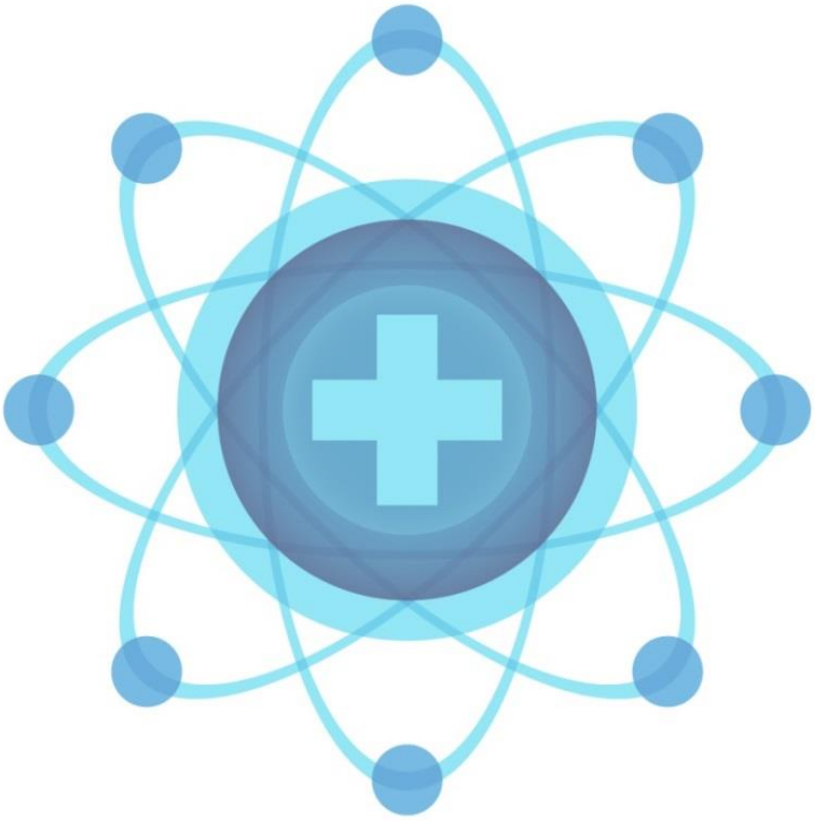

INTERNATIONAL MEDICAL SCIENTIFIC JOURNAL

ART OF MEDICINE

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Available at https://www.bookwire.com/
ISBN: 978-0-578-26510-0

10.5281/zenodo.7100268

PREVENTION OF TISSUE RESORPTION DURING IMMEDIATE IMPLANT PLACEMENT BY USING SOCKET SHIELD TECHNIQUE

J.A.Rizaev, L.R.Bekmuratov
Samakand State Medical University Department of Oral Surgery and Dental implantology

Abstract. Stable hard and soft tissues around the implant are important factors for its long-term success. In this context, an immediate implant placement, especially in the aesthetic anterior area, is becoming an increasingly important issue. Various augmentation measures to improve the condition of the hard and soft tissues around the implant can also be used to immediately place the implant in order to compensate for the physiological remodeling after tooth extraction. However, in the following case, a preventive approach using socket shield technique (SST) is primarily applied to avoid the need for augmentation.

Clinical case: A healthy 43-year-old patient underwent an immediate implant placement of tooth 12 with fractured coronal part at the gingival level. Lateral incisor was partially removed, but the vestibular part of the root remained in the upper third of the alveolar socket. This preserves the periodontal fibrous apparatus in this area and is directed to prevent possible resorption of the vestibular wall of the alveolar bone.

Result and conclusion: The aesthetic criterion plays an important role in the area of the anterior teeth. Modern preventive approaches during immediate implant placement, such as SST, can lead to adequate formation of hard and soft tissues and thus avoid additional augmentation measures. However, SST has a very limited range of indications and has not yet established itself in clinical practice due to long-term clinical data and prospective studies.

Keywords: immediate implant placement; anterior region; immediate landing; socket shield technique; direction of soft tissues; direction of hard tissues.

