SINAI International Scientific Journal (SISJ)
Volume 1, Issue 4, April 2025

Immediate Implant Placement in The Esthetic Zone Using The "Socket-Shield Technique": A Clinical Report

Mazen Afesh[1], *Mohammad M Rayyan*[2], *Mohamed Hamada*[2,] *, *Hiba A Makarem*[1], *Hazar Rifai*[1]

[1]*Department of Oral Surgical Sciences, Faculty of Dentistry, Beirut Arab University. Beirut, Lebanon*
[2]*Department of Prosthodontics, Faculty of Dentistry, Sinai University. Sinai, Egypt*
**Corresponding author*

Correspondence:

Mohamed Hamada
Email: muhamed.hamada@su.edu.eg

Citation:

Afesh M, Rayyan M, Hamada M, Makarem, Rifai H. " Immediate Implant Placement in the Esthetic Zone using the "Socket-Shield Technique": A Clinical Report", SINAI International Scientific Journal (SISJ), vol.1 issue 4, pp. 77-84, 2025

Received: 18 July 2024

Accepted: 22 October 2024

ABSTRACT

The replacement of maxillary anterior teeth with an implant-supported prosthesis presents a challenging esthetic dilemma for both the surgeon and prosthodontist. This is due to the cascade of events that follow tooth extraction in the incisor area, including bone resorption and soft tissue retraction. The maxillary anterior area of the buccal plate, being most often very thin, shows significant dimensional changes during the immediate post-extraction period. These events could interfere with optimal implant positioning and jeopardize the esthetic outcome of final restoration. It is challenging to achieve an esthetic emergence profile for the implant-supported restoration in such compromised site. Various approaches have been devised to overcome some challenges, one of which is resecting the tooth crown and leaving a section of the root submerged in bone to act as a shield to the socket and prevent subsequent bone resorption and tissue loss. The following is a clinical case report on the socket-shield technique. The current study aimed to evaluate the effect of immediate implant placement using SST in maintaining the hard and soft tissue architecture on the anterior maxillary region as well as to report any complications associated with the technique.

KEYWORDS: Socket-Shield Technique, Emergence Profile, Immediate Implant, Bone Remodeling

1. INTRODUCTION

It has long been a challenge to replace a maxillary anterior tooth with an implant supported restoration while maintaining optimal function and aesthetics. This is due to subsequent bone resorption and soft tissue retraction [1]. The buccal plate of the maxillary anterior area, being most often very thin, experiences significant dimensional changes during the immediate post-extraction period [2]. This often leads to apical migration of the soft tissue at the crest of the alveolar ridge, accompanied by flattening defects on its facial surface [3]. It is challenging to achieve an esthetic emergence profile for the implant-supported restoration in such a compromised site and to recreate a mucosal zenith at the same level as that of the gingival zenith points of the proximal teeth, even after tissue grafting [4, 5]. One approach for treating such cases was to employ graft materials and techniques [6, 7]. Those showed fluctuating levels of predictability [8-12] and failed to fully compensate for bundle bone resorption [1]. Another approach, immediate implant placement, was not enough to prevent bone remodeling and resorption initiated upon the recreation of biologic width around the implant upon function 1 as it was followed by tissue collapse [13, 14]. Other techniques included platform switching [15, 16] and the scalloped implant [17, 18]. Since it was suggested that the events following tooth extraction may result from the loss of periodontal ligament and associated trauma at the buccal plate of bone [2], it could be assumed that retaining the root

Online ISSN: 3009-7800
Print ISSN: 3009-6324

would prevent resorption. Ref. [19] reported that implants placed in contact with ankylosed root fragments showed no signs of pathological reaction after a loading period of 12–42 months. Influenced by those findings, a procedure that involves resecting a tooth crown and then covering it with a surgical flap was documented in the 1960s. This procedure, known as the RST [20, 21], was created to prevent resorption of alveolar bone after tooth extraction. The rationale behind the intentional retention of the buccal aspect of the root with its periodontal apparatus is that a portion of the blood supply that derives from the PDL is maintained, a thing that might allow to preserve aesthetics of the ridge based on biologic principles without the use of any biomaterial [22, 25]. This is to report a case in which the socket-shield technique was applied to a hopeless maxillary central incisor, followed by immediate implant placement and provisionalization.

