

DENTAL TECHNIQUE

Prosthetic management of implants placed with the socket-shield technique

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Root submergence to preserve the alveolar ridge was first reported about 50 years ago.¹ In 2010, Hurzeler et al² published a method of preserving the facial ridge at immediate implant placement with part of a submerged root. These authors sectioned the submerged

tooth root such that its facial root portion remained attached to a healthy and intact periodontium adjacent to an immediate implant. This technique has been described in several reports³⁻¹⁰ and has been somewhat modified by Gluckman et al.¹¹⁻¹⁵ The original technique proposed applying enamel matrix derivative to the inner dentin surface of the socket-shield to promote cementum formation.² However, the technique may not require this step. Not only are these materials exceedingly costly but also human histology has demonstrated that bone can grow between root dentin adjacent to an implant surface without enamel matrix derivative.¹⁶ Baumer et al¹⁵ also omitted this step in their follow-up study. The original technique by Hurzeler et al² also advocated drilling through the root with the implant drills and preparing the initial osteotomy somewhat inside the tooth root, with the socket-shield 1-mm coronal to the facial bone crest. A similar treatment, the root membrane technique, also advocated these steps¹⁷ although the modified technique reported by Gluckman et al¹⁸ did not. In the largest cohort reported to date of 128 socket-shields

ABSTRACT

Partial extraction therapies, such as the socket-shield technique, use the patient's tooth tissues and periodontium to preserve the alveolar ridge and limit postextraction resorption. Internal exposure through the overlying peri-implant mucosa has been reported as the most common complication, suggesting that the preparation technique requires modification. This technique report describes the prosthetic management of the socket-shield technique, emphasizing preparation of the socket-shield to the bone crest, and the creation of an S-shape prosthetic emergence profile to support maximal soft tissue infill. (J Prosthet Dent 2018;■:■-■)

followed up to 4 years, the authors reported the most common complication encountered to be internal exposure. This means that the coronal portion of the socket-shield facing the implant crown and abutment penetrated the soft tissue (in 9.4% of the treatments), and in some instances, inflammation was noted. Regardless, the authors stated this as a complication requiring management. The peri-implant mucosa should be healthy and not ulcerated. This technique report will provide step-by-step management of the coronal socket-shield and prosthetics in an effort to limit this complication.

TECHNIQUE

The clinician providing immediate implant treatment and the socket-shield technique should be experienced with advanced training. For all treatments, comprehensive planning must be carried out, including planning the prosthetic outcomes with digital smile design and/or with trial restorations. Data are typically obtained with 3-dimensional cone-beam computed tomography scan of

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Figure 1. A, Preoperative periapical radiograph of maxillary left lateral incisor. B, Decoronated tooth with long-shank rotary instrument inserted to root length.

the treatment site. The following steps outline the clinical procedures once the treatment has been thoroughly planned and indications for the socket-shield met.¹³

As described previously,¹⁸ the socket-shield for single-rooted teeth is prepared as follows:

1. Achieve adequate local anesthesia of the working site and decoronate the tooth planned for partial extraction. At all times, take care not to cut or damage the adjacent structures (gingiva, adjacent teeth, or restorations). Cut the crown with a conventionally irrigated high-speed handpiece coupled to a straight diamond rotary instrument (Bur H254LE; Komet Dental) to approximately the level of the gingiva (Figs. 1, 2). Complete the preparation of the socket-shield with the same handpiece with sequential rotary instruments under copious irrigation.
2. Once decoronated, section the tooth root vertically in a mesiodistal direction, creating a facial and a palatal root portion. Aid sectioning of the root by making sequential periapical radiographs (Fig. 1). Use an endodontic file or a Gates-Glidden rotary instrument inserted to the apex to orient and measure on the radiographs. If previously endodontically treated, these may aid in removing the root canal obturation materials (Figs. 1-3).
3. Use periostomes and microelevators to carefully dislodge the palatal root portion into the buccal space created when sectioning the root. Be sure to handle the tissues with care at all times. Do not ever lever against the facial root portion but instead apply finger pressure to support and sense movement. Once loose, remove the palatal root portion with microforceps (Fig. 3).
4. Refine the facial root portion with a long-shank diamond rotary instrument (Bur 801; Komet

