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PUBLISHED: **JUNE 2025**
EXPIRES: **MAY 2028**

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Implant placement and loading protocols in partially edentulous patients

What clinicians should know first

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ABSTRACT

This review explores different strategies and outcomes associated with different timings of dental implant placement and loading, emphasizing their roles in achieving esthetic and functional success in implant dentistry. The four categories of implant placement timing after tooth extraction, proposed at the Third ITI Consensus Conference, are discussed. Overall, each timing strategy serves distinct clinical scenarios, and their successful implementation hinges on a thorough understanding of patient-specific anatomical and esthetic needs, ensuring high predictability and patient satisfaction with the implant outcomes.

EDUCATIONAL OBJECTIVES

At the conclusion of this course, the oral health-care provider will be able to:

1. Distinguish among the four implant placement timing categories (types 1-4) by comparing their clinical practice indications, advantages, and limitations
2. Determine the appropriate implant placement timing (immediate, early, or delayed) for a given clinical scenario by analyzing site-specific factors such as bone volume, soft-tissue phenotype, and infection status
3. Implement safe and effective surgical techniques for immediate implant placement by selecting suitable flap designs, grafting protocols, and 3D positioning to reduce complications such as mucosal recession and fenestration
4. Evaluate different implant loading protocols (immediate, early, and conventional) by assessing patient-related outcomes (e.g., comfort, esthetics, function) and implant survival rates in both fully edentulous and partially edentulous cases

Timing plays a critical role in the success of dental implant procedures. Research on socket healing has demonstrated that within three to four months, the socket may be filled with newly formed bone, creating favorable conditions for successful dental implant placement with optimum primary stability.[1,2] This breakthrough has significantly influenced the loading protocols for dental implants.[3]

Four categories of implant placement timing after tooth extraction have been proposed at the Third ITI Consensus Conference based on the desired clinical outcome of the wound-healing process.

- **Type 1** placement involves implant placement on the same day of tooth extraction and within the same surgical procedure.
- **Type 2** placement occurs after soft-tissue healing but before

any clinically significant bone fill within the socket.
- Conversely, **type 3** placement is characterized by implant placement following the socket's considerable clinical and radiographic bone fill.
- Finally, **type 4** placement involves the insertion of an implant in a fully healed site.[4]

Esthetic conditions of peri-implant tissue could be enhanced with immediate implant placement and provisionalization compared to standard protocols.[5-7] The Fourth ITI Consensus Report defines immediate loading as delivering a provisional prosthesis to the implant during the first week of healing. Early loading is defined as one to eight weeks of healing, while conventional loading is accomplished after two months.[8] In cases where primary stability is achieved, a provisional restoration can be placed after an implant-level impression for a single tooth or with an abutment-level impression for partial and complete arch implant restorations, as required.

Timing of implant placement

In 2003, the International Team for Implantology Consensus Conference in Gstaad, Switzerland, introduced standardized terminology for implant placement timing, distinguishing between immediate, early, and delayed options, particularly in the esthetic zone.[9] When considering treatment options, it is crucial to evaluate each option's advantages and disadvantages comprehensively. In the anterior maxilla, achieving an esthetically pleasing outcome with long-term esthetic stability is paramount, followed by proper function and phonetics. Therefore, implant therapy must be judiciously planned to meet these objectives. The patient's unique clinical circumstances and needs must be evaluated carefully to produce the best possible outcome. This will help determine the optimal action to take.[10]

In the following paragraphs, there is a summary of each type of implant placement timing period.

Immediate implant placement: According to the SAC Classification (straightforward [S], advanced [A], complex [C]), immediate implant placement (type 1) will always be a complex dental procedure that involves inserting a dental implant into a fresh socket after tooth extraction. This procedure may offer superior esthetic outcomes, a low morbidity rate, and the possibility of delivering an immediate provisional prosthesis on the extraction day. Still, its success depends on various factors, including ideal anatomical conditions. Some of the factors that can impact the success of immediate implant placement include:
- The facial bone wall should be fully intact, with no dehiscence or fenestration defects that could compromise the implant's primary stability and esthetics.[11]
- A thick wall phenotype (thickness greater than 1 mm), which is relatively rare in the anterior maxilla, is ideal.[12-14]
- A thick gingival biotype is less prone to recession and can better support the implant, contributing to a better esthetic outcome. However, the facial soft-tissue thickness in the anterior maxilla is generally thin and should be anticipated to be thin.[15]
- The extraction site should have sufficient bone volume apical and palatal to ensure correct 3D implant positioning and adequate primary stability.[16]
- The presence of acute infection at the extraction site can also impact the procedure's success by affecting the healing and integration process of the implant. Late complications include but are not limited to retrograde peri-implantitis.[17]
- Flapless surgery is a preferable option to minimize the chances of midfacial mucosa recession and minimize patient morbidity.[18] Despite this, potential complications such as bony dehiscence and fenestration may arise.[19,20] Thus, selecting the appropriate flap design is based on the need for access for ridge augmentation as well as the surgeon's expertise.[21]
- Avoiding facial malpositioning of implants is crucial during immediate placement to reduce mucosal recession risk.[22]

Providing sufficient space of at least 2 mm between the implant and the internal surface of the facial bone wall is recommended to reduce postsurgical orofacial bone resorption and ensure sufficient future buccal bone thickness, which is vital for preserving blood supply and healthy tissues.[9,23,24] See Figures 1a-1f.