2. CASE REPORT

A 27-year-old, healthy, non-smoking male presented with an ill-fitting acrylic temporary restoration on a badly destructed maxillary left central incisor (#9) (Fig. 1). He had high functional and aesthetic expectations. Periapical radiography revealed a crown-root fracture; the fracture line extends 2 mm apical to palato-gingival margin, less than 1 mm root-wall thickness, and no alveolar bone resorption or apical radiolucency. It was deemed non-restorable. The adjacent incisors were perfectly sound. Periodontal examination revealed healthy periodontal tissues except palatal #8, where bleeding on probing was noted.

Fig. 1: A badly destructed maxillary left central incisor.

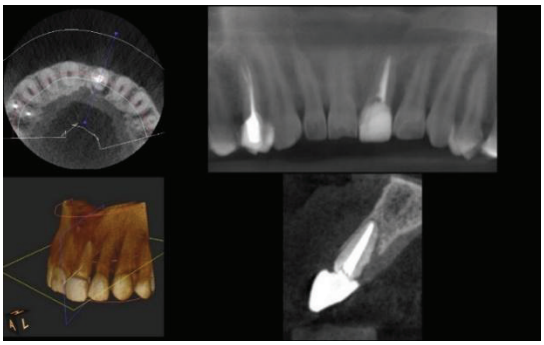

Fig. 2: CBCT showing badly destructed maxillary left central incisor.

A periapical radiograph, diagnostic cast, wax-up of future restoration, surgical and prosthetic guide, and a CBCT (KODAK CS 3D Imaging) (Fig. 2) were performed to confirm

Online ISSN: 3009-7800
Print ISSN: 3009-6324

eligibility for endosseous implant insertion and showed a thin buccal plate but sufficient bone width, palatal to the planned root section. The treatment plan involved immediate implant placement using the socket-shield technique for tooth #9 and the construction of an interim restoration on the same visit. The procedure was explained to the patient, and a signed approval was obtained. A prophylactic 2 g of amoxicillin was orally delivered to the patient one hour before surgery along with a 0.2% chlorhexidine mouthwash. Following administration of local anesthesia to the treatment site, the root was mesiodistally segmented along its long axis as far apically as possible, using root resection bur (Komet Dental) combined with copious irrigation (Fig. 3). The facial half was left unmanipulated and attached to the tooth socket. Periotomes (Hu-Friedy) were then applied to remove the palatal root segment without disturbance to the facial segment. The remaining root segment was then reduced to 1 mm above the alveolar crest and thinned slightly to a concave contour in an apico-coronal and mesiodistal direction by careful application of a long shanked round diamond bur (Komet Dental).

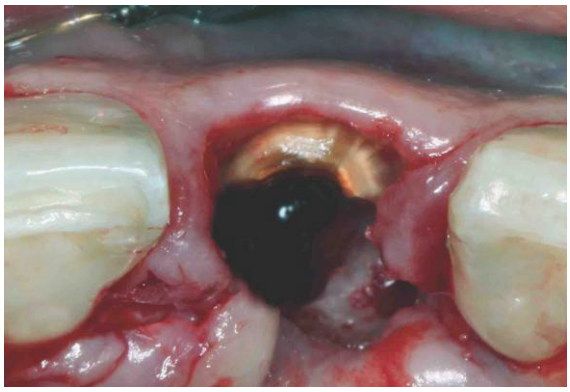

Fig. 3: Mesiodistal root segmentation.

The palatal socket wall and apex were curetted to remove any tissue remnants. The remaining facial root segment became what we know as the socket-shield (SS). The socket was gently debrided and irrigated with normal saline. The implant-bed was then sequentially prepared at the palatal wall of the socket. A 3.6 × 14 mm internal conical connection implant (Superline, Dentium) was placed palatal to the SS without contacting it by the aid of a surgical guide. The implant prosthetic platform was 1 mm apical to the palatal marginal gingiva (Fig. 4).

