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Socket Shield Adjacent to Complete Root Shield in the Anterior Zone: A Case Report

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ABSTRACT

Since its introduction, the "socket shield" technique has been a subject of interest and investigation. Its main aim is to leave the buccal portion of a root *in situ* where a dental implant is planned for placement. The root remnant acts as a "shield" holding and preserving the attached periodontal apparatus. It is expected to preserve the buccal peri-implant bone architecture with no changes.

This case report highlights the feasibility of two Partial Extraction Therapy (PET) techniques: implant placement following the traditional socket shield technique in a single-rooted tooth and a modified approach applied to an adjacent two-rooted tooth on the same side.

The proposed modification eliminates the need for the technically demanding and time-consuming preparation of a socket shield. Instead, the technique involves sectioning the two-rooted tooth, extracting only the palatal root while preserving the buccal root intact, and placing the implant within the extraction socket of the palatal root. This approach simplifies the procedure while maintaining the benefits of bundle bone preservation, similar to the traditional socket shield technique.

The results showed noticeable preservation of buccal bone volume and enhanced emergence profile of the implant rationed restoration. However, on the contralateral side, where a conventional implant placement was performed, the expected post-extraction bone remodeling is observed. This serves as a comparative reference, demonstrating the enhanced bone preservation achievable with PET prior to implant placement and the feasibility of the modified PET technique applied.

Keywords: Socket shield technique, Complete root shield, Partial extraction therapy, Immediate implant insertion.

1. Introduction

Tooth extraction results in an inevitable loss of the surrounding alveolar bone, Tan et al. estimated it to be 30%-60% horizontally and 11%-22% vertically after six months of extraction (1). Since dental implants became a valuable treatment option to replace missing teeth, bone availability in terms of quality and quantity became a major concern. Hence, techniques to either preserve (2) or regenerate (3,4,5,6,7) lost bone have been studied and clinically applied. Common techniques, such as socket preservation, horizontal and vertical bone grafts, and root submergence techniques have been utilized (8).

Unfortunately, none of the proposed techniques could completely preserve alveolar bone after teeth loss, and none could counteract the physiological process of bone resorption (9). Hurzeler et al. suggested a technique in 2010, which was termed "socket shield" (10). They suggested keeping a buccal fragment of the tooth as an attempt to preserve the buccal surrounding

bone. Then, a dental implant was inserted palatal to the preserved buccal shield. Their technique has been investigated thoroughly ever since, and many clinicians have adopted this technique into their practice (11,12,13,14). In the following 13 years, the socket shield technique has been discussed and referred to as potentially the only technique to carry the potential of completely preserving buccal bone around dental implants.

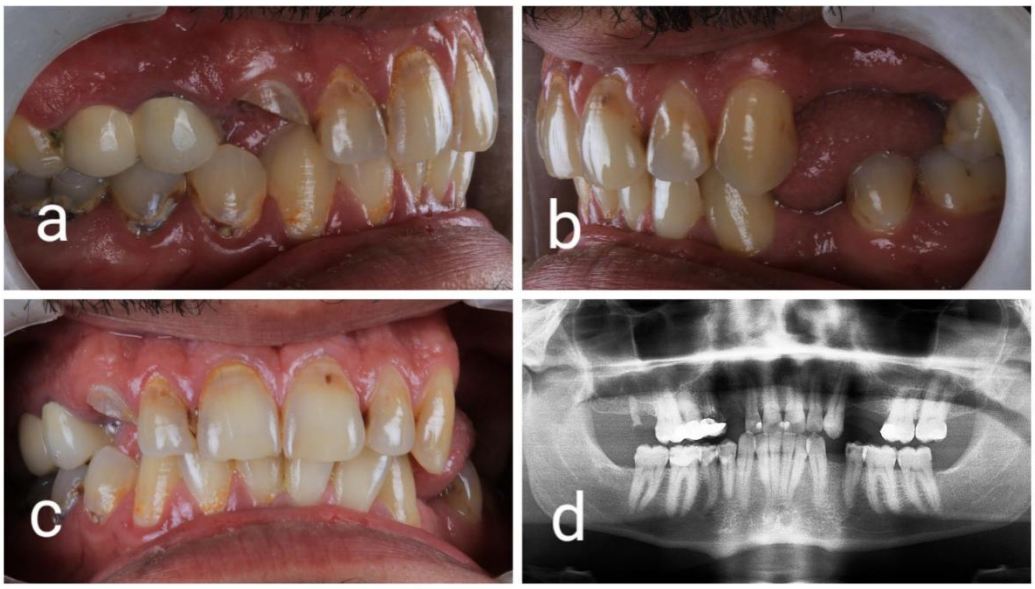

Figure 1: a- Pre-operative lateral right view. b-Pre-operative lateral left view. c- Pre-operative frontal view. d- Pre-operative panoramic radiograph

2. Case Report

A 35-year-old healthy male, with no significant medical history, presented to dental office complaining of the non-aesthetic look of his teeth and to rehabilitate his poor oral condition.

