The socket-shield technique at molar sites: A proof-of-principle technique report

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Abstract

The socket-shield technique for avoiding postextraction tissue alteration was first described in 2010. The technique was developed for hopeless teeth in anterior esthetic sites but has not yet been described for molar sites. Managing postextractive ridge changes in the posterior region by prevention or regeneration remains a challenge. The socket shield aims to offset these ridge changes wherever possible, preserving the patient's residual tissues at immediate implants. This technique report describes the molar socket-shield step by step.

Hurzeler et al[1] first described the socket-shield technique in 2010 as an innovative attempt to prevent postextraction facial ridge loss with immediate implant placement. Although the technique has since been revised slightly,[2, 3, 4] with numerous reports on anterior esthetic sites, an innovation or proof-of-principle report has yet to describe the socket-shield in molar sites. Reports of postextraction changes of the residual ridge adversely impacting implant therapy have focused on anterior sites.[5, 6] Vertical midfacial bone loss at the maxillary central incisors has been reported to be as great as 7.5 mm.[7] Such bone loss may lead to esthetic complications and also make the implant vulnerable to infection.[8] Collapse of the buccal ridge at posterior sites may also present esthetic, as well as functional, challenges including loss of vestibule, loss of attached keratinized tissue, and food and plaque impaction.[9] While immediate implant placement limits the number of surgical interventions and shortens time to definitive treatment, ridge changes can be unpredictable.[10] The socket-shield technique may overcome this.

The treatment presented was carried out as a modification of the Hurzeler et al[1] report, and was conducted in accordance with ethical principles, including those of the World Medical Association Declaration of Helsinki (version 2008). Treatment planning included a complete dental and periodontal examination, preparation of trial restorations for the missing tooth sites, and radiographic examination by cone beam computed tomography (CBCT). The tooth was unrestorable but ideally suited for a socket-shield. The site was free of apical infection and had a wide residual ridge and adequate vertical bone without the need for sinus augmentation. Comprehensive treatment planning and selection criteria have been previously described.[3, 4, 11] Informed consent was obtained, and the treatment commenced. The technique is described hereafter as immediate molar implant placement.

Technique

1.After local anesthesia of the site, decoronate the tooth (Fig. 1).

Figure 1. Preoperative presentation of nonrestorable maxillary left second molar planned for extraction.

2.Hemisection the root trunk mesiodistally with a long-shanked, straight diamond rotary instrument in a high-speed handpiece with copious irrigation (Fig. 2). The buccal roots are separated from the palatal root. Determine the appropriate depth of this cut and the root trunk length from preoperative radiographs.

Figure 2. Root trunk and buccal root trunk sectioned consecutively. Palatal portions of buccal roots split.

3. Make a similar mesiodistal preparation into the buccal roots, thereby beginning preparation of the 2 socket-shields (Fig. 2). The authors recommend raising a conservative flap to visualize the bone crest and socket-shields if multiple partial extractions are to be carried out (or, as in this patient, multiple implants placed).

4. First, remove the palatal root and then the palatal portions of the sectioned buccal roots. Only the buccal portions of the buccal roots are to remain.
5. Carefully prepare the socket-shields of these buccal roots by thinning each mesiodistally with the same long-shank rotary instrument.
6. Using a large round diamond rotary instrument, reduce the crestal portion of the socket-shields to bone level.
7. Reduce the crestal portion of each socket-shield further by creating a 2-mm internal chamfer bevel that provides prosthetic space for the crown (Fig. 3 and Fig. 4).

Figure 3. Fully prepared socket-shields of buccal roots. All other root portions, with apical lesions and endodontic obturation fully removed and sockets rinsed.

