
Conclusion: Platform switching seems to reduce peri-implant crestal bone resorption and increase the long-term predictability of implant therapy.


Conclusion: This proof-of-concept study suggests that immediate loading with platform switching can provide peri-implant hard tissue stability with soft tissue and papilla preservation.


Conclusion: Within the limits of the present study, it was concluded that both CAM and CPS implants revealed crestal bone level changes after 28 days of healing.

The ITI Consensus Statements and recommended clinical procedures regarding esthetics in implant dentistry (ITI Treatment Guide Volume 1 – Quintessence) have to be mentioned here as the authors wish to avoid raising false expectations that only platform switching (a group of prosthetic and restorative procedures) can lead to predictable results. The authors’ statements in the articles are based on:

1. Long-term results (from evidence to newer surgical approaches)
2. Surgical considerations (from extraction planning to soft tissue stability)
3. Prostodontic and restorative procedures (from standards for esthetic fixed-implant restorations to location of the implant shoulder)
4. Well-executed esthetic risk analysis performed prior to any treatment planning.

Conclusion: The authors would like to end questions raised by DM Gardner in an article in NDSU, from APRIL, 2005:

• Can implants be placed closer than 3mm from an adjacent implant, while still maintaining interproximal height of bone?
• Can implants be placed less than 1.5mm from an adjacent tooth and still maintain interproximal bone?

The authors’ personal experience is of course limited to one manufacturer, but over time the results are encouraging and many more long-term multicentre studies are needed to obtain evidence.

About the author

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In the past two decades, immediate implant placement into fresh extraction sites has gained in popularity and is considered a predictable and acceptable procedure.¹⁻⁶ However, the dimensional changes and aesthetic results are controversial.⁷⁻¹⁰ The rationale behind immediate implant placement is, in part, based on observations that it may contribute to bone preservation.⁸,⁹ Early extraction and immediate placement could lead to a favourable crown-implant ratio, better esthetics, and a favourable interarch relationship.¹,¹¹

Immediate loading of immediate implants

Dr Devorah Schwartz-Arad discusses a preferred solution in the esthetic zone

Fig 1a: In this case, the right maxillary canine was scheduled for extraction due to root fracture. Single-tooth replacement through immediate provisiona-

lisation was chosen as the treatment method.

Fig 1b: A pre-operative CT scan revealed thin buccal plate in the area of this canine.

Fig 1c: The canine was atraumatically extracted, taking care not to damage the buccal plate and the adjacent papillae.

Fig 1d: An implant was immediately placed into the fresh extraction socket without raising a flap.

Fig 1e: An acrylic resin provisional crown without any occlusal contacts was fabricated and placed.

Fig 1f: Healthy soft tissue around the provisional crown is evident at six months.

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In 2001, Garber et al. introduced immediate provisionalisation of immediate implants and described the next generation of the immediate implantation technique, which included atraumatic tooth removal with simultaneous root-form implant placement and temporisation in one session. This technique of “Immediate Total Tooth Replacement” allows for the maintenance of the bony housing and soft-tissue form that existed before extraction, while simultaneously establishing a root-form anchor in the bone for an esthetic restoration.

Diagnosis and treatment planning
These are key factors in achieving successful outcomes after placement and restoration of implants inserted immediately after tooth extraction. A socket often presents dimensions that may be considerably greater than the diameter of most implants after extraction. In a histological report, Wilson et al. stated that the horizontal component of the peri-implant defect was apparently the most critical factor relating to the final amount of bone-implant contact. Botticelli states that small defects (1-1.25 mm) may heal with new bone and a high degree of osseointegration and that the placement of a barrier membrane after implant installation does not improve the outcome of healing. Jung et al. concluded that the remaining defect, small enough to be clinically neglected, irrespective of gap size within two mm, does not need any kind of regenerating procedures.

