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IMMEDIATE IMPLANTS – AN INSIGHT

Dental Science

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ABSTRACT

The practice of immediate implant placement is gaining momentum in clinical practice and can be a very rewarding way to deliver implant therapy to patients. Appropriate patient selection and an understanding of newly developed techniques and protocols are needed to ensure that the high rates of success seen with conventional implant therapy hold true for implants placed immediately. While gaining in popularity in recent years, 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 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 implants, osseointegration, bone grafts.

Introduction-

Tooth loss by caries, periodontal diseases or fractures are common in daily practice[1]. In anterior teeth, the esthetic involvement is increased, where a careful planning is required to maintain the contour of the gingival tissue, especially when the implants are used.[2,3] In anterior teeth, decreased tissue promotes aesthetic changes that hinder the prosthetic rehabilitation. The decrease in the thickness of the crest, change gingival contour and loss of dental papilla with the appearance of black spaces are found in these cases.[4] The atraumatic extractions,[5] implant installation in the alveoli of the extracted tooth[6] and immediate provisionalization have been proposed as alternatives to maintain the volume and contour tissue, decrease costs and time of treatment.[7] Placing an implant immediately after tooth extraction offers several advantages, including a decrease in rehabilitation treatment time, fewer surgical sessions, the ability to place the fixture in an ideal axial position, positive psychological impact on the patient, and enhanced hard and soft tissue maintenance. [8,9]

History

The initial report in the literature regarding the placement of an implant immediately following tooth extraction was published by Schulte in 1976.[10] It was not until the early 1990s that the concept was reintroduced in the English-language literature by Lazzara, who illustrated this method of treatment with three case reports.[11] Lazarra's landmark paper provided insight into the future of surgical implant dentistry, with technical aspects that remain critical today. The immediate placement treatment protocol was validated in the literature several years later by Gelb, who reported on a series of fifty consecutive cases followed over a 3-year period, providing a survival rate of 98%.[12]

Changes in alveolar bone following immediate implant placement

Opinion has been divided on the ability of immediate implants to maintain alveolar bone following tooth extraction, and thus, interfere with hard tissue changes that would otherwise occur.[13] The apparent maintenance of alveolar bone after extraction has been used as a rationale for immediate implant placement,[14] although, as discussed later, this was not supported by conclusive evidence. One of the few clinical trials used to support this controversial claim, albeit weakly, are data from a splitmouth study by Paolantonio et al.[15] in which patients received bilateral implants, one in mature bone, and another in a contralateral fresh extraction socket. The histological and radiographic results showed no difference in vertical bone height lost between the groups over a 12-month period, suggesting immediate implants preserve alveolar bone dimensions and counteract tissue modeling. The authors thus stated that "early implantation may preserve the alveolar anatomy and that the placement of a fixture in a fresh extraction socket may help to maintain the bony crest structure".

Indications and contraindications for immediate implant placement

Indications-

- Endodontically failed tooth
- Root fracture
- Root resorption
- Periapical pathology
- Root perforation
- Unfavorable crown to root-ratio (not due to periodontal loss).[16]

Contraindications-

- Presence of periodontal disease.
- Presence of acute/subacute periodontal or periapical infection.
- Unfavourable anatomy
- Bisphosphonates therapy.[17,18]

Advantages and disadvantages of immediate implant placement

Advantages:

1. Reduction in the number of surgical interventions and in the treatment time required.
2. Bone width and height of the alveolar bone is preserved, enabling maximal utilization of bone-implant surface area.
3. Tooth angulations, ie., ideal implant location mesiodistally and buccolingually can be attained provided that the extracted tooth has a desirable alignment, crown length is in harmony with the adjacent teeth, natural scalloping and distinct papilla are easier to achieve and there is maximal soft tissue support.
4. Ideal orientation of the implant.
5. Preservation of bone at the extraction site
6. Optimal soft tissue esthetics may be achieved.
7. Eliminates the emotional trauma associated with loss of anterior teeth.
8. Shortening in treatment time, since with immediate placement it is not necessary to wait 6-9 months for healing and bone neo formation of the socket bed to take place.
9. Preservation of the vestibular cortical component allows precise implant placement, improves the prosthetic emergence profile, and moreover preserves the morphology of the peri-implant soft

tissues thereby affording improved esthetic-prosthetic performance.
10. Single tooth-by-tooth reconstruction provides easy access for the patient to floss and clean the areas compared with the relative difficulty in maintenance when crowns are splinted.

