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SHIELDING THE SOCKET – A REVIEW

Periodontology

Eshani Yeragi* PG Student, Y.M.T. Dental College & Hospital, Kharghar *Corresponding Author
Amit Benjamin HOD & Professor, Y.M.T. Dental College & Hospital, Kharghar
Kavita Pol Nalawade Reader & Guide, Y.M.T. Dental College & Hospital, Kharghar
Saurabh Gotmare M.D.S. Endodontist, Y.M.T. Dental College & Hospital, Kharghar - +917506093111
Kajal Mahajan PG Student, Y.M.T. Dental College & Hospital, Kharghar
Shalmali Karnik PG Student, Y.M.T. Dental College & Hospital, Kharghar

ABSTRACT

Extraction of teeth leads to cascade of events like unsupported buccal plate bone and decrease in the blood supply and resorption will also be expected since the plate is very thin. Numerous techniques were tried to prevent this sequence and to create a natural emergence profile around dental implant prosthesis. For this a new innovative technique was introduced known as Socket preservation procedures wherein the root was bisected, and the buccal two-third of the root is preserved in the socket so that the periodontium along with the bundle bone and the buccal bone remains intact. Also, a classification for SST technique is proposed depending on the position of the shield in the socket. This classification helps in better understanding the preparation design and the role of shield and in maximizing the usage of the shield to achieve best possible esthetics in immediate implant placement sites. This article reviews Socket Shield Techniques using articles that were procured from various search engines google, google scholar and PubMed.

KEYWORDS

Socket Shield Technique, Implants, Bone Resorption

INTRODUCTION

One of the major goals of prosthetic rehabilitation is to achieve and maintain the harmony between the pink and white zones especially in the esthetic areas[1]. Loss of buccal bone, both vertically and horizontally as well as flattening of the interproximal bony scallop occurred following atraumatic extraction of a tooth with immediate implant placement resulting in a complicated rehabilitation[2]. The socket-shield technique (SST) was first introduced and described by Hürzeler et al.[3]. The procedure consists of leaving a root fragment when extracting the tooth, specifically the vestibular portion of the most coronal third of the root. It is widely known that following the extraction of a tooth a dimensional modification of the ridge is going to happen. This technique is additionally known as partial extraction therapy,[4] root membrane technique,[5] and partial root retention

Due to loss of supporting bone unaesthetic black triangles occurs between teeth followed by the apical migration of soft tissues. This presents an incredibly challenging situation to a clinician in restoring the missing tooth with restoration having an acceptable esthetics, especially in anterior region. Many preventive procedures such as ridge preservation techniques, and post-ridge collapse procedures, such as bone augmentation, soft-tissue augmentation, or a combination of these, have been used in the past in order to compensate for this loss. The SST is used as a predictable therapy with minimum surgical intervention, less duration of total treatment, and an optimum esthetic result[6,7,8].

The SST is aimed at making up for this loss of the vestibular volume "misleading" the bundle bone since the periodontal ligament remains attached to the dentine and cement of the root fragment.

TECHNIQUE

The steps of the SST used for immediate implant placement are as follows9: -

Step 1: Cut the crown horizontally at the gingival level; Horizontally section of the crown at gingival level

Step 2: Bisect the root vertically in such a manner that palatal half is removed along with the apex. The length of the shield should be kept at two-third of the root length. This step requires lot of practice, patience, and time. The buccal part is then reshaped such that the shield width is about 1.5–2 mm. The shield should be trimmed to the bone level. A bevel or S-shaped profile on the inner side of the shield is given to accommodate the restorative components.

Step 3: Placement of implant in correct three-dimensional (3D) position.

The optimum space between shield and implant is 1.5 mm or more. A bone graft is suggested if the gap is more than 3 mm. A provisional crown or a customized healing abutment given immediately after the implant placement will help in maintaining the soft-tissue contours. The choice of prosthesis for the final restoration is a screw-retained crown or a cement-retained crown with restorative margin that can be easily accessed for cement clean up.

