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# Implant Prosthetics: A Brief Review

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***Abstract:***

*The goal of modern dentistry is to restore the normal contour, function, comfort esthetics, speech, and health regardless of the atrophy, disease, or injury of the stomatognathic system. Modern dentistry has changed tremendously with implant therapy. For the successful implant therapy, making a proper treatment plan considering both surgical and prosthetic part in mind is the key of success.*

***Aim:*** *The aim of present review of literature is to discuss the scope of implant dentistry at present time.*

***Review result:*** *The appeal and demand for implants had grown acutely since the past decades. Most patients nowadays choose implants compared to other prosthetic options. Further research and development lead to the digitalization of implant dentistry. Implants have become the treatment of choice in many, if not most, situations when missing teeth require replacement. Studies of the interaction between implant-supported restorations and the surrounding oral environment appear, fortuitously, to support the conclusion that the human host response to oral implants is favourable. The treatment planning for an implant restoration is unique regarding the number of variables that may influence the therapy.*

***Keywords:*** *Implant, Prosthetics, Implantology*

## Introduction

The goal of modern dentistry is to restore the normal contour, function, comfort esthetics, speech, and health regardless of the atrophy, disease, or injury of the stomatognathic system. **[**1**]** However, the more the number of teeth missing in a patient, it becomes more difficult to achieve this goal with traditional dentistry. Dental implantology is a term used today to describe anchoring of alloplastic material into the jaws to provide support and retention for prosthetic replacement of teeth that has been lost. **[**2,3**]**

Various modalities of treatment are available to replace missing teeth depending on the number and condition of remaining teeth, space available, adequacy of bone support, cost, and patient desires. Implant supported fixed dental prosthesis has been proven as an efficient modality of treatment. **[**4**]** Implant is connected to remaining natural teeth sometimes when there is an anatomic limitation of space for implants or failure of an implant to Osseo integrate. **[**5**]**

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. **[**6**]**

An important factor in determining the success of implants is the integrity of the peri-implant hard & soft tissue. Therefore, the implant surgical protocol and the restorative protocol should be designed to favour the formation and maintenance of the peri-implant hard and soft tissue. **[**7**]**

**Anatomy and Physiology:**

A proper knowledge of anatomical landmarks and its variations prior to implant placement is indispensable to ensure a precise surgical procedure and safeguard the patient against iatrogenic complications. The precise evaluation of distinct anatomical factors such as the position of the mandibular canal, maxillary sinus, the width of the cortical plates, the existing bone density, etc. is very important in appropriate implant selection and planning the most appropriate implant position in the existing clinical condition. Important anatomical structures in the maxilla are a nasal floor, nasopalatine canal anteriorly and maxillary sinus posteriorly. Iatrogenic sinus perforation is commonly encountered complication. This problem can be taken care of by selection of short implants and Sinus lift and bone augmentation procedure.

The most important anatomical consideration while placing an implant in the mandibular arch is the location of the inferior alveolar canal which contains inferior alveolar nerve and artery. Injury to these vital structures during implant placement can cause pain, altered sensation, excessive bleeding, etc. Hence it is important to determine the location as well as the configuration of the mandibular canal prior to implant placement. **[**8,9**]**

**Components of Dental Implant: [**10**]**

Fixture or implant: An implant provides the anchor or foundation for a restoration. It is screwed into the bone of the jaw providing a fixed platform on which an abutment can be screwed. Bone tissue can grow around the implant regenerating and strengthening the jaw reducing the bone loss which occurs when natural teeth are lost. It is made from titanium for biocompatibility with the body.

**Abutment:**

An abutment provides support for the crown. It is also the interface between the crown and the implant. Rotation (twist) is controlled by lugs shaped on the abutments stem. These lugs restrict the abutments rotational placement to set incremental steps. Different manufactures use different systems with more or less adjustment. It has screw that links it to the fixture. It is made from titanium.

**Crown:**

Crowns are the top part of a restoration and are the part that we see in the mouth. They replicate the original teeth to provide a biting surface and aesthetic appearance. They are hand made by the technician. The supporting substructure for the crown may be handmade or machined (onsite or offsite). The completed crown is either cemented or screwed onto an abutment. It is made from Porcelains (metal supported or metal free) or metal (normally gold).

