Indira
EDUCATION

INDIRA JOURNAL of INTEGRATED HEALTH SCIENCE AND RESEARCH

PRIYADARSHINI DENTAL COLLEGE AND HOSPITAL

A UNIT OF INDIRA EDUCATIONAL INSTITUTION

REVIEW ARTICLE

Socket Shield Technique– A Review Article

Doddy Lokanathan Balaji[1] , Sheela Kumari .k[2], Murugesan .K[3], Anitha .K.V[4], Brindha Jei[5]

Reader[1], Reader[2] , Professor and Head[3] , Department of Prosthodontics and Crown and bridge, Priyadarshini Dental College and Hospital, Tiruvallur, Professor[4,5], Department of Prosthodontics and Crown and bridge, SRM Dental College and Hospital, Ramapuram, Chennai, Tamil Nadu, India.

ABSTRACT

To replace missing teeth, dental implants have become the norm. While single teeth replacement has increased in popularity in recent years, especially in the aesthetic area, dental implants were originally primarily utilised to attach complicated multi-unit prostheses. This has resulted in a necessity to preserve buccal hard and soft tissues, coupled with an ever-increasing desire to generate cosmetically acceptable results. Resorption of buccal bundle bone following tooth extraction and implant insertion can be a serious issue with sometimes extremely poor cosmetic outcomes. Grafting procedures are commonly carried out to reduce the loss of bundle bone. After tooth extraction, there is a reduction in the buccal bone, resulting in both vertical and horizontal bone loss. In such cases, advanced techniques for repairing both hard and soft tissues are essential to achieve aesthetically pleasing outcomes. One such technique is the socket-shield technique (SST), where the tooth's root is split in half, with the front two-thirds left within the socket to safeguard the periodontium, bundle bone, and buccal bone.

Keywords: Preserving alveolar bone, handling bone, handling extraction sockets, immediate implant placement and implementing socket shield techniques.

INTRODUCTION:

One of the primary goals of prosthetic rehabilitation is to create and sustain a harmonious relationship between the gingival (pink) and dental (white) components, with a special focus on achieving aesthetics in the treatment. A rapid implant implantation after an atraumatic tooth extraction caused the interproximal bony scallop to flatten and lose vertical and horizontal buccal bone, necessitating a challenging rehabilitation. [1] The presence of unattractive gaps or black spaces between teeth often results from the loss of underlying bone support, which leads to the downward shift of the surrounding soft tissue. This presents a considerable challenge for clinicians, particularly when it comes to replacing missing teeth with aesthetically pleasing restorations, especially in the front upper part of the mouth. To adDr. ess this bone loss, various preventive and post-bone loss techniques have been employed, including ridge preservation methods and interventions for post-ridge collapse like bone augmentation, soft tissue enhancement, or a combination of these approaches. Conversely, the Socket-Shield Technique (SST) is employed as a predictable therapy with little need for surgery, a shorter length of time for the entire course of treatment, and the best possible aesthetic outcome.[2] Achieving natural-looking prosthesis emergence relies on the creation of appropriate hard and soft tissue dimensions, which can be accomplished through techniques like socket preservation or alveolar ridge preservation [3]. In the mid-1980s, the concept of "alveolar ridge preservation" emerged as a means to retain ridge volume. This technique involves the placement of graft material into a tooth socket after extraction, with or without the use of a barrier membrane or soft tissue. Due to its conceptual appeal, technical simplicity, and ongoing assessment, this preservation method is commonly employed in dental practice [4]. There is a growing demand for placing implants in the esthetic region of the upper jaw immediately after tooth extraction. The front part of the maxilla, being prominently visible, demands a high degree of precision in implantology to meet long-term patient expectations. The loss of teeth leads to alterations in the natural volume of the alveolar bone[5,6]. Following implant placement, it is crucial to not only ensure successful osseointegration but also to maintain the aesthetics of the adjacent area,

Corresponding author: Doddy Lokanathan Balaji Reader, Prosthodontics and Crown & Bridges. Priyadarshini Dental College and Hospital, Tiruvallur

Email Id: dr.lokanathan.balaji@gmail.com

especially in the anterior maxillary region. Implants are often placed Alveolar bone resorption tends to be more pronounced in the buccal plate compared to the lingual plate [9]. Approximately 56% of horizontal resorption in buccal bone dimension occurs within the first 4 months following tooth extraction, while the lingual/palatal bone wall experiences a 30% reduction in width during this period [10]. The loss of the periodontal ligament and subsequent changes, especially in the buccal bone plate, are responsible for the noticeable alterations that occur after tooth extraction. Alveolar bone resorption can pose challenges for implant placement, particularly in areas where aesthetics are crucial, such as the anterior maxilla. Various methods have been proposed to mitigate the adverse effects of tooth loss, including immediate implants, socket preservation with biomaterials, and alveolar ridge preservation with bioabsorbable membranes [11,12].

