

## SOCKET SHIELD TECHNIQUE FOR IMMEDIATE IMPLANT PLACEMENT : A REVIEW

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### ABSTRACT

Resorption of alveolar bone height and width following extraction of tooth exert a difficulty in implant placement as it interferes with optimal implant positioning and its overall aesthetic outcomes as well. The resorption of the alveolar ridge is more pronounced on the buccal than on the lingual aspect of the extraction socket. To overcome this complication, a minimally invasive procedure socket shield technique was introduced in 2010 by Hurzeler et al. In this clinical procedure, a partial buccal root fragment was retained around an immediately placed implant with the aim of avoiding both hard and soft tissue alterations after tooth extraction. Histologic evaluation in a beagle dog showed no resorption of the root fragment and new cementum formed on the implant surface. Therefore, SST prevents alveolar ridge resorption and achieves tissue preservation. Some Clinical studies suggested that retaining of buccal aspect of the root during implant placement does not interfere with osseointegration and a maximum amount of horizontal resorption at the buccal side was 0.72mm.

### KEY WORDS

**socket shield technique (SST), resorption of alveolar bone, immediate implant placement, partial extraction therapy, root membrane technique, partial root retention.**

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### INTRODUCTION

Extraction of teeth triggers alveolar bone remodelling process especially affecting buccal lamina and leads to horizontal and vertical bone loss. After three weeks of extraction, bone remodelling starts with bone resorption to about 50% of the height of the original alveolar socket and initial bone formation (Lindhe et al., 1998). According to several studies, an average of 5-7mm of alveolar width is resorbed within the first 12 months following tooth extraction<sup>1</sup>. The resorption of the alveolar ridge is more pronounced on the buccal than on the lingual aspect of the extraction socket (Pietrokovski & Massler 1967, Araujo & Lindhe 2005).

In particular in the aesthetic zone, the successive soft and hard tissue deficiencies can interfere with optimal implant positioning and hamper the overall aesthetic outcome of implant-supported prostheses. In order to overcome the negative consequences of tooth extraction, various treatment approaches such as immediate implants, graft materials and/or barrier membranes have been advocated and described in the literature. The majority of the studies shows that socket preservation is a suitable technique for socket augmentation with the ability to maintain the ridge dimension to a certain amount<sup>2</sup>.

Clinical studies have tested the hypothesis that root retention, either of vital or nonvital teeth, may be able to avoid tissue alterations after tooth extraction<sup>3</sup>. A new surgical procedure called as **socket shield technique (SST) was introduced by Hurzeler et al (2010)**, in which a partial root fragment was retained around an immediately placed implant with the aim of avoiding tissue alterations after tooth extraction. This proof-of-principle experiment confirms that buccal root retention in conjunction with immediate implant placement is able to achieve osseointegration without causing inflammation and resorption<sup>2</sup>. This technique is also known as **partial extraction therapy**<sup>4</sup>, **root membrane technique**<sup>5</sup> and partial root retention.

### Aims and Basic Principle of Socket Shield Technique:

▶ The main aims of socket shield technique is preserving the buccal two-third of the root in socket so that the periodontium, along with the bundle bone and the buccal bone remains, intact. Also, some modified socket shield technique is suggested where the shield is located in the interproximal area than the buccal area to preserve inter-implant papilla<sup>6</sup>.

▶ The principle of socket shield technique is to create a safeguard (so called buccal shield) by preparing the root of a tooth indicated for extraction in such a way that the facial root section remains in-situ with its physiologic relation to the buccal plate intact. The periodontal attachment apparatus (periodontal ligament, vascularization, attachment fibres, cementum of root, bundle bone, alveolar bone) of tooth root is intended to remain vital and unharmed to prevent the post extraction alveolar bone loss and to support the facial tissues<sup>7</sup>.

## Indications

1. To support and preserve the buccal/facial bone plate of extraction socket in cases of post extraction immediate implant placement.
2. Socket shield technique is indicated in vertical fracture of teeth without pulpal pathologies, where the tissue preservation and aesthetics are a priority<sup>3</sup>.
3. To preserve the papilla between the dental implants<sup>6</sup>.

### Contraindication:

contraindications include

1. If, loss of buccal bone due to vertical fracture
2. If, loss of buccal bone due to periodontitis
3. If, caries on root fragment is present

**Armamentarium:** Required instruments are-

- Periotome
- Long shank carbide bur on high-speed air turbine drill

- Long shank round or tapered fissure diamond bur of various diameters
- Zekrya gingival retractor
- Fine-tipped elevators
- Curved artery forceps
- Fine-tipped extraction forceps
- Bone curettes
- Needle holder & scissors
- Implant surgical kit

### Step-by-step surgical procedure:

The whole Surgical procedure is carried out under the local anaesthesia. The clinical steps of socket shield technique used for immediate implant placement are summarized as below-

**Step 1 :** With a diamond bur, clinical crown of a selected tooth is cut off above the gingival level.

**Step 2 :** Bisect the root vertically with the help of a tapered fissure diamond bur

**Step 3 :** Conservative extraction of the palatal root fragment with the apex was done with periotome and fine tipped extraction forceps without putting stress on buccal tissues