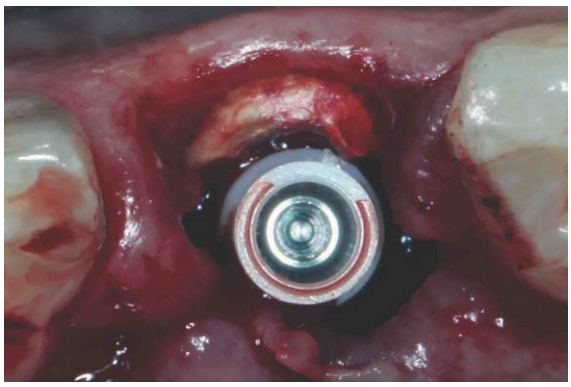

Fig. 4: installation of dental implant after socket preparation.

Online ISSN: 3009-7800
Print ISSN: 3009-6324

A gap between the SS and implant surface was left to allow blood clot formation. The socket was partially closed by a figure-of–eight suture. A plastic temporary abutment in conjunction with Bis-acrylic resin temporary material (Luxatemp, DMG) was utilized to construct a chair-side provisional crown with Provisional-To-Final (P2F) concept [23]. An "S-shaped" emergence profile of the provisional crown was created to ensure adequate space for soft tissue growth between the SS and the provisional crown. The triangular form of the incisor crown was duplicated in the interim restoration to perfectly contour the gingival cuff. The resin part of the temporary restoration was polished after grinding away the contact points with the opposing arch. The hypothesis of the current study was that immediate implant placement using SST is effective in maintaining the hard and soft tissue architecture on the anterior maxillary region as well as reporting any complications associated with the technique.

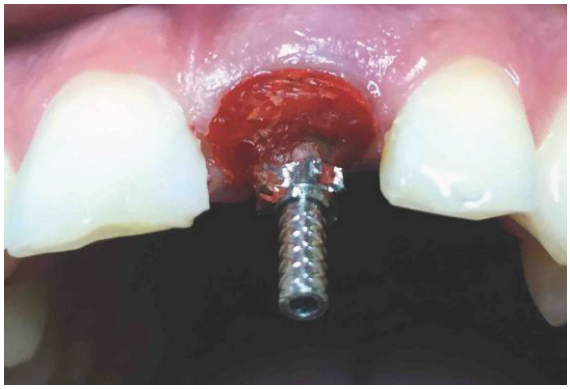

Fig. 5: Impression coping inserted into implant with custom-made gingival cuff to simulate emergence profile of central.

Follow-up visits (weeks 1 & 4) showed uneventful healing with no signs of infection. After 4 months, the patient returned for the restorative phase of the treatment. Osstell (Stampgatan) ISQ reading was 72 objectively demonstrating successful osseointegration. A pick-up elastomeric impression was taken (Fig. 5), a stone model prepared and scanned by an extraoral scanner. A CAD model of customized screw-retained full contour zirconia crown (Fig. 8) (Zenotec Zr Bridge, Wieland Dental) was sent to the milling machine (Zenotec Select, Wieland Dental).

Fig. 6: Final cemented crown.

Online ISSN: 3009-7800
Print ISSN: 3009-6324

After sintering, the integrated abutment-crown unit was tried for marginal fit, proximal contacts, papillary support, and desired occlusion. Final veneering was performed using IPS e.max Ceram (Ivoclar Vivadent AG), and the color was verified before glazing (Fig. 6). The finished crown was torqued into the implant at 20 N-cm. Post insertion periapical radiograph showed a satisfactory result (Fig. 7). A follow-up visit after 1 year revealed comparable soft tissue contours to adjacent teeth and no evident tissue recession or other complications. There was an increase in bone height interproximal to the implant site, the adjacent tooth and a tissue bulk facial to the implant (Fig. 8).