HISTORY OF SOCKET SHIELD TECHNIQUE

Utilizing a dental implant to replace a missing or damaged tooth in the aesthetic zone poses a significant challenge for the dentist. Achieving the best possible aesthetics requires careful planning of the entire treatment process, starting from tooth extraction to the placement of the definitive implant-retained prosthesis. Hurzeler and colleagues [2] introduced the "socket-shield technique," a clinical approach in which the buccal portion of the root is preserved to safeguard the periodontal ligament and bundle bone. Subsequently, an immediate implant is positioned adjacent to this remaining root segment. This method effectively mitigates the adverse consequences of retaining only part of the root after extraction. It acts as a protective shield against buccal bone resorption, leading to improved tissue contour and enhanced aesthetic outcomes [8].

CLASSIFICATION

Since the inception of the socket-shield technique by Hürzeler et al. (2010), numerous modifications have been proposed to standardize its clinical execution and classification. Kumar and Kher (2018) initially proposed a positional framework that categorized the technique according to the location and extent of the retained root fragment, and later refinements by Kher and Tunkiwala (2020) and Sethiya et al. (2023) integrated morphological and biomechanical considerations. These systems have collectively evolved to define six principal types of socket-shield designs, each suited to specific anatomical, esthetic, and functional requirements.

BUCCAL SHIELD – TYPE I

The buccal shield configuration is the most commonly employed form of the socket-shield technique and is primarily indicated for single anterior teeth with intact buccal bone and adjacent natural dentition. In this design, the facial or buccal portion of the root is retained, extending from the mesiolabial to the distolabial line angle. Its primary objective is to maintain the mid-facial soft-tissue contour and prevent buccal bone resorption following extraction. By preserving the periodontal ligament complex along the buccal plate, this design sustains vascular supply to the facial bone, thereby

(Figure1–BuccalShield)

maintaining alveolar ridge morphology and esthetic harmony. Long-term studies by Gluckman et al. (2018) and Bäumer et al. (2017) have validated the buccal shield as a predictable and biologically stable modification for immediate implant placement in the esthetic zone. (Figure 1)

FULL C BUCCAL SHIELD – TYPE II

The full-C buccal shield extends beyond the facial surface to include both proximal aspects of the root, thereby forming a continuous C-shaped fragment. This modification is primarily indicated when preservation of both mesial and distal papillae is essential, such as in maxillary central incisor or

(Figure 2 – Full C Buccal Shield)

premolar regions where adjacent natural teeth or implants are present. The continuous curvature of the shield supports the interdental bone and papillae, enhancing pink esthetics and reducing the risk of black triangles. This design ensures three-dimensional stability of peri-implant tissues, making particularly suitable in high-esthetic-demand cases.

HALF C BUCCAL SHIELD – TYPE III

(Figure 3 – Half C buccal shield)

The half-C buccal shield design involves retention of the buccal and only one proximal aspect—either mesial or distal—of the root fragment. It is indicated when one side of the socket is edentulous or where adjacent bone support is deficient. This design provides localized soft-tissue and bone preservation, ensuring stability of the interdental papilla on the supported side while allowing flexibility for implant placement and prosthetic design. Clinically, it balances esthetic preservation with surgical accessibility, especially in cases with asymmetric ridge anatomy or single missing teeth bordered by one natural tooth and one edentulous space**.**

INTERPROXIMAL SHIELD – TYPE IV

The interproximal shield is retained solely at the mesial or distal surface of the extraction socket and serves to protect the interdental papilla and interproximal bone crest. It is particularly beneficial in scenarios where the buccal bone is compromised or thin but the interproximal bone remains intact. By retaining the root fragment adjacent to the papilla, the technique maintains soft-tissue height and contour, preventing the collapse of the interdental architecture. This approach is often adopted in multi-unit anterior cases, especially when papillary preservation is prioritized for esthetic continuity.

(Figure 4 – Type IV- Interproximal)

MULTIPLE SHIELD – TYPE V

This type involves the intentional retention of two or more root fragments, such as a combination of buccal and interproximal or buccal and lingual shields. It is primarily indicated in multi-rooted or vertically fractured teeth where ridge preservation is essential across multiple aspects of the socket. The multiple-shield design provides superior three- dimensional tissue stability, helps preserve the inter- implant papillae in multi-unit restorations, and minimizes ridge collapse following extraction. Execution of this technique is surgically complex and demands precise CBCT-based assessment, meticulous sectioning, and stabilization of each fragment to ensure immobility. When properly performed, it offers exceptional esthetic and functional outcomes, maintaining both the horizontal and vertical ridge dimensions over time.