Thus, clinicians who perform immediate implant placement must have high skill, experience, and knowledge of anatomical variations to ensure optimal outcomes and be able to avoid the challenges of implant bed preparation and the risk of apical perforation or facial malpositioning of the implant.[25]

Early implant placement with soft-tissue healing

Early implant placement with soft-tissue healing, or type 2 placement, is a dental implant protocol involving a healing period of four to eight weeks following tooth extraction before implant insertion. This approach provides several advantages for both the clinician and the patient by simplifying the surgical procedure and reducing the risk of postsurgical complications. In addition, during the healing period, the soft

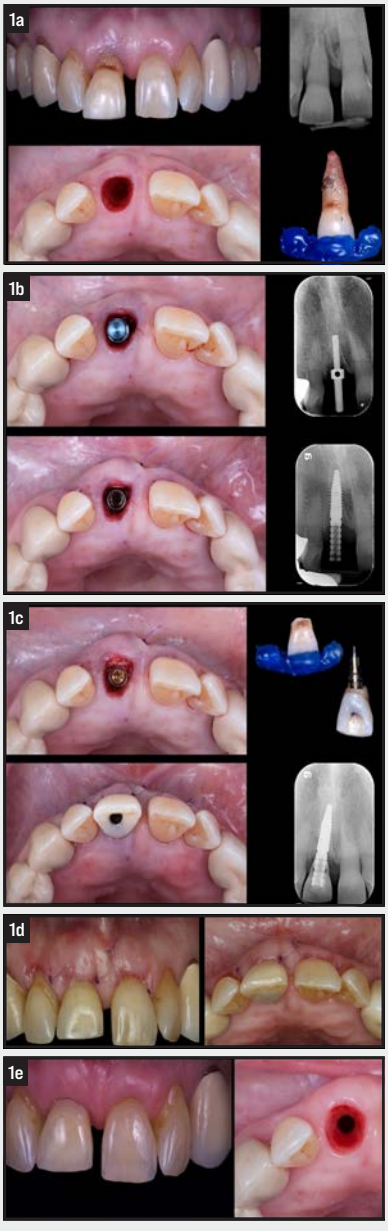


FIGURE 1: Immediate implant placement

The sequence of immediate implant placement in the maxillary esthetic zone

(1a) Preoperative phase: The maxillary right central incisor exhibits midfacial gingival recession, a noncarious cervical lesion (NCCL), and blunted papillae. The periapical radiograph shows a radiolucent periapical lesion, extensive bone loss, and disruption of the lamina dura. The postextraction socket demonstrates intact facial and palatal walls, while the extracted tooth reveals external root resorption and apical blunting.

(1b) Intraoperative phase: The occlusal view following site preparation illustrates the direction indicator within the osteotomy, demonstrating proper alignment in both the bucco-palatal and mesiodistal directions relative to the adjacent teeth. There is an adequate amount of keratinized tissue, and the preservation of the facial bone plate is evident. This is further verified by a periapical radiograph, which shows that the placed implant is parallel to the adjacent teeth.

(1c) Provisionalization phase: An occlusal view illustrates the healing abutment securely positioned within the implant body. The extracted crown has been modified for loading as a screw-retained provisional restoration. Modifications included hollowing the crown and adapting it to a temporary abutment. The provisional crown was placed immediately, with careful contouring of the emergence profile to preserve papillary fill and the integrity of the facial gingival architecture. A periapical radiograph was obtained post-provisionalization to confirm the positioning of the implant and the proper seating of the restoration, revealing no signs of abnormalities.

(1d) Healing phase: Two-week follow-up: Left: Frontal view showing healthy, well-contoured peri-implant soft tissue with reestablished papillary form. Right: Occlusal view further demonstrates soft-tissue closure and early tissue integration around the provisional crown.

(1e) Four-month postoperative phase: Left: Frontal view reveals stable gingival margin, and well-preserved papillae, maintaining harmony with adjacent dentition. Right: Occlusal view after provisional crown removal reveals a healthy peri-implant mucosa with a well-defined soft tissue emergence profile.

(1f) Definitive prosthesis phase: Left: An intraoral frontal view shows the definitive screw-retained crown harmoniously integrated within the esthetic zone. The restoration exhibits ideal shade matching, contour, and emergence profile. Right: A periapical radiograph verifies the proper positioning of the implant with its corresponding crown with no signs of inflammation.

