

Socket Shield Technique for Ridge Preservation : A Case Report

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Abstract

The "socket shield technique" has demonstrated the potential in preventing buccal tissue from resorption in animal and clinical studies. It is assumed that retaining a root fragment attached to the buccal bone plate in this technique can avoid tissue alteration after tooth extraction. This article presents a 58-year-old healthy man with a failing upper right second premolar which would be replaced by an implant-supported single crown. Leaving a partial root fragment at buccal side in combination with immediate implant placement lingual to the retained fragment was performed. Four months after implant placement, clinical examination showed healthy peri-implant soft tissue and the ridge was well preserved. A definitive metal ceramic crown was fabricated and cemented on a titanium abutment. The prosthesis successfully restored the function of the patient. A maximum amount of horizontal resorption at the buccal side was 0.72mm. Applying socket shield technique and immediate implant placement may be a feasible treatment option in case with high esthetic concern.

Keywords: ridge preservation, immediate implant placement, extraction socket, socket shield, tooth retention

Introduction

Healing of extraction sockets are characterized by bone formation within the socket and loss of the alveolar ridge width and height externally.¹ The alteration of ridge contour may compromise the restoration-oriented three-dimensional positioning of the implant which requires optimal support and stability of surrounding hard and soft tissues.² In esthetic region, the height and thickness of facial and interproximal bone walls are the important factors for successful pink esthetic outcomes, which are made up by the color, shape, and character of the marginal peri-implant mucosa and the presence of interdental papilla.³ Different techniques such as immediate implant placement⁴ and ridge preservation procedure⁵ have been proposed to maintain the ridge dimension to a certain amount. However, applying these methods to extraction sockets could not completely preserve the coronal part of facial bone walls which were comprised almost entirely of bundle bone.

Araújo and Lindhe suggested that following tooth extraction, the blood vessels in periodontium to the thin bone walls are severed, thereby causing facial bone plate resorption.⁶ Thus it can be assumed that retaining a root may alter the occurrence of facial bone resorption.



Fig. 1 Complicated crown-root fracture at tooth 15 restored temporarily with composite resin.



Fig. 2 Tooth 16 and 17 were restored by implants which showed healthy peri-implant mucosa.

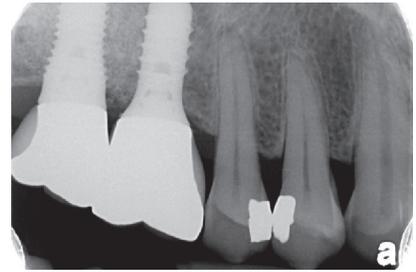


Fig. 3 Periapical radiograph taken before removing the tooth fragment showed moderate bone resorption and apical radiolucency at 15.

Retaining a root for alveolar ridge preservation has been tested in several clinical studies. In a case report, decoronation of an ankylosed tooth demonstrated complete maintaining of the height and width of the alveolar ridge prior to implant placement.⁷ Salama et al. recommended a root submergence technique in which a natural tooth root was maintained and the surrounding tissue could be preserved at the pontic site.⁸ Periodontal regeneration including new attachment apparatus, cementum, connective tissue, and bone could be formed around a submerged root whose surface was pathologically exposed.⁹

Davarpanah & Szmukler-Moncler reported a series of five cases that implant osteotomy preparation and placement were through the ankylosed roots.¹⁰ The root fragments were deliberately left and did not seem to interfere with implant integration in the mid-term.

In 2010, Hürzeler et al. introduced a new method, the socket shield technique, in which a partial root fragment was retained around an immediately placed implant with the aim of avoiding tissue alterations after tooth extraction.¹¹ Histologic evaluation in a beagle dog showed no resorption of the root fragment and new cementum formed on the implant surface. Their clinical case demonstrated excellent buccal tissue preservation and clinically successful osseointegration of the implant. Joseph & Kitichai¹² reported an alternative approach in a case utilizing a retained proximal root fragment to maintain the inter-implant papilla.¹² Bäumer et al. conducted a pilot study concentrated on the histological, clinical, and volumetric observation of the alveolar ridge and implant after applying this technique.¹³ Healthy periodontal ligament of the tooth segment, minor volumetric change of the ridge contour, and direct bone-to-implant contact manifested that



Fig. 4 Thin buccal plate and sufficient bone apico-palatal to the root on the CBCT image.

this technique is a feasible treatment option.

This article describes a patient whose alveolar ridge of a failing tooth is preserved by the "socket shield technique" and immediate implant placement.

Case Report

A 58-year-old, healthy, and non-smoking male patient presented with a complicated crown-root fracture on the upper right second premolar restored temporarily with composite resin. The fracture line extended 3mm apical to the palatal gingiva. The adjacent molars, tooth 16 and 17, were replaced by an implant-supported fixed partial denture after sinus elevation procedures. (Fig. 1,2) Clinical examination showed healthy periodontal and peri-implant tissues except 15 where bleeding on probing and plaque accumulation were found at its palatal side. Periapical radiograph of 15 taken before removing the fracture part of the tooth revealed moderate alveolar bone resorption and apical radiolucency. (Fig. 3)

Treatment options were discussed subsequently and implant-supported single crown was the choice for replacing the failing 15. Cone-beam computed tomography (CBCT) demonstrated thin buccal plate and sufficient residual bone apico-palatal to the root. (Fig. 4)



Fig. 5 Shield was prepared and conservative removal of the palatal root fragment.