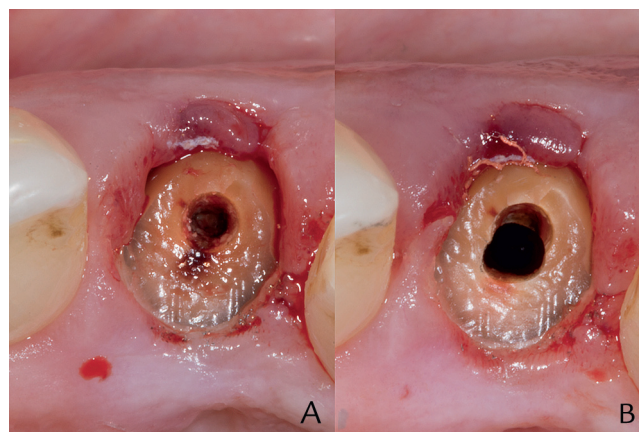


Figure 2. A, Occlusal view after decoronation. B, Root canal widened to apex with long-shank root resection rotary instrument.

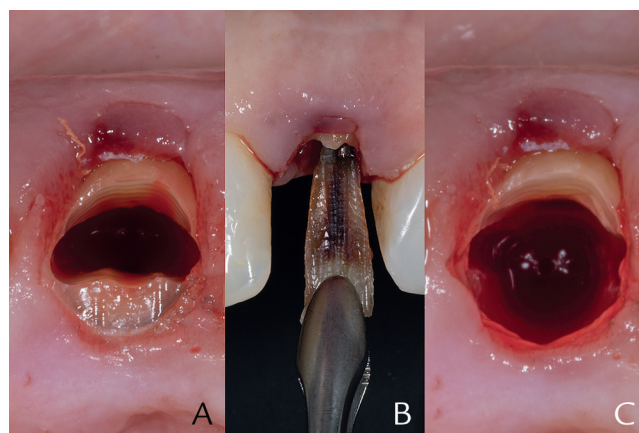


Figure 3. A, Root sectioned vertically and cut mesiodistally into facial and palatal portions. B, C, Palatal root portion removed.

- Dental) and gingival protector (Wound Retractor 24-158-00; Ustomed), orienting the rotary instrument toward the tooth apex in a triangular movement. As much as possible, avoid cutting excessively into adjacent alveolar bone. Reduce the socket-shield to approximately half the thickness from the canal to the root's facial limit, creating a concave structure extending from the mesial to the distal of the socket.
5. Curette the apex and rinse repeatedly. Make sequential periapical radiographs to ensure all root canal obturation materials are fully removed and that the root apex with all its contents and any pathologic tissues are removed. If an apical periodontal ligament space can be seen on the radiograph, or any other radiopaque dental materials, then repeat this step carefully until all are removed. Do not proceed without ensuring complete removal of pathologic tissues.
6. Reflect and protect the gingiva and complete the definitive coronal reduction with a large round diamond rotary instrument (Bur 801; Komet

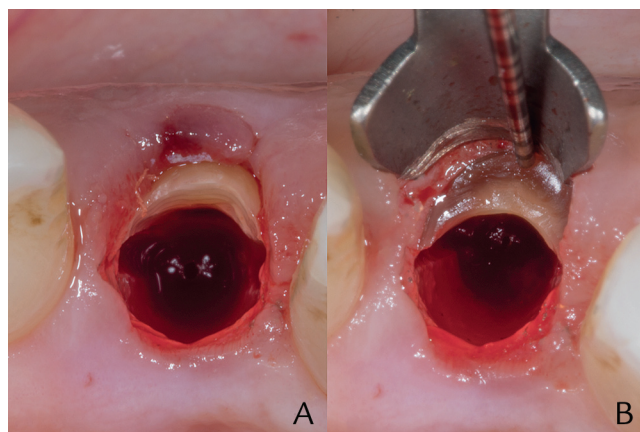


Figure 4. A, Apical and root canal contents removed, socket rinsed. B, Under magnification, gingiva protected, socket-shield reduced to crestal bone.

Dental) (Fig. 4). Cut the coronal socket-shield to the alveolar crest but do not leave a 1- to 2-mm coronal portion as previously described. Then, cut an internal beveled chamfer in the socket-shield to create the required prosthetic space to accommodate an S-shaped prosthesis emergence profile (Figs. 4B, 5A).

7. Prepare the implant osteotomy apical/palatal to the fully prepared socket-shield. Follow conventional immediate implant placement protocol and insert the implant (Fig. 5). Seal the implant with its cover screw and graft the facial gap if accessible with a bone material (NovaBone Putty; NovaBone) (Fig. 6A). Omit this step if the space between the implant and socket-shield is small.
8. Verify the implant's primary stability. If adequate implant stability quotient (ISQ; >70), attach an interim crown immediately. If less than adequate (<60 ISQ), attach a custom transgingival abutment to the implant that mimics the intended emergence profile (Fig. 6B, C). Ensure ample space for soft tissue by designing a narrow but expanding S-shape curve in the transgingival, prosthetic component. Observe the facial gingiva and ensure that minimal to no blanching of the tissue occurs. Reduce the prosthetic component if needed while maintaining an emergence that seals the socket entrance.
9. Ensure the interim crown has no contact in maximum intercuspation or excursive moments, or if a custom abutment is used, ensure no contact with the subsequent interim prosthesis.
10. Make a postoperative radiograph.