tissue undergoes healing and produces an additional 3-5 mm of keratinized mucosa at the site of the future implant.[25] However, the bundle bone, particularly in the midfacial area of the extraction socket, tends to resorb due to high osteoclastic activity, which is a natural part of the initial wound healing phase. In cases with a thin facial bone wall or a damaged facial wall, spontaneous thickening of the soft tissue occurs, which can increase soft-tissue thickness sevenfold in the midfacial region as demonstrated by Chappuis et al.[26,27] Recent clinical studies showed that immediate socket grafting or alveolar ridge preservation (ARP) added value may be limited when implant placement is planned within an eight-week window postextraction. One randomized control trial found no significant differences in esthetic, clinical, or patient-reported outcome measures (PROMs) at one year between patients who underwent early implant placement with or without ARP using either a collagen matrix or a palatal graft to replace a single missing tooth.[28] Another prospective study reported that although DBBM-C with a collagen matrix preserved more mineralized tissue upon histological analysis, all treatment protocols—including spontaneous healing—underwent substantial soft- and hard-tissue remodeling within the first eight weeks, with stable peri-implant tissues maintained up to one

year postloading, regardless of whether ARP was performed or not.[29] Moreover, a study by Strauss et al. emphasized that while ARP reduced the need for simultaneous GBR at implant placement (31%-32% vs. 68% in the non-ARP group), the best radiographic and profilometric outcomes were observed when GBR was performed at the time of early implant placement, regardless of whether ARP had been done previously.[30] A broader systematic review by Mardas et al. concluded that while ARP significantly reduced the need for additional augmentation, it did not improve implant survival, success, marginal bone loss, or placement feasibility compared to unassisted socket healing.[31]

This approach has several advantages from a surgical perspective. The thickened mucoperiosteal flap that results from the healing period enhances vascularity, improves healing capacity, and potentially reduces the need for connective tissue grafting for soft-tissue augmentation.[26] Any acute or chronic infections or fistulae at the extraction site typically resolve, offering a future implant site with reduced bacterial risk. Moreover, new bone formation at the apical portion of the socket facilitates easier implant bed preparation than a fresh extraction socket.[25] In comparison to a fresh extraction socket, a healed socket exhibits increased cortical bone density and greater structural maturity. Conversely, fresh sockets are generally characterized by lower-density trabecular bone, particularly in the apical region. The superior bone quality found in healed sites is likely to enhance implant engagement by facilitating more precise osteotomy preparation and enabling greater mechanical bone-to-implant contact. This contributes to improved primary stability, which is a critical prerequisite for successful osseointegration and the subsequent establishment of long-term secondary stability.[32,33]

Early implant placement with soft-tissue healing is a well-documented and frequently used approach in the anterior maxilla that offers favorable regenerative and esthetic outcomes with high predictability and low risk of mucosal recession.[34,35] Due to its enhanced soft-tissue thickness and vascularity, this technique is an auspicious option for implant placement, especially in cases with a thin or damaged facial bone wall. It is particularly beneficial in cases where the local bone anatomy allows for correct 3D implant positioning and good primary stability.[36] See

FIGURE 2: Early implant placement

The sequence of early implant placement in the maxillary esthetic zone

(2a) Preoperative phase: Pre- and post-extraction, prior to early implant placement.

(2b) Soft tissue healing phase: Four to eight weeks postextraction, demonstrating complete soft tissue healing and socket closure.

(2c) Surgical reentry phase: A full-thickness mucoperiosteal flap reflection reveals a mature alveolar ridge and adequate keratinized tissue. The occlusal view illustrates the meticulous preparation of the implant bed within the alveolar housing, subsequent to the completion of the initial osteotomy.

(2d) Implant placement phase: After the insertion of the implant, a frontal view shows that the fixture is positioned at the level of the crestal bone, with a cover screw in place. This was confirmed by a periapical radiograph, which illustrates the direction indicator within the implant bed.

(2e) Simultaneous guided bone regeneration (GBR): Bone augmentation was performed to enhance the insufficient thickness of the facial bone surrounding the dental implant.

(2f) Immediate postoperative phase: Frontal view showing tension-free primary closure and flap adaptation achieved with stable interrupted sutures over the augmented ridge.

(2g) Stage two of implant placement: Implant uncovering was performed, and healing abutments were adapted. Implant and healing abutment integrity was confirmed