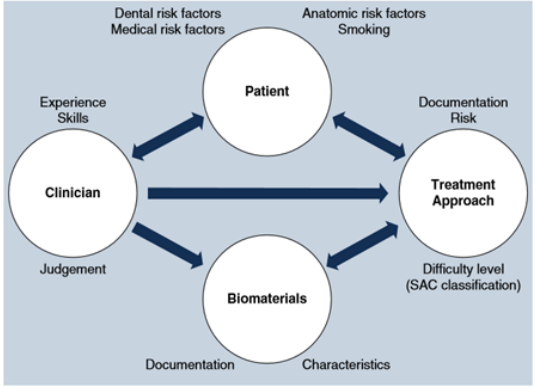
Disadvantages:
1. Tooth location: Malalignment of the extracted tooth may lead to unfavorable angulation of the fixture.
2. Anchorage: Stabilization may require more bone than is available beyond the apex. Where vital structures, such as the maxillary sinus or the inferior alveolar nerve are closely related to the apex, immediate implantation may have hazardous consequences.
3. Flap design. The mucogingival condition around the extraction socket may be unfavorable to primary closure.
4. The procedure may be technically more demanding.
5. The additional cost associated with grafting and use of barrier membrane offsets the perceived advantage that the cost is lower due to a lesser number of surgeries.

Types of osseous topography of the extraction socket and implant placement modalities:

OSSEOUS TOPOGRAPHY OF SOCKET	TREATMENT MODALITY
1. Socket with five bony walls	Immediate implantation with simultaneous grafting of peri-implant socket spaces, if required, using any resorbable graft material.
2. Socket with four bony walls	Immediate implantation with simultaneous grafting of peri-implant socket spaces and lost bony wall using autogenous bone or any resorbable graft material covered with a barrier membrane.
3. Socket with three bony walls	Immediate implantation with simultaneous grafting of peri-implant socket spaces and lost bony walls using autogenous bone mixed with any resorbable graft material covered with a barrier membrane supported by the tent screw from underneath for space maintenance.
4. Socket with two bony walls	Option 1. Socket grafting using autogenous bone mixed with resorbable graft material covered with barrier membrane supported by the tent screw from underneath for space maintenance. Implant placement after 4–6 months in healed bone. Option 2. Block grafting and delayed implant placement in the healed bone after 4–6 months.
5. Socket with one bony wall	Block grafting and delayed implant placement in the healed bone after 4–6 months.

Risk assessment

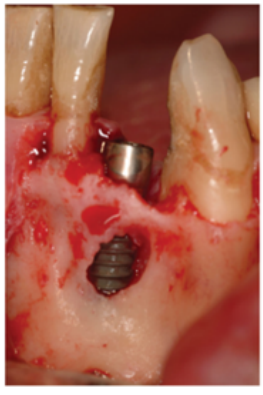
With this as the endpoint, several primary factors should be evaluated. These include the judgment and experience of the dentist, the local and systemic factors of the patient, and the biomechanics of the chosen implant system and grafting materials (Figure). Together, comprehensive evaluation of these factors will empower the dental team toward obtaining an ideal outcome.

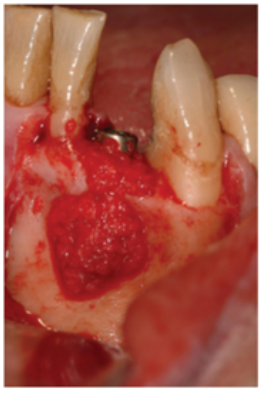


Bone grafts (fillers)

Quite often with immediate implant placement, a vertical or horizontal gap occurs between the socket wall and implant surface. This is particularly desired along the labial plate to avoid compression necrosis of the boney wall. Experimental and clinical studies have shown that a horizontal gap measuring less than 2 mm will regenerate as long as a blood clot forms and is not disrupted. Bone grafts have proven helpful with more extensive horizontal and vertical gaps to expedite osseointegration and provide shorter intervals for healing, as well as to provide support to barrier membranes and prevent their collapse into the defect. Autogenous coagulum and chips were originally recommended for this function; however, new products have been developed as alternatives to autogenous grafts to simplify surgical procedures for the clinician and reduce patient morbidity and risk. Autogenous grafts are still considered the standard for small implant defects, but when utilized, non-autogenous grafts should have the following characteristics:

- Minimal foreign body reaction
- Osteoconductivity
- Low substitution rate
- Favorable particulate size
- Ease of handling
- Cost-effectiveness



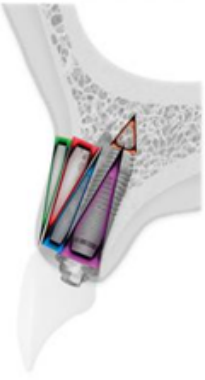


Decision making for placing immediate implants-

To achieve excellence when placing immediate implants, the diagnosis and planning of the case must be precise. There are 5 key aspects to consider during the decision-making process, to help prevent blunders that can lead to difficult esthetic situations. The following are

(I) the presence of a buccal plate,
(II) primary stability,
(III) implant design,
(IV) filling of the gap between the buccal plate and the implant, and
(V) tissue biotype.