Introduction: After tooth extraction, an inevitable cascade of bone resorption and socket reduction occurs. This reduction appears to have more effect on vertical ridge height more buccaly than lingualy, causing aesthetic defect, especially when restoring upper and lower teeth in the anterior aesthetic zone [1, 12].

Immediate implant placement, which has been described in the past as a ridge-preserving method, gives excellent survival results but does not appear to affect this biological response of bone resorption [1,19]. Regenerative materials and atraumatic extraction of a failing tooth have also been combined with immediate implant placement, as well as a traditional implantation protocol that has shown results, but unable to avoid resizing the socket to the extent that a predictable, satisfactory aesthetic result can be achieved [1,15,17].

Noting the excellent results of crestal preservation with ankylosed tooth decoronation first seen by Malmgren et al. (1984) and osseointegration of implants in contact with ankylosed tooth fragments, as well as in other animal studies and clinical trials, the guard socket technique has been developed [4,11,17]. Socket Shield Technique is a method in which the buccal root of a hopeless tooth to be extracted is kept intact in situ along with the buccal alveolar bone to avoid the pronounced

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dimensional changes after extraction that usually occur and have a more esthetic result. This technique is always combined with implant placement in the lingual socket [17].

However, more and more attention is paid to the disadvantages of this procedure, such as long-term treatment and atrophy of hard and soft tissues present during this period [20]. Immediate implantation has become popular in recent years to prevent bone recession [14, 21]. Despite being atraumatic and without incisions, this technique can also lead to soft tissue recession or atrophy, especially in the vestibular region of the implant [8]. However, from an aesthetic point of view, inflamed tissue around the implant in the buccal region is of key importance and primarily depends on the preservation of the vestibular bone [19]. However, tooth extraction leads to the loss of periodontal fibers and, consequently, to loss of bone tissue [2]. The degradation of bone cells, in turn, leads to the process of bone resorption, especially in the vestibular region, which can lead to soft tissue recession or a deficit in vestibular volume [3, 8]. For this reason, many authors call for strict selection of patients for immediate implant placement in the aesthetic area [8]. Particular attention is paid to a fairly wide vestibular bone plate in combination with a thick gingival morphotype [8, 21].

Although this does not prevent resorption phenomena caused by ligament death, the clinical consequences of immediate implantation are much less pronounced than in the case of thin residual vestibular bone or thin mucosa [15]. Therefore, immediate implantation is usually combined with soft and/or hard tissue augmentation in these suboptimal initial situations [13]. However, in contrast to this augmentative approach, the root shield technique aims to prevent tissue loss [10]. The principle is based on the fact that only partial tooth extraction is performed. A certain part of the root was deliberately left in the vestibular region of the alveolar socket in order to preserve the bone wall on the buccal side of the implant [19]. Since in the area where the tooth fragment remains in the alveolar process, the periodontal fibrous apparatus is intact, and thus prevents bone resorption (Fig. 1) [5,15].

This “biological concept” of preventing alveolar bone atrophy by maintaining healthy tooth roots has already been described for complete dentures or intermediates [9]. However, this approach has not been able to justify itself in everyday clinical practice due to known problems such as the tendency for root residues to migrate towards crowns, caries and odontogenic infections [9, 19].

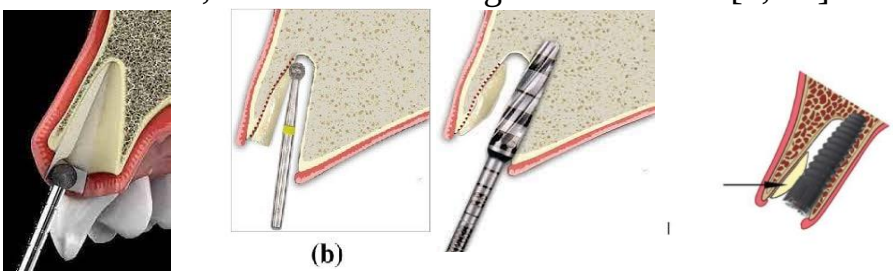

Figure 1. During tooth extraction a fragment of the vestibular tooth remains to prevent resorption of the buccal wall of the alveolar process.