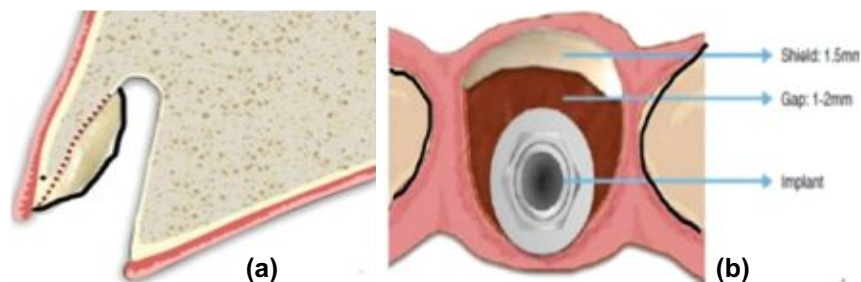
**Step 4 :** The length of the shield should be kept at least 8mm or about two-third of the root length. The buccal part is then reshaped such that the shield width is about 1.5–2 mm (8) using round diamond burs along with copious irrigation with saline.

**Step 5 :** The shield should be trimmed to the crest level of labial bone. A bevel or S-shaped profile on the inner side of the shield is given to accommodate the restorative components(8).

**Step 6 :** As per planned for an immediate implant placement, the osteotomy has to be done on the palatal socket wall sequentially and implant is inserted palatal to the socket shield.

**Step 7 :** The optimum space in between shield and implant surface is 1-2mm or more and this space

**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.**



**Schematic diagram of ideal shield design. a Cross-sectional view. b Occlusal view**

should be left to enable the blood clot formation. A bone graft has been suggested if the gap is more than 3 mm.

**Step 8 :** Sockets can be closed with sutures. A provisional crown or a customized healing abutment can be given immediately after the implant placement. This will help in maintaining the soft-tissue contours.

After the procedure, patient is advised to rinse the mouth with 0.2% chlorhexidine mouthwash two times daily for at least ten days. Antibiotics and anti-inflammatory drugs are also prescribed as per needed.

### **Difficulties that occur during performing the socket shield procedure:**

#### **A. Improper Sectioning:**

Sectioning of the root in an improper direction, results in extraction of a small palatal root fragment without the apex. In such cases, a long shank carbide drill is used on a high-speed handpiece through the socket to access and trim the apical portion of the root<sup>9</sup>.

#### **B. Mobility of the labial shield:**

During extraction of the palatal fragment, inadvertent mobility of the labial root fragment can occur

#### **C. Labial fenestration:**

A labial fenestration can be created inadvertently adjacent to the root apex while sectioning of the root. An aesthetic buccal flap technique can be used to access and placed a graft in the fenestration.

#### **D. Inadequate implant stability:**

In case of low insertion torque values, immediate provisional restoration of an implant during implant placement is not recommended. In this case, the implant is placed at a submerged level and a socket seal is developed with a small portion of a palatal pedicle graft or a free gingival graft.

#### **E. Spinning of the implant:**

If an implant has low primary stability, and it spins internally in its final position, then remove the implant followed by staged implant placement is recommended. Bone graft should be placed in the socket after removal of spinning implant. A barrier membrane, pedicle flap or a free gingival graft should be used for closure of the surgical site.

### **Advantages:**

1. SST helps in preservation of buccal/ facial bone

structures, if implant is placed in contact to the natural tooth fragment and it prevents lamellar bone resorption.

2. It helps in maintaining the hard and soft tissue contour by preserving a part of root.

3. Even in cases with adjacent implant placement, the interdental papilla can be preserved by preparing interdental socket shield.

4. maintain aesthetics.

5. Intact buccal shield also guides in placing implants in correct position.

6. Complete osseointegration can be achieved by this technique.

7. Helps in avoiding formation of fibrous tissue around the implant.

8. Minimally invasive surgical procedure.

9. It can be viable treatment for vertically fractured teeth.

10. Least armamentarium is required to perform this procedure.

### **Disadvantages and limitations:**

1. The socket shield procedure is highly technique-sensitive.

2. The long-term survival of implants and the surrounding alveolar bone is impaired by the errors occur during shield preparation.

3. Very thin shields are vulnerable to migration or mobility.

4. Very thick shields can interfere with implant placement and can contact the implant after placement of implant.

5. Displacement or fracture of buccal root fragment can be occurred during removal of palatal portion of the root.

6. Incomplete sectioning of the root can cause accidental movement of the labial segment or inadvertent extraction of the entire root resulting in procedural failure.

7. Long term behaviour of the buccal shield has not yet been clarified (10).

### **CLASSIFICATION:**

It is proposed that the classification of SST technique will help in understanding the clinical application of this technique depending on the position of the shield in socket. This classification is required to help in understanding the preparation design and role of shield for treatment planning of various clinical scenarios which discussed below-

### **Type I : Buccal shield**

A case can be classified as buccal shield when the shield lies only in buccal part of the socket, (between proximal line angles of tooth). It is indicated in single edentulous site with both mesial and distal tooth presents.

