

Management of Factors Affecting Immediate Implant Placement in the Maxillary Anterior Region - A Narrative Review

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ABSTRACT: Immediate implant placement (IIP) in the aesthetic zone of the maxillary anterior region is commonly becoming a very rapidly accepted and practised procedure. There are multiple factors which can have an influence of IIP and play a vital role in the success/ failure of implants in this aesthetically cervical area. These factors need to be identified and managed using various methods and techniques to increase the success rates of IIP in the maxillary anterior region. Some of the important factors like alveolar bone dimensions, soft tissue biotype, proximity to anatomical structures, buccal undercuts, tooth root angulation, position and the like if present in deficient dimensions can severely impact the aesthetic and result in soft and hard tissue deformities surrounding the implants causing its failure. These factors can be managed using a combination of hard and soft tissue augmentation procedures, atraumatic extraction technique, orthodontics and longer, angulated implants/ abutment the various factors to manage IIP in the maxillary anterior region.

Keywords: Surgical management, Non-surgical management, Immediate Implant Placement, Maxillary anterior region, Aesthetic zone.

INTRODUCTION

Implants when placed deep in the apex of the extraction socket (3-5 mm. beyond) increase the chance of implant success. To select the appropriate implant size and placement angle, it is critical to determine the alveolar bone morphology and its dimensions.

Immediate dental implant placement (IIP) is a technically demanding surgical procedure, and should be done under the following clinical circumstances: enclosed extraction socket space, absence of acute infection at the host site, adequate bony presence at all surfaces, good insertion torques of more than 25 Ncm, implant stability values of more than 70, good patient compliance and a minimum thickness of at least 1 mm. of the facial bone (Heimes *et al.*, 2021).

The use of implants right away has some benefits over delayed surgical procedures, according to Mello *et al.* reported a decrease in the period needed for osseointegration, a reduction in loss of bone by maintaining the dimensions of the tooth supporting

apparatus, increased aesthetics, particularly in the area around the upper incisors. In addition to preserving the alveolar ridge, reducing morbidity, speeding up recovery, and improving patient satisfaction, immediate implant placement is also thought to be more cost-effective and to have clinical advantages. However, drawbacks to IIP as well, including chances of failure of the implant, minor bone loss, and peri-implant soft tissue ailment (Heimes *et al.*, 2021).

FACTORS AFFECTING IIP

The ideal anatomical circumstances (thick gingival phenotype, thick facial bone wall phenotype), according to recommendations for IIP, must be met. IIP is a difficult course of treatment and carries a higher risk of complications. Incorrect drill angulation during surgery can result in a malaligned implant, faulty emergence, dehiscence or osseous defects. It can also result in defects/ loss of facial or palatal bony wall. Although this could occur with a delayed approach too,

buccopalatal collapse and gingival recession are frequent problems encountered with IIP. To increase success rates of IIP, selection of indicated patient and ideal treatment planning is mandatory. The characteristics of gingiva, facial bony plate dimensions, presence of enough dimensions of bone post-apex, and buccal space are important factors that affect the outcomes of IIP. Variables affecting the angulation of the implant, the choice of screw- or cement-retained prosthesis, the employment of angled, straight or custom abutments, the angulation of adjoining and antagonistic teeth, occlusion, and other factors are all taken into consideration when making decisions and planning for IIP (Gluckman *et al.*, 2018).

REQUIREMENTS FOR IIP SUCCESS

The International Team for Implantology Consensus Statement placed a strong emphasis on the requirements for a facial bone wall, thick soft tissue, the absence of acute local infection, and an adequate amount of bone present below and on the palatal side ensures good stability to the IIP. In order to ensure primary stability, a sum of parameters needs to be considered including root length and sagittal root position (SRP), as well as the shape of the bone complex (Gluckman *et al.*, 2018).