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Scientific data on SST are currently still very limited [6, 19]. However, this approach has already been explored at the histological level in animal studies. This shows sufficient osseointegration of the implant while maintaining periodontal attachment in the area of the remaining tooth fragment [5]. Two modern histological studies of human samples have come to similar results [11, 16]. There are various names in the literature, such as "partial extraction therapy (PET)" or "root membrane technique (RTM)" for the prophylactic approach in immediate implantation [11]. The respective authors justify this by making specific changes, which was originally proposed by Hürtzler et al. who described the protocol for SST therapy [10]. However, they are all based on the same basic preventive idea. Leaving a certain fragment of the tooth in the extraction alveolus preserves the periodontal fibrous apparatus or bone ligament and thus prevents atrophy of the alveolar bone in the vestibular region. Currently, in addition to documenting a few individual cases, several retrospective studies with a follow-up period of at least 5 years have been published [4, 6, 17].

In existing clinical studies, this method has been consistently validated with very good aesthetic results, and in 2 ongoing studies, the 10-year duration is estimated at 96% [16, 18]. Currently, there is only one prospective randomized study of SST with a small number of cases involving 40 implants. Here, after a 3-year follow-up period, one can see a significantly better result for esthetics with identical SST implant survival compared to conventional immediate implantation [7]. At the same time, the frequency of complications from a broken tooth left in the alveolus is quite high [16]. The most important are the internal or external exposure of the tooth fragment due to trends coronal migration and root resorption [11, 16]. Added to this is a very narrow indication. SST is contraindicated in periodontal disease, increased degree of loosening, or an enlarged periodontal gap of the tooth to be replaced. In addition, vertical root fractures and horizontal root fractures well below the alveolar process are contraindications, and this procedure should also not be used on teeth with external or internal resorption [6, 11].

Research material and methods used to carry out this research work: During a consultation, a 43-year-old healthy non-smoking patient was found to have a 12th tooth that could not be saved. Clinical examination showed no inflammatory signs around a tooth with a transverse fracture at gingival level, which was restored with a fiberglass post after root canal treatment (Fig. 2). A 3D CT scan was performed as part of the treatment plan. The vestibular bone plate was also thin, but intact during analysis and virtual planning of the implant position. Apically, at the tip of the root of the 12th tooth, there was a sufficient amount of bone tissue. The root had a sagittal slope favorable for immediate implant placement (Fig. 3). Along with a clinically healthy thick gingival phenotype, there were favorable clinical conditions for immediate implant placement. The indication for SST was a thin plate of the vestibular bone. Atraumatic partial tooth extraction was performed under local anesthesia. Due to the deeply localized transverse fracture, there was no need to separate the crown part of the tooth at the gum level. The root was then divided mesio-distally to remove its palatal portion. The remaining fragment of the vestibular root was thinned in the coronal part and then reduced in the vertical dimension to a

position just above the buccal bone wall (Fig. 4). The implant site was then drilled and prepared using osstem surgical kit, according to this drilling protocol, the appropriate size of the dental implant was chosen and placed in the socket. A palatal position and an insertion axis inclined towards the mouth were chosen in order to allow a future screw-retained prosthetic restoration (Fig. 5). In addition, during the installation of the implant, the tooth fragment was somewhat compressed in the apical part through the thread of the implant. This was necessary to prevent possible coronal migration of the residual root. To achieve sufficient primary stability, an implant with an aggressive self-tapping thread design (TS III CA 4.0×11.5 mm, Osstem, South Korea) was chosen.

Figure 2. Initial clinical situation. Tooth 12 fractured transversely at bone gingival level with non-irritated mucosa and no clinical symptoms.

Figure 3. Preoperative 3D CT scan with virtual implant planning: It shows an intact vestibular lamella with no evidence of chronic inflammation in the root area and sufficient apical bone supply.