Fig. 6 The implant is placed at palatal position without contacting the shield.

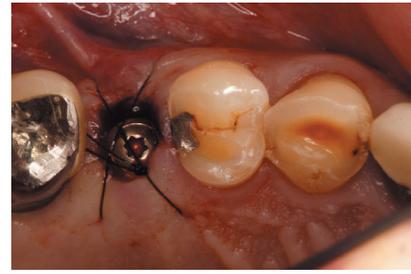


Fig. 7 Partial closure of the extraction socket by a minor pouch flap and stitch.



Fig. 8 Uneventfully healing of the peri-implant soft tissue after 4 months.



Fig. 9 Shallow probing depth around the implant.



Fig. 10 Titanium abutment was connected to the implant.

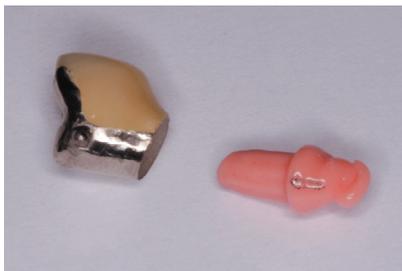


Fig. 11 A silicone index (pink) formed to the internal configuration of the implant restoration.



Fig. 12 Excess luting material could be wiped off after placing the implant crown onto the silicone index.



Fig. 13 A thin and evenly distributed layer of luting agent was provided for cementation.

The treatment plan implicated an immediate implant placement within the meaning of the socket shield technique and flapless implant placement at tooth 15 without damaging the adjacent implants.

Prophylactic procedures including taking 2g of antibiotic (Curam®, Sandoz GmbH, Kundl, Austria) one hour before surgery and rinsing his mouth with 0.2% chlorhexidine solution were performed. Tooth 15 was decoronated with coarsed-grained diamond bur and the shield was segmented and prepared by osteotomy drills. Conservative extraction of the palatal root fragment was done with periostome and forceps. (Fig. 5) The socket was debrided gently and irrigated with normal saline. Implant bed preparation at the palatal wall of the socket was performed and a root-form implant (Tapered Effect implant 4.1 X

12mm, Straumann®, Basel, Switzerland) was placed according to the manufacturer's recommendations without contact to the shield. The apico-coronal position of the implant platform was situated 1mm apical to the palatal marginal gingiva. The gap between the shield and implant surface was left to enable blood clot formation. (Fig. 6) The socket was partially closed by a minor partial-thickness pouch flap elevated at the buccal side and a Figure-of-eight stitch. (Fig. 7) After 4 months, the soft tissue around the implant healed uneventfully, and represented shallow depth on probing. (Fig. 8,9) The final impression was taken and a porcelain-fused-to-metal crown was fabricated. A titanium abutment (RN synOcta cementable abutment, Straumann®, Basel, Switzerland) was torqued into the implant at 35N-cm. (Fig. 10) In order to reduce the cement extrusion into



Fig. 14 Final metal ceramic crown in situ. The gingiva height of 15 was maintained.



Fig. 15 The buccal ridge contour of 15 was preserved.

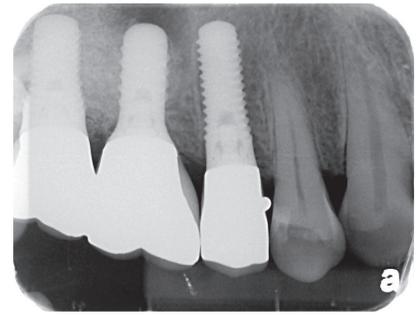


Fig. 16 Periapical radiograph taken after temporary cementation of the crown.

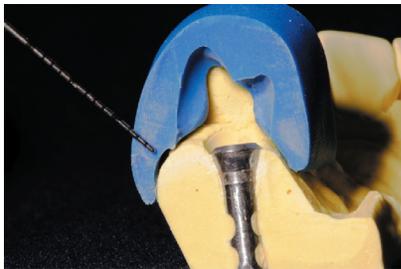


Fig. 17 Comparison of pre-operative (blue putty) and post-operative (yellow stone) ridge shapes. Only minor resorption of the buccal and palatal surfaces could be observed.

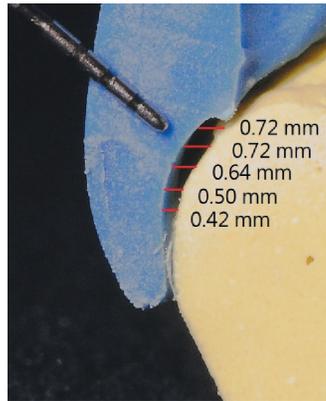


Fig. 18 The amount of horizontal resorption of the buccal surface was measured.