Clinical examination revealed the existence of rampant caries, missing teeth, retained roots (Fig. 2- a, b), as well as poorly fitting crown and bridge work. A treatment plan was designed to place implants at the sites of missing left maxillary first and second premolars, and to perform partial extraction therapy at the sites of non-restorable right maxillary canine and left maxillary second premolar.

Socket shield technique procedure was performed (Fig. 2- c) at the site of right maxillary canine as follows: the caries on the coronal part of the remaining root was cleaned and the surface was reduced to an epicrestal level using a wheel diamond bur. The procedure was carried out carefully not to rupture the soft tissue of the keratinized gingiva. In the next step, a tapered round-edge diamond bur was utilized to cut the root mesiodistally, starting at a distance dividing the occlusal surface of the root into a one-third facing the buccal side, and two-thirds at the palatal side; the cut was sloping from the one third line of the root bucco-lingualy, toward the buccal part, the cut ends being at a level laying somewhere around the midway of the apico-coronal distance of the root. The cut was made wide enough to liberate the resultant buccal fragment from the rest of the root and to prevent traumatizing this fragment while luxating the rest of the root using straight elevators 301 and 302. The remaining part of the root was extracted (Fig. 2- d) afterwards, leaving the buccal fragment intact to save the canine eminence and the bundle bone.

The resultant fragment was reshaped to look semilunar in shape when it is viewed from the occlusal aspect. Implant placement was not intended at this session.

The poorly fitting splinted PFM crowns on right maxillary first and second premolars were removed. Extensive decay on non-restorable right maxillary first premolar was revealed and right maxillary second premolar was found to be vital (Fig. 3- a).

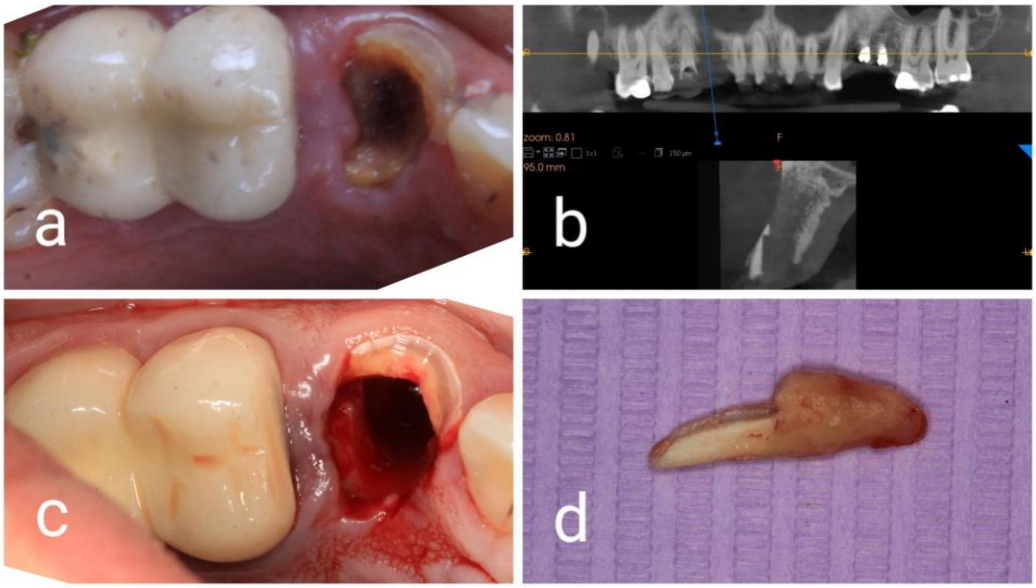

Figure 2: a- Pre-operative occlusal view of the upper right canine. b-Pre-operative view showing the intact socket shield at the site of upper right canine. c- Socket-shield technique performed leaving part of the tooth intact to the buccal bone. d-The rest of the root after extraction and leaving the buccal part intact

CBCT examination displayed that right maxillary first premolar has two roots with nearly no buccal bone present (Figure 3, b). Additionally, a periapical lesion with a short endodontic filling was evident; thus, re-treatment was concluded to achieve an ideal root canal filling of the buccal root. The orifice was sealed using MTA filling and the root was dissected mesiodistally to separate the buccal and palatal roots. The palatal root was gently extracted (Figure 3-d, c). The palatal side of the intact buccal root was reduced to create space facilitating an ideal three-dimensional implant placement.

