

Immediate Implant Placement: A Review

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Abstract: Placement of implants immediately following extraction has become an increasingly common strategy to preserve bone and reduce treatment time. This technique not only shortens treatment time but also improve esthetics by preserving the soft tissue envelope. Immediate implant placement is technically challenging and should only be undertaken by clinicians with considerable experience in implant dentistry, both surgically and prosthetically. The objective of this article is to provide a general review about immediate implant placement and to summarize uses and applications in which this technique can be indicated.

Keywords: Immediate implant, Immediate placement, Primary stability

I. Introduction

The goal of modern dentistry is to restore patients' teeth to normal contour, function, comfort, aesthetics, speech and health, whether by removing caries from a tooth or replacing several teeth. Missing teeth can be replaced with a fixed partial denture, removable partial denture or a dental implant. Dental implants have changed the face of the restorative procedures in dentistry; they provide a realistic treatment alternative for rehabilitation of patients with lost teeth.

Technologic advances and new surgical innovations have helped introduce various radical modifications to the original protocol that has shown promising and predictable outcomes. One such treatment protocol is the placement of implants into fresh extraction sockets, otherwise commonly known as immediate implant placement.^[1]

Immediate implant placement may be defined as implant placement immediately following tooth extraction and as a part of the same surgical procedure, or as implant placement immediately following extraction of a tooth which must be combined in most patients with a bone grafting technique to eliminate peri-implant bone defects.^[2]

Schulte and Heimke^[3] first described immediate placement of a dental implant in the extraction socket in 1976. Lazzara^[4] later in 1989 reintroduced the method of immediate implant placement into fresh extraction socket with 3 case reports.

The fresh extraction socket in the alveolar ridge represents a special challenge in everyday clinical practice. Regardless of the subsequent treatment maintenance, the ridge contour will frequently facilitate all further steps of therapy. This is particularly true for treatments involving the placement and reconstruction of dental implants.

After extraction of natural teeth, the greatest reduction of the alveolar bone occurs in the first 6 months to 2 years. Healing process following tooth extraction leads to a reduction of the external contours of the ridge accompanied by filling of the socket with newly formed bone. The internal and external dimensions of extraction sockets and thus the dimensions of the residual alveolar ridge changes if sockets are left without treatment, if uncontrolled this resorption will lead to bone deficiencies that sometimes may contraindicate the placement of dental implants.

Immediate placement into fresh extraction socket allows placement of implants during the same visit at which the tooth is extracted, thus it reduces the treatment time and cost, preserve the gingival aesthetics by preventing atrophy of the alveolar ridge and increases the comfort of the patient. The primary advantage of immediate implant placement is the reduction of healing time. Because the implant is placed at the time of extraction, the bone-to-implant healing begins immediately with extraction site healing. Another advantage is that the normal bone healing, which generally occurs within the extraction site, takes affect around the implant.^[5]

The placement of immediate implant offers a unique challenge compared to placement at other time points following tooth extraction. Regardless, of the site being treated, the morphology of the extraction socket is essential in the placement of an immediate dental implant and affects the clinician's choice of flap designs,

implant size selection, necessity for hard tissue grafting, and weather to submerge or non-submerge the implant during healing.

Gleb^[6] in 1993 reported a series of fifty consecutive cases followed over a 3-year period and provided a survival rate of 98% that validated the immediate placement protocol in literature. Since then, numerous animal studies, human case reports, and several randomized controlled studies have furthered the science of this treatment modality.

II. Classifications

WILSON AND WEBER^[7] used the terms Immediate, Recent, Delayed, and Mature to describe the timing of implant placement in relation to soft tissue healing and the predictability of guided-bone regeneration procedures.

However, no guidelines for the time interval associated with these terms were provided.

MAYFIELD et al^[8] used the terms,

- i. Immediate- Time interval of zero week after extraction
- ii. Delayed – Time interval of 6 to 10 weeks after extraction
- iii. Late- Time interval of 6 months or more extraction

The interval between 10 weeks and six months was not addressed.

HAMMERLE et al (2004) AND ESPOSITO et al^[9] (2006) (According to Timing of implant placement)

AUTHOR	CLASSIFICATION	IMPLANT PLACEMENT
HAMMER LE et al	Type I	In fresh extraction sockets
	Type II	After soft tissue coverage (4-8 weeks)
	Type III	Radiographic bone fill (12-16 weeks)
	Type IV	Healed sockets (>16 weeks)
ESPOSITO et al	Immediate	In fresh extraction sockets
	Immediate- Delayed	< 8 weeks post extraction
	Delayed	>8 weeks post extraction

GARBER et al^[10] 2007 (According to timing of tooth extraction and implant placement)

Class I: Extraction, with immediate implant placement directly into the extraction socket via,

- (a) “Incisionless” implant placement
- (b) Raising of a mucoperiosteal flap and placement of the implant into the extraction socket concomitant with either,
 - i. Osseous augmentation or Guided bone regeneration (GBR)
 - ii. Connective tissue or allograft

Class II: Early implant placement.

