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INDICATIONS AND CONTRAINDICATIONS FOR IMMEDIATE AND DELAYED IMPLANT PLACEMENT

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Abstract. In the contemporary era, timing has become a critical factor in implant therapy. “Time truly is everything”. The art lies in knowing when to accelerate treatment to meet patient requests and when to slow down to respect biological healing achieving the delicate balance between efficiency and predictability.

The timing of implant placement following tooth extraction remains one of the most debated and clinically significant subjects in modern implant dentistry [1,2]. Immediate implant placement [Type I] and delayed implant placement [Type IV] each possess unique biological, esthetic, surgical, and prosthetic advantages and limitations. Selection of the optimal timing protocol requires careful evaluation of local anatomical conditions, soft and hard tissue quality, systemic patient-related factors, primary stability, infection status, and esthetic demands. Recent advances in digital implantology, guided bone regeneration, biomaterials, and prosthetically driven treatment planning have significantly improved the predictability of both immediate and delayed implant protocols. Nevertheless, inappropriate case selection remains a major cause of implant complications, peri-implant tissue collapse, esthetic failure, and long-term marginal bone loss.

This review article presents a comprehensive and evidence-based analysis of the indications and contraindications for immediate and delayed implant placement, emphasizing biological principles, surgical considerations, clinical outcomes, esthetic parameters, risk assessment, and modern treatment protocols. The aim of this article is to get a deeper insight into the timing of the implantation as it is one of the key aspects to long-term treatment success.

Keywords: immediate implant placement; delayed implant placement; post-extraction implants; dental implantology; osseointegration; implant timing protocols; peri-implant tissues; esthetic zone implants; primary stability; socket preservation; atraumatic extraction; peri-implant bone loss; implant survival rate; soft tissue management; ridge augmentation;

Introduction. Patients increasingly demand fast tooth replacement with minimal morbidity and cost; however, clinicians must balance these expectations with biological limitations and long-term treatment success. Dental implantology has developed from a delayed two-stage surgical approach into a biologically and prosthetically driven discipline focused on minimizing treatment duration while maximizing long-term esthetic and functional outcomes. Traditionally, Brandmark’s protocol recommended implant placement after complete socket healing, usually 4–6 months following extraction, to ensure undisturbed osseointegration and minimize the risk of implant failure [6,7]. However, prolonged healing periods frequently result in alveolar ridge resorption, soft tissue collapse, prolonged edentulism, and psychological discomfort for patients.

Following tooth extraction, significant dimensional alterations occur in both hard and soft tissues. Studies have demonstrated that approximately 50% of alveolar ridge width reduction occurs within the first 12 months after extraction, with the greatest changes during the initial 3 months [9,10]. Buccal bone resorption is especially pronounced in the anterior maxilla because the facial cortical plate is often thinner than 1 mm. These biological changes directly affect implant positioning, emergence profile, papillary architecture, and esthetic outcomes.

Immediate implant placement was introduced to reduce treatment time, preserve alveolar anatomy, decrease the number of surgical interventions, and improve patient satisfaction [5,8,16].

Immediate placement involves insertion of the implant directly into the fresh extraction socket during the same surgical appointment. Delayed implant placement, in contrast, is performed after complete soft and hard tissue healing, usually after 4–6 months.

The International Team for Implantology [ITI] classification categorizes implant placement timing into four major types:

Type I – Immediate implant placement: implant placement immediately after extraction.

Type II – Early implant placement with soft tissue healing [4–8 weeks].

Type III – Early implant placement with partial bone healing [12–16 weeks].

Type IV – Late or delayed implant placement after complete healing [>6 months].

Modern implant therapy aims not only to achieve osseointegration but also to preserve peri-implant hard and soft tissue stability, maintain papillary morphology, achieve ideal prosthetic emergence profiles, and ensure long-term biological success.

1.1. Biological Basis of Implant Timing

Tooth extraction initiates a complex cascade of inflammatory, vascular, cellular, and molecular events that significantly influence future implant placement protocols. Immediately after extraction, the socket becomes occupied by a blood clot composed of erythrocytes, platelets, inflammatory mediators, and fibrin matrix. This coagulum serves as a temporary scaffold for angiogenesis and migration of osteogenic precursor cells. During the first week, granulation tissue progressively replaces the clot, followed by formation of provisional connective tissue matrix and woven bone deposition. Osteoclastic activity becomes especially intense along the buccal plate because the bundle bone loses its periodontal ligament vascularization after tooth extraction [9,17,18].

