Immediate Implant Placement with Immediate Loading in Periodontally Compromised Patients: A Literature Review

Nabeeh Abdullah AlQahtani

Abstract:
The aim of the present literature review was to assess the outcomes of immediate implant placement with immediate loading in periodontally compromised patients and to review the guidelines for this type of treatment. The MEDLINE-PubMed databases were searched for appropriate articles addressing the purpose of this study. The search included articles published in English literature from 1977 up to 2014. The placement of implants immediately in fresh sockets with immediate loading in periodontally compromised patients is a promising treatment modality, but the practitioner should follow a very strict protocol. Further long-term research is required to prove the predictability of utilizing guided bone regeneration around immediate implants with immediate loading in periodontally compromised patients.

Key Words: Immediate implant placement, immediate loading, periodontally compromised patients

Introduction
Dental implants were first described and successfully employed in the treatment of completely mandibles edentulism in 1965,1 implant supported various designs of prostheses have been shown to be a predictable and reliable treatment option for both partially and fully edentulous patients.2,4 Historically, the initial phase of implant integration should be at least 4-6 months before any restoration was placed as described by the original Branemark’s protocol.7 Consequently, the whole treatment time will take 24 months or longer, resulting in a significant delay between the time of implant placement and the final restoration. Other concerns with using Branemark’s protocol,7 include alveolar bone loss, longer treatment time with edentulism, additional surgical procedure, and patient psychological impaction. After extraction, bone remodeling will take place to the alveolar ridge, which causes bone volume loss, especially within the 1st year.8,9 The same study reported that overall reduction in ridge height of 4.0 mm and 25% loss of total bone volume occurred within the 1st year post-extraction, and the volume of bone loss increased 40-60% in 3 years.8 “Conventional loading”10 is a predictable, dependable, safe, and accepted treatment modality that has been used as the main point of comparison for other dental implant loading protocols.11 Recently, clinicians have increasingly begun to evaluate and examine the possibilities of shortening treatment periods either by earlier delivery of the implant-supported restoration or by placing implants in extraction sockets at the time of extraction.2,3,11,12,13 Implant placement in fresh extraction sockets was first described by Schulte and Heimke, who referred to this procedure as “immediate implant.”14 Several studies, for example, Yukna, 1991, Becker et al., 1998, 1999, Polizzi et al., 2000, and for example, Gelb, 1993, Watzek et al., 1995, Pecora et al., 1996, Goldstein et al., 2002, Cooper et al., 2014 reported high survival rates with this type of treatment.15-23

The Advantages and Disadvantages of Immediate Implant Placement
Several papers suggest that immediate implant placement may provide some advantages, such as, (i) Preventing bone resorption, (ii) maintaining alveolar crest width and height, (iii) reducing surgical procedures and treatment time, and finally, and (iv) good esthetic results, as the implant can be seated according to the natural tooth angulation and aligned with the adjacent teeth.19,24-33 On the other hand, there are potential disadvantages of implants being placed in fresh extraction sockets, including, but not limited to the following: (i) Difficulty in controlling the final implant position, (ii) difficulty obtaining primary stability, (iii) inadequate soft tissue coverage, (iv) inability to inspect all aspects of the extraction socket for defects or infection, (v) osteotomy preparation difficulty due to bur movement (chatter) on the walls of the extraction site, and (vi) the additional cost of bone grafting. Since all the disadvantages listed are not present in every situation, any disadvantage may result in a compromised case.23 One clinical and histological study compared histologic specimens of implants placed into fresh extraction sockets with those placed into mature healed bone. The investigators observed active secretion of osteoblasts in the coronal part of the alveolar crest; no signs of bone resorption were present in either specimen. Furthermore, there were no significant differences in the clinical and radiographic parameters noticed, suggesting that the degree of osseointegration does not differ between immediately placed implants and implants placed...
Kois emphasized five diagnostic keys to allow for long-term success. A surgical approach for immediate implant placement with immediate loading is crucial for determining if the patient has the right diagnostic keys to meet the criteria. The diagnostic keys to allow for long-term success are:

1. Tooth position and its relation to the gingival margin
2. Form of the periodontium
3. Gingival biotype
4. Shape of the tooth
5. Position of the bone crest before tooth extraction.

The predictability of esthetic success of implant-supported restoration resulted from the implant position in the bone. Bashutski and Wang (2007) proposed surgical guidelines for implant placement surgery. The implant should be placed at least 2 mm of the buccal bone, 3 mm apical to the cementoenamel junction of the adjacent teeth, and about 1.5 mm from the adjacent tooth root or 3 mm from the adjacent implant. Furthermore, the placement should be more toward the palate and more apically.