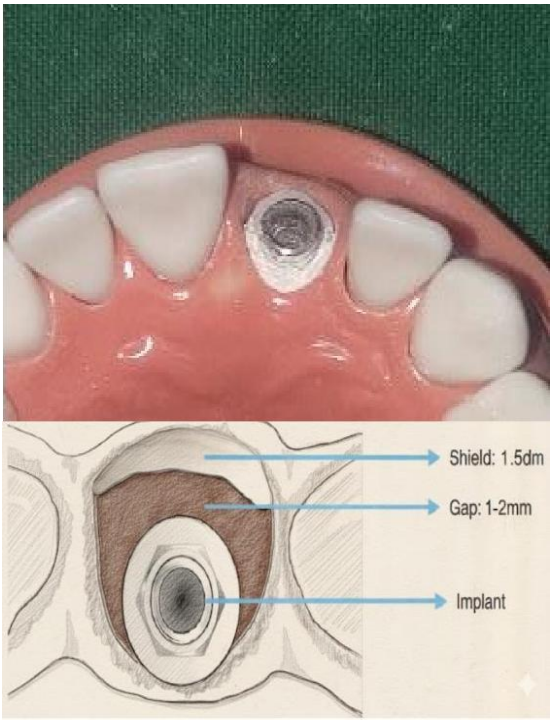
(Figure 5 - Type V – Multiple Shield)

LINGUAL SHIELD – TYPE VI

The palatal or lingual shield design involves preserving the palatal segment of the root and is typically indicated in posterior maxillary teeth or premolars where buccal bone integrity is maintained. This configuration focuses on preserving the internal

ridge form and palatal soft- tissue thickness, contributing to an optimal prosthetic emergence profile. In addition, it aids in maintaining the three-dimensional ridge contour and provides resistance against palatal bone resorption. Although less commonly utilized than buccal shields, this type expands the versatility of SST to posterior and multi- rooted regions.

(Figure 6 - Type VI – Lingual Shield)



(Figure 7) Placement of Graft

PROCEDURE

The primary goal of the socket shield technique, a surgical procedure employed in implant dentistry, is to safeguard the buccal plate of the alveolar socket. The key steps in the procedure are outlined as follows:

PREOPERATIVE EVALUATION AND PLANNING

A comprehensive preoperative evaluation is critical to achieving a successful outcome. This includes detailed assessment of the patient's dental and medical histories, thorough clinical examination, and acquisition of diagnostic radiographs such as cone-beam computed tomography (CBCT). Radiographic analysis helps determine the thickness of the buccal plate, root morphology, proximity of adjacent teeth, and the feasibility of retaining a partial root fragment. The presence of a thin or compromised buccal plate, vertical root fractures, or periapical pathology may contraindicate the technique. Before surgery, local anesthesia is administered to ensure complete patient comfort. Atraumatic extraction protocols should be followed to minimize damage to the surrounding alveolar bone and soft tissues. The use of **periotomes and micro- elevators** is recommended for gentle tooth mobilization. Maintaining the integrity of the socket walls is essential for long-term success of the implant and soft-tissue profile.

TOOTH EXTRACTION

After decoronation of the tooth to the level of the gingival margin, the root is sectioned vertically along its long axis using a long-neck diamond bur or, preferably, a **piezosurgical device** such as *Mectron Piezosurgery®, Acteon Piezotome®, or NSK VarioSurg®*. These piezoelectric systems allow precise, vibration-controlled sectioning while minimizing the risk of heat generation and bone microfracture. The tooth is divided into buccal and palatal fragments, and the palatal portion is carefully removed, leaving the buccal fragment intact. This retained portion forms the "socket shield." The ideal shield should extend from the apical aspect to the crestal level, maintaining a thickness of approximately 1.5–2.0 mm to ensure structural rigidity while preserving the periodontal ligament attachment.

IMPLANT POSITION

Osteotomy is prepared palatal to the retained buccal fragment following the standard sequence recommended by the selected implant system. Surgical kits such as *Straumann®, Nobel Biocare®, or BioHorizons®* may be used, depending on the clinical preference.The implant should be placed in close proximity to the palatal wall, ensuring there is no direct contact with the inner surface of the shield.

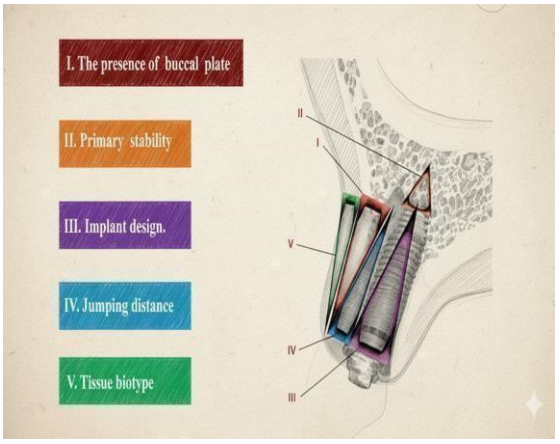
Maintaining primary stability and ideal occlusal alignment is critical. Use of **guided-surgery templates** can enhance precision and angulation, particularly in esthetically sensitive zones. Throughout the osteotomy preparation, intermittent irrigation should be maintained to avoid thermal trauma to the bone.

