmentation procedures at the time of implant placement.
2. Also prevents movement of the implant by

the patient who may inadvertently chew on it during the healing period.

Flap design

Flap management for implant surgery will vary slightly depending on the location and objective of the planned surgery. Two types of incisions, crestal or remote can be used. The remote incision is made some distance from planned osteotomy site. For the crestal design, the incision is made along the crest of the ridge, bisecting the existing zone of keratinised mucosa. When extensive bone augmentation is planned, a remote incision with layer suturing technique is used to minimise the incidence of bone graft exposure. The crestal incision, is preferred in most cases because it is easier to manage and results in less bleeding, less edema and faster healing. For a knife edged alveolar process with sufficient alveolar height and distance from vital structures a large round bur is used to recontour the bone to provide a reasonably flat bed of implant site.

Implant site preparation

Once the flaps are reflected and the bone is prepared, the implant osteotomy site can be prepared. A series of drill are used to prepare the osteotomy site precisely and incrementally for an implant. A surgical guide or stent is inserted, checked for proper positioning and used throughout the procedure to direct the proper implant placement.

1. A small round bur is used to mark the implant sites
2. Guide is removed and the initial marks are checked for their appropriate buccal-lingual and mesial-distal location. Slight modifications may be necessary to adjust the spatial relationships and to avoid minor ridge defects. Each marked site is then prepared to a depth of 1 to 2mm with a round drill.
3. A small twist drill usually 2mm diameter and marked to indicate various lengths is used next to establish the depth and align then long axis of the implant recipient site. This drill may be externally or internally irrigated. In either case a twist drill is used at a speed of 800-1200rpm with copious irrigation. When multiple implants are used a guide pin is used

- to check for the alignment and parallelism through out the preparation site.
4. Next step is to use series of drill systemically to widen the size to accommodate the selected size of the implants.
 5. Pilot drill: following the 2mm twist drill, a pilot drill with a non cutting 2-mm diameter guide at the apical end and a cutting 3 mm wider diameter midsection is used to enlarge the osteotomy site, thus facilitating the insertion of the subsequent drill in the sequence.
 6. The 3-mm twist drill: the final drill in the preparation of the standard-diameter implant is the 3-mm twist drill. It is used to widen the site along the entire depth of the osteotomy from 2-3mm. This final drill in the sequence will finish cutting the osteotomy site and will help the clinician determine whether the implant will be stable or not. Regardless of the system used, it is important to know that the final diameter drilling be accomplished with a steady hand, without wobbling.
 7. Countersink (optional): countersink drill is used to avoid the risk of premature exposure from the pressure of the temporary denture. It is used to shape or flare the crestal aspect of the osteotomy site. This allows the coronal flare of the implant and cover screw to fit within the osteotomy site.
 8. Bone tap: used for the threaded implants. In dense cortical bone or when placing longer implants to a moderately dense bone, it is prudent to tap the bone before implant placement to facilitate implant insertion and to reduce the risk of implant binding.
- Note: when the bone quality is soft and poor (loose trabecular in the posterior site) tapping is not necessary. It is important to create a recipient site that is very accurate in size and angulations. It is sometime important to replace the molar with a wider diameter implant because the larger diameter better approximates the size and the emergence profile of molar sized teeth.
9. Implant placement: implants are inserted with a handpiece rotating at slow speed or by hand with a wrench. Insertion must follow the same path or line as the osteotomy site. When multiple implants are used it is helpful

- to use the guide pins in other sites to have a visual guide for the path of insertion.
10. Flap closure and suturing: once the implants are placed and the cover screw secured, the surgical site should be thoroughly irrigated with sterile saline and proper closure of the flap must be obtained.