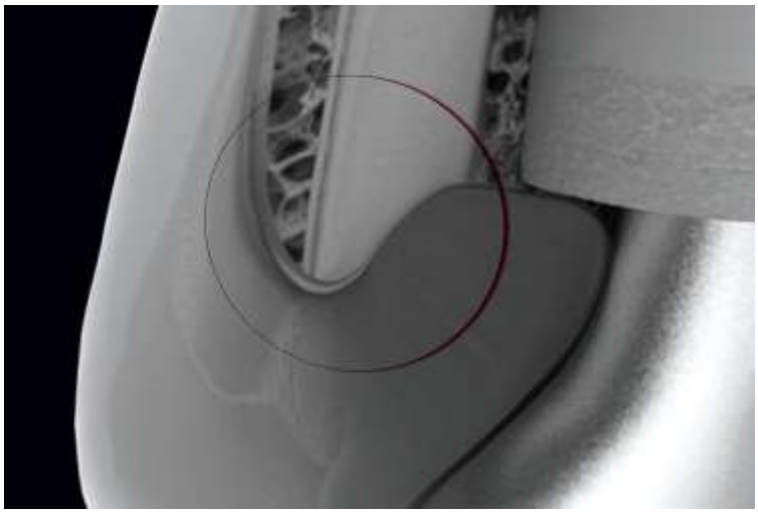

Figure 4. Cross-sectional diagram of coronal portion of socket-shield reduced to crestal bone level with internal beveled chamfer.

8. Curette the sockets, especially the apical areas, and rinse vigorously to clean.
9. Make intraoperative periapical radiographs to confirm that all endodontic obturation material, root canals, and root apices have been removed.
10. Verify absolute immobility of the socket-shields by applying a sharp explorer to the internal/dentin surface of the shield.

11. Then, prepare the implant osteotomy from the prosthetic/surgical planning and guide into the furcal bone of the extraction site. The authors recommend using the osseodensification technique described by Huwais and Meyer.[12]
12. Insert the implant (Fig. 5), verify primary stability (preferably using a resonance frequency analysis device), and graft the buccal gap with a bone particulate material.

Figure 5. Implants inserted. First molar site fully healed, delayed loading. Second molar site, immediate placement at socket-shields. Socket filled with xenograft.

13. Seal the socket entrance (though not illustrated here) with a custom, transgingival healing abutment constructed with a flaring emergence profile that conforms to the socket circumference (Fig. 6).

Figure 6. Transgingival healing abutments secured to implants. Site sutured and closed.

14. Give explicit postoperative oral hygiene instructions, typically a regimen of a 0.2% chlorhexidine oral rinse twice daily for 2 weeks. Prescribe only systemic analgesics when/if needed. Systemic antibiotics are unnecessary and not prescribed.
15. Recall the patient for a 48-hour short follow-up and then for a 2-week follow-up for suture removal (Fig. 7 and Fig. 8). Monitor for any adverse healing events.

Figure 7. Molar site healing by secondary intention, after 2 weeks of healing.

Figure 8. Fully healed sites at 4 months.

16. After approximately 3 to 4 months of healing, verify osseointegration by resonance frequency analysis. The implant stability quotients should be >70.
17. Restore according to the clinician's preference. The authors always recommend restoring with screw-retained restorations whenever possible (Fig. 9 and Fig. 10).

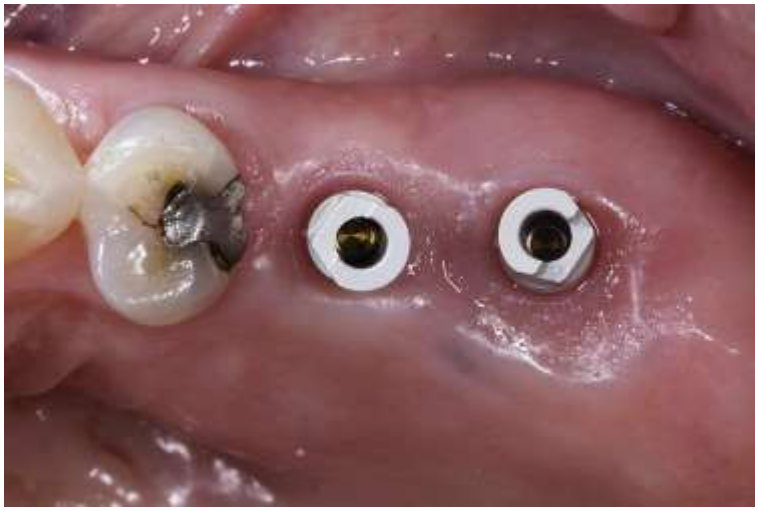

Figure 9. Scannable abutments secured to implants.