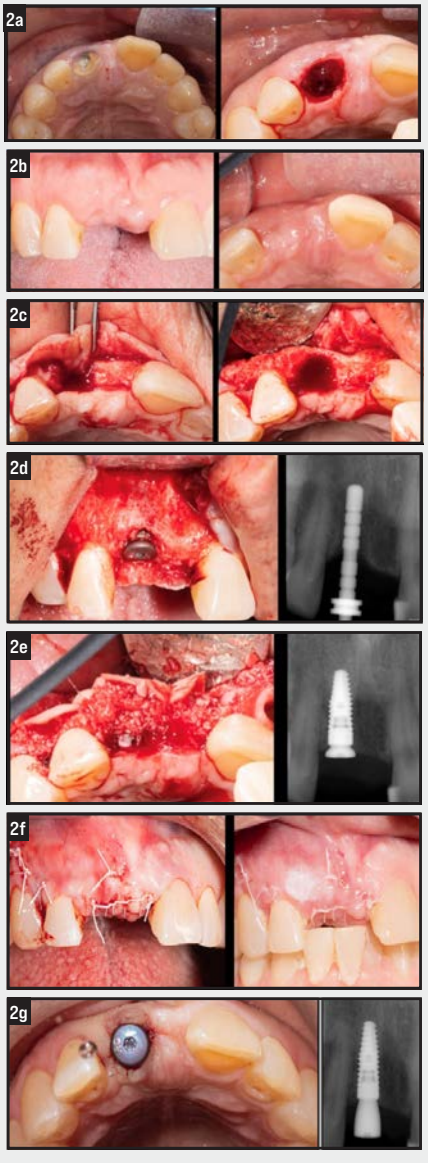
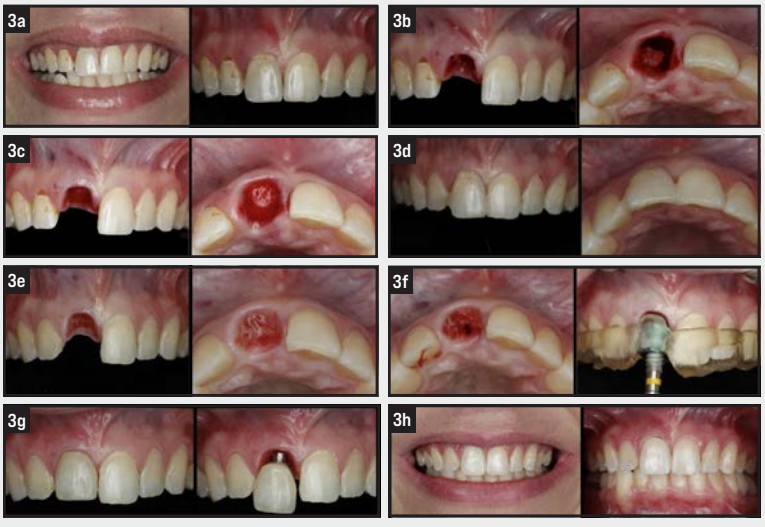


Figure 2a-2g.

On the flip side, type 2 implant placement is technique-sensitive and combines the challenges associated with types 1 and 4, namely, the need for ideal implant positioning in a compromised socket (similar to type 1), and at the same time, the need for simultaneous bone augmentation with implant placement (similar to type 2).[37]

FIGURE 3: Delayed implant placement

The sequence of delayed implant placement in the maxillary esthetic zone.



(3a) Preoperative esthetic zone assessment: Showing discoloration and coronal damage to the maxillary right central incisors surrounded by erythema and mild swelling along the marginal gingiva and right interdental papilla with visible small fistulous opening.

(3b-3c) Socket healing phase: Shows socket immediately postextraction and grafting.

(3d) Provisional prosthesis phase: Occlusal and frontal view of a fixed provisional bridge replacing the missing central incisor during healing.

(3e) Healed edentulous area postextraction after four months.

(3f) Intraoperative phase: Osteotomy initiation for delayed implant placement using a custom-fabricated surgical guide.

(3g) Immediate provisional phase: Single screw-retained crown delivered following implant placement.

(3h) Definitive prosthesis phase.

Early implant placement with partial bone tissue healing

Early implant placement with partial bone healing, also referred to as type 3 implant placement, is a dental implant protocol involving a healing period of 12 to 16 weeks that allows for sufficient bone regeneration to ensure the stable placement of the implant. It is part of a comprehensive treatment plan for achieving optimal esthetic and functional outcomes in various clinical situations where conditions are not suitable for either immediate implant placement (type 1) or early implant placement with soft-tissue healing (type 2).[38] It is recommended in cases where a significant bone lesion in the periapical area prevents immediate implant placement in the correct 3D position following tooth extraction.

This technique is also ideal for replacing multirooted teeth, which are rare in the maxillary anterior area, where complex root structures and larger extraction sockets may require additional time for bone healing to achieve sufficient primary stability for implant placement.[39,40]

Late implant placement

Late implant placement, or type 4 implant placement, is a protocol in which the implant is placed in the extraction socket after a healing period of six months or more. It may require additional procedures such as guided bone regeneration to ensure successful implant integration and esthetic results. Lengthy treatment duration makes this option less attractive to patients. Type 4 placement may be required for specific patient- or site-related reasons.[41] For instance, young adolescents who have experienced tooth loss due to trauma but are not yet eligible for implant therapy, pregnant patients, or individuals who are unable to undergo surgery earlier due to personal or professional commitments may require late implant placement due to patient-specific reasons. Site-specific reasons may include large apical bone lesions such as radicular cysts or ankylosed teeth in an apical position with insufficient bone volume for immediate or early implant placement. As a result, the International Team for Implantology (ITI) recommends socket grafting postextraction as a ridge preservation technique to prevent ridge alterations and atrophy.[9,42] Although performing simultaneous guided bone regeneration cannot prevent bundle bone resorption in the first weeks of healing, which may lead to some bone resorption in the crestal aspect

of facial bone, it aims to avoid more invasive ridge augmentation procedures later, and it is still required at implant placement in esthetic sites to compensate for crestal bone resorption.[43] See Figure 3a-3h.

Timing of implant loading

Immediate loading of dental implants in the esthetic zone has emerged as a promising technique that offers several benefits over traditional implant placement and loading protocols. These benefits include superior esthetic outcomes, reduced treatment time, high patient satisfaction, better soft-tissue management, and improved quality of life.[44,45] Patients tend to prefer this technique due to its less invasive nature and fewer disruptions to their daily lives. However, it is essential to note that immediate loading is a technique-sensitive procedure that requires a skilled and experienced surgical team to ensure successful outcomes. Therefore, the benefits of immediate loading should be weighed against the potential risks and limitations before making a final decision.