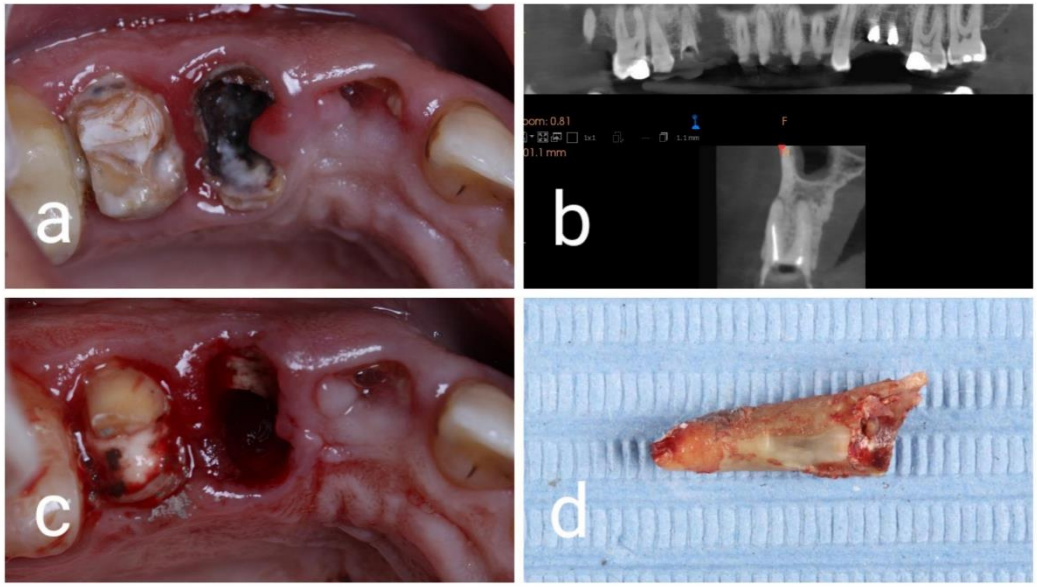

Figure 3: a- Pre-operative occlusal view of the upper right first premolar. b- Pre-operative CBCT showing the two-rooted upper right first premolar. c-Partial-extraction therapy in which the palatal root was removed and the buccal one was saved and left *in situ*. d-The extracted palatal root

Delayed implant placement was placed at the site of right maxillary canine following the socket shield procedure done in a previous session. A tapered design, two-piece titanium implant with a conical connection (1.5° Morse Taper) Argon K3Pro™ Rapid (R-Line) (Argon dental GmbH. Bingen, Germany) 4 x 11.0 implant was placed (Fig. 4-c) 3.5 x 11.0 was used (Figure 4-a). At the site of the right maxillary canine, another implant 4.0 x 8.0 was placed touching the buccal root of the right maxillary first premolar (Figure 4-b).

Contralaterally, at the site of missing maxillary first premolar, an Argon K3Pro™ Rapid (R-Line), 4 x 11.0 implant was placed (Fig. 4-c) and another implant 3.5x9.0 was placed at the site of left maxillary second premolar. Both implants were kept unloaded (Fig. 4-d).