BONE ANGULATION

Increased stability and the desired emergence profile might be made possible by placing an immediate implant even slightly deeper. In situations involving immediate or early implant placement, a bone supplementation procedure employing periodontal flap surgery is recommended in order to achieve a successful aesthetic outcome. In most cases, bone supplementation is required to restore enough ridge dimensions that has been lost due to conditions like tooth removal, injury, disease of the periodontium, sinus thickening, or prolonged employment of removable dentures. It has been illustrated that bone supplementation for better aesthetic outcomes should be done in absence of osseous defects also. Short implants are a good alternative when restoring cases having alveolar bone atrophic jaws. The interproximal papilla level may be impacted by insufficient crest height, which could harm aesthetic results. When immediate implant placement is required, factors such as the dimensions of the facial plate and the height of the bone in the critical anterior maxillary area can influence the choice of a suitable therapeutic strategy (Sheerah *et al.*, 2019).

FACIAL BONE THICKNESS

The analysis of facial bone thickness is crucial in order to prevent crestal bony defects, loss of gingiva, and to foresee areas of bone loss during implant procedure due to the incidence of loss of bony dimensions after tooth removal. As a result, choosing the best treatment strategy for implant treatment requires carefully assessing the patient's detailed bony dimensions as well as inclination of the tooth (Affendi *et al.*, 2023).

The facial bone crest can be preserved using a variety of preventative techniques, including atraumatic extraction or partial extraction therapy, because this anatomical structure has been reported to be primarily thin (1mm). To get around the anatomical restrictions of thin facial bone, additional surgical methods like minimal or flapless surgical elevation can be used (Affendi *et al.*, 2023).

IMPLANT STABILITY

The immediate implant treatment protocol relies on the thickness of the palatal alveolar bone to direct implant placement in the anterior region at the ideal site. An earlier investigation discovered that implant engagement can achieve primary stability without coming into contact with the buccal wall because of the palatal alveolar bone aspect. In order to achieve initial stability, it was advised that the immediate implant be positioned a minimum of 3 mm below the site of tooth removal and 2 mm apical to the mid root of the palatal bone (Affendi *et al.*, 2023).

OPTIONS FOR MANAGEMENT OF FACTORS

In order to choose the right implant with the desired dimension, predict the need for bone regeneration, and make future prosthetics plans, it is also necessary to evaluate tooth angulation. A lesser circumference implant, option of cemented or with an angled screw, or additional bone supplementation with delayed placement of implant may be used by clinicians because there was a reminiscent association in inclination of tooth and bone dimensions (Affendi *et al.*, 2023).

According to clinical recommendations, a minimum buccal osseous thickness of 1-2 mm is needed to preserve the dimensions after tooth removal and IIP.

ROLE OF CBCT

Cone-beam computed tomography (CBCT) images of the place of the tooth root in the socket can give data that is helpful for preventing frontal bone ruptures because the sagittal root position can significantly affect the likelihood of labial bone perforation. Therefore, in order to evaluate the risk factors for placement of fixture, presurgical diagnostic procedures are necessary. Due to its accuracy, convenience, and low radiation exposure, presurgical CBCT is now a standard procedure for IIP, particularly in the maxillary frontal zone (Affendi *et al.*, 2023).

The implant's aesthetics and success are at risk due to the thinner bone's contribution to increased osseous loss, crestal bony deformities and loss of gingival tissue.

BONE GRAFTING

In order to preserve the osseous bone after tooth removal or to enhance the shape at the time of IIP, supplementary surgical techniques, like bone grafting, can be done to augment the thin facial alveolar bone, especially at the crest.

In order to attain the correct contour, profile and esthetics for extended favourable outcomes, fixture placement in the aesthetic zone may be necessary employing soft tissue augmentation, hard tissue supplementation, or an amalgamation of the two techniques.

The procedure that comes next after performing immediate implant placement is bone grafting in the space between the implant and the remaining socket.

IIP in the upper frontal region have been shown to produce the best clinical results when osseous augmentation procedures are combined with palatal positioning of the fixtures (Affendi *et al.*, 2023).

SAGITTAL ROOT POSITION (SRP)

The most frequently SRP class identified is SRP class I, which occurs in the scenario where the tooth root is inclined in proximity to the labial bone. This implies that fixtures that are intended to be IIP in the upper front jaw will need to have their coronal part tilted labially to get adequate stability in the apical bone. The majority of the fixture-supported single dental crowns would need to be cemented on a customized abutment, which had a mean labial-palatal angulation of nearly 18 degrees. This finding has clinical ramifications. Customized abutments with an angled screw channel would be another alternative prosthetic treatment, allowing the implant to be restored with a screw-retained dental crown (Botermans *et al.*, 2021).