As early as the 1990s, Ericsson et al. had demonstrated that osseointegration can be achieved equally well with a one-stage approach in the intraforaminal area of the mandible without compromising bone remodeling.[46] By this time, studies had accepted an immediate loading protocol as a promising procedure.

Immediate loading is defined as attaching a prosthetic appliance to the implant(s) within three days after implant surgery rather than waiting for a traditional healing period. This time frame aligns with the time necessary for dental technicians to process provisional or definitive restorations and is currently accepted in implant dentistry. Initial attempts for immediate loading by Linkow et al. were met with limited success due to fibrous encapsulation, leading to the adoption of the delayed protocol as the standard approach.[47,48] In the late 1990s, studies began to show positive outcomes with early loading, particularly in the edentulous mandible, irrespective of the implant system or surface topography (surface treatment) used.[49-51]

Studies conducted by Degidi et al. in 2003 reported positive outcomes of immediate loading of titanium implants in humans.[52] The histologic and histomorphometric evaluation of peri-implant bone showed successful osseointegration and bone-implant contact. In another study, the same authors analyzed clinically retrieved immediately loaded titanium implants and found successful osseointegration after six months of function.[53] Furthermore, a case report by Di Stefano et al. in 2006 demonstrated successful long-term osseointegration of a blade implant immediately loaded and retrieved after a 20-year loading period, with histologic and histomorphometric evidence.[54]

Immediate loading in fully edentulous patients

Immediate loading began with a strong focus on the fully edentulous mandible, which was shown to be highly predictable. It involves the placement of dental implants and the immediate attachment of a prosthesis, providing patients with functional teeth shortly after the surgical procedure. The fully edentulous mandible using an overdenture is highly predictable in implant survival, with success rates above 95%, indicating a high-reliability level for this treatment approach in the mandibular arch.[55-57] Also, crestal bone loss associated with immediate loading of mandibular overdentures is typically minimal, with reports ranging from 0 to 0.2 mm in early loading and an average of 0.7 mm in immediate loading.[57] This bone loss includes remodeling due to establishing a transmucosal connection.[58] The number of implants used for connection is primarily based on patient selection and the preferences of the clinician or patient and the prosthetic design planned.[53]

The clinical outcome of overdentures in the maxilla with immediate loading is cautiously optimistic. It is becoming more common, but further research is needed to establish comprehensive guidelines.[59] Regardless, immediate loading of overdentures in the upper jaw can result in a clinical implant survival rate of over 97%.[54,55] For instance, one implant system showed a 97.8% implant survival rate over 12-54 months.[60] According to a study by Pieri et al., within the first year of having attached maxillary overdentures, the survival rate was 97.1%.[61] Immediate loading for fully edentulous patients in both the maxilla and mandible in terms of overdentures has been associated with high patient satisfaction, mainly due to improvements in comfort, function, and oral health-related quality of life, but not in the cleaning feasibility category, showing that some patients may face cleansing difficulties. While the implant survival rates are high, there is a need for early maintenance, as technical prosthetic complications, including denture fractures, can occur. These may include the need for denture relining, metal framework reinforcement, attachment matrices replacement, and occlusal adjustment.[62-64]

Immediate loading with a complete fixed prosthesis was attempted by introducing the Novum Concept (Nobel Biocare) for immediate loading of dental implants in the mandible, which involves placing three implants in a tripodal configuration within the interforaminal area of the jaw.[65] These implants are then

connected by a horseshoe bar. This concept faced challenges, such as ongoing bone loss and implant failure of 7.4%.[65,66] It ended with a disappointing result, suggesting that three implants are insufficient to support an immediately loaded fixed prosthesis, especially taking into consideration the additional expenses for repairs in that case.

The "All-on-4" concept was introduced in 2003 and aimed to place two implants in the anterior, and two tilted implants in the posterior region. The tilted implants were specially designed to pass coronally to the mental foramen, increasing the anterior-posterior (AP) spread, and required an angled abutment. It was found that the total failure rate using four to six implants was 0.75%.[67] Additionally, when initial implant stability was provided, the bone loss associated with immediate loading protocols was reported to be below 1 mm, comparable to delayed loading protocols and within acceptable clinical limits. Therefore, immediate loading is as adequate as the traditional methods used in mandibles with entirely missing teeth.[68-70]

Studies have found that immediate loading in the maxilla can be a successful treatment option if enough implants are used.[59] Typically, utilizing six to eight implants results in a low failure rate of 0%-3.3%.[71] However, decreasing the number of implants to four may increase the risk of implant failure, ranging from 1.6%-7.2%.[72] To ensure a positive outcome, factors such as longer implants, initial implant stability, and cross-arch splinting must be considered.[73,74] While clinical survival rates are promising, remaining mindful of potential technical complications is imperative. One such complication is the risk of fractures in the provisional fixed prosthesis. To avoid failure during the healing process, additional reinforcement may be necessary. It is critical to maintain diligent and regular follow-up with the prosthesis to address any issues that may arise during the initial healing phase. This approach is essential to guarantee the ongoing success of the prosthesis.[53]

Immediate loading in partially edentulous patients in healed sites versus fresh extraction sockets

The success observed in the immediate-loading protocol in the fully edentulous jaw led to a broader acceptance of the immediate loading concept. Then, its application was expanded to partially edentulous patients, focusing on the load-carrying part of the dentition.[59] The clinical outcomes of immediate loading in the partially edentulous patient are generally positive and predictable, particularly when a fixed prosthesis is used. The implant survival rates for such procedures are high, ranging from 95.5% to 100%.[75-77] However, it is essential to note that while there is substantial evidence regarding the success of immediate loading in terms of implant survival and bone loss, there is a lack of data on soft-tissue parameters, esthetic aspects, and patient-centered outcomes, especially in the esthetic zone of the dentition.