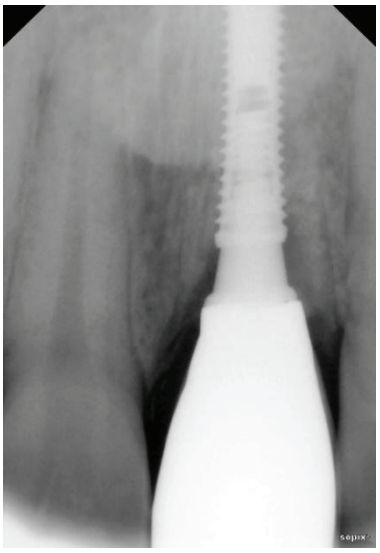

Fig. 7: Post insertion periapical radiograph.

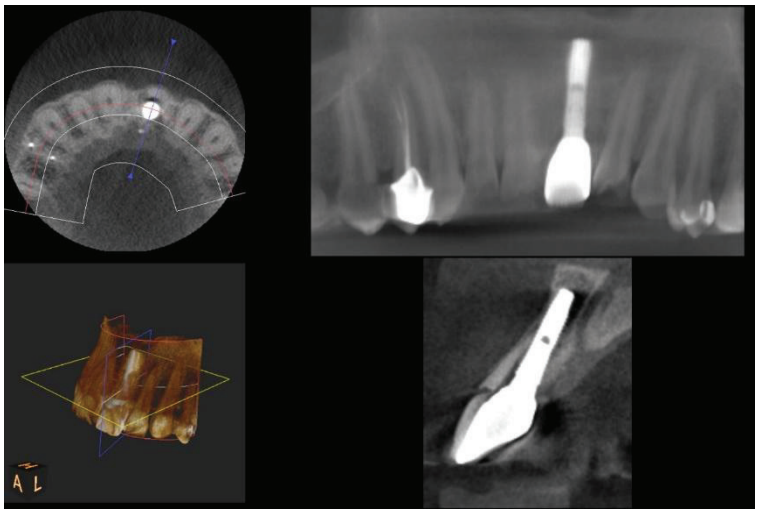

Fig. 8: One year follow up CBCT of the implant.

3. DISCUSSION

The main goal of this study was to test the hypothesis that immediate implant placement using SST is effective in maintaining the hard and soft tissue architecture on the anterior maxillary region, as well as to report any complications associated with the technique. Based

Online ISSN: 3009-7800
Print ISSN: 3009-6324

on the results of this study, SST showed that it is possible to establish osseointegration with buccal root retention and immediate implant insertion without inducing resorptional reactions. Although there are various advantages of delayed implant placement, like better primary stability and fewer complications, the prolonged treatment duration and need for additional surgical procedures were considered a major disadvantage [24]. An immediate implant placement protocol was applied to overcome the prolonged treatment duration, in which various benefits can be obtained, like socket serving as a guide for implant site preparation.

SST procedures were developed to preserve the natural ridge dimension, in which a partial buccal root fragment was retained, followed by immediate implant placement. SST was since preserving the attachment system around submerged roots may entirely preserve alveolar ridge. The normal physiologic bone remodeling was induced by the retained facial tooth segment along with PDL fibers and vascularity interconnected with bone [25]. The retained facial tooth segment may prevent the body from recognizing the extracted tooth and the following physiologic bone remodeling associated with healing procedures [26]. The outcomes of this study coincide with Hürzeler *et al.* [27].

Contrast to previous studies, Langer *et al*. [28] showed that infection of implants placed close to the root section may occur due to the SST technique. According to the course of the current study, the retained root sections did not show evidence of resorption. Some studies recommended that to decrease the possibility of root fracture, the left root section should be at the same level as the buccal alveolar ridge. Murata *et al*. [29] suggested that the root should be at least 1 mm above the alveolar ridge to protect more of the periodontal ligament and retain soft tissue. Habashneh *et al.* [30] suggested using a heterologous graft material in the empty space to decrease bone resorption. Siormpas *et al*. [31] suggested that there is no need for putting graft in the gap between the labial shield and the implant, which is consistent with our study, where no graft material was added. Despite the promising results of SST, long-term clinical studies are needed to safely apply this newly introduced technique in everyday dental practice. This is a sensitive technique, and it needs extensive planning and good operational skills to obtain a satisfying and long-lasting rehabilitation.