The implant is placed after extraction, and soft tissues are allowed to heal for 6 to 8 weeks.

GBR can be performed at the time of extraction and/or at the time of implant placement.

Class III: Delayed implant placement.

The implant is placed a minimum of 4 to 6 months after extraction, with preservation of alveolar ridge using grafting techniques and/or GBR, either at the time of extraction or concomitant with implant placement.

Soft tissue reconstruction in these cases will be invariably required.

GARBER et al^[10] (Based on both the osseous and soft tissue levels of the potential site at the time of extraction)

Class	Buccal Bone & Gingival Biotype	Viable Implant Placement Technique	Expected Results Of Immediate Implant Placement	Indication For Immediate Implant Placement
Class I	Intact with thick gingival biotype.	Immediate without flap reflection (incisionless)	Optimal	Yes
Class II	Intact with thin more scalloped gingival biotype.	Immediate with connective tissue graft or staged connective tissue graft	Good	Yes
Class III	Deficient, but implant placement possible in remaining alveolar housing of extraction socket.	Immediate with simultaneous guided bone regeneration and connective tissue graft or followed by staged connective tissue graft	Acceptable	Limited
Class IV	Deficient and implant may deviate from alveolar housing	Delayed	Unacceptable	No

III. Rationale For Immediate Implant Placement ^{[11]-[13]}

1. Treatment time is reduced.
2. Amount of surgery is reduced.
3. Width and height of the alveolar bone are preserved.
4. Ideal implant location can be achieved provided that the extracted tooth has a desirable alignment and there is maximum soft tissue support.
5. Reduced surgical morbidity
6. Reduced treatment time and expense
7. Better patient acceptance

IV. Indications

1. Retained deciduous teeth
2. Non-restorable carious teeth
3. Vertical/Horizontal root fracture
4. Periodontally involved teeth
5. Chronic periapical/ periodontal infection
6. Fenestration defects

V. Contraindications

1. Acute periapical/periodontal infections
2. Proximity to vital anatomic structures
3. Sites requiring guided bone regeneration
4. Patients with high lip line
5. Tissue phenotype
6. Dehiscence defects

VI. Incision Designs

Conservative flap designs should be employed during the surgery especially while placing an implant in the aesthetic zone. It is important to avoid unnecessary tissue reflection when providing sufficient access to the underlying structures.

- i. A full thickness flap design is employed rather than a flapless technique.
- ii. Flapless technique should only be employed when there is a favourable zone of attached gingiva, the aesthetic demand is low, and the site has been assessed radiographically indicating favourable clinical conditions such as intact, thick facial bony walls.
- iii. A vertical releasing incision into the mesial or distal papilla is employed to gain access to the site and inspect the buccal plate for any dehiscence or fenestration defects.
- iv. Bilateral incision designs are employed where flap advancement is desired for a submerged or semi-submerged healing approach. This is the case in the aesthetic zone to allow for over contouring of buccal profile using soft and/or hard tissue grafting.

VII. Tooth Extraction

Atraumatic tooth extraction is one of the key to successful immediate implant placement. It is very important for the success of immediate implants and facilitates maintenance of the maximum amount of bone. All teeth should be viewed as either a single root, multi-rooted teeth should be sectioned into separate roots prior to removal in an effort to avoid trauma to the hard tissues.

Various methods employed for extraction of teeth include use of Tooth extraction forceps, Dental elevators, Dental luxators and Periotomes, Vertical root distractors or Peizo surgery.

VIII. Site Preparation

- i. After the extraction the site is thoroughly de-granulated and all remnants of fibres and soft tissues removed with curettes or with a low speed rotary instrumentation using a round diamond bur, with copious chilled irrigation.
- ii. The number of remaining osseous walls is an important parameter in case selection criteria. Presence of 3-4 remaining osseous walls is essential for immediate implant success.^[7]
- iii. A series of depth gauges of varying diameters are used to inspect the site and to determine as to whether the implant can be successfully positioned into an ideal prosthetic relationship with primary mechanical stability.