The facial cortical plate in the anterior maxilla is frequently thinner than 1 mm and is therefore extremely susceptible to rapid resorption. Histologic and CBCT investigations demonstrated that horizontal ridge contraction may reach 3–5 mm within the first year after extraction, while vertical resorption predominantly affects the buccal crest [10,18,22]. These biological alterations compromise future implant positioning, emergence profile development, papillary architecture, and peri-implant soft tissue stability.

Cellular and Molecular Basis of Osseointegration

Osseointegration is a biologically dynamic process involving direct structural and functional connection between living bone and implant surface under functional loading. Following implant insertion, plasma proteins rapidly adsorb onto the titanium surface, initiating platelet activation and cytokine release. Growth factors including platelet-derived growth factor, transforming growth factor-β, vascular endothelial growth factor, insulin-like growth factor, and bone morphogenetic proteins regulate osteoblastic differentiation, angiogenesis, extracellular matrix synthesis, and mineralization.

Primary implant stability represents mechanical engagement between implant threads and cortical bone, whereas secondary stability develops through biologic bone remodeling and new bone apposition. Excessive implant micromotion exceeding 100–150 μm may result in fibrous encapsulation rather than osseointegration. Therefore, immediate implant placement requires optimal insertion torque values and adequate residual bone volume.

Additionally, implant macro design, thread geometry, implant-abutment connection, surface roughness, and hydrophilicity significantly influence healing kinetics and peri-implant bone remodeling. Contemporary moderately rough implant surfaces demonstrate superior bone-to-implant contact and accelerated healing compared with older machined surfaces [15,27].

1.2. Immediate Implant Placement

Immediate implant placement refers to insertion of a dental implant into a fresh extraction socket immediately following tooth removal during the same surgical appointment. Immediate implant placement represents one of the most technically demanding procedures in oral implantology because extraction surgery, implant insertion, hard tissue preservation, and soft

tissue management are performed during the same clinical intervention. The principal objective is not simply insertion of an implant into a fresh extraction socket, but preservation of the entire dento-gingival complex and minimization of post-extraction tissue collapse.

Clinical success of immediate implantation depends largely on atraumatic extraction techniques. Preservation of socket walls, interdental papillae, periodontal ligament remnants, and facial cortical bone is essential for maintenance of peri-implant tissue stability. Excessive extraction trauma may fracture the thin buccal plate and significantly increase the risk of recession, esthetic compromise, and marginal bone loss. Therefore, piezo surgery, peristomes, root sectioning techniques, and minimally invasive extraction systems are strongly recommended.

Immediate implant placement is associated with several biological and clinical advantages that make it an attractive option in properly selected patients. It significantly reduces the overall treatment time because extraction and implant insertion are performed in a single surgical session, often allowing earlier prosthetic rehabilitation compared with delayed protocols. By placing the implant immediately into the fresh extraction socket, clinicians can help preserve the alveolar ridge dimensions and support the surrounding soft tissues, which contributes to maintenance of the preexisting gingival architecture and papillary height, especially in the esthetic zone. This approach usually requires fewer surgical interventions, since it can eliminate the need for a separate ridge preservation or later implant placement surgery, thereby minimizing cumulative surgical trauma. From a patient-centered perspective, immediate placement offers clear psychological benefits, as the rapid progression toward tooth replacement and reduced edentulous period often enhance satisfaction and perceived quality of life, particularly when provisional restorations restore esthetics and function at an early stage. When appropriate case selection and meticulous surgical and prosthetic protocols are followed, recent systematic reviews report high survival rates for immediate implants, commonly ranging between approximately 94% and 98% (and in some studies up to 100%), indicating that this modality can achieve predictability comparable to conventional timing strategies in well-controlled clinical scenarios. [1,2,3,5].