4. CONCLUSION

Within the limitations of the study, our results showed that the socket-shield technique for immediate implant placement is effective in maintaining the hard and soft tissue architecture of the anterior maxillary region. However, more clinical studies that compare the socket-shield technique with other techniques are needed to draw any definitive conclusion.

INFORMED CONSENT

The informed consent was approved by the patient.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

Online ISSN: 3009-7800
Print ISSN: 3009-6324

REFERENCES

[1.] Scala A, Lang N, Schweikert M, de Oliveira J, Rangel-GaricaI J, Botticelli D. Sequential healing of open extraction sockets. An experimental study in monkeys. Clin Oral Implants Res 2014; 25:288-383.

[2.] Kubilius M, Kubilius R, Gleiznys A. The preservation of alveolar bone ridge during tooth extraction. Stomatologija. 2012; 14:3-11.

[3.] Kotsakis G, Chrepa V, Marcou N, Prasad H, Hinrichs J. Flapless alveolar ridge preservation utilizing the ‘’socket-plug’’ technique: Clinical technique and review of the literature. J Oral Implantol. 2012; 3:24–30.

[4.] Cosyn J, Eghbali A, De Bruyn H, Collys K, Cleymaet R, De Rouck T. Immediate single-tooth implants in the anterior maxilla: 3-year results of a case series on hard and soft tissue response and aesthetics. J Clin Periodontol. 2011; 38:746–799.

[5.] Rayyan M, Abdallah J, Segaan LG, Bonfante EA, Osman E. Static and Fatigue Loading of Veneered Implant-Supported Fixed Dental Prostheses. J Prosthodont. 2020 Oct;29(8):679-685.

[6.] Carmagnola D, Adriaens P, Berglundh T. Healing of human extraction sockets filled with Bio-Oss. Clin Oral Implants Res. 2003; 14:137-43.

[7.] Araújo M, Linder E, Lindhe J. Effect of a xenograft on early bone formation in extraction sockets: an experimental study in dog. Clin Oral Implants Res. 2009; 20:1-6.

[8.] Buser D, Dula K, Belser U, Hirt HP, Berthold H. Localized ridge augmentation using guided bone regeneration. 1. Surgical procedure in the maxilla. Int J Periodontics Restorative Dent. 1993; 13:29-45.

[9.] Simion M, Baldoni M, Rossi P, Zaffe D. A comparative study of the effectiveness of e-PTFE membranes with and without early exposure during the healing period. Int J Periodontics Restorative Dent. 1994; 14:166-246.

[10.] Rayyan M, Hussien A, Sayed N, Abdallah R, Osman E, El Saad N, Ramadan S. Comparison of four cordless gingival displacement systems: A clinical study. J Prosthet Dent. 2019; 121:265-270.

[11.] Gher M, Quintero G, Assad D, et al. Bone grafting and guided bone regeneration for immediate dental implants in humans.J Periodontol 1994;65:881–972.

[12.] Becker B, Becker W. Guided tissue regeneration for implants placed into extraction sockets and for implant dehiscence: Surgical techniques and case reports. Int J Periodontics Restorative Dent. 1990;10: 377-468.

[13.] Sanz M, Cecchinato D, Ferrus J, Pjetursson E, Lang N, Lindhe J. A prospective, randomized-controlled clinical trial to evaluate bone preservation using implants with different geometry placed into extraction sockets in the maxilla. Clin Oral Implants Res. 2010; 21:13–21.

[14.] Maisoun Latrash, Nagwa Sayed, Roula Abiad, and Mohammad Rayyan. Fracture Resistance of Different Restorative Techniques for Endodontically Treated Teeth. IAJD. 2015; 6:65-70.

[15.] Lazzara RJ, Porter SS. Platform switching: a new concept in implant dentistry for controlling postrestorative crestal bone levels. Int J Periodontics Restorative Dent. 2006; 26:9-17.

Online ISSN: 3009-7800
Print ISSN: 3009-6324

[16.] Joukhadar C, Osman E, Rayyan M, Shrebaty M. Comparison between different surface treatment methods on shear bond strength of zirconia (in vitro study). J Clin Exp Dent. 2020; 12: e264-e270.
[17.] Wöhrle P. Nobel Perfect esthetic scalloped implant: rationale for a new design. Clin Implant Dent Relat Res. 2003; 5:64-73.
[18.] Ayash G, Ossman E, Segaan L, Rayyan M, Joukhadar C. Influence of core color on final shade reproduction of zirconia crown in single central incisor situation - An in vivo study. J Clin Exp Dent. 2020; 12:e46-e51.
[19.] Davarpanah M, Szmukler-Moncler S. Unconventional implant treatment: I. Implant placement in contact with ankylosed root fragments. A series of five case reports. Clin Oral Implants Res. 2009; 20:851-857.
[20.] Salama M, Ishikawa T, Salama H, Funato A, Garber D. Advantages of the root submergence technique for pontic site development in esthetic implant therapy. Int J. Periodontics Restor. Dent. 2007; 27:521-528.
[21.] Ayash G, Osman E, Segaan L, Rayyan M, Joukhadar C. Influence of resin cement shade on the color and translucency of zirconia crowns. J Clin Exp Dent. 2020; 12: e257-e263.
[22.] Siormpas K, Mitsias M, Kontsiotou-Siormpa E, Garber D, Kotsakis G. Immediate implant placement in the esthetic zone utilizing the "root-membrane" technique: clinical results up to 5 years postloading. Int J Oral Maxillofac Implants. 2014; 29:1397-1802.
[23.] Canullo L, Bignozzi I, Cocchetto R, Cristalli P, Iannello G. Immediate positioning of a definitive abutment versus repeated abutment replacements in post-extractive implants: 3-year follow-up of a randomised multicentre clinical trial. Eur J Oral Implantol. 2010; 3:285-381.
[24.] Fickl S, Zuhr O, Wachtel H, Stappert C, Stein J, Hürzeler M. Dimensional changes of the alveolar ridge contour after different socket preservation techniques. J Clin Periodontol 2008; 35: 906–913.
[25.] Sayed N, Aly N, and Rayyan M. The Effect Of Different Double- Step Impression Techniques On Accuracy Of Stone Dies. EDJ. 2015; 61:641-694.
[26.] Filippi A, Pohl Y, von Arx T. Decoronation of an ankylosed tooth for preservation of alveolar bone prior to implant placement. Dent Traumatol. 2001; 17:93-98.
[27.] Hürzeler M, Zuhr O, Schupbach P, Rebele S, Emmanouilidis N, Fickl S. The socket-shield technique: a proof-of-principle report. J Clin Periodontol. 2010; 37:855-917.
[28.] Langer L, Langer B, Salem D. Unintentional Root Fragment Retention In Proximity To Dental Implants: A Series Of Six Human Case Reports. Int J Periodontics Restorative Dent. 2019; 35: 305-318.
[29.] Murata M, Akazawa T, Mitsugi M, Um I, Kim K, Kim Y. Human Dentin As Novel Biomaterial For Bone Regeneration. Biomaterials - Physics and Chemistry. 2021; 127-167.
[30.] Habashneh R, Walid M, Abualteen T, Abukar M. Socket-shield Technique and Immediate Implant Placement for Ridge Preservation: Case Report Series with 1-year Follow-up. J. Contemp. Dent. Pract. 2019; 20: 1108-1125.
[31.] Siormpas K, Mitsias M, Kotsakis G, Tawil I, Pikos M, Mangano F. The Root Membrane Technique: A Retrospective Clinical Study with up to 10 Years of Follow-Up. Implant Dent. 2018; 27:564-574.

Online ISSN: 3009-7800
Print ISSN: 3009-6324