The above mentioned procedure was a standard implant procedure but sometimes on opening the flap, we may encounter an inadequate bone, in such conditions advanced surgical procedures may be necessary. The availability of the bone is the most important factor which determines the ultimate success of the implant. Horizontal bone deficiencies are managed quite predictably with localised bone augmentation. However vertical bone deficiency is a much more challenging problem. Certain anatomic factors may limit the proper placement of implants. The most important are the maxillary sinus and the inferior alveolar nerve. Long-standing edentulous posterior maxilla often represents a challenge because of the insufficient bone volume resulting from pneumatization of the maxillary sinus along with the resorption of the alveolar crestal bone. This can be managed by the maxillary sinus lift procedures. Inferior alveolar nerve may hinder the placement of implants in mandible which is managed by inferior alveolar nerve lateralization procedure.

Other procedures which help in the management of the deficient bone are:

1. Bone augmentation procedures:
2. Ridge split osteotomy which can be done using manual instrument or the piezo
3. Placement of zygoma implants
4. Distraction osteogenesis
5. Inferior alveolar nerve lateralization

**Inferior alveolar nerve lateralization
Indications**

Inferior alveolar nerve lateralization and distalization of the mental neurovascular bundle merit consideration when:

1. Removable prosthetic appliance is to be replaced
2. temporomandibular joint stabilization
3. serve to reduce alveolar ridge atrophy.

Limitations

Limiting factors include the following:

1. These procedures are technically difficult and therefore not suited for every doctor.
2. Nerve damage is a significant risk of the procedures. Both the surgical manipulations of the neurovascular bundle and the overall surgical procedure can cause post operative nerve deficits. Each patient should be informed about the risk for permanent nerve deficits, which include anesthesia, parasthesia, dysesthesia and hyperesthesia.
3. Fracture of the mandible due to atrophy.
4. Acceptance by patient is very low.

A higher degree of neurologic deficiency is associated with distalization of mental neurovascular bundle then with the lateralization of the inferior alveolar nerve.

Guided Bone Regeneration & Augmentation

Biologic Requirement for Bone Regeneration

Blood Supply - Cortical Perforation

Stabilization - Fixation Screws, membrane tacks

Osteoblasts - Autogenous bone (Graft/Recipient site)

Confined Space - Barrier Membrane

Space Maintenance - Tenting screws, Bone graft

Wound Coverage - Suturing & Flap Management

Bone Augmentation Techniques

Bone Augmentation with Barrier Membrane Technique

Particulate Bone Grafting Technique

Block Grafting Approaches

Combination Approaches

Ridge Expansion Technique

Distraction Osteogenesis: (6)

- Introduced by Gavriel Ilizarov that causes displacement of fractures which causes in expansion of soft tissue and bone simultaneously.

Alveolar Distraction Osteogenesis

- Displacement of the osseous segment results in positioning of a healthy portion of bone into a previously deficient site.
- Expansion of the soft tissue adjacent the bone segment .
- Original location fills by bone.
- Filling with bone instead of fibrous tissue is a function of the surrounding, healthy cancellous bone walls and location within the skeletal functional matrix .
- Growth phenomena is determined by continuous tension inside the tissues that precipitates a growth in the volume and number of cells.
- This process ends when the push is exhausted and the cells have occupied all the space genetically allocated to them.

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REFERENCES

1. Misch CE. *Implant Dentistry*. 1st edition, Mosby, USA, 1999.
2. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: A review and proposed criteria of success. *Int J Oral Maxillofac Implants*. 1986; **1**:11–25
3. Jumshad B. Mohamed, Sabitha Sudarsan, K. V. Arun, and B. Shivakumar. Rehabilitation using single stage implants. *J Indian Soc Periodontol*. 2009; **13**(1): 32–40
4. Boris Abayev and Gintaras Juodzbalys. Inferior Alveolar Nerve Lateralization and Transposition for Dental Implant Placement. Part I: a Systematic Review of Surgical Techniques. *J Oral Maxillofac Res*. 2015; **6**(1): e2.
5. Jie Liu and David G Kerns. Mechanisms of Guided Bone Regeneration: A Review. *Open Dent J*. 2014; **8**: 56–65.
6. Fernandes, F. H. C. N.; Orsi, I. A. & Bezzon, O. L. Distraction osteogenesis in dentistry. *Int. J. Morphol*. 2010, **28**(3):743-748.