Figure 10. Definitive screw-retained restorations. A, Occlusal view. B, Buccal view.

Discussion

Since the first report of the socket-shield technique, clinical reports and case series have been added to the body of literature on this treatment. Schwimer et al[13] presented some of the first human histology that demonstrated bone formation between root dentin adjacent to an implant surface. Mid-term follow-up of the technique at 5 years has been reported by Baumer et al[14] and at 4 years by Gluckman et al.[11] These studies report successful preservation of the ridge at anterior esthetic sites, successful osseointegration adjacent to socket-shields, and implant survival rates comparable with those of conventional immediate and delayed implant treatment. Although these studies have reported primarily on anterior esthetic sites, the impact of postextraction ridge resorption managed by using the socket-shield technique has not been widely described in posterior sites. This technique report demonstrates that the socket-shield may be effective at molar sites (Fig. 11).

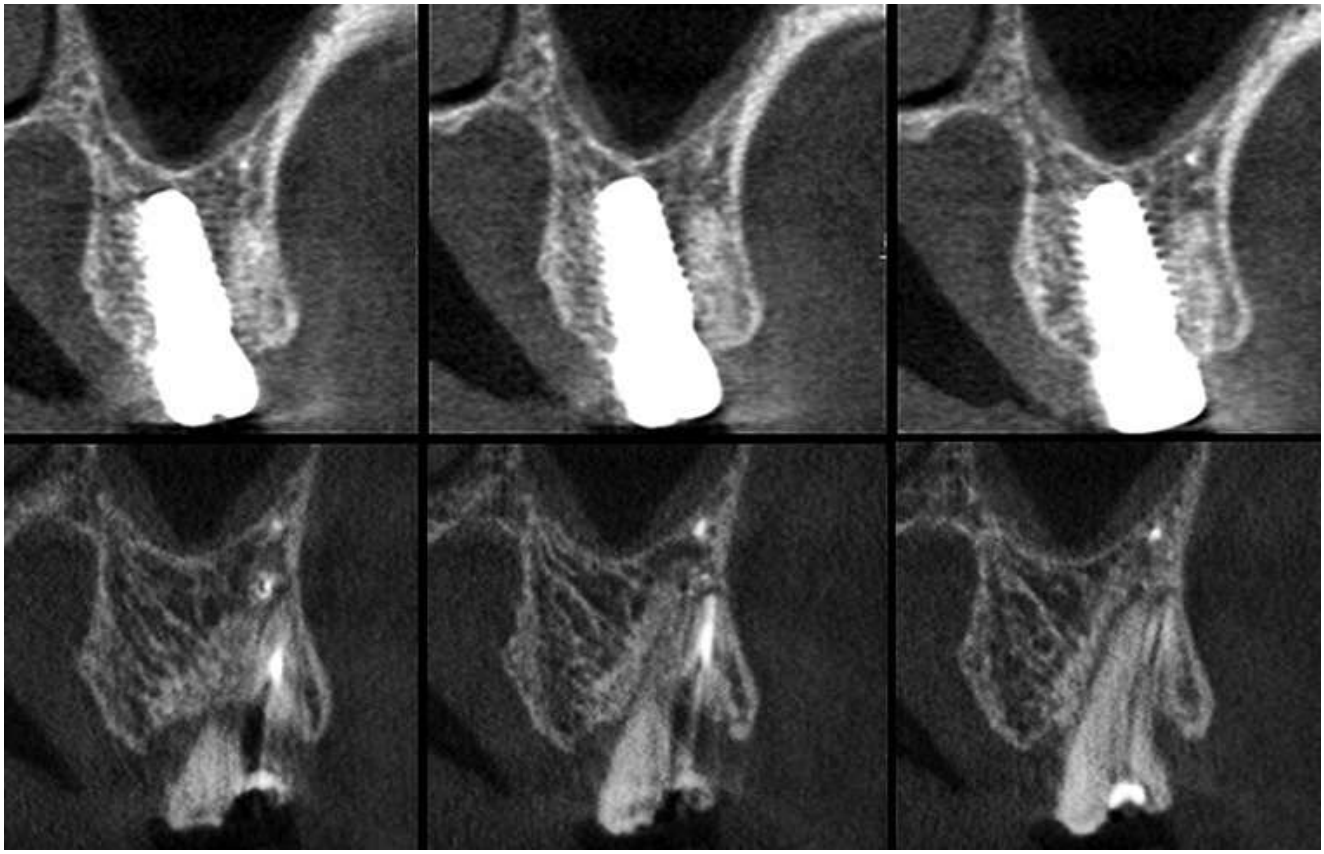

Figure 11. Postoperative cone beam computed tomography radial plane views (above) and preoperative views (below).

The posterior ridge may incur esthetic compromise when substantial alveolar ridge loss is evident. More importantly, loss of posterior bone may result in vestibular depth reduction and lack of attached keratinized tissue.[15] Such changes, coupled with inadequate alveolar bone, may negatively impact the health of the implant and predispose to peri-implantitis.[16] Surgical correction by vestibuloplasty, mucogingival free grafts, guided bone regeneration, and/or sinus augmentation may be indicated. However, these procedures are not without complication and require a high level of surgical expertise.[10, 17]

As evidence for or against partial extraction therapy grows, the clinician needs to select the best-suited treatment option for a particular patient. No one treatment option can be advocated as perfectly suitable for all patients and without disadvantages. Specific to the socket-shield technique, the following technical points may aid this decision-making process. At molar sites, the treatment is notably more difficult and, in the opinion of these authors, should only be attempted by those clinicians experienced in immediate implant placement and who have mastered the socket-shield technique in anterior single-tooth