Despite various studies, the influence of occlusal contact on implant survival, which typically ranges from 85.7%-100%, has not been definitively demonstrated.[78,79] Immediate loading has a slightly higher risk of failure than delayed loading protocols,[59] specifically in the anterior dentition area, due to studies that have failed to demonstrate this impact in the molar area.[80] Studies have reported reduced peri-implant bone resorption following immediate loading, with mean bone loss below 1 mm.[81,82] So far, there is no clear evidence that immediate loading of single implants leads to superior soft-tissue preservation or esthetic outcomes compared to other loading protocols.[83]

Regarding single implants installed in healed bone, immediate loading may minimize soft-tissue remodeling. However, the response of soft tissues may vary for implants placed in extraction sockets. Studies have shown a mean midfacial recession with immediate loading ranging from 0.3 mm to 1.0 mm.[84] Immediate loading has been linked to significant gains in papilla fill, as measured by linear measurements and the papilla index. The few studies that have reported on patient satisfaction with the esthetic outcomes of immediate loading have found high levels of patient satisfaction, with many reporting improvements in appearance and chewing and a willingness to recommend the procedure to others. Provisional restorations can aid soft-tissue conditioning and can be easily adapted to influence tissue response. They can be used to manage tissue abundance and shape the transmucosal profile.[78,85]

Immediate provisionalization in partially edentulous patients

In 1998, Wöhrle demonstrated pleasing outcomes of immediate implant placement and provisionalization of single anterior maxillary implants, which is a dental procedure that involves the insertion of an implant into the extraction socket of a failing tooth, immediately followed by the attachment of a provisional (temporary) crown.[86] This approach is particularly relevant in the esthetic zone, where the appearance of the teeth is crucial. The procedure aims to preserve the soft- and hard-tissue contours, thereby maintaining esthetics after tooth loss. Several studies have confirmed the effectiveness of such treatments in optimizing esthetic success by preserving the existing

osseous and gingival architecture.[86,87] Studies have shown high survival rates for implants placed immediately postextraction, with minimal changes in crestal bone and soft-tissue levels when appropriate guidelines are followed.[88]

Compared to the delayed approach, this method offers a shorter treatment time, preserves soft-tissue morphology, and provides better immediate esthetics. On the other hand, there is a risk of mucosal recession, particularly in the presence of a thin periodontal biotype or the absence of a vestibular bone plate.[10]

Opting for a cement-retained provisional restoration may result in a more esthetically pleasing appearance, especially when the implant access opening is at or near the incisal edge. However, this option poses a higher risk for gingival inflammation at the abutment-cement-restoration interface and the possibility of cement debonding. Recent research has shown that, after immediate implant placement in an anterior tooth socket, the facial bony plate undergoes remodeling, which involves bone fill from the socket's inside and resorption of the labial bony plate from the outside. Without a bone graft, this often leads to facial gingival tissue loss due to significant horizontal and vertical facial bone loss.[89,90]

Even in cases of unfavorable implant angulation, screw-retained provisionals can be fabricated to achieve satisfactory esthetic outcomes, making them a preferred solution for immediate and delayed loading protocols.[91] A newer implant-prosthesis connection known as a "hybrid abutment crown" or "screwmentable prosthesis" has recently been introduced. In this approach, the definitive crown or multiunit prosthesis is designed with screw access channels, and abutments are cemented to the prosthesis extraorally. The entire unit is then attached intraorally by screw into the implant. In another variant, a titanium insert, or titanium abutment serves as a foundation, onto which a CAD-CAM crown with a screw access channel is cemented outside the mouth.[92] Alternatively, a CAD-CAM custom abutment is fabricated and cemented onto a titanium base, providing support for a separate crown with an access hole. Screwmentable prostheses combine certain benefits of both screw- and cement-retained prostheses, including improved passive fit, retrievability, ease of extraoral cementation, tissue-compatible design, and enhanced esthetics.[93]

Conclusion

This review explores different strategies and outcomes associated with different timings of dental implant placement and loading, emphasizing their roles in achieving esthetic and functional success in implant dentistry. Immediate implant placement directly after tooth extraction offers esthetic benefits and reduced treatment times but requires precise surgical skills to manage potential complications such as bone loss and soft-tissue recession. Early implant placement, whether after soft-tissue or partial bone healing, provides a balance by allowing for natural healing processes that can enhance implant stability and esthetic outcomes. Although less favored due to the extended treatment time, late implant placement remains a necessary approach in specific clinical situations. Overall, each timing strategy serves distinct clinical scenarios, and their successful implementation hinges on a thorough understanding of patient-specific anatomical and esthetic needs, ensuring high predictability and patient satisfaction with the implant outcomes.