ROLE OF NASOPALATINE CANAL

It has been found that 50% of the implants had nasopalatine canal perforation. Ideally 4.3 mm implants should be placed in the central incisor sockets in a bone-driven position while maintaining the safety distance of 2 mm. from the adjacent anatomic regions in 61.1% of cases, choosing implants with a smaller diameter could even now result in a significant number of nasopalatine canal encounters (43.7%). Before placing an implant, the canal's contents are advised to be curetted out to prevent sensory issues in the anterior palatal region. Nevertheless, the greater palatine nerve branches' compensatory action causes this sensation to typically return after a few months. When planning to implant in the anterior maxilla, it's also crucial to take the existence of accessory canals of the canal sinuous into account (Botermans *et al.*, 2021).

In contrast to delayed placement, a longer implant is typically required in IIP to obtain more apical anchorage.

NARROW IMPLANTS

In comparison to narrow implants, the wider implants posed roughly a twofold increased risk of bony ruptured grooves when fixture was placed in the surgically driven position. To lower the chance of perforation and to ensure maintenance of the 2 mm jumping distance, a narrow fixture can be thought of as a safer option. However, a narrower implant may sacrifice a wider space available in between the alveolar bone and the implant fixture. The clinical result may be harmed if

soft tissue develops at the implant-bone junction (Botermans *et al.*, 2021).

Clinicians must take into account the use of bone grafts in subjects with thin facial osseous surface to prevent the buccal plate from resorbing while maintaining the aesthetic results and the three-dimensional positioning of the implant (Botermans *et al.*, 2021).

ATROPHIC JAWS

When jaw atrophy and insufficient alveolar osseous width is present in the surgical area, supplementation surgical procedures like soft tissue and hard tissue osseous supplementation are necessary (Botermans *et al.*, 2021).

PERFORATIONS AND COMPLICATIONS

An alveolar cortical plate perforation and surgical complication risk are increased by buccal or lingual undercuts, and they may also necessitate additional grafting procedures. An implant may need to be positioned off-axially and restored with an angled abutment in order to account for this anatomical variation (Botermans *et al.*, 2021).

FENESTRATION

Although there is no difference in Facial Cortical Bone Thickness (FCT) between the various arch forms, the ovoid shape of alveolar arch possesses the minimum value of FCT, so precaution needs to be taken to prevent fenestration when placing an IIP. When placing immediate implants, fenestration is linked to thin facial cortical bone. It has been recommended that a presurgical clinical assessment of the arch form will be beneficial in providing a basic indication of the potential therapeutic options and complications which may happen during the surgery. This will be succeeded by the specific examination and inspections needed to determine the final treatment plan.

If the jaw bone atrophy identified by CBCT is rigorous, a supplementation surgery might be needed to strengthen the bone surrounding the implant fixture.

SOFT TISSUE LOSS

From the standpoint of dental implant aesthetics, clinicians should be extremely concerned about the incidence of soft tissue loss around the periphery of the implant fixture that occurs in the frontal and proximal surfaces after fixture placement. It was discovered that the soft tissue gingival loss around a single implant fixture was 0.5-1 mm. In contrast, the thick and wide biotype was discovered to be one of the most critical factor in achieving a pleasing outcome post implant restorations. Patients with slender scalloped gingiva have shown more predilection for soft tissue gingival loss. Furthermore, some clinicians have noted that slender alveolar shape are hidden by slender gingival shapes, which suggests that gingival shapes are associated to the underlying bony anatomy. Hence, bone anatomy has a major impact on soft tissue aesthetics around implants (Hassan *et al.*, 2022).