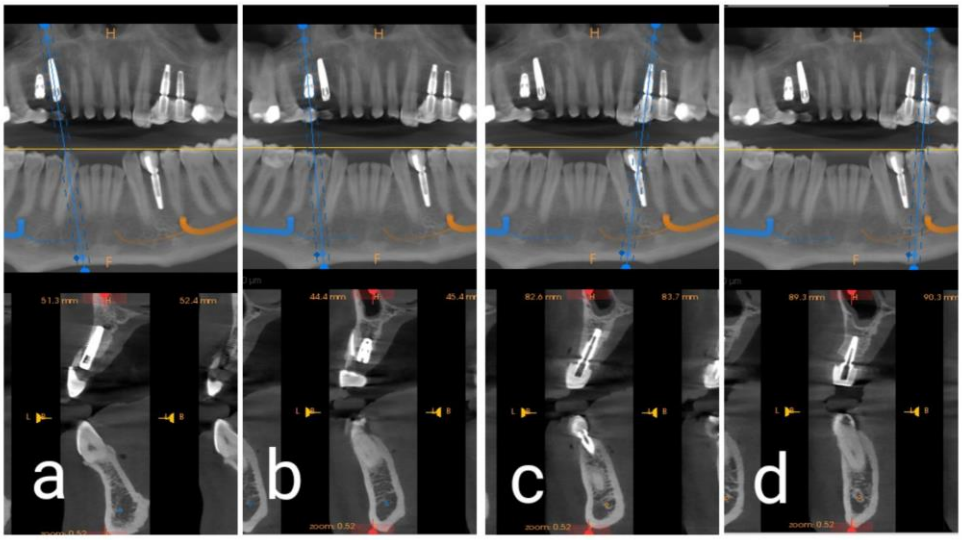

Figure 4: a- Implant placed with the socket-shield technique at the site of upper right canine. b-Implant placed with the buccal root in place at the site of upper right first premolar. c-Implant placed at the site of missing upper left first premolar. d-Implant placed at the site of missing upper left second premolar

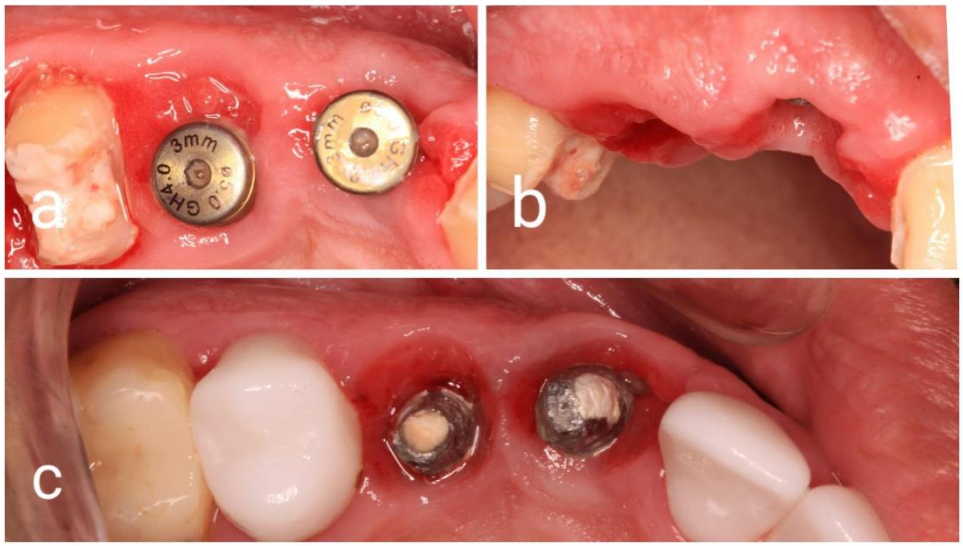

Figure 5: a- Occlusal view showing the placement of gingival formers at the sites of upper right canine and upper right first premolar. b- The lateral view after removing the gingival formers showing that the papilla between the sites of the two implants was maintained, attributed to the partial-extraction therapy at the two sites of implant placement. c- The tissues around implant abutments showing the maintenance of the hard and soft tissues and the avoidance of the remodeling process at buccal side

Throughout the healing period, at the two sites where partial extraction therapy was applied (Figure 5-a), the bone volume on the buccal sides of the PET remained stable and soft tissue exhibited optimal healing (Fig. 5-c and-d).

Following a three-month healing period and implant osseointegrartion, the anterior natural teeth were prepared to receive zirconia crowns. A digital scan was made of the natural teeth and implants to fabricate single crown restorations for the teeth (Figure 6-a). The final result after restoration shows the maintenance of the natural emergence profile at the sites where partial extraction therapies were applied (Figure 6-b), compared with the sites where no partial extraction therapy was performed, after delayed implant placement and after bone remodeling (Figure 6-c).

Figure 6: a- Post-operative frontal view after delivering the zirconia crowns. b-Two years' follow-up, post-operative lateral right view showing the natural emergence profile around the implants placed with socket-shield and partial-extraction therapy. c-Two years' follow-up, post-operative lateral left view showing the volumetric difference of tissues around the implants at the sites of the missing teeth which were subjected to remodeling process, in comparison with the implants which were placed using partial-extraction therapy

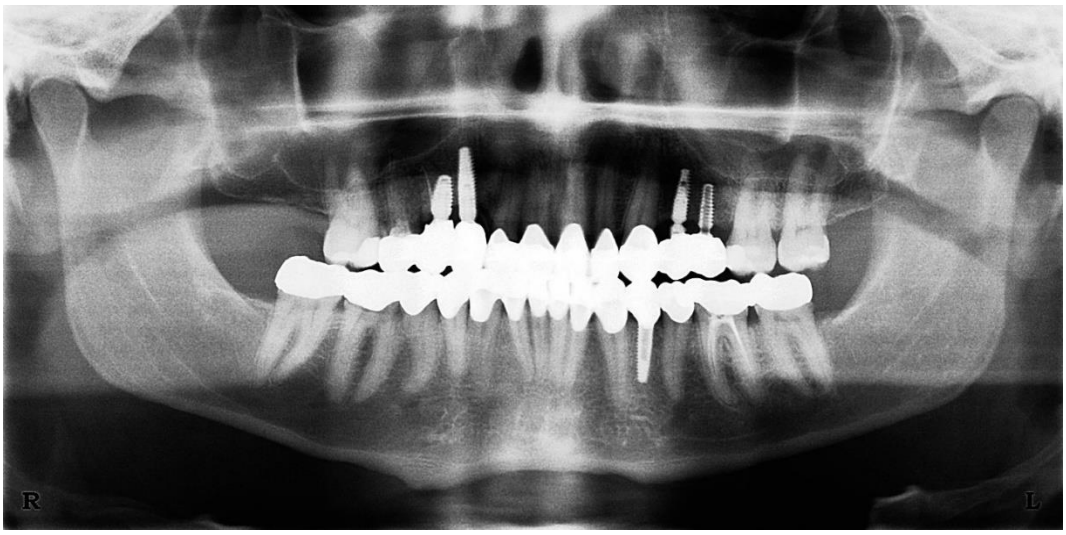

Figure 7: Two-year panoramic radiograph

The patient was followed up at multiple visits and post-operative radiographs were taken for a 2-year follow-up period. The implants on both sides remained functional and showed no clinical or radiographic signs of failure.

The outcome was favorable for both the socket shield and complete root shield techniques compared to the conventional approach. It is obvious after clinical and radiographic examination by comparing the pre-operative CBCT of the right maxillary first premolar to the post-operative CBCT of the same tooth that the surrounding tissues on the shielded side were better preserved. This produced a more satisfying and pleasing result for both the clinician and the patient. However, the conventionally treated side displayed noticeable loss of hard and soft tissues, compromising the emergence profile and the overall aesthetics.

3. Discussion

In this case report, besides the socket shield technique, which was performed on a single-rooted tooth—the maxillary right canine-, another modification of the socket shield technique was introduced, referred to as the complete root shield technique. This procedure was applied to a two-rooted tooth-the maxillary premolar-, in which root separation and extraction of the palatal root were carried out in an endodontically and periodontally inflammation-free tooth. The intact properly treated buccal root was left in place. Leaving a root *in situ*, root submergence technique of a non-restorable tooth to preserve the alveolar ridge tissues was first introduced by Salama et al. in 2007 (15).

Socket shield is well documented in the literature and many authors proved the viability and the advantages of this technique. Abadzhiev et al. and Siormpas et al. compared conventional implant insertion and socket shield technique, and concluded that the latter was superior in terms of architecture preservation and aesthetics (16,17). Mitsias et al. presented the first and only available human histologic evidence on the validity of socket shield technique (18).

In 2018, Bramanti et al. published the first randomized clinical study on socket shield. They showed 100% success of all implants and better results in term of bone stability and aesthetics compared to conventional implant insertion (19). However, application of the socket shield procedure is still technique-sensitive and requires a high level of skill from the practitioner. Utilizing it in the daily practice can present different challenges.

Troiano et al. and Guirado et al. introduced the root-T-belt technique (14,20). This modification of the socket shield technique involves leaving the whole root circumference *in situ* without sectioning. The implant osteotomy was prepared through the root and the implant inserted subsequently to be surrounded completely by the root.

Variations introduced over the years reflect a great deal of interest and confidence in the practicality of this technique. The currently presented modification aims to ease and simplify its application, as well as to utilize the socket shield technique in a different setting and display its predictability under these conditions. The primary goal of the original socket shield technique is to preserve the bundle bone by maintaining the periodontal system. In this modification-the complete root shield technique-the same objective is achieved with less effort: the technically demanding and time-consuming preparation of the socket shield is replaced by leaving the entire root intact while still achieving the desired outcome.

4. Conclusions

Within the limitations of this case report, it seems that socket-shield technique and its modified version, referred to in this report as the complete root-shield technique, may offer superior outcomes in tissue preservation and aesthetics. This modified approach involves sectioning a two-rooted tooth, extracting only the palatal root while preserving the buccal root intact, and placing the implant within the extraction socket of the palatal root. However, additional studies and randomized controlled clinical trials are needed to validate this modification of the socket shield technique.

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