Fig. 19 One-year follow-up manifested constant morphology of the alveolar ridge.



Fig. 20 Peri-implant tissue showed an absence of inflammation after one year.

the peri-implant sulcus area, a silicone index made by filling it into the internal configuration of the definitive restoration (Fig. 11) was used to prepare a uniform layer of luting agent. Lining the intaglio of the restoration with cement (TempBond; Kerr, Orange, Canada), seating the crown onto the silicone index, and wiping off the excess material eventually produced an evenly distributed layer of luting agent. (Fig. 12,13) The crown was then placed on the abutment intraorally and only a minor amount of excess cement could be detected and removed. The height and width of the ridge was preserved. (Fig. 14,15) Radiograph showed that the implant was well integrated. (Fig. 16)

Pre- and post-operative stone models were matched for comparing the ridge alteration after this intervention. A silicon putty impression was taken from the pre-operative stone model to record the baseline ridge morphology. The impression was cut in bucco-palatal direction at tooth 15 and placed on the post-operative

model for comparison by using adjacent teeth as references. (Fig. 17)

The long axis of the implant dictated the vertical orientation of the measurements. The amount of horizontal resorption of the buccal surface are measured in pixels and calibrated by a periodontal probe at different points apical to the bottom of gingival sulcus in an interval of 0.5mm. The area showed the highest amount of resorption measured 0.72mm in palatal direction was the most coronal part of the ridge. (Fig.18)

The crown was definitively cemented with reinforced glass ionomer cement (FujiCEM®, GC Corporation, Tokyo, Japan) after two weeks. One-year follow-up fulfilled the criteria for implant success. (Fig. 19,20)¹⁴

Discussion

This case report confirmed that retaining a root fragment adjacent to the buccal crestal bone and placing an implant engaged to the palatal socket wall immediately are able to maintain the contour of the ridge. The implant can achieve osseointegration without any inflammation at peri-implant tissue. While histological examination is needed to verify the preservation of buccal bone plate and tissue regenerated between the shield and implant, the clinical outcome demonstrated the potential of socket shield technique to avoid noticeable alteration of ridge shape after tooth extraction.

In scientific literatures, immediate implant placement is a predictable procedure to accomplish osseointegration.¹⁵ However, the biological response to tooth extraction, such as marked resorption of the buccal bone plate, is not altered when an implant is installed into the socket.¹⁶⁻¹⁸ Simultaneously grafting the void between the implant and socket walls with bone substitutes in conjunction with a barrier membrane does not preserve the buccal bony wall either.¹⁹ Applying guided bone regeneration (GBR) and/or soft tissue augmentation at the external buccal surface of the ridge can only partly compensate but not prevent the resorption process.²⁰ In GBR, flap elevation and overbuilding the buccal contour are necessary for predictable results. Scar formation, insufficient soft tissue for coverage, additional surgical wound for hard/soft tissue harvest, and high cost of biomaterials are main drawbacks of GBR technique used in immediate implant placement.

Socket shield technique meets the demands of minimal invasion, tissue preservation, and no need of bone substitute materials. Baumer et al. proved that the remaining tooth segments showed healthy periodontal ligament at buccal side and no osteoclastic remodeling of the coronal part of the buccal plate.¹³ They also analyzed the clinical volumetric change of the alveolar ridge in a case and showed a mean loss of 0.88mm in labial direction with a maximum of 1.67mm and a minimum of 0.15mm. In our case, the maximal horizontal loss is 0.72mm, less than that report. Different subject, measurement method and tooth position may cause the dissimilarity.

Socket shield technique for ridge preservation can be applied not only for maintaining buccal contour of an edentulous ridge but also for keeping the inter-implant soft and hard tis-

sue.⁷ Kan and Rungcharassaeng¹² used proximal socket shield procedure in conjunction with immediate implant placement and provisionalization on a failing tooth adjacent to an implant restoration. The well-preserved inter-implant papilla and satisfactory esthetic results after 1-year follow up were shown in their case report. Diversification of this technique used for tissue preservation such as socket preservation for future implantation in adolescence may be practical. However, more studies are needed to prove the feasibility.

Excess residual cement around the margin of cement-retained implant restoration has been proved to cause peri-implant inflammation.²¹ Wadhvani and Piñeyro introduced a method of controlling cement flow using a duplicated silicone abutment with smaller dimensions.²² Chee et al. compared different cement application methods and manifested that this technique produced the least amount of excess cement than other conventional methods such as applying the cement on the internal margin or axial wall only.²³ As the crown margin is located below the marginal peri-implant mucosa in our case, we employ this technique in the process of cementation in order to reduce the amount of residual cement.

In this case report, the application of socket shield technique combined with immediate implant placement for replacing a failing tooth obviously maintains the ridge shape. The implant-supported prosthesis functions well and healthy peri-implant soft tissue is observed. Further studies with larger scale of evidence and long-term follow up are needed to substantiate the validity of this technique.

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