IX. Implant Selection And Primary Stability

The selected implant should not be too wide or too narrow in relation to the extraction socket. A narrow implant will jeopardise the primary stability and a wider implant can lead to compression necrosis of the bone.

The implant should be 2 mm longer than the tooth socket and totally immobilized in the site without the benefit of graft material. If the implant is not immobilized, chances of osseointegration will be greatly diminished.^[14] Selection of an implant with a threaded profile and roughened surface offers greater predictability for osseointegration and initial stability.

Standard cylindrical implants though provide excellent results; tapered anatomically shaped implants are usually preferred to be used in fresh extraction socket. Advantages of tapered implants include better buccal support and help preserve the root prominence. The incidence of fenestration and dehiscence is greatly reduced with tapered implants. Tapered design also allows the implant to be placed in the same position as the extracted tooth and avoids the buccal or labial wall perforation common in the anterior maxilla when using parallel-walled implants.^[14]

Newly introduced Active implants are of choice now for immediate placement in the extraction socket. Active implants have expanding tapered body, and are indicated specially in regions of diminished bone quantity or quality due to its bone condensing capability. It has shorter drilling protocols and the apex of the implant has reverse cutting flutes, which enables gradual widening of osteotomy sites and causes minimum trauma to the bone and surrounding tissues. It has the ability to change direction on insertion. These features enable active implants to achieve higher primary stability in situations like soft bones and extraction sockets.

Lang et al^[15] in 2008 compared the clinical outcomes of standard, cylindrical, screw-shaped to novel tapered, transmucosal dental implants immediately placed into extraction sockets. Outcomes were evaluated in 208 implants over 3-year observation period. Patients centered outcome did not differ between two implants design. A clear preference of the surgeon's perception for the appropriateness of the novel-tapered implant was evident. They concluded that tapered or cylindrical implants yielded clinically equivalent short-term outcomes after immediate implant placement into fresh extraction sockets.

PRIMARY STABILITY

The primary stability is the initial engagement between the bone and implant and one has to ensure that it should be strong and paramount.^[16]

Implant requires engaging the lateral walls of the socket without changing the original socket depth, or by engaging bone apical to the original socket dimensions, in either of the these situations, only one to three threads of the implant need to be in contact with the osteotomy site. An implant that can moved laterally with finger pressure following placement will have a poor chance of achieving osseointegration and should be aborted.^[17]

If an implant design with a reduced thread radius is used, it is desirable to slightly under prepare the osteotomy site by 0.2-0.5 mm in an effort to achieve primary stability.

X. Immediate Implants In The Esthetic Zone

The anterior region of the maxilla is frequently termed the aesthetic zone due to its high visibility and influence on facial appearance. Meticulous planning is necessary for immediate implant placement in this region. Tooth extraction in this region can be done with or without elevating the flap. Elevating a flap may cause alveolar bone resorption, specially if gingiva has a thin biotype. Evans CDJ, Chen ST^[18] in 2008 gave a retrospective review on aesthetic outcome of 42 non-adjacent implant restorations completed using an immediate implant placement surgical protocol. The results showed that thin tissue biotype showed slightly greater recession than thick tissue biotype. Implants with buccal shoulder positions showed more recession than implant with lingual shoulder position with difference being highly statistically significant and recommended that implants should not be placed buccally to avoid gingival recession.

Flapless technique reduces patients discomfort, alveolar crest dimensional alterations and the vascular supply is maintained because the periosteum is maintained. Implant must be placed considering positional parameters, these are buccolingual, mesiodistal and apicocoronal positions relative to implant platform as well as the angulation of implant. Placement of the implant can be either submerged (bone level) or non-submerged (tissue level). Usually in the maxillary anterior region submerged implants are preferred to achieve esthetics.

The implant head should be a minimum of 3 mm apical to an imaginary line connecting the cemento-enamel junctions of the adjacent teeth and apical to the interproximal and crestal bone. Bucco-lingually the implant should be placed more palatally. It is important to engage the palatal wall of the extraction socket and engage the bone 2-3 mm apically. If this guideline is not followed, implant will be placed too close to the labial crest which may result in poor aesthetic outcome due to loss of crestal bone loss and marginal tissue recession. Mesio-distally a minimum of 1.5mm of distance should be maintained from the adjacent teeth

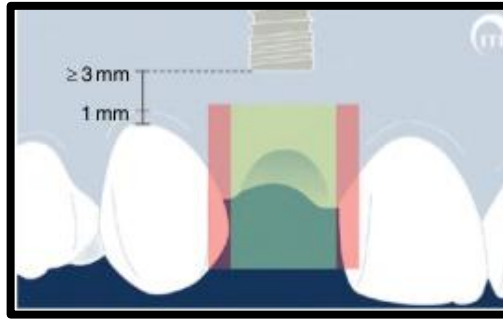


Fig. 1: Ideal mesio-distal and apico-coronal placement of the implant in esthetic zone

