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Case Report

Dentistry Section

Redefining Immediate Implant Aesthetics with Socket-shield Technique: A Case Report

A LUBNA FIRDOSE[1], D PREETHA[2], KJ NAGASURTHI[3], R KADHIRESAN[4], U ARUNMOZHI[5]

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ABSTRACT

Tooth loss has been a longstanding issue, prompting the exploration of various treatment modalities. Dental Implants have emerged as one such biocompatible treatment modality for replacement of missing teeth. Following tooth extraction preservation of facial alveolar bone and soft-tissue architecture is critical for achieving optimal aesthetic outcomes in the anterior maxilla. Physiologic post-extraction remodelling, particularly resorption of the buccal plate, often compromises aesthetic results even with immediate implant placement. Conventional extraction and implant protocols may not completely prevent these dimensional changes. The Socket-shield Technique (SST) is a biologically driven approach that aims to preserve the periodontal ligament-bundle bone complex through intentional retention of the buccal root fragment, thereby limiting post-extraction hard and soft-tissue collapse. Hereby, the authors described the clinical application of SST with immediate implant placement in a 27-year-old male patient presenting with repeated fracture of a composite restoration in a previously endodontically treated maxillary left central incisor (21). Clinical and radiographic follow-up demonstrated preservation of the facial bone contour, stable peri-implant soft-tissues and favourable aesthetic outcomes. Within the limitations of a single case, SST appears to be a viable option for managing aesthetically demanding anterior maxillary implant sites when performed with careful case selection and surgical precision.

Keywords: Alveolar bone loss, Bundle bone, Decoronation, Root retention, Tooth extraction

CASE REPORT

A 27-year-old systemically healthy male patient reported with the chief complaint of replacing the composite restoration in relation to 21. The tooth had been endodontically treated one year earlier following trauma, with a composite restoration placed due to limited remaining coronal structure. The patient had a history of repeated fracture of the composite restoration in 21. The patient underwent restoration in 21 before reporting to the Department as the tooth is located in the aesthetic zone. But the patient expressed dissatisfaction with aesthetics and wanted a fixed replacement, particularly in the maxillary anterior aesthetic zone where post-extraction tissue remodelling is critical.

Patient was systemically healthy and had no history of Gastro Oesophageal Reflux Disease (GERD). Patient had a dental history of multiple restoration in cervical region in mandibular teeth and root canal treated 11. The patient had also undergone uneventful extraction of 12 and 22 following trauma and implant placement of the same teeth one year prior, which were stable and intact. Patient had no complaints about 11, 12 and 22. Patient had poor oral hygiene maintenance with severe calculus and stains. So patient was advised and explained ways to improve oral hygiene for better prognosis after the treatment.

Preoperative Evaluation

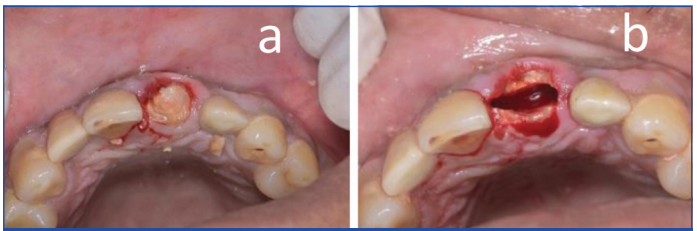
Intraoral examination revealed a composite restoration in relation to tooth 21. The tooth was asymptomatic and exhibited no signs of mobility. Clinically adequate bone height was confirmed with probing pocket depth of less than 3 mm [Table/Fig-1a,b]. Intraoral periapical radiographic examination demonstrated an adequately obturated root canal, no crestal or interdental bone loss in relation to 21, an intact buccal cortical plate and sufficient bone volume for immediate implant placement [Table/Fig-1c] making the site favourable for a socket-shield-based approach.

Clinical and radiographic findings revealed absence of mobility, no crestal, interdental bone loss and periapical pathology. SST was selected to preserve the buccal alveolar bone and maintain soft-tissue architecture, thereby minimising post-extraction ridge resorption and enhancing long-term aesthetic stability in the anterior maxilla.

[Table/Fig-1]: a) Preoperative frontal view; b) Preoperative occlusal view; c) Preoperative RVG.

Surgical Procedure

The patient was explained about the procedure and written informed consent was obtained. The procedure was carried out under local anaesthesia following strict aseptic protocol. The existing restoration was removed. Removal of Gutta-percha which was used for obturating is done using Gates Glidden drill and the tooth was decoronated at the level of the gingiva [Table/Fig-2a]. The palatal root segment was sectioned and resected, while the buccal root portion was preserved as per the socket-shield protocol [Table/Fig-2b].

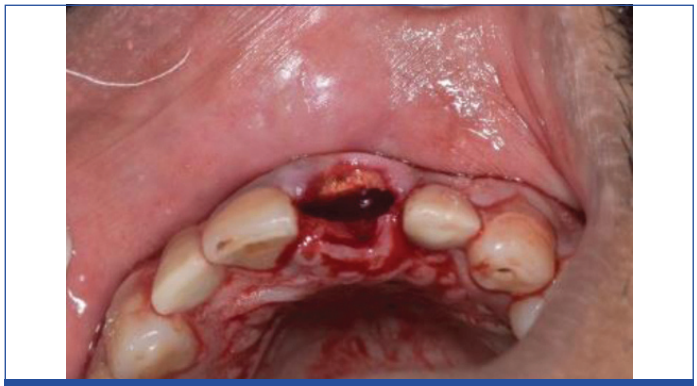


[Table/Fig-2]: a) Decoronation; b) Resection of palatal root segment.

The resected palatal root segment was atraumatically removed without disturbing the buccal fragment [Table/Fig-3]. The retained buccal root segment was reduced to approximately 1.5-2 mm thickness and trimmed to the level of the crestal bone, ensuring stability and absence of mobility.

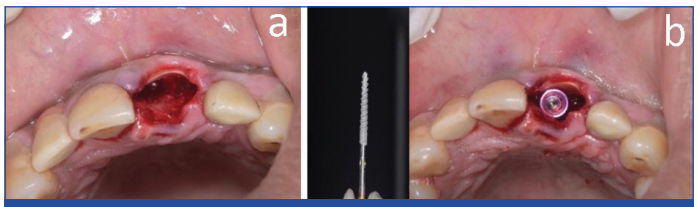
[Table/Fig-3]: Removal of palatal root segment.

The retained buccal root fragment was then carefully reduced and contoured to form a stable buccal shield, ensuring it was immobile and flush with the crestal bone [Table/Fig-4].



[Table/Fig-4]: Buccal shield preparation.

An osteotomy site was prepared palatal to the buccal shield and a Minimally Invasive Surgery (MIS) dental implant measuring 4.2×13 mm was placed, achieving adequate primary stability [Table/Fig-5a,b]. As the horizontal jumping distance exceeded 1.5 mm, bone graft material was placed in the peri-implant gap to promote optimal bone healing and implant integration [Table/Fig-6].



[Table/Fig-5]: a) Osteotomy site preparation; b) MIS implant 4.2×13 mm placed.

[Table/Fig-6]: Graft placement.

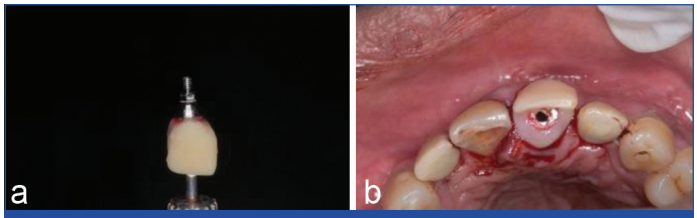
Implant Stability and Provisionalisation

Primary implant stability was evaluated using Resonance Frequency Analysis (RFA), yielding an Implant Stability Quotient (ISQ) value of 63 [Table/Fig-7]. A screw-retained provisional crown was delivered immediately to support peri-implant soft-tissue contours and preserve gingival architecture during healing [Table/Fig-8]. Following stability assessment, an implant abutment was placed [Table/Fig-9].

Postoperative Evaluation

At the one-month follow-up visit, clinical examination revealed healthy peri-implant soft-tissues with satisfactory gingival contour and emergence profile [Table/Fig-10a]. Radiographic evaluation confirmed appropriate implant positioning and favourable peri-implant bone response [Table/Fig-10b]. Healing was uneventful and the patient reported no discomfort or functional impairment.

[Table/Fig-7]: Primary stability assessment RFA-63.



[Table/Fig-8]: Screw-retained provisional crown.

[Table/Fig-9]: Implant abutment placement.

[Table/Fig-10]: One-month postoperative images: a) Radiovisiography (RVG); b) Clinical images.

DISCUSSION

The SST was first introduced by Hürzeler MB et al., who demonstrated in a proof-of-principle study that intentional retention of a buccal root fragment during immediate implant placement may preserve the buccal bone plate and limit post-extraction ridge alterations [1]. In the same study through a preclinical model, Hürzeler MB et al., also demonstrated preservation of the periodontal ligament-bundle bone complex and formation of mineralised tissue between the implant surface and retained root fragment [1].

Maintenance of facial bone and peri-implant soft-tissue contours remains a major challenge in implant rehabilitation of the anterior maxilla. Following tooth extraction, dimensional changes of the alveolar ridge have been consistently demonstrated, with marked horizontal and vertical bone reduction, particularly affecting the buccal aspect [2,3]. These alterations are more pronounced in the anterior maxilla due to the thin buccal cortical plate.

Animal studies have validated the biologic concept of SST. In a preclinical dog model, the retained root fragment remained attached to the buccal bone via a periodontal ligament, with maintenance of the buccal bone plate observed [4]. Similarly, animal studies on root retention concepts have shown maintenance of surrounding alveolar bone and reduced resorption following retention of root structures [5].

Human histological evidence has further supported these findings. Bäumer D et al., demonstrated the formation of cementum-like tissue in direct contact with the implant surface adjacent to the retained root fragment without signs of inflammation or fibrous encapsulation [6]. In addition, clinical studies by Siormpas KD et al., reported favourable outcomes of SST with high implant survival rates and maintenance of peri-implant tissues over a follow-up period of up to five years [7].

The concept of SST has been incorporated into Partial Extraction Therapies (PET), which include root submergence, pontic shield and proximal SSTs aimed at preserving alveolar ridge architecture [8,9].

Long-term clinical data have demonstrated stable peri-implant bone levels and volumetric tissue stability following SST [10]. Case-based reports have also shown favourable aesthetic outcomes and soft-tissue stability in the anterior maxilla [11]. Modifications in surgical technique have been proposed to improve clinical applicability and simplify the procedure [12].

Systematic reviews have concluded that SST is a promising technique for ridge preservation, although it remains technique-sensitive and dependent on appropriate case selection [13]. Comparative analyses suggest that SST provides favourable or comparable outcomes in maintaining facial bone thickness and soft-tissue contours when compared with conventional immediate implant placement approaches [14].

Despite these encouraging findings, complications such as shield exposure, root fragment mobility and infection have been reported, often related to surgical technique or case selection. Careful patient selection and precise surgical execution are therefore critical.

Delayed implant placement may reduce surgical complexity but is associated with greater ridge dimensional changes and may require additional augmentation procedures. In contrast, SST aims to preserve native tissues by maintaining the root-periodontal ligament complex.

Long-term follow-up with clinical and radiographic evaluation is essential to monitor peri-implant tissue stability. Patient compliance and oral hygiene maintenance also play a critical role in long-term success.

From a clinical perspective, SST should be performed by experienced clinicians within a prosthetically driven treatment approach. Adjunctive procedures such as immediate provisionalisation may further support soft-tissue contour preservation in selected cases.

In the present case, SST combined with immediate implant placement and provisionalisation resulted in preservation of facial contour and peri-implant tissue stability, consistent with previously reported histological and clinical findings.

CONCLUSION(S)

The SST is a biologically sound and clinically effective approach for implant placement in the aesthetic zone of the anterior maxilla. By preserving the buccal root fragment and associated periodontal ligament, SST limits post-extraction alveolar resorption and supports stable peri-implant soft-tissue architecture. Within the limitations of a single case report, SST demonstrated favourable aesthetic and functional outcomes. Meticulous case selection and precise surgical execution are essential for predictable results.

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PARTICULARS OF CONTRIBUTORS:
1. Postgraduate Student, Department of Periodontology and Oral Implantology, Venkateswara Dental College and Hospital, Chennai, Tamil Nadu, India.
2. Postgraduate Student, Department of Periodontology and Oral Implantology, Venkateswara Dental College and Hospital, Chennai, Tamil Nadu, India.
3. Postgraduate Student, Department of Periodontology and Oral Implantology, Venkateswara Dental College and Hospital, Chennai, Tamil Nadu, India.
4. Professor, Department of Periodontology and Oral Implantology, Venkateswara Dental College and Hospital, Chennai, Tamil Nadu, India.
5. Professor and Head, Department of Periodontology and Oral Implantology, Venkateswara Dental College and Hospital, Chennai, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
D Preetha,
Off. Old Mahabalipuram Road, Thalambur Road, Near Navalur,
Chennai-600130, Tamil Nadu, India.
E-mail: preethadivakaran97@gmail.com

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