## General Principle for Implant Placement

Initial Preparation and Treatment Planning: The initial consultation is the first step in determining whether a patient qualifies for a reconstructive procedure. A preliminary treatment plan based on chief complaint of the patient, history of present illness, medical history, and clinical and radiographic examination, to be made. Diagnostic impressions should be made to obtain accurate study models. Diagnostic casts or study models are essential to help guide both the preimplant and treatment phases of implant therapy. **[**3,11**]**

As both implant and preprosthetic procedures are elective surgeries aimed at restoring function and comfort of patients, they should be restricted to ASA1 (patients with no health problems) and ASA2 (patients with minor health problems who respond well to treatment). Any patient whose health condition places him in Category ASA3 (major health problems with partial correction) or higher should be carefully screened for relative contraindications or possibly absolute contraindications. **[**12**]**

**Relative contraindications for Dental implant**

Children & adolescents

Epileptic patients

Severe bleeding tendency

Endocarditis risk

Osteoradionecrosis risk

Myocardial infarction risk

**Patient Preparation:**

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

Radiographic Assessment: An acceptable clinical examination and an appropriate radiographic examination are mandatory before every implant surgery. Diagnostic imaging and techniques help develop and implement a cohesive and comprehensive implant treatment plan. The purpose of implant imaging is to provide accurate and reliable diagnostic information on the patient's anatomy at the proposed implant sites. Current radiation protection regulations are based on justification and the as low as reasonably achievable principle. This implies that every radiographic examination must be carried out to the benefit of the patient by application of the lowest possible dose. Therefore, the selection of imaging technique is already part of radiation protection measures. **[**13,14**]**

Computed tomography (CT) procedures can identify the available bone height and width accurately at a proposed implant site, the exact position and orientation of the implant (which many times determine the actual length and diameter of the implant) often are dictated by the prosthesis. **[**15**]**

Diagnostic Casts: Diagnostic casts or study models are essential to help guide both the preimplant and treatment phases of implant therapy. Many patients have been partially edentulous for an extended period of time. The combination of continued bone loss and dentition changes related to missing teeth greatly increases the factors that must be considered for oral rehabilitation with implants. Diagnostic casts enable these prosthodontic factors, for example, maxillomandibular relationships, existing occlusion, and potential future occlusal schemes to be evaluated in the absence of the patient. **[**11**]**

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. **[**16**]**

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.

Implant placement: 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.

**A small round bur is used to mark the implant sites**

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 1to 2 mm with a round drill.

A small twist drill usually 2 mm 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 800-1200 rpm 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.

Next step is to use series of drill systemically to widen the size to accommodate the selected size of the implants.

**Pilot Drill:**

Following the 2 mm 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.

**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.

**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.

**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

**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.

Guidelines for selecting implant size and evaluating mesiodistal space for implant placement: **[**17**]**

The implant should be at least 1.5 mm away from the adjacent teeth.

The implant should be at least 3 mm away from an adjacent implant.

A wider diameter implant should be selected for molar teeth because of the high occlusal loads. Spacing is required to provide the following:

To allow for 1.5 mm of crestal bone interproximally, this in turn will allow for proper development of a healthy papilla.

To develop proper contacts and the contours in the restoration.

To allow for an adequate width of soft tissue between implants and adjacent teeth.

For the prosthetic components not to impact on each other

For the effective cleaning of the prosthesis by the patient

To develop harmonious occlusion.

To allow for at least 1 mm space from the implant to the adjacent root.

**Prosthetic Considerations in Implant Prostheses: [**18,19,20**]**

To balance between now increasing demand of aesthetics along with function, prosthetically driven implantology has come to play i.e. prosthetic part of the prosthesis is considered before the surgical part. The prosthetic considerations include the physical and medical status of the patient, bone evaluation, radiographic considerations, factors that implant selection will affect occlusal scheme considerations and maintenance by the patient, and follow-up by the clinician.

## General consideration

**Age:** Implant placement needs to be done after the completion of the growth of the patient. If done before growth completion it may lead to complications such as submerging of implant and/or its relocation.