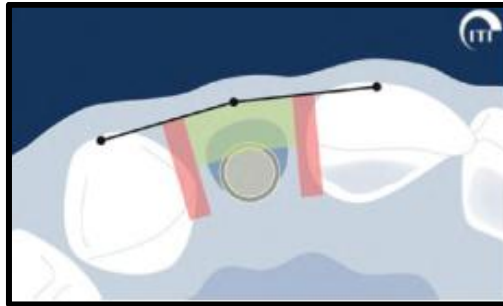


Fig. 2: Ideal bucco-lingual placement of the Implant in esthetic zone

Placement of a wide diameter or a wide platform implants should be avoided in the aesthetic zone sites. Implants that exceed the morphology of the socket usually results in complications such as mucosal recession resulting from restorative platform being positioned too far facially. Usually, maxillary central incisors and cuspids and premolars and also mandibular cuspids and premolars are treated with implants having a diameter of approximately 4 mm. Lateral incisors and mandibular incisors not to exceed a diameter of 3.5 mm.¹⁷

XI. Immediate Implants In The Posterior Region

In the molar region, implant placement in the root socket can lead to a non-ideal restorative position. This may result in mechanical overload of the implant. Furthermore, the resulting shape of the restoration may render oral hygiene more difficult, which enhances the risk for peri-implantitis. To avoid these potential problems, studies have suggested placing the implant into the inter-radicular bone and augmenting the remaining socket with graft material and a membrane. Implants in the posterior must engage the bone 2 mm apically beyond the extraction socket to achieve primary stability.

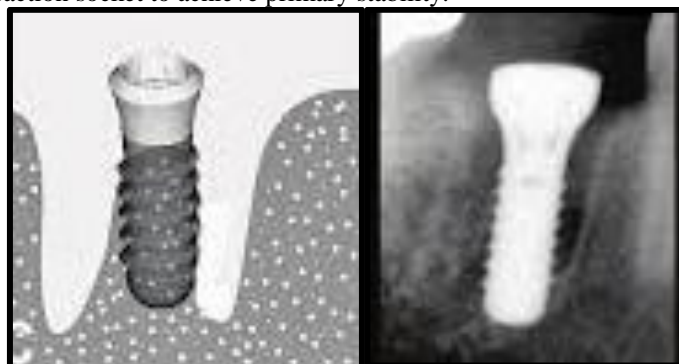


Fig. 3: Placement of the implant in inter-radicular septum

XII. Horizontal Defect Dimension (Hdd)/ Vertical Defect Dimension (Vdd)

Placement of an immediate dental implant can invariably result in either HDD or VDD gap between the implant surface and alveolar socket. The distance between immediate implant and the adjacent bone is called the 'Jumping Distance.'

Mostly, this gap is treated using a hard or soft tissue graft. But if the gap is <2mm, no augmentation of the defect is required and it can be left untreated but covered with a mucoperiosteal flap, as spontaneous bone healing and osseointegration take place if the implant has a rough surface.

The untreated gaps success usually depends upon maintaining bone viability, stabilization of the blood clot, prevention of inflammation, soft tissue collapse and epithelial down growth. In cases where the defects are quite complex both hard tissue grafting as well as barrier membranes are used. Care should be taken in such cases as the barrier membranes can become prematurely exposed and subsequently infected.

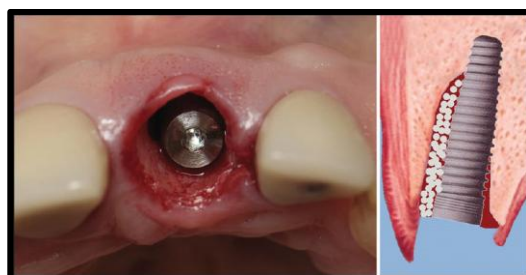


Fig. 4: Jumping distance

XIII. Conclusion

Following tooth removal a variable amount of ridge collapse takes place because of bone resorption. This bone resorption reduces bone available for implant placement; immediate implant placement into these extraction sockets prevents further bone resorption. This technique allows for bone and soft tissue preservation and shortens treatment time by reducing the number of surgical procedures. With proper treatment planning and diagnosis, and taking into consideration patient's anatomical presentation, accidents and complications, success can be achieved by this technique.

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