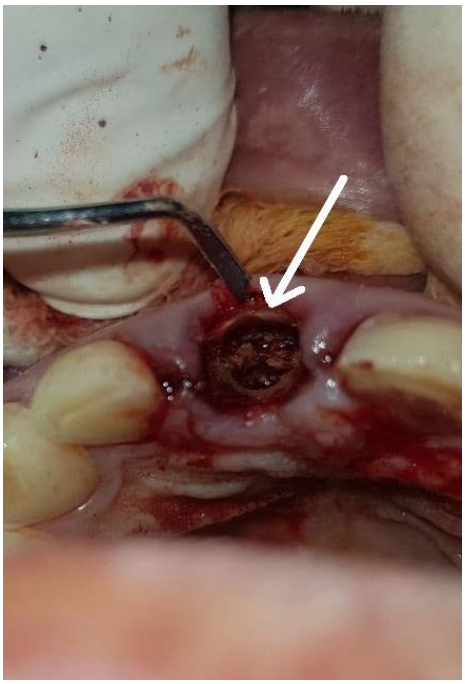

Figure 4. Intraoperative situation: atraumatic partial tooth extraction with preservation of a vestibular tooth fragment (white arrow). The tooth shard is concavely thinned and reduced to just above the vestibular bone lamella.

Figure 5. TS III CA 4.0×11.5 mm implant was placed behind the remaining root fragment. Final stability 35 Ncm with torque wrench.

Implant was placed with sufficient primary stability (> 25 Ncm). Than healing abutment was placed and sutured with vicryl 4/0 and the post-operative X-ray was taken as well (Fig. 6). After a healing phase of 6 months, the final prosthetic restoration was integrated with sufficient hard and soft tissue around the implant (Fig. 7). The chosen axis of the implant made it possible for prosthetic restoration on it with a metal-ceramic crown with palatal screw fixation (Fig. 8).

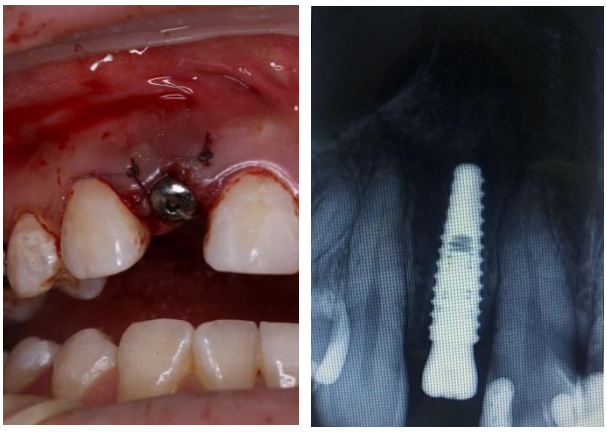

Figure 6. Healing abutment placement and post

Figure 7. After 6 months post operative view.

Figure 8. After 6 months of healing period 12 permanent metal-ceramic crown operative X-ray.

Conclusion. In recent decades, the concepts of therapy in dental implantology have been constantly developed. Classical delayed implantation is still considered the gold standard. However, this method has certain limitations. On the one hand, a longer duration of treatment burdens the patient, on the other hand, there is an

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increased risk of local bone and soft tissue atrophy during several months of healing, which often requires additional surgery to increase bone volume.

Immediate aesthetic implantation is currently a current treatment concept and offers many benefits. Minimized treatment time and fewer surgical interventions lead to increased patient comfort. However, a significant disadvantage is the partially unpredictable processes of resorption of hard tissues and inflammation of soft tissues in the vestibular region. A new approach in root socket shield technique is the prevention of these resorption processes. Leaving the vestibular fragment of the tooth in this area prevents bone loss by preserving the periodontal fibrous apparatus. The first published clinical results are very promising, but prospective studies with a sufficient number of cases and follow-up periods have not been conducted. In addition, there is a limited range of indications, since the initial clinical situation often does not allow leaving a root fragment in the alveolar socket of the tooth. The high success rates published to date have come from specialized centers and cannot simply be transferred to routine clinical practice.

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