The proposed 5 keys to consider are important to take into account prior to tooth extraction, and what considerations to have during and after implant placement. This can guide the clinician to choose favorable cases and avoid complications.[19]



Risk chart

The clinician should employ a risk factor chart when treatment planning immediate implants.[20]

Esthetic Risk Factors	Low Risk	Moderate Risk	High Risk
Medical Status	+ Immune		– Immune
Smoking Habit	None	<10 cigs/day	>10 cigs/day
Patient's Esthetic Expectations	Low	Medium	High
Lip Line	Low	Medium	High
Gingival Phenotype	Low, thick	Medium, thick	High, thin
Shape of Tooth Crowns	Rectangular		Triangular
Infection at Site	None	Chronic	Acute
Adjacent Tooth Bone Level	<5 mm	5.5–6.5 mm	>7 mm
Adjacent Tooth Restorative Status	Virgin	Minimal	Restored
Width of Edentulous Span	1 tooth >7 mm	1 tooth <7 mm	>2 teeth
Alveolar Crest Anatomy	No deficiency	Horiz. defect	Vert. defect
Timing of Implant Placement	T 4	T 2 & T 3	T 1

From *ITI Treatment Guide*, vol. 1. Courtesy of Quintessence Publishing.

Classification of implants based on timing of implant placement

Classification of implants based on the timing of placement as given by Hammerle et al.[21]

Timing of implant placement

Classification	Terminology	Time After Extraction	Clinical Findings
Type 1	Immediate implant placement	Immediately	Fresh extraction socket
Type 2	Early implant placement	4–6 wk	Healed soft tissue
Type 3	Delayed implant placement	3–4 mo	Healed soft tissue and substantial bone healing
Type 4	Late implant placement	>4 mo	Completely healed bone

Armamentarium involved-

The implant surgeons require special armamentarium for atraumatic extraction to preserve the hard and soft tissue architecture of the socket for ideal implant placement. A set of periotomes and luxators for atraumatic extractionare required. The special extraction kit of the piezotome, offers several advantages for atraumatic extraction.

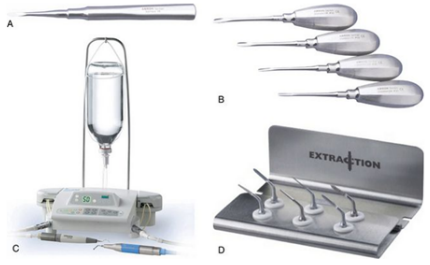


Fig 9.7 Use of (A) periotomes, (B) luxators is highly recommended for atraumatic extraction of the tooth planned for immediate implantation. (C) The piezotome with (D) its special extraction kit offers several advantages for atraumatic extraction of the tooth planned for immediate implantation

Jumping distance or critical space

In many cases, after immediate implant placement, a space often exists between the surface of the implant and the socket walls. This space is known as jumping distance and needs to be filled with bone to achieve an optimal outcome. This bone healing is dependent on stabilization of the initially formed coagulum in this space. Clot stabilization and bone formation may be adversely affected by lack of intact bony walls. In the intact socket, a critical component of the peri-implant defect is the size of the horizontal defect, which is the longest distance in a perpendicular direction from the implant surface to the socket wall. It has been shown that for implants with horizontal defect of 2 mm or less, spontaneous bone healing and osseointegration take place if the implant has a rough surface. Horizontal defects in excess of 2 mm have been shown to not heal predictably with bone. However it may be possible to achieve predictable bone fill in such situations by using collagen barrier membranes and implants with a sand blasted and acid etched surface. Studies including one from Schropp L, Kostopoulos L, Wenzel A in 2003 have shown that bone augmentation techniques may not be required where the distance between the implant body and bony wall is less than 2 mm.[22]

Complications

Accidents and complications are a part of clinical practice and reality in all aspects of dentistry. A primary challenge for practitioners is to provide care to patients with the least degree of risk in an effort to achieve the highest possible functional and esthetic outcome.[23] An accident is defined as an event that occurs during a surgical or restorative procedure, while a complication is a pathologic condition that appears postoperatively. Surgical accidents can affect the soft tissues, blood vessels, nerve trunks, sinuses, and adjacent teeth. Accidents may also involve the creation of dehiscence/fenestration defects; fractured, ingested, or inhaled instruments; and overpreparation of the osteotomy leading to the lack of primary stability.

Surgical complications may result in mucosal disturbances, loss of osseointegration, technical challenges related to the restoration process, and short-/long-term esthetic and phonetic outcomes.[24] Early complications following a surgical procedure can result in infections, edema, ecchymosis, hematomas, emphysema, bleeding, flap dehiscences, and sensory disorders. Late complications may consist of perforations of the mucoperiosteum, maxillary sinusitis, mandibular fractures, failed osseointegration, infraboney defects, periapical implant lesion, and peri-implantitis.

Conclusion

Placement of an implant directly into a prepared extraction socket at the time of extraction has several advantages that have the potential to improve patient acceptance of the procedure. Possible explanations may be proper case selection, diagnosis, aseptic method of surgery, maintenance of labial cortical plate and good oral hygiene maintenance during follow-up period.

Current evidence suggests a high success rate of 95% - 98% with immediate implant placement and loading when case selection criteria have been well followed. Hence immediate dental implant case selection based on sound clinical practice and research can maximize the advantages afforded by immediate implants and minimize treatment failures. In order to increase our understanding, studies need to be conducted with longer duration and more samples.

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