The Guidelines for Immediate Implant Loading
Cochran et al., 2004, recently published consensus statements and recommended clinical procedures regarding loading protocols for endosseous dental implants and promoting the following terms:

1. Immediate restoration (also known as immediate provisionalization): The restoration is delivered within 48 h of implant placement but no occlusal contact with the opposing dentition.
2. Immediate loading: The restoration is placed within 48 h of implant placement and is functionally in occlusal contact with the opposing dentition.
3. Early loading: The implant is restored with a fully functional restoration (in occlusion with opposing dentition) at a second stage procedure between 48 h and 3 months from the time of implant placement.
4. Conventional loading: The implant(s) is restored after a second stage procedure, 3-6 months after implant placement surgery.
5. Delayed loading: An implant-supported prosthesis is placed onto the implant(s) after a period longer than the conventional loading time (3-6 months).

The Advantages of Immediate Implant Loading
Immediate implant loading presents several other advantages when compared to conventional loading protocols. These include:

1. Overall reduction in treatment time
2. Reduction in the alveolar ridge resorption
3. An immediate, esthetic and/or pleasing restorative solution
4. Psychological, resulting in increased patient acceptance
5. Quicker solution to return to function
6. Avoidance of a removable prosthesis that may disturb the healing
7. Superiority of soft tissue profile when utilizing both the immediate implant placement with immediate loading
8. Reduced surgical interventions.

Immediate implant placement indications and contraindications
Evaluation of smile line, bone architecture, gingival biotype, and hard and soft tissue levels are crucial and essential for implant esthetics. Kois emphasized five diagnostic keys for predictable, single-tooth, peri-implant esthetics when immediately placing implants in fresh extraction sockets. They are:

1. Tooth position and its relation to the gingival margin
2. Form of the periodontium
3. Gingival biotype
4. Shape of the tooth
5. Position of the bone crest before tooth extraction.

Three of the five diagnostic keys involve hard and soft tissue components. Consequently, when considering immediate implant placement, a careful analysis of the addressed factors is crucial for determining if the patient has the right diagnostic keys to allow for long-term success. A surgical approach for an immediate and conventional implant placement is almost similar except that in immediate implant placement; a possibility of implant shift toward the buccal side should be taken into consideration and certain clinical precautionary measures taken. This is due to a thin buccal plate with a high content of bundle bone and the nature of self-tapping implants that in current use. It is essential to understand the hard and soft tissues surrounding the surgical area in order to appropriately select cases for which immediate implant placement would be successful. Gingival biotype affects the periodontal tissue dimensions, including biologic width and masticatory mucosa. Thick gingival biotype is defined when the periodontal probe cannot be seen through gingival tissues, whereas it is visible in thin biotypes. A thick biotype is resilient and more prone to the
This classification system supports the idea that case selection is critical for determining whether immediate implant placement should be considered, and the importance of hard and soft tissue parameters in this selection. In general, immediate implant placement can be challenging due to the hard and soft tissue healing being unpredictable. Cases should be selected carefully to avoid treatment failures and esthetic complications. Furthermore, explaining the risks, benefits, and limitations of immediate implant placement with patients is important to avoid any future misunderstanding.

**GBR around immediate implant**

GBR can be used to manage the exposure of the implant surface due to the incongruity between the implant diameter and the morphology of the alveolus. In this situation, a regenerative barrier is applied, and primary closure of soft tissues is considered a prerequisite to the success of the GBR process. Although there are contrasting opinions about the necessity of primary closure in GBR, most authors agree that primary closure is very crucial and at least a goal that a clinician should consider in GBR. Important to the procedure is that, after installing the immediate implant, the flap edges are approximated and the socket is passively (without tension) closed. Tension must be avoided, as it may lead to ischemia and flap necrosis, and increases the likelihood of barrier exposure with the associated infection, bone loss and even implant failure. When flap closure is not possible, the use of relaxing incisions, or rotated pedicle flaps, or a combination of them should be considered to reduce tension and increase flap manipulation. The relaxing incisions are either vertical or horizontal releasing incision of the periosteum.

In the pedicle flap technique, the anterior part of the flap is dissected to separate a mucosal layer from the underlying periosteum using a split-thickness incision (pedicle flap). Then, the pedicle layer is rotated laterally to cover the immediately placed implant. Horizontal mattress sutures are recommended to close the wound. However, soft tissue closure should be modified depending on the region where the implant is placed. On occasions, gingival grafts or split thickness connective tissue grafts may be utilized. Becker et al. used non-resorbable expanded polytetrafluoroethylene (e-PTFE) membranes for GBR around immediate implants.
and reported an incidence of 40% wound dehiscence necessitating premature membrane removal in an additional surgery. The frequent occurrence of membrane exposures in immediate implant placements was probably caused by inadequate primary wound closure.65