SHIELD GRAFTING AND STABILISATION

Once the implant is placed, the shield may be refined and polished using specialized burs from the **Socket-Shield Preparation Kit (Bredent Medical®)** or **Versah® Osseodensification Burs**. These systems provide smooth diamond and tungsten-carbide burs that allow precise trimming and shaping of the retained root surface. If a gap exists between the shield and implant, it can be filled with a fine-grained xenograft or alloplastic bone substitute material to promote osseointegration and maintain the buccal contour. The use of a resorbable collagen membrane over the shield is optional but can aid in stabilization during early healing. Proper adaptation of the shield ensures that it remains immobile throughout the osseointegration phase.

FLAP CLOSURE AND POSTOPERATIVE CARE

After implant placement, the soft tissues are repositioned and sutured using fine monofilament sutures such as 5-0 or 6-0 to achieve tension-free



primary closure. A healing abutment or cover screw is attached depending on the desired protocol. The patient is prescribed antibiotics, nonsteroidal anti-inflammatory medication, and a 0.12% chlorhexidine mouth rinse twice daily for one week. Postoperative care instructions include maintaining oral hygiene without disturbing the surgical area and avoiding mechanical trauma during the healing period. Sutures are generally removed after seven to ten days.

FOLLOW-UP AND RESTORATION

Regular follow-up appointments are scheduled to monitor soft-tissue healing, bone remodeling, and implant stability. Radiographic evaluation using periapical or CBCT imaging is recommended to assess integration and peri-implant bone levels. After sufficient osseointegration, typically three to four months post-surgery, prosthetic restoration is initiated. A screw-retained or cement-retained crown is fabricated, designed to follow the natural emergence profile preserved by the socket shield. The integration of advanced instrumentation—such as piezosurgery units, osseodensification burs, and dedicated socket-shield preparation kits—enhances surgical accuracy, preserves the buccal bone plate, and supports long-term esthetic and functional outcomes.

CLINICAL STUDIES ON SOCKET SHIELD TECHNIQUE

Bäumer et al. conducted retrospective research on patients who underwent immediate implant implantation using the socket shield approach and discovered that all implants healed normally. During follow-up, the volumetric analysis revealed minimal contour alterations and mucosal recession at the implant restoration, which were equivalent to those at the adjacent teeth.[14] Gluckman et al. assessed 123 immediate implants that were placed in the maxilla and mandible using the socket-shields approach, and they discovered that they had an osseointegration success rate of 96.1% after 1-4 years of follow-up.[15] In their study with a 12- to 48- month follow-up, Zhu et al. [16] evaluated the clinical outcome of the socket shield technique in the anterior region of the maxilla in nine patients who had immediate implant placement. They discovered no implants were lost during the observation period and discovered good aesthetic results. To assess the marginal bone level, survival rate, and aesthetic outcome of dental implants implanted in a high aesthetic zone, Bramanti et al [17] conducted a randomised controlled experiment. When compared to the conventional insertion approach, implants put using the socket shield technique had improved values for the pink aesthetic score and marginal bone level. In their investigation, Hinze et al [18] discovered that the socket-shield approach, fast implantation, and providing all contributed to the stability of the volume of mucosa adhering to the implant. No matter what, there was no effect on the buccal mucosa, the apical height of the bone, or the gingival width. By keeping the 1.5 mm thick buccal

region of the root with the most coronal portion at the bone crest level, Han et al. provided a "modified" socket shield approach. Patients received immediate implant insertion, resulting in a 100% survival rate.[19]

DISCUSSION

The success of implant placement in the aesthetic zone is influenced by various interrelated factors, including the timing of implant placement, the biological characteristics of the alveolar socket, the harmony between soft and hard tissues, the surgeon's level of expertise, implant design, precise three-dimensional positioning, and the degree of patient compliance [8]. Each of these parameters directly impacts both the biological integration of the implant and the overall aesthetic outcome. Understanding the indications and contraindications for selecting appropriate roots is therefore crucial to minimize the failure rate of the socket shield approach and to ensure long-term peri-implant stability. The socket-shield technique is primarily recommended in cases involving vertical root fractures, unsalvageable teeth indicated for extraction, immediate implant placement in the esthetic zone, and ridge preservation procedures aimed at preventing buccopalatal collapse and maintaining papillary height and soft-tissue contours [20,21]. From an esthetic standpoint, both the hard- and soft-tissue characteristics play a decisive role in the final result. Ideal outcomes depend not only on osseointegration but also on the preservation of the peri-implant mucