

Review Article

Socket Shield Technique-A Neoteric Approach in Ridge Preservation

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Abstract: Resorption of alveolar bone subsequent to extraction resulting in loss of alveolar bone height and width is sequelae that pose difficulty in placement of an implant especially in esthetically important area like maxillary anterior region. Several approaches have been described in the literature to overcome the complications of alveolar ridge resorption and to preserve the ridge like the hard and soft tissue augmentation with GBR, bone substitutes with or without immediate implant placement. An ideal method should always be cost effective and minimally invasive. Socket shield technique is one such new method where buccal root segment is retained as a shield which prevents resorption and achieves complete alveolar ridge preservation.

Keywords: Alveolar ridge resorption, Socket shield technique

INTRODUCTION

Hopeless teeth are always an indication for extraction. Loss of teeth triggers alveolar bone remodelling process especially affecting buccal lamina and leads to horizontal and vertical bone loss. The bundle bone is primarily vascularised by the periodontal membrane of the tooth. Thus, this part of the alveolar bone is compromised by the extraction, to such an extent that the buccal lamina is insufficiently nourished, leading to its total or partial resorption. Apart from affecting aesthetics, these resorption processes have a negative impact on the subsequent implant based rehabilitation.

Various techniques have been described in literature to overcome these negative consequences of tooth extraction such as hard and soft tissue augmentation with GBR, bone grafts following extraction with or without immediate implant placement [1]. However, immediate implant placement still does not prevent buccal bone resorption as it is a biological phenomenon [2]. Applying GBR at the external surface of ridge also does not prevent resorption². Moreover, the search for minimally invasive procedures with minimal requirements always goes on. Cost is another factor which needs to be considered. Meeting these criteria's is not possible with any of these current methods used.

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 that is anticipated after tooth extraction.

REVIEW OF LITERATURE

The most simple and from an ontogenetic perspective, most physiological approach to the prevention of alveolar ridge resorption is to naturally preserve the inflammation free dental root if possible [3]. Technique for sub mucosal vital and non vital root retention has already been described [4]. Araújo and Lindhe in 2005, suggested that following tooth extraction, the blood vessels in periodontium to the thin bone walls are severed, thereby causing facial bone plate resorption. Thus it can be assumed that retaining a root may alter the occurrence of facial bone resorption [5]. Salama *et al.* in 2007, recommended a root submergence technique in which a natural tooth root was maintained and the surrounding tissue could be preserved at the pontic site [6].

Davarpanah and Szmukler-Moncler in 2009, reported a series of five cases in which the implant osteotomy preparation and placement were through the ankylosed roots. The root fragments were deliberately left and did not seem to interfere with implant integration in the mid-term [7]. Hürzeler *et al.* introduced a new method, the socket shield technique, in which a partial root fragment was intentionally retained around an immediately placed implant with the aim of avoiding tissue alterations after tooth extraction [8]. Recently Von Arx *et al* published a new method to

preserve the alveolar ridge after post traumatic ankylosis and external root resorption by leaving the decrowned root fragments [9]. Joseph and Kitichai in 2013, reported an alternative approach in a case utilizing a retained proximal root fragment to maintain the inter-implant papilla [10]. Bäumer *et al.* in 2013 conducted a pilot study which concentrated on the histological, clinical, and volumetric observation of the alveolar ridge and implant after applying this technique. Healthy periodontal ligament of the tooth segment, minor volumetric change of the ridge contour, and direct bone-to-implant contact manifested that this technique is a feasible treatment option [11].

SOCKET SHIELD TECHNIQUE

This technique was first introduced by Hürzeler *et al* in 2010 where the coronal buccal root portion ensured the physiological preservation of labial and buccal bone structures if the implant is placed in contact to this natural tooth fragment or the shield. 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. The technique offers a viable solution when managing the post extraction ridge and its complications associated with immediately placed implants [9].

Table 1: Review of the Available Literature on the Socket –Shield Technique [12]

Year	Author(s)	Study
2015*	Bäumer <i>et al.</i>	Animal histology of 3 cases of socket-shield with vertical fractures
2014*	Siormpas <i>et al.</i>	46 Case series of the "root-membrane technique" with follow up varying 2-5 years
2014	Holbrook	Case report: Guided implant placement with socket-shield
2014*	Cherel & Etienne	Case report: Modified socket-shield for papillae preservation
2014*	Glocker <i>et al.</i>	Case series: Modified socket-shield for ridge preservation, delayed placement
2013*	Kan & Rungcharassaeng	Case report: Proximal socket shield for papillae preservation
2013	Chen & Pan	Case report: Socket-shield with immediate implant placement
2010	Hürzeler <i>et al.</i>	Animal histology of 1 case of socket-shield technique, & 1 human clinical case of implant restoration with socket-shield

The Principle of Socket-Shield (SS) Technique

1. Preparation of the root of a tooth indicated for extraction in such manner that the buccal / facial root section remains in-situ with its physiologic relation to the buccal plate intact.
2. The tooth root section's periodontal attachment apparatus (periodontal ligament (PDL), attachment fibers, vascularization, root cementum, bundle bone, alveolar bone) remain vital and undamaged to prevents the expected post-extraction socket remodelling and to support the buccal / facial tissues.
3. The prepared tooth root section acts as a socket-shield and prevents the recession of tissues buccofacial to an immediately placed implant [12].

Clinical Concept

Based on this concept of root submergence technique (RST), submucosal root retention can virtually eliminate bone resorption, the retention and stabilization of the coronal and buccal bundle bone and the retention of the periodontal membrane by retaining a coronal tooth fragment (so-called "socket shield"), including adequate blood supply, can be expected. To ensure complication-free healing, special attention should be paid to wound stabilization. Depending on the individual treatment plan of a patient, there is the option for immediate implant placement and to either wait for two to six months to allow for the formation of

new bone, followed by implantation, or to leave the site without subsequent second procedure [3].

Indications

- i. Vertical fractures of teeth without pulpal pathologies, where the tissue preservation and aesthetics are a priority.
- ii. Potential indications include their use as a part of delayed or late implantation approach or optimization of pontic support in crown bridge reconstructions or to improve the prosthesis base for removable dentures [3].

Contraindications

General contraindications:

- i. All usual restrictions of oral surgical procedures:
- ii. Bisphosphonate medication
- iii. Immunosuppression
- iv. Radiation therapy
- v. Anti coagulation etc

Local contraindications:

- i. Absent buccal lamina which develops for instance after vertical root fractures or periodontitis[3].

Step By Step Procedure:

- ii. Local anaesthesia should be administered.

- iii. The crown of the tooth to be extracted is decoronated with a coarse-grained diamond bur.
- iv. The root of the tooth was sectioned mesiodistally with a long tapered fissure diamond bur coupled to a hydrated high-speed hand piece into facial and palatal halves followed by conservative extraction of the palatal root fragment using periosteal luxators and forceps preserving the facial root section unmanipulated and attached to the tooth socket.
- v. Periostomes can be inserted between the palatal root section and the alveolar socket wall to sever the PDL and the section of root can then carefully delivered with so as not to disturb the facial root section.
- vi. The tooth socket's palatal wall and apex were then curetted to remove any tissue or infective remnants.
- vii. With the preparation steps complete, the tooth root hereafter was known as the socket-shield (SS)
- viii. If planned for an immediate implant placement, an osteotomy was then sequentially prepared and a selected implant was inserted palatal to the socket shield.
- ix. The gap between the shield and implant surface was left to enable blood clot formation.
- x. Sockets can be closed with sutures (Figure 1).

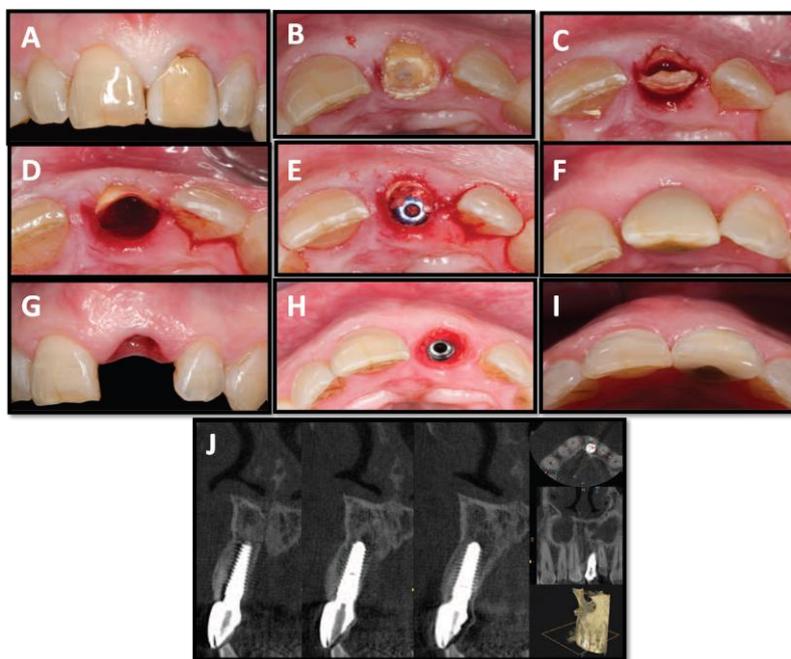


Fig-1: A. The preoperative view with an interim restoration at 21. B. Decoronation. C. The tooth root sectioned mesiodistally. D. The prepared socket-shield. E. The jump gap between socket-shield & implant grafted. F. The 1 month follow up visit, occlusal view. G. 3 Months postop at the start of restorative treatment. H. 3 Months postop with the facial ridge very well maintained. I. Soft tissue contours comparable to tooth 11. J. CBCT at the 1 year follow up. Note the bulk of tissue facial to the implant. Cross Reference [12]. Picture courtesy: Howard Gluckman et al. The socket-shield technique to support the buccofacial tissues at immediate implant placement. International dentistry – african edition vol. 5, no. 3

Advantages

- i. Help ensure physiological preservation of labial and buccal bone structures if implant is placed in contact to the natural tooth fragment (shield) and prevent lamellar bone resorption.
- ii. Tissue preservation-preserves healthy peri-implant tissues.
- iii. Buccal shield serves as a guiding structure when placing implants in optimum position.
- iv. Complete osseointegration can be achieved.
- v. Formation of fibrous tissue around implant can be avoided.
- vi. Cost effective.
- vii. Minimal invasiveness.

- viii. Minimal material requirement(no bone substitute, GTR etc).
- ix. Offers a feasible option for vertically fractures teeth.
- x. Helps maintain aesthetics.

Disadvantages and limitations:

- i. Resorption associated with usual biological long term complication that may occur especially in the presence of pre existing or developing periodontal or endodontic infections or inflammations of the retained root fragments.
- ii. Technique sensitive.

- iii. Displacement of buccal root fragment or even buccal lamellar bone.
- iv. Long term behaviour of the buccal shield has not yet been completely clarified³.

CONCLUSION

Apart from affecting aesthetic outcome, alveolar ridge atrophy following tooth extraction has, above all a negative impact on the subsequent prosthetic or implant restoration. Ideally a method for preservation of alveolar ridge resorption should be cost effective and minimally invasive, with only minimal material requirements. However, these criteria are not entirely met by any of the methods available today. The targeted retention of root fragments via socket shield technique appears to be the only approach capable of achieving these criteria and complete alveolar ridge preservation. This technique avoids resorption of bundle bone by leaving a buccal root segment (socket shield) in place. The socket shield technique provides a promising treatment adjunct to better manage the risks of extraction and preserve post extraction tissue in aesthetically challenging cases. Further studies should test, whether the root fragments should be removed or if persisting, may lead to long term remodelling or resorption effects and long term results of this technique.

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