**Medical History:** Patients with cardiovascular disorders should be advised to get clearance for implant placement by the cardiologist or their physician. In patients with pulmonary disorders, alginate impressions should be avoided as it can lead to suffocation.

**Oral Hygiene and Habits:** The patient's oral hygiene has a direct influence on the prognosis. Patients with poor oral hygiene or habits such as tobacco chewing and chain-smoking have a higher risk of implant failures. Patients with a history of smoking should cease smoking for a minimum of one week prior and at least 8 weeks after implant surgery.

**Parafunctional Activity:** Activities such as bruxism and clenching have been identified as a major concern in implant treatment planning as they result in increased pressure on the implants and eventually metal fatigue and bone loss.

## Intra oral considerations:

**Soft Tissue Considerations:** Gingival biotype plays a crucial role in the aesthetic success of the prosthesis. Thick and fibrous biotype provides better aesthetic results while thin biotype does not mask the implant and abutment parts. In Gingival papillae that are fine and long, aesthetic results are difficult to obtain. Whereas in thick and short papillae natural regeneration is facilitated.

**Evaluation of Alveolar Bone:** Alveolar bone should be evaluated for bone defects. In cases of the presence of difference in the bone level at the implant site and adjacent to that, there is an increased risk to both- periodontal and peri-implant tissue. Reconstruction f crest either by regeneration or bone grafting becomes important.

Inter-arch distance and space evaluation: Inter-arch distance for proper visibility and instrumentation should be evaluated.

## Implant related considerations

**Thread Design:** Thread design should be such that it maximizes BIC and therefore reduces stress. Smaller pitch i.e. the distance between two threads indicates more surface area for better stress distribution.

**Thread Depth:** deep threads increase the surface area and contribute to the primary stability of the implant.

**Implant length and width:** increase in implant length increases the primary stability but it doesn't decrease the stresses. For regions where maximum stresses are concentrated, an increase in the width of the implant is a better way to distribute the stresses.

**Crest module:** the crest module is always slightly larger than the outer thread diameter. A parallel or same-sized crest module increases the risk of bone loss after loading.

## Implant selection considerations

**Implant Length:** It is selected according to bone availability, anatomic vital structures.

**Implant Diameter:** Buccolingual and mesiodistal ridge dimensions usually determine the diameter of the implant to be used. A minimum of 1mm of bone should be presented buccal and lingual to the implant. A minimum of 3mm between the edges of two implant platforms is necessary and a minimum of 1.5mm bone from an adjacent tooth is required. All these criteria help to determine the diameter of the implant.

**Implant Surface:** Smooth implants have been used for years, but roughened surfaces are used because of the enhanced bone-implant interface. Roughened surface increases the initial fixation of the implant TPS (titanium-plasma sprayed) implants have increased load-bearing capacity by 25-30%.

**Implant Position:** Implant angulation for posterior segments should be such that the long axis emerges from the center of the occlusal surface. In the anterior tooth region, the long axis of the implant should emerge from the cingulum of the tooth. Implant position should not be compromised by the availability of bone. Bone grafting in such cases should be planned prior to implant placement.

**Implant Number:** Though one implant for one tooth is the best option, however, five implants are sufficient for 12 teeth in the mandible and 8-12 implants for the maxilla depending on bone and parafunctional habits.

## Conclusion

Implant dentistry is the branch of dentistry gaining popularity among dentist as well as in patient, which provide a clinical solution in cases of distal extention edentulousness, where conventional approaches fails to provide fixed treatment. Furthermore it is more conservative in terms of conventional FPD where tooth prepration is mandatory. Success is achieved if the prosthesis is designed taking care of aesthetics, function, and hygiene. It falls into the hands of the dentist to identify possible complications at the right time to avoid implant failures. Several risk factors associated with high failure rates have been identified. Poor bone quality, bone grafts, irradiation, immunosuppressive medication, and selected disease states are universally recognized as risk factors, furthermore, factors such as bruxism, alcoholism, tobacco smoking, and osteoporosis are relative contraindications whereby treatment results may be compromised. All diagnostic procedures should be in a detailed manner to design the treatment plan accordingly. These included intraoral and extraoral evaluation, radiographic evaluation, implant design considerations, and biomechanical considerations.

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