INCISIVE CANAL

It is crucial that the clinician evaluates the IC separately from bone quality and quantity on a CBCT scan because placing an implant too close to the Incisive Canal could result in long-term sensory damage. The two most prevalent patterns in this study, SS and SCS, appear to be the safest and most appropriate for implant placement. This population is also reasonably safe for implant placement thanks to the single canal IC. The doctor must exercise caution when deciding whether to use more tapered implants or grafts in this area because of the elderly age group. Prior to placing the implant fixture adjoining the NPC, the morphology and dimensions of the NPC must be assessed in order to minimize these complications (Sonawane *et al.*, 2022). Incorrect drilling identical path to the long axis may be caused by the extraction socket's natural profile, which can be confusing for clinicians. Some researchers suggested placing the implant right away and using a round bur rather than a straight drill to create a depression on the palatal side in the socket's apex area.

LABIAL GAP

When the immediate implant is located palatally, a space between the labial wall and implant exists. Caneva and colleagues found that applying a collagen membrane above the space may help preserve the outline of the bony crest and eventually close the gap. By using collagen membrane and deproteinized bovine bone mineral particles, other studies demonstrated noticeably improved osseous fill in the labial space. Bio-Oss® Collagen (Geistlich Pharma AG, Wolhusen, Switzerland) was used in the gap before IIP and the conclusion was that the technique increased the quantity of osseous fill at the start of the prior socket, improving the crestal osseous bone-implant fixture contact, and successfully suppressed soft tissue gingival loss. The gold standard to manage the labial gap still remains elusive. Spray and others recommended that to prevent crestal loss, a frontal osseous bone thickness of 1.8 mm should be maintained during implant fixture placement. In order to ensure adequate labial bone thickness, we therefore advised inserting osseous grafts at the labial space for immediate implants. Even though immediate implantation of implants has many benefits, delayed implantation is preferred in patients who have severe jaw atrophy or facial osseous defects in the upper frontal region (Zhixuan *et al.*, 2014).

ADDITIONAL TECHNIQUES FOR MANAGEMENT OF FACTORS

For primary stability, surgeons placing implant fixtures deeper in the osseous bony socket may encounter loss of crestal and labial bone at the apex. In other words, subjects with retracted maxillae, dentists must angle the fixture's apex more towards the palatal surface at the upper central incisor region. In light of the need for balancing towards the buccal wall at the coronal region and prevent fenestration or losing the crestal bone, it is

recommended that the implant not be angulated too palatally at the apical area. A supplementation procedure can be carried out, and the structures within the naso-palatine canal (NPC) could be relocated or obliteration of the entire soft tissue content can be done before grafting, if the expansion of the NPC and the insufficient alveolar bony ridge width affects the accurate positioning of implant fixtures and the accomplishment of pleasing results in the aesthetic zone. The upper frontal region had an interproximal osseous height of more than 1.5 mm. However, due to the trauma following tooth removal or severe periodontal diseases, the peak of interdental bone is smaller than 1.5 mm or even nonexistent. Clinicians should employ certain procedures, such as socket supplementation surgery and guided bone regeneration (GBR), to rebuild the height of the bone while maintaining the papillary presence.

In order to prevent osseous loss and soft tissue papillary loss at the interdental region, it is advised keyhole surgery and osseous supplementation at the interdental area during IIP (Zhixuan *et al.*, 2014).

To lessen crestal/ marginal osseous loss from encroachment, it is advised to leave a minimum of 2 mm amidst the implant fixture and the adjoining teeth. A procedure for augmentation is required before or during implant placement if this is not possible. Implants in the central incisor are recommended to have a diameter of between 5 and 6 mm. The maxillary central incisor's facial bony curvature angle beneath the root apex was negligible, and it appears that the facial bony plate of the central incisor nearly all of it is twisted. In order to avoid perforating the buccal alveolar plate, the long axis of the drill used at the time of preparation of the osteotomy should be as parallel to the long axis of the central incisor as possible. The implant should also have a tapered shape. When placing an implant right away after removing a tooth, it is recommended that the longest implant fixture possible should be surgically placed to provide good primary stability (Lee *et al.*, 2010).

FUTURE SCOPE

Randomized controlled trial and further studies with longer sample size needs to be conducted to validate all the treatment options listed above for the management of the factors affecting IIP in the maxillary anterior region.

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Conflict of Interest. None.

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