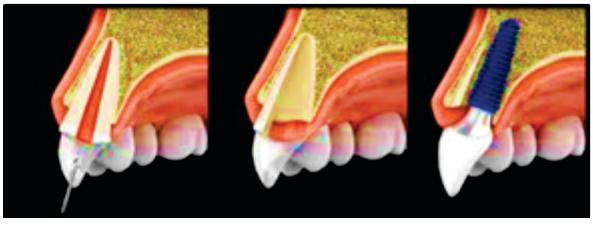

Figure 1: - Socket shield technique

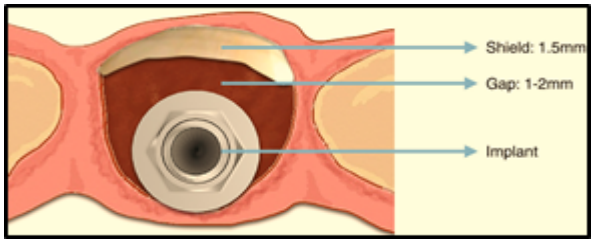

Figure 2: - Socket Shield Principle[10]

CLASSIFICATION[1]

Type I : Buccal shield (the shield lies only in buccal part of the socket, between proximal line angles of tooth)

Indication: Single edentulous site with both mesial and distal tooth present.

Type II : Full C buccal shield

Indication:
1. Existing implant on either side of the proposed site.
2. Missing tooth on either side without an implant.
3. Having implant on one side and missing tooth on the other side.

Type III : Half C buccal shield
Indication: when there is tooth on one side and implant or a missing tooth on the other side

Type IV : Interproximal shield
Indication: when there is buccal bone resorption requiring graft, and there is an adjacent side with missing tooth or an implant.

Type V : Palatal shield
Indication: Maxillary molars

Type VI : Multiple buccal shield
Indication: when it has two or more shield in the socket. It is indicated in cases with a vertical root fracture. There is evidence to show bone deposition in between fractured roots which could assist in holding the two fragments in place.

"The classification discussed above is a suggestive hypothesis and needs to be confirmed by clinical studies to prove the safety as well as the claims that bone height and papilla will be maintained, applying such modifications of the original technique.

ADVANTAGES AND LIMITATIONS OF THIS PROCEDURE

Minimally invasive surgical procedure aimed at preserving a part of the root to help in maintaining hard and soft-tissue contours. It minimizes the need of soft and hard tissue grafting procedures and hence shortens the overall treatment duration. Even in cases with adjacent implants, the interdental papilla can be preserved by preparing interdental socket shield. Helps in maintaining pink and white esthetics. Also provides a solution for esthetically critical cases such as high lip line and maxillary anteriors. This technique not only preserves but also helps to maintain the hard and soft tissues.

Advantages	limitations
Protects the integrity of bundle bone.	Technique sensitive requires highly trained operators. Patience to avoid mobility of the shield.
Acts as a guidance for implant placement in optimal position with slight palatal shift.	Risk of displacement of root fragment.
Cost effective.	The long term behavior of buccal shield hasn't been completely clarified.
Interdental papilla can be preserved by interdental socket shield	Periodontal membrane may be formed around the implant when the implant root interface has a loose structure and a larger gap is left.

DISCUSSION

Various hypothesis on root retention have been put forward as well as tested clinically to avoid tissue alternation and minimize the influence of teeth removal in resorption process. Salama, et al.[2] demonstrated Root Submerge Technique (RST) which preserved the natural periodontium and prevent bone resorption.

In 2010, Hürzeler, et al.[3] introduced a new method, the socket shield technique on beagle dog's third and fourth mandibular premolars. He retained a partial root fragment around an immediately placed implant with the goal of avoiding tissue alterations after tooth extraction and used coarse-grained diamond bur to decoronate the distal aspect of the pre-molar. After 4-month Histological evaluation 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.

He concluded that leaving coronal buccal root portion intact helps to ensure the physiological preservation of labial and buccal bone structures if the implant is placed in contact to this natural tooth fragment. However certain risks are associated with these approaches, such as formation of pre-implant periodontal membrane[2], preimplant infection. These occur in the presence of pre-existing or developing periodontal or endodontic infections or inflammations of the retained tooth fragment.

Hypothesis tested by Filippi, et al.[13] by retaining root either of vital or pulpless teeth avoid tissue alternation and consequence of tooth extraction, he showed that decoronation of an ankylosed tooth preserved the alveolar bone before implant placement.

Malmgren, et al. Malmgren, et al. Andersson, et al. [13,14,15] presents a studies that demonstrated that the preservation of decoronated roots in the alveolar process not only helps maintaining existing bone volume but also enables vertical bone growth, which can be observed coronally to the decoronated root. A study that confirmed regeneration of alveolar bone around endodontically treated teeth done by Bjorn[16]. O'Neal, et al. [17] in his study reported that a new cementum and connective tissue form over the coronal surface of submerged roots separating the dentine from new bone.

Von Arx, et al.[18] published a method to preserve the alveolar ridge by leaving the de-crowned root fragments. Davarpanah & Szmukler[19] published a case series of five patients showing that immediately placed implants where direct implant contact with ankylosed tooth fragments was ensured, were preserved without any signs of abnormal changes over a follow-up period of two years.

A case report presented by Al-Dary H[20], using technique was described by Hürzeler, et al.[3] in which the root was hemisected using a fissure bur in a mesiodistal direction, then removal of the lingual fragment (atraumatic) of the root was achieved, then the buccal fragment was reduced using surgical bur leaving a thin layer of the root aspect intact to the buccal plate of the bone. In this study the author used one piece implant, since study conducted by Hermann et al. showed that significantly increased amounts of crestal bone loss around two-piece vs. one-piece implants, which result in a significant more apical position of the gingival margin, also, the degree of inflammation in peri-implant tissues is less around one-piece implants compared to two-piece implants. In his study he concluded after 5 month waiting time retaining the buccal aspect of the root in conjunction with immediate implant placement is a viable technique to achieve three dimensional positioning of the implant which requires optimal support and stability of surrounding hard and soft tissues. Another case report conducted by same author he used a bone trephine was used to take out the remaining root, leaving an organized rounded section of the palatal/lingual extraction site with a semi lunar internal shape of the buccal aspect of the root that will receive an implant. He concluded that preparing the shield with a trephine may be of a great advantage than using fissure bur[14].

A case report conducted by Chen & Pan[21] used this technique for failing upper right second premolar and concluded that Clinical examination after 4 month of installation showed healthy peri-implant soft tissue and the ridge was well preserved. A maximum amount of horizontal resorption at the buccal side was 0.72mm.

A comparison study on human was performed by Abadzhiev M, et al.[22] The author concluded that radiological examination immediately after implantation and on every 6 months during the next 2 years shows considerable bone loss in conventional implantation. Up to 12% in the first two years, which is equal up to 5mm. Contrary in socket-shield technique during 2 years follow up bone loss is 2% which is equal to 0.8mm. Soft tissue volume is assessed by the quantity of attached gingiva. 18% compared with 2% in favour of the socket-shield technique. High bone resorption leads to lack of soft tissue support and is a precondition for mucogingival surgery for increasing the volume of attached soft tissue. The result from the clinical assessment of aesthetics showed the predominant natural appearance of socket-shield treated teeth.

A Pilot Study[23,24] was done on beagle dogs to assess histologically, clinically, and volumetrically the effect of separating the remaining buccal root segment in two pieces before immediate implant placement was performed. 4 month later the specimens were investigated for histological diagnosis and were concluded: a. Healing of all experimental sites proceeded without adverse events and without signs of inflammation. b. Presence of a tooth fragment apically in contact with the threads of the implant which was still attached to the buccal bone plate by periodontal ligament. c. On the buccal alveolar crest, no osteoclastic remodeling was found. d. Junctional epithelium ending at the cemento-enamel junction detected using a higher magnification.

Although the amount of marginal bone loss in the SST is still not conclusively proved, current clinical experiences seem to point to a minimal, negligible, or even not existent bone loss after extraction. Because of this, soft tissue grafting would not be necessary in most of the patients treated by this technique. In the case-control study in 2014, the authors found a significant difference in aesthetic impact when comparing the socket shield to the conventional technique[18].

Needless to say, that if grafting is not an aesthetic requirement to compensate the horizontal bone loss, the treatment becomes more patient-friendly with less duration and morbidity. Nevertheless, the SST is an operator-sensitive procedure, delicate to handle, and sometimes hard to perform.[7]

The uneventful healing of sockets with root fragments has been well documented[12]. Both vital tooth retention[13,14] and submergence of endodontically treated roots have been recommended to prevent excessive resorption of the residual ridge. One of the main factors for the success of the SST is that the root fragment should not encounter something that could facilitate the infection. Utmost care should be taken to prevent mobility of the shield; if it so happens during the placement of Implant then go ahead with conventional immediate implant placement protocol.

CONCLUSIONS

Long term success of implant in aesthetics zone requires prudent participation of clinicians to contribute to the knowledge base before the procedure can be routinely prescribed. Socket shield technique is cost effective but still technique-sensitive, success require a unique case selection to achieve desirable output. Moreover, appropriate surgical treatment, restorative procedures, and clinical experience are essential when performing immediate instalment of implants. The SST is gaining popularity among the clinicians across the world. The technique is very promising for the preservation of hard and soft tissues in cases of post extraction immediate implant placement. The proposed classification will enable clinicians to obtain the shield depending on the clinical scenario and to achieve the best possible aesthetic results even in immediate implant cases.

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