In 1998, this author examined the hypothesis that immediate implants can succeed without primary flap closure. A technique was described that does not require any incisions during immediate implant placement. No barrier membranes were used and the sole grafting material was autogenous bone chips. Clinical osseointegration was achieved with minimal gingival recession and papillae preservation. It was concluded that immediate implant placement in the anterior maxilla can be successful in replacing a single tooth even without primary closure.
The esthetic zone
Preservation of the buccal bone crest after tooth extraction is of major importance in achieving esthetic results and long-term implant survival. However, controversy exists in the literature regarding immediate implantation benefits for preserving the morphological ridge contour. A marked resorption of the buccal bone following implant placement in fresh extraction sockets has been shown in animal studies.[5,6] For example, Araújo et al.[5] concluded that the bone-to-implant contact established during the early phase of socket healing following implant installation was partly lost when the buccal bone wall continued to resorb, and that implant placement failed to preserve the hard tissue dimension of the ridge after tooth extraction.

The buccal and lingual bone walls were both resorbed. The surgical procedure included mucoperiosteal full-thickness flaps that were elevated to disclose the buccal and lingual hard tissue wall of the ridge. The same surgical procedure conducted by Botticelli et al.[7] also concluded that the height of the approximal socket walls may be retained and the reduction of the crestal bone will be limited to the buccal walls of the recipient site.

Bone preservation
The controversy regarding bone preservation has been discussed in several studies. Fickl et al.[8,9] have shown that the resorption rate of the extraction socket decreases when the peristeme remains in place. A significant lower resorption rate was found in the “flapless group” with and without the socket-preservation techniques. Furthermore, the flapless technique implementing bone augmentation materials preserves the socket volume better. In their study on dimensional changes of the alveolar ridge contour after different socket preservation techniques, Fickl et al.[10] were not entirely able to compensate for the alterations after tooth extraction. Yet, incorporation of BioOss collagen seems to have the potential to limit but not avoid post-operative contour shrinkage. Treatment of the extraction socket with BioOss collagen and a free gingival graft is beneficial in limiting the resorption process after tooth extraction.

A pilot study in which buccal bone preservation after immediate implantation, using a flap or flapless approach in mongrel dogs was evaluated, has shown that the flapless approach reduces the buccal bone height loss for immediate post-extraction implants.[11] A reasonable explanation could be the preservation of the periosteal vascular network. Immediate post-extraction implants also have a high percentage of bone-to-implant contact.

Immediate loading of immediate implants
The objective of immediate provisionalisation or loading of dental implants is to combine tissue preservation with bone preservation (Total Volume Preservation) that follows immediate placement. This will preserve proper volume and shape of the hard and soft tissues. Immediate provisionalisation also results in fewer surgical interventions and a simpler solution for the patient.

Immediate loading of immediate implants does not impair osseointegration of an immediate post-extraction implant compared to an unloaded post-extraction implant. The key difference between success and failure of osseointegration of the immediately loaded implants is controlling the micromotion, which is reduced through broad anteroposterior distribution of the immediately loaded implants.

Anchorage of the cortical bone, especially in the maxilla, may be necessary to increase implant stability. Recently, this author found that after a mean follow-up of 15.6 months, provisionalisation of immediately placed implants proved a predictable procedure with a high implant survival rate (97.6 per cent).[12] Histologic observations from different animal and human studies have shown that immediately loaded implants can have a direct bone-to-implant interface without any fibrous tissue formation.[13] Success in immediate placement and loading of implants is based on several clinical parameters.

Therefore, this treatment concept can be applied to everyday clinical practice in properly selected patients who

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References
1. Bland J, Altman D. Multiple in vivo studies for patients to brush for longer, for increased fluoride protection and plaque removal.
have good primary stability and sites with a fully preserved extraction socket with no bone dehiscence. Immediate provisionalization should be proposed only if an appropriate initial insertion torque has been applied to the implant.22

Implant placement in extraction sockets combined with immediate function has been widely reported.20,23–25 The esthetic success10,26,27 is related to Total Tissue Preservation and to several other parameters, including maintenance or re-establishment of harmoniously scalloped soft tissue lines and natural contours, number of missing teeth, location of missing teeth and the relation to the midline, whether missing teeth are adjacent, etc.