DISCUSSION

The socket-shield technique is potentially one of the most significant contributions to implant and restorative

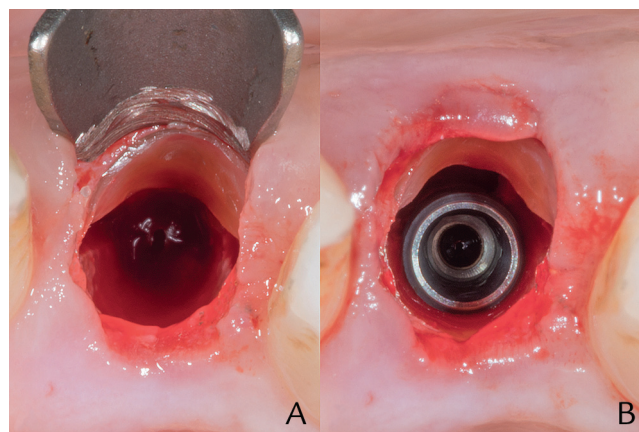


Figure 5. A, Internal, coronal portion reduced, creating beveled chamfer. B, Immediate implant placement, palatal to socket-shield.

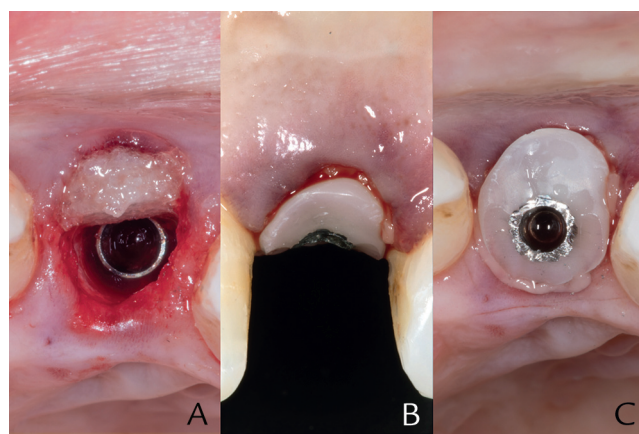


Figure 6. A, Facial gap grafted with bone particulate. B, C, Custom healing abutment attached to implant, with platelet-rich fibrin membranes beneath.

dentistry, managing the resorptive sequelae of tooth extraction. The technique, part of a collective concept known as partial extraction therapies, challenges the extract-and-augment mindset.¹² Although clinical reports, case series, and trial studies have been published,^{3-10,14,15} a consistent approach to the technique is essential.

The technique as it is known today requires preparation of the socket-shield to bone level as previously reported.¹⁸ Many aspects of the socket-shield technique and other partial extraction therapies remain to be researched. These include factors such as vertical length of the socket-shield, its thickness, grafting the gap, materials and instrumentation, and their impact on overall treatment. However, what is known from the current literature is that the original socket-shield preparation as recommended by Hurzeler et al² at 1 mm or more above the socket crest may result in perforation of the shield through the overlying healed/healing soft tissue, known as exposure.¹⁸ When this occurs facing the implant

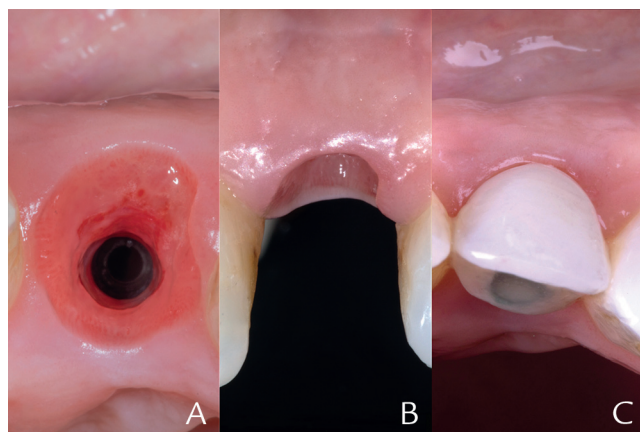


Figure 7. A, B, 3 months of healing. C, Definitive metal-ceramic, screw-retained crown.