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1. According to the SAC Classification cited in the text, which implant placement timing is always considered a "complex" procedure?
   - A. Any implant placement in the posterior maxilla
   - B. Delayed implant placement
   - C. Immediate implant placement (type 1) in a fresh extraction
   - D. Type 3 implant placement

2. What does the Third ITI Consensus Conference classify as type 1 implant placement?
   - A. Placement after complete soft tissue healing
   - B. Placement on the same day of tooth extraction
   - C. Placement after partial bone fill in the socket
   - D. Placement in a fully healed site

3. What is expected within three to four months postextraction for successful implant placement?
   - A. Soft-tissue healing
   - B. Development of keratinized tissue
   - C. New bone formation in the socket
   - D. Complete resorption of the alveolar bone

4. What aspect of dental implants do patients tend to favor?
   - A. Conventional loading
   - B. Short treatment protocols
   - C. Delayed implant placement
   - D. Multiple surgical sessions

5. What minimum gap distance between the implant and the facial bone wall is recommended to reduce postsurgical orofacial bone resorption?
   - A. 1 mm
   - B. 1.5 mm
   - C. 2 mm
   - D. 3 mm

6. Which of the following is not considered an advantage of type 1 implant placement?
   - A. Reduced treatment time
   - B. Reduced number of surgeries
   - C. Improved implant orientation
   - D. Enhanced bone density

7. What characterizes type 4 implant placement?
   - A. Same-day extraction and placement
   - B. Placement after soft tissue healing
   - C. Placement after partial bone fill
   - D. Placement in a fully healed site

8. What is the primary benefit of flapless surgery for immediate implant placement?
   - A. Increased implant cost
   - B. Reduced soft-tissue recession
   - C. Enhanced esthetic outcomes
   - D. Immediate loading capability

9. Which factor is crucial to prevent bone resorption after immediate implant placement?
   - A. Use of narrow diameter implants
   - B. Thickness of the buccal bone plate
   - C. Length of the implant
   - D. Type of implant surface texture

10. What is the recommended waiting period for early implant placement with partial bone tissue healing, as per ITI Consensus Guidelines?
   - A. 1-2 weeks
   - B. 4-6 weeks
   - C. 12-16 weeks
   - D. 6 months

11. Which of the following significantly influenced the loading protocols for dental implants?
   - A. Antibiotic prophylaxis
   - B. Esthetic considerations
   - C. Osseointegration research
   - D. Implant material innovations

12. What does "provisionalization" typically involve in the context of dental implants?
   - A. Permanent placement of final prosthesis
   - B. Attachment of a temporary prosthesis
   - C. Complete healing of the extraction site
   - D. Full osseointegration of the implant

13. What is the main risk associated with immediate implant placement?
   - A. Infection control
   - B. Increased bone loss potentially leading to bony dehiscence
   - C. Implant misalignment
   - D. Prolonged treatment time

14. What can improved implant orientation prevent?
   - A. Bone resorption
   - B. Soft-tissue recession
   - C. Infection at the implant site
   - D. Need for additional anesthesia

15. What does type 2 implant placement involve, based on definitions from the ITI Consensus Conference
   - A. Immediate placement in the extraction socket
   - B. Placement after soft tissue healing but before significant bone fill
   - C. Placement after significant bone fill
   - D. Placement in a completely healed site

16. What has research shown to be critical for dental implant success?
   - A. Optimum primary stability
   - B. Use of synthetic bone grafts
   - C. Multiple implants in the same session
   - D. Long-term antibiotic use

17. What is considered an ideal outcome for esthetic dental implants in the anterior maxilla?
   - A. Minimal patient discomfort
   - B. Maximum implant size
   - C. Long-term esthetic stability
   - D. Immediate full functionality

18. What adjunct can enhance the success of immediate implants?
   - A. Systemic antibiotics
   - B. Use of bone grafts
   - C. High-speed drilling
   - D. Soft-tissue augmentation only

19. What is the primary complication associated with type 1 implant placement?
   - A. Occlusal misalignment
   - B. Bony dehiscence
   - C. Delayed healing
   - D. Implant fracture

20. When is immediate loading of a dental implant typically performed?
   - A. After six months
   - B. During the first week of healing
   - C. After complete osseointegration
   - D. Once the soft tissue has fully healed

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21. Which timing protocol for implant loading, as defined by the Fourth ITI Consensus, involves placing a provisional prosthesis within the first week of healing?

A. Early loading
B. Immediate loading
C. Conventional loading
D. Delayed loading

22. In which type of implant placement protocol (according to ITI) is the implant inserted 12-16 weeks postextraction to allow partial bone healing?

A. Type 1 (immediate placement)
B. Type 2 (placement after soft-tissue healing only)
C. Type 3 (early implant placement with partial bone healing)
D. Type 4 (placement in a fully healed site)

23. How does type 3 implant placement differ from type 4, as described in the ITI Consensus?

A. Type 3 occurs after considerable clinical and radiographic bone fill.
B. Type 4 is performed without waiting for any healing.
C. Type 3 requires the immediate use of a temporary prosthesis.
D. Type 4 involves additional soft-tissue augmentation.