Atraumatic tooth extraction is essential for successful immediate implant placement and the maintenance of the buccal plate (see Fig. 1c). The most important factors and main prerequisites for immediate loading are sufficient initial implant stability and insertion torque of about 40 N/cm. When a single-tooth implant is immediately loaded, the implant-abutment connection should also be stable; primary stability is fundamental.

Single-tooth replacement does not actually represent immediate functional loading, since clinicians normally prevent any occlusal function of the provisional restoration. Therefore, these types of restorations are classified as immediate provisionalisation only.

A strong advantage of this treatment protocol is immediate placement of the restoration. This eliminates the need for a provisional removable prosthesis and leads to satisfactory esthetic results. Second-stage surgery is unnecessary, and excellent soft tissue healing occurs predictably, with a stable mucogingival junction in relation to adjacent teeth and with preserved interproximal papillae. These clinical outcomes reduce the necessity of further surgical procedures to improve the gingival architecture.

Multiple adjacent implants
Replacement of multiple adjacent teeth with fixed implant restorations in the anterior maxilla is poorly documented. The esthetic results are not always predictable because the mechanism of tissue behaviour in the context of the esthetic outcome is still not fully understood.28 The distance of the bone crest from the restoration’s contact point is related to the presence of the interimplant papillae.29 This may imply that preservation of this bone crest is imperative for
interimplant papilla regeneration.\textsuperscript{6,16}

The effect of immediate implants on non-compromised bone shape and quality (for example, in the maxillary premolar and anterior mandibular regions) is less important. However, it becomes a major contributing success factor when bone shape and quality are compromised (for example, in the anterior maxillary and posterior regions of both arches). The preservation of alveolar ridge dimensions immediately after tooth extraction has been documented.\textsuperscript{11}

Immediate loading of multiple adjacent implants in a partially edentulous arch could result in success rates even higher than those for single-tooth replacement\textsuperscript{10} (Figs. 2a to 2j). This might be due to the distribution of forces among the adjacent implants and the absence of rotational forces that act on a single implant.

As with single-tooth implants, the clinician is advised to eliminate any function of the provisional restoration for the first three to six months, which is the waiting period prior to final restoration.

**Tips for success**

Several important parameters should be considered for successful implant placement with immediate loading:

- Primary stability is crucial (40 N/cm is recommended). An implant with stability less than 50 N/cm should not be loaded.
- Flapless surgery is preferable in the esthetic zone.
- Gap filling is recommended at the esthetic zone.
- The use of membrane is not necessary.
- Implant placement should be slightly palatal for better esthetics and volume maintenance in the anterior maxilla (with augmentation at the buccal area).
- Rigid fixation is used when more than one implant is involved.
- The provisional crown or fixed partial denture should not be in occlusal contact.
- Strategic extraction should be considered when it allows placement of longer implants, which leads to better prognosis and prosthetic positioning, especially in the esthetic zone.

**References are available on request.**

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**About the author**

Dr Devorah Schwartz-Arad received her DMD and PhD degrees from the Faculty of Medicine, Hebrew University, Jerusalem, Israel. She is a specialist in oral and maxillofacial surgery. She is a member of the Specialty Examination Board for Oral and Maxillofacial Surgery in Israel, has published numerous scientific articles and abstracts, and presented more than 100 papers at scientific meetings in Israel, Europe, and the United States. She has been awarded several academic and professional awards, including the Israeli Academy of Sciences and the Israel Cancer Association. She has been a lecturer and a senior lecturer for more than 20 years at the Department of Oral and Maxillofacial Surgery, School of Dental Medicine, Tel Aviv University and is a well-known lecturer internationally. Dr Schwartz-Arad is the owner and senior surgeon of an active Day Care Surgery Center specializing in oral and maxillofacial surgery, qualified by the Israeli Ministry of Health for Surgery and General Anesthesia with special expertise in orthognathic surgery, bone grafting and dental implantation.

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