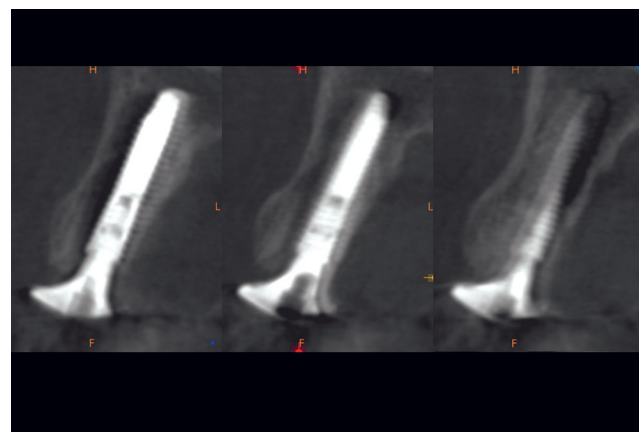


Figure 8. Postoperative cone beam computed tomography at integration check, before proceeding to definitive restoration.

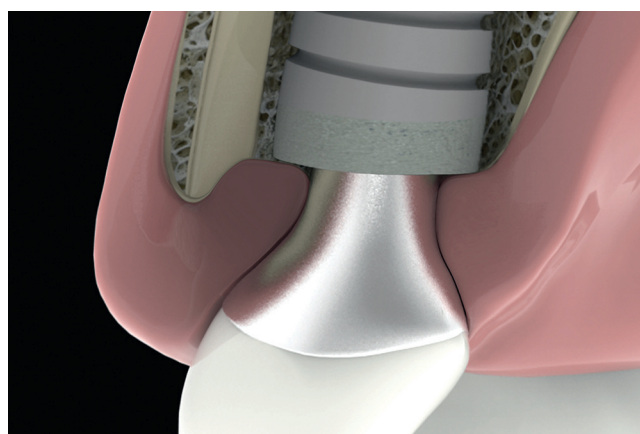


Figure 9. Diagram of socket-shield, reduced to crestal bone with internal beveled chamfer. Note S-shape contour of transgingival prosthetic portion.



Figure 10. Definitive outcome.

prosthesis, it is termed an internal exposure, and this type has been reported to be the most common complication of the technique (9.4% of the treatments).¹⁸ This could also be expected of the root membrane technique of Siormpas et al,¹⁷ one that is similar to the original method by Hurzeler et al, that also proposes a 1-mm or more supracrestal preparation of the tooth root portion. For this reason, the current authors strongly recommend meticulous reduction of the socket-shield to the bone crest, achievable almost exclusively with reflection of the coronal gingiva under magnification.

Because of the risk of tissue loss, a full-thickness flap is not recommended in most patients, especially in single-tooth and esthetic zone sites. Instead, a gingival protector should reflect the soft tissue away during preparation of the coronal socket-shield (Fig. 4B). However, multiple partial extraction therapies, multiple submerged root sites, and socket-shields adjacent to each other may better be prepared by raising a flap.

The second important aspect of this technique report is the preparation of an internal beveled chamfer (Fig. 5A). After the socket-shield has been reduced to crestal bone, it needs to be cut in an oblique direction, reducing its most coronal and internal aspect facing the socket. A large round diamond rotary instrument coupled to a high-speed handpiece cuts away this area, providing more prosthetic space for soft tissue infill between the implant prosthesis' emerging transgingival portion (Fig. 7). The socket-shield in situ, healed and prepared as described, can be seen on the cone-beam computed tomography at an integration check before the definitive restoration (Fig. 8). The third important aspect of this technique is the preparation of the prosthetic emergence profile. This should reflect an S-shape (Fig. 9). The connecting abutment at the implant needs to emerge as narrow as possible, then curve wider, and then back toward the implant's long axis. This prosthetic design provides maximal soft tissue infill and avoids excessive pressure on the socket-shield's coronal portion that previously resulted in internal exposure. The intended esthetic outcomes (Fig. 10) with a bulk of tissue

supported facial to the immediate implant was achieved for the patient described (Figs. 7, 8).

SUMMARY

With each addition of the socket-shield technique to the literature, more is learned about the treatment's potential and how to minimize its complications. Internal exposure of the socket-shield is a known complication and can be adequately managed by reducing the coronal portion. Conversely, this technique report emphasizes the prosthetic management of this area to prevent the complication. The restoration and/or interim restoration/customized transgingival healing abutment must be prepared in an S-shape to allow for maximal infill of the coronal soft tissue.

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