sites. Not only is the treatment technique sensitive but it also takes additional time—likely a longer procedure than conventional extraction with forceps alone. Moreover, complications have been reported at socket-shields, including infection at the site (2.3% of procedures), internal exposure (9.4%), external exposure (3.1%), implant failure to osseointegrate (3.9%), and orthodontic migration of shields (1.5%).[11] Moreover, previous clinical reports have addressed problems with accidental implant misplacement into unintentionally retained and infected tooth root fragments.[18, 19, 20] This, however, differs greatly from the socket-shield technique, which is a

very deliberate procedure for carefully preparing a root fragment and removing all the canal and apical contents.

With regard to technique and specific to molar sites, long and widely divergent, excessively curved roots at molars are particularly challenging. The anatomy of the mesiobuccal roots of maxillary molars makes it difficult to access the apical root portion for removal. In such situations, it is likely that the coronal portion that is more straight would be separated from the curved apical portion and the root tip delivered. The palatal root typically does not present a challenge and should be removed early to provide working space in the socket. The maxillary molar buccal roots are smaller, and all root canal contents, apical root portions and contents, as well as endodontic obturation material must be completely removed.[4] This is achieved by making intraoperative radiographs to confirm complete materials and root apex removal. Though not used in this particular patient, a custom transgingival abutment is highly beneficial to seal the socket entrance and stabilize the blood clot and graft material. Care must be taken not to provide excessive contour with the custom abutment to allow maximal soft-tissue infill.

Summary

The socket-shield technique as a partial extraction therapy to preserve buccofacial tooth structure and maintain the ridge at anterior implant sites has received much attention in recent years. However, the significance of ridge collapse at posterior sites is often overlooked. From the technique presented in this report, socket-shields may help maintain the alveolar ridge at immediate molar implant placement sites. The authors strongly encourage additional reports to further elucidate the procedure.

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