24. What surgical approach is often preferred to minimize midfacial mucosa recession when performing immediate implant placement?

A. Full-thickness flap with releasing incisions
B. Flapless surgery
C. Coronally advanced flap
D. Palatal rotation flap

25. What does the term “primary stability” refer to in the context of dental implants, as essential for success?

A. The initial healing of soft tissue
B. The mechanical stability of the implant upon placement
C. Long-term bonding of the implant to the bone
D. The esthetic alignment of the implant

26. What does alveolar ridge preservation help with in dental implantology?

A. Reducing the need for local anesthesia
B. Increasing the speed of soft-tissue healing
C. Maintaining the contour of the jawline postextraction
D. Enhancing the color match of prosthetics

27. What clinical scenario might lead to the preference for type 4 implant placement?

A. A patient requesting the quickest treatment possible
B. A clinical need for immediate esthetic improvement
C. A case with extensive periapical pathology requiring more extended healing
D. An uncomplicated single-tooth replacement

28. What is one method to enhance peri-implant tissue conditions in immediate implant scenarios?

A. Delayed loading of the implant
B. Use of shorter implants
C. Application of connective tissue grafts
D. Elimination of provisional restorations

29. What is the primary consideration in selecting implant timing according to patient preference?

A. Cost of the implant materials
B. Duration of the treatment protocol
C. Color of the final restoration
D. The brand of the implant system

30. What is crucial for the success of immediate implant placement in the esthetic zone?

A. Use of biocompatible implant coatings
B. Adequate apical and palatal bone volume for 3D positioning
C. Immediate application of permanent crowns
D. Use of digital impressions for implant planning

PUBLISHED: **JUNE 2025**
EXPIRES: **MAY 2028**

Implant placement and loading protocols in partially edentulous patients

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EDUCATIONAL OBJECTIVES

1. Distinguish among the four implant placement timing categories (types 1-4) by comparing their clinical practice indications, advantages, and limitations
2. Determine the appropriate implant placement timing (immediate, early, or delayed) for a given clinical scenario by analyzing site-specific factors such as bone volume, soft-tissue phenotype, and infection status
3. Implement safe and effective surgical techniques for immediate implant placement by selecting suitable flap designs, grafting protocols, and 3D positioning to reduce complications such as mucosal recession and fenestration
4. Evaluate different implant loading protocols (immediate, early, and conventional) by assessing patient-related outcomes (e.g., comfort, esthetics, function) and implant survival rates in both fully edentulous and partially edentulous cases

COURSE EVALUATION

1. Were the individual course objectives met?

   Objective #1: Yes No Objective #3: Yes No

   Objective #2: Yes No Objective #4: Yes No

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 0.

2. To what extent were the course objectives accomplished overall?	5	4	3	2	1	0
3. Please rate your personal mastery of the course objectives.	5	4	3	2	1	0
4. How would you rate the objectives and educational methods?	5	4	3	2	1	0
5. How do you rate the author's grasp of the topic?	5	4	3	2	1	0
6. Please rate the author's effectiveness.	5	4	3	2	1	0
7. Was the overall administration of the course effective?	5	4	3	2	1	0
8. Please rate the usefulness and clinical applicability of this course.	5	4	3	2	1	0
9. Please rate the usefulness of the references.	5	4	3	2	1	0
10. Do you feel that the references were adequate?	Yes	No				
11. Would you take a similar course on a different topic?	Yes	No				

12. If any of the continuing education questions were unclear or ambiguous, please list them.

13. Was there any subject matter you found confusing? Please describe.

14. How long did it take you to complete this course?

15. What additional dental continuing education topics would you like to see?

Mail/fax completed answer sheet to:

Endeavor Business Media

Attn: Dental Division; 7666 E. 61st St. Suite 230, Tulsa, OK 74133

Fax: (918) 831-9804

☐ Payment of $69 is enclosed (this course can be completed online for $39. Scan the QR code or go to dentalacademyofce.com to take advantage of the lower rate).

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3.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	18.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
4.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	19.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
5.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	20.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
6.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	21.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
7.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	22.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
8.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	23.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
9.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	24.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
10.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	25.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
11.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	26.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
12.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	27.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
13.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	28.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
14.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	29.	Ⓐ	Ⓑ	Ⓒ	Ⓓ
15.	Ⓐ	Ⓑ	Ⓒ	Ⓓ	30.	Ⓐ	Ⓑ	Ⓒ	Ⓓ

CUSTOMER SERVICE: (800) 633-1681

EXAM INSTRUCTIONS. All questions have only one answer. If mailed or faxed, grading of this examination is done manually. Participants will receive confirmation of passing by receipt of a Verification of Participation form. The form will be mailed within two weeks after receipt of an examination.

COURSE EVALUATION AND FEEDBACK. We encourage participant feedback. Complete the evaluation above and e-mail additional feedback to Rachel McIntyre (rmcintyre@endeavorb2b.com) and Laura Winfield-Roy (lwinfield@endeavorb2b.com).

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