### **Type II : Full C buccal shield**

A case can be classified as Full C Buccal shield when the shield lies in buccal part and the interproximal part on both sides of the socket.

### **Type III : Half C buccal shield**

A case can be classified as half C buccal shield when the shield lies in buccal part and one of the interproximal parts. This design is recommended when there is tooth on one side and implant or a missing tooth on the other side.

### **Type IV: Interproximal shield**

A case can be classified as interproximal shield when shield lies only in mesial or distal part of the socket. This design is indicated when there is buccal bone resorption requiring graft, and there is an adjacent side with missing tooth or an implant. Extraction of the complete tooth in such cases may lead to loss of the valuable interproximal bone.

### **Type V: Lingual-palatal shield**

A case can be classified as Lingual-Palatal shield when the shield lies on the lingual or palatal side of the socket. This type of shield design has few indications but could be considered for maxillary molars.

### **Type VI: Multiple buccal shields**

A case can be classified as multiple buccal shields 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.

## **DISCUSSION**

Immediate implant protocols have been introduced to reduce the treatment time and to get a pleasing aesthetic result with good function in selected situations. But it has a higher risk for mucosal recession and volume loss. This is where the socket shield technique was introduced in an effort to make a positive difference.

Hurzeler et al (2010) histologically and under

backscatter scanning electron microscopy, evaluated a beagle dog treated by socket shield technique. They concluded that retaining the buccal aspect of the root during implant placement does not appear to interfere with osseointegration and may be beneficial in preserving the buccal bone plate<sup>2</sup>.

Abadzhiev et al (2014) compared conventional immediate implant placement including hard and soft tissue grafting with socket shield technique using 25 patients. They found out that conventional approach was clearly inferior regarding the aesthetic outcomes and tissue changes<sup>12</sup>.

Preservation of inter-implant papilla is critical in cases of multiple adjacent implants in aesthetic region. Few studies have been done using modified socket shield technique with aim of achieving predictable aesthetic success for adjacent multiple immediate implants.

Glocker et al (2014) did three cases using a modified method of socket shield technique and delayed implant placement was planned. After six months, during re-entry the new bone formation in the alveolar bone and the residual ridge was clinically evaluated as proof of principle. It was demonstrated that the bone was clinically preserved with this method.

Gluckman et al. also used the modified socket shield technique for a situation with two implants besides each other and reported aesthetically good result by this method.

Kan et al have reported a case with a modified shield technique with the shield located in the interproximal areas rather than the buccal area for interimplant papilla preservation and they got good success in maintaining the bone level and the periodontium.

Baumer et al presented volumetric analysis of case treated by socket shield technique and it showed a low degree of contour changes from extraction and implant placement to the followups. They also analysed 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. Mucosal recession at the implant restoration was comparable to that of the nearby teeth. They concluded that socket shield technique offers reduced invasiveness at the time of surgery and high aesthetic outcomes with effective preservation of facial tissue contours<sup>11</sup>.

In some case report shows that applying socket shield technique after immediate implant placement, a maximum amount of horizontal resorption at the buccal side was 0.72mm<sup>13</sup>

Siormpas KD et al reported data from 46 patients who were treated by immediate implant placement with simultaneous intentional retention of the buccal aspect of the root. All these implants successfully maintained osseointegration at the end of the follow-up period for a 100% cumulative survival rate, based

on clinical and radiographic criteria. It was concluded that the intentional retention of the buccal aspect of the root with its periodontal apparatus during immediate implant placement can lead to predictable and sustainable osseointegration of implants placed in the maxillary anterior region of healthy adults.

Socket shield technique has shown positive results in previous studies, there are few possible risk factors and lack of thorough knowledge regarding consequences of socket shield technique. There can be possible risk of resorption of retained root fragment. Few studies have used enamel matrix derivative to induce cementum formation on inner side of root fragment and inhibit its resorption. Also, inflammation, caries and pocket formation can complicate the outcomes of treatment.

Also, extrusion of retained root fragment can be a possible risk factor regarding this method. More comparative and long term follow up studies are needed to prove long term stability of this technique outcomes.

## CONCLUSION

Alveolar ridge resorption following tooth extraction has negative impact on subsequent implant placement and prosthetic restoration. The socket-shield technique is the treatment modality for aesthetic enhancement and ridge preservation technique but this technique has been less discussed and documented in literature. Ideally a method for preservation of alveolar ridge resorption should be cost effective and minimally invasive, with only minimal armamentarium. But these criteria are not entirely met by any of the present available methods. So, 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 prevents the resorption of bundle bone by leaving a buccal root segment (socket shield) in place. In future, the socket shield technique may be an alternative to surgical augmentation for ridge defects. Further studies also required to examine, whether the root fragments should be removed in future or not. If persisting, then test the long terms effects of remodelling or resorption and long terms results of this technique.

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