Indications for Immediate Implant Placement

The most favorable indication for immediate implantation is a socket with intact four-wall anatomy, particularly preservation of the facial cortical plate. Intact socket morphology facilitates primary stability and minimizes peri-implant soft tissue collapse. Additionally, it has been detected that patients with thick periodontal phenotype demonstrate superior soft tissue stability and lower risk of midfacial recession following immediate implantation [11,13]. Thin biotypes are associated with increased recession risk and esthetic complications which influences the outcome of our implantation immensely.

Although modern literature suggests that immediate implantation may be possible in selected infected sockets following meticulous debridement, ideal candidates are sites without acute suppuration or extensive periapical pathology. Without neighboring pathology primary implant stability can be implemented for successful osseointegration as immediate implants require sufficient residual apical and palatal bone beyond the extraction socket to obtain insertion torque and mechanical stability.

Immediate implantation is frequently indicated in the anterior maxilla where preservation of gingival contour, papillae, and emergence profile is critically important in terms of time management and results. Patients seeking shorter treatment duration and fewer surgical appointments may benefit significantly from immediate protocols.

Contraindications for Immediate Implant Placement

Severe buccal bone deficiency can be one of the most thought-provoking cases as extensive facial plate destruction increases the risk of soft tissue recession, compromised esthetics, and implant exposure. Such cases often require staged augmentation and delayed implantation.Furthermore, acute uncontrolled infection demands specific attention as the

presence of severe purulent infection, cellulitis, active abscess formation, or extensive periodontal destruction may compromise osseointegration and wound healing.

In some cases inability to achieve primary stability plays a determining role due to inadequate residual bone which results in insufficient insertion torque.

In regards to biological contraindications such as uncontrolled diabetes mellitus, immunosuppression, recent radiotherapy, severe osteoporosis, and bisphosphonate-related complications may contraindicate immediate implantation. Bruxism and excessive occlusal loading increase micromotion and may compromise osseointegration. As it is complicated to control patients' hygiene and habits, there may be consequences with untreated periodontitis and inadequate plaque control significantly increase peri-implant disease risk. Especially, smoking negatively affects vascularity, angiogenesis, osteoblastic activity, bone healing, and soft tissue maturation, increasing the risk of implant failure and peri-implantitis [5,15].

1.3. Delayed Implant Placement

Delayed implant placement refers to the insertion of a dental implant into an edentulous site after complete healing of the extraction socket, usually following a healing period of approximately 4–6 months after tooth extraction, allowing full maturation of both hard and soft tissues before implant surgery. This protocol corresponds to Type IV implant placement according to the International Team for Implantology (ITI) classification system.

Delayed implant placement offers several important advantages that justify its selection, especially in compromised extraction sites. Allowing a healing interval after tooth extraction facilitates complete resolution of local infection and inflammation, which reduces microbial load and improves the biological environment for subsequent osseointegration. During this period, soft tissues can fully heal and stabilize, leading to mature keratinized gingiva and more predictable soft tissue contours at the time of implant placement. The extended healing time also permits the formation and remodeling of mature bone within the socket, creating a denser and more stable recipient bed that supports primary stability and long-term implant survival.

From a surgical standpoint, delayed placement provides better visualization of the healed anatomy and facilitates easier flap elevation and manipulation, which is particularly beneficial when simultaneous hard- or soft-tissue grafting is required. In sockets that were initially compromised by infection, bone defects, or thin buccal plates, deferring implant placement decreases surgical complexity by allowing staged regeneration and contour augmentation before implant insertion. In esthetically demanding or high-risk cases, such as those with significant tissue recession, thin biotypes, or severe alveolar defects, delayed protocols can lower the esthetic risk because they give clinicians time to optimize both hard and soft tissue conditions before placing an implant in the final restorative position. For these reasons, delayed implant placement continues to be regarded as the most predictable and conservative protocol in severely compromised sites, where immediate placement would jeopardize primary stability, tissue support, or prosthetic outcome.

Indications for Delayed Implant Placement

Delayed implantation is recommended when severe buccal plate defects, dehiscence, fenestration, or traumatic extraction damage are present. This method of implant placement can present sufficient time for regeneration of soft and hard tissues. If patient does not wish to risk peri-implant disease with immediate implant placement, delaying the operation is the optimal option for both doctor and patient. Ideally, patients with acute odontogenic infection, extensive cystic lesions, osteomyelitis, or periodontal abscesses often require delayed therapy after infection control.

The need for ridge augmentation represents one of the principal indications for delayed dental implant placement following tooth extraction. After extraction, physiological remodeling of the alveolar ridge leads to significant horizontal and vertical bone resorption, particularly during the first 3–6 months. These dimensional alterations may compromise the quantity and

quality of hard and soft tissues necessary for ideal three-dimensional implant positioning, primary stability, and long-term esthetic outcomes. In such situations, delayed implant placement allows sufficient time for site healing and for augmentation procedures aimed at reconstructing deficient alveolar anatomy. Alveolar ridge augmentation becomes especially important in cases characterized by severe periodontal destruction, traumatic extraction, chronic periapical infection, thin buccal cortical plates, fenestrations, dehiscence defects, or extended edentulous periods associated with progressive ridge atrophy. These kinds of factors can result in insufficient bone volume which prevents predictable stabilization.

Complex anatomical situations such as close proximity to the maxillary sinus, nasal cavity, or inferior alveolar nerve may necessitate delayed placement and augmentation procedures. Traumatic extractions also demand time for healing and reconstruction after extensive wall damage, in which delayed dental implantations come in hand.

Contraindications for Delayed Implant Placement

Delayed implant placement is contraindicated in several clinical and patient-centered scenarios. Severe ridge resorption poses a significant risk because prolonged healing intervals can lead to advanced alveolar collapse, thereby complicating subsequent implant positioning and compromising prosthetic outcomes. Patients who explicitly refuse extended treatment durations are poor candidates for delayed protocols, since these approaches typically necessitate prolonged healing periods and multiple surgical stages that require commitment and adherence. In the esthetic zone, particularly the anterior maxilla, delayed placement may precipitate soft tissue shrinkage and papillary loss, undermining cosmetic results and making predictable soft tissue management more difficult. Finally, individuals who experience psychological distress or functional limitations that prevent them from tolerating removable provisional prostheses during the healing phase are not suitable for delayed strategies, as provisionalization is often essential for comfort, function, and tissue preservation throughout the treatment course.

1.4. Immediate Versus Delayed Implant Placement: Survival Rates

Recent evidence-based studies suggest that survival rates for immediate and delayed implants are generally comparable when strict case selection criteria, atraumatic surgical principles, and adequate prosthetic planning are respected [1,2,5,16].

Systematic reviews report:

Immediate implants: approximately 94–98% survival.

Delayed implants: approximately 95–99% survival.

1.5. Risk Assessment and Case Selection

Proper patient selection remains the cornerstone of successful implant therapy. The following factors should always be assessed:

-Systemic health.
-Oral hygiene.
-Bone quantity and quality.
-Esthetic expectations.
-Parafunction.
-Smoking status.
-Periodontal condition.
-Soft tissue phenotype.
-Occlusal risk.
-Infection status

No surgical protocol can compensate for poor diagnosis, inadequate risk assessment, or improper case selection. Modern implantology increasingly emphasizes individualized treatment planning based on biological width preservation, peri-implant phenotype management, prosthetically guided positioning, and long-term maintenance protocols [6,8,15].

Conclusion. The decision between immediate and delayed implant placement should be based on evidence-based biological principles, comprehensive clinical examination, radiographic analysis, prosthetic planning, and individualized patient-centered assessment. Immediate implant placement offers major advantages including reduced treatment time, preservation of tissue architecture, and improved patient satisfaction; however, it is highly technique-sensitive and requires ideal anatomical conditions and careful patient selection.

Delayed implant placement remains the gold standard for compromised sites characterized by severe infection, inadequate bone volume, or advanced hard and soft tissue destruction. Contemporary implantology increasingly emphasizes minimally invasive approaches, digital planning, regenerative procedures, and prosthetically guided treatment concepts to maximize long-term functional and esthetic outcomes.

Future research should continue investigating long-term peri-implant tissue stability, biologic complications, digital workflows, and biomaterial innovations to optimize implant timing protocols and improve predictability across diverse clinical scenarios.

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