Several authors reported incomplete bone regeneration in cases of early membrane exposure associated with signs of inflammation.66,67 To avoid all these disadvantages, resorbable membranes were introduced and compared with the conventional e-PTFE-material. Zitzmann et al., comparing the defect fill utilizing the collagen membrane Bio-Gide A and the Gore-Tex barrier, reported a mean defect reduction of 92% and 78%, respectively. Using absorbable collagen membrane, the occurrence of wound dehiscence did not lead to an adverse clinical reaction in the surrounding soft tissues. However, premature degradation of the collagen membrane in the exposed area was reported, resulting in a shortened barrier function of the Bio-Gide membrane with reduced bone fill (87%), compared to areas without wound dehiscence (94% bone fill).68 In another study of 1925 immediate implants, performed between 1988 and 2004, mineralized freeze-dried bone allograft with an absorbable barrier was utilized to cover exposed implant threads. They retrospectively reviewed the charts and reported a 1-16 years survival rate of 96%, with a failure rate of 3.7% pre-restoration and 0.3% post-restoration.69

Gelb (1993) mentioned another factor influencing the success of bone regeneration by describing the defect morphology and distinguished among no-wall, 3-wall, and circumferential defects. He covered the exposed implant surfaces with or without bone grafting material and/or membrane, depending on the residual bony walls surrounding the defect.20 Apart from factors such as wound dehiscence with membrane exposure and defect morphology, no other factors have, according to the literature, been mentioned to determine the amount of bone fill achieved when using GBR techniques around implants. Poor bone quality in the maxilla and cigarette smoking have been reported as complicating factors in relation to a higher number of implant failures.70-72

On the other hand, Chen et al. conducted a prospective study and compared five groups in which patients received an immediate implant, randomly received 1 of 5 augmentation treatments and were submerged with connective tissue grafts: Group 1 e-PTFE membrane only, Group 2 resorbable polylactide/polyglycolide copolymer membrane only, Group 3 resorbable membrane and autogenous bone graft, Group 4 autogenous bone graft only, and Group 5 no membrane and no bone graft as control group. His results showed that defects adjacent to immediate implants might heal predictably without the use of membranes and/or bone grafts.73

Finally, most authors agree that primary closure is one of the important factors that clinicians should consider in GBR. The use of a non-resorbable membrane or a resorbable allogenic material around immediate implants can provide predictable results in the long term. The use of grafts under barrier membranes in immediate implantation is a clinical judgment, and most studies indicate the superiority of combining bone grafts with barriers over the single use of either of them.74

Esthetics is not only about harmonizing the size, shape, position, and color of each prosthesis with the adjacent teeth.75 It is also essential to establish peri-implant soft tissue compatibility with the surrounding gingiva and mucosa.76 Hence, the contralateral natural tooth may be considered the ultimate reference, especially in the anterior teeth. All morphometric differences in papilla levels, midfacial soft tissue levels, and crown parameters have been used to assess the esthetic outcome of single implant treatment.77,78 Obvious advantages of immediate implant placement include, in addition to what was mentioned previously, potentially superior esthetics since hard and soft tissues have not fully remodeled yet. At least with respect to the midfacial soft tissue level, Schropp et al. described the ideal clinical crown length in significantly more cases following early placement when compared with conventional placement.79 While a recent systematic review showed the lack of comparative studies with thorough esthetic analyses by clinicians and patients, it remains unclear whether single implant placement in healing sites of the anterior maxilla yields superior esthetic treatment outcome when compared with healed sites.80

Immediate implant in periodontally compromised patients
Historically, many studies showed that patients previously treated for periodontitis were at a higher risk of developing peri-implantitis and implant loss compared with periodontally healthy patients.81 Thus, it was suggested that periodontitis still persists, even after tooth extraction, and it may impact the survival rate and long-term prognosis of dental implants.82-84 Good results have been documented with early implant function after insertion in fresh extraction sockets of periodontally compromised teeth at 1-year follow-ups, with high survival rates (100%) and low marginal bone loss (0.5-0.7 mm) when requiring high-implant stability and low inflammation during surgical and post-surgical treatment.85 These recent studies suggest that the immediate implants placed in immediate function in patients with a history of the periodontal disease may be viable; this surgical protocol is used to control the inflammatory response. While several studies have reported the success of immediate placement in periodontally compromised patients, clinical documentation of the long-term survival of these implants is still lacking.

Conclusion
The placement of implants immediately in fresh sockets with immediate loading in periodontally compromised patients is a promising treatment modality, but the practitioner should follow a very strict protocol. Further long-term research is
required to prove the predictability of utilizing GBR around immediate implants with immediate loading in periodontally compromised patients.

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Immediate implant placement with immediate loading in periodontally compromised patients: A literature review... AlQahtani NA


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