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Review Article

SOCKET SHIELD TECHNIQUE: A REVIEW

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ABSTRACT

Preservation of ridge after extraction is biggest challenge to implant dentistry as it interferes with optimal implant positioning and its overall esthetic outcomes as well. A new method called as socket shield technique was introduced in which a partial root fragment was retained around an immediately placed implant with the aim of avoiding tissue alterations after tooth extraction. This review article presents overview of surgical technique, advantages, disadvantages and results of various other studies in previous literature. Also, this article gives short overview of challenges of using socket shield technique in clinical practice and newer modified form of socket shield technique.

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INTRODUCTION

It is well established that tooth extraction is followed by horizontal as well as vertical dimensional changes of alveolar ridge. It is suggested that following tooth extraction, the blood vessels in periodontium to the thin bone walls are severed, thereby causing facial bone plate resorption as periodontal membrane primarily vascularizes bundle bone of tooth¹. Hence, preservation of ridge after extraction is biggest challenge to implant dentistry as it interferes with optimal implant positioning and its overall esthetic outcomes as well. In order to overcome the negative consequences of tooth extraction, various treatment approaches such as immediate implant placement, socket preservation and guided bone regeneration have been recommended².

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. Filippi *et al*, showed that decoronation of an ankylosed tooth preserved the alveolar bone before implant placement³. Also, 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.^{2,3}

A root submergence technique is demonstrated to maintain the natural attachment apparatus of the tooth in the pontic site, which in turn allows for complete preservation of the alveolar bone frame and assists in the creation of an aesthetic result in adjacent multiple-tooth-replacement cases.⁴ Periodontal regeneration including new attachment apparatus, cementum, connective tissue, and bone could be formed around a submerged root whose surface was pathologically exposed.⁵

A new method called as socket shield technique 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.⁶

Also, modified socket shield technique is suggested where the shield is located in the interproximal area than the buccal area to preserve inter-implant papilla.⁷

Basic Principle of Socket Shield Technique

The principle of socket shield technique is to create a safeguard (so called buccal shield) by preparing the root of a tooth

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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 fibers, 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.⁸

Indications

1. To support and preserve buccofacial bone plate of extraction socket in cases of immediate implants.
2. Socket shield technique is indicated in vertical fractures of teeth without pulpal pathologies, where the tissue preservation and aesthetics are a priority.
3. To preserve papilla between the dental implants.⁷

Contraindication

1. As general contraindications, the usual restrictions for oral surgical procedures.
2. Local contraindications include
 - Loss of buccal bone due to vertical fracture⁸
 - Loss of buccal bone due to periodontitis⁸
 - Caries on root fragment to be retained.

Instruments

Periotome
Black's excavator
Gingival scissors
Needle holder
Surgical forceps
Diamond burs (Round bur of diameter 1 mm or tapered fissure bur)

Clinical Steps of Surgical Technique

Under local anaesthesia, following procedure is carried out:

1. With a diamond bur, clinical crown of the tooth is cut off above the gingival level.
2. The tooth was sectioned vertically using long tapered fissure diamond bur
3. Conservative extraction of the palatal root fragment was done with periotomes and forceps without putting stress on buccal tissues. This results in an intact lamella of the root in the area of the buccal bony socket.
4. That root fragment is thinned out to a thickness of 2-3 mm using round diamond burs along with copious irrigation with saline.
5. If planned for an immediate implant placement, then an osteotomy is prepared sequentially and implant is inserted palatal to the socket shield.
6. The gap between the shield and implant surface was left to enable blood clot formation.
7. Sockets can be closed with sutures.



After the procedure, patient is advised to rinse the mouth with 0.2% chlorhexidine mouthwash two to three times daily for one minute over a period of at least ten days. During this time, mechanical oral hygiene is avoided in the surgically treated area and only restarted after the follow-up examination and suture removal after ten days. Anti-inflammatory drugs are prescribed as needed.⁸

Advantages

- a. Helps to preserve buccal/ facial bone structures if implant is placed in contact to the natural tooth fragment and prevents lamellar bone resorption.
- b. Ensures preservation of peri-implant tissues.
- c. Helps to maintain aesthetics.
- d. Intact buccal shield also guides in placing implants in correct position.
- e. Complete osseointegration can be achieved by this technique.
- f. Helpful in avoiding formation of fibrous tissue around implant.
- g. This treatment is cost effective as no expensive armamentarium is needed.
- h. This is technique presents minimal invasiveness.
- i. Least material requirement.
- j. Presents viable treatment for vertically fractured teeth.⁹

Disadvantages and limitations

- a. 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.
- b. Technique sensitive.
- c. Displacement of buccal root fragment or even buccal lamellar bone.
- d. Long term behaviour of the buccal shield has not yet been completely clarified.⁹

DISCUSSION

To streamline the process and reduce treatment time, immediate implant protocols have been introduced. They can also provide a pleasing esthetic result with good function in selected situations, but not on a predictable basis and have 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.

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 follow-ups. Mucosal recession at the implant restoration was comparable to that of the neighboring teeth. They concluded that socket shield technique offers reduced invasiveness at the time of surgery and high esthetic outcomes with effective preservation of facial tissue contours.¹⁰

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.¹¹

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.²

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 esthetic outcomes and tissue changes.¹²

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

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.¹³

Cherel *et al* observed complete preservation of the papilla between two neighboring central incisors without any adverse events at 11 months after implant placement using modified socket shield technique.¹⁴

Gluckman *et al.* also used the modified socket shield technique for a situation with two implants besides each other and reported esthetically good result by this method.⁷

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.¹⁵

Similar positive experience have been reported by Chen & Pan *et al* (2013)¹⁶, (Mitsias *et al.* 2015)¹⁷, Lagas *et al.* (2015)¹⁸, Engelke *et al.* (2015)¹⁹; Al Dary & Al Hadidi (2015)²⁰.

Anas B *et al* concluded in their review that socket shield technique provides a promising treatment adjunct to better

manage the risks of extraction and preserve post extraction tissue in aesthetically challenging cases.⁹

As the level of the papilla can be maintained by the proximal periodontium²¹, modified socket shield technique is also used in various studies and case reports. Cherel F applied the socket-shield technique on two adjacent hopeless teeth. However, instead of buccal root retention, proximal root fragments were left intact to preserve the papilla bone peak, in combination with immediate implant placement and immediate provisionalization.²²

Future Prospects

Eventhough 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. Less instruments are needed for this technique, but its technique sensitive. 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 be conducted to prove long term stability of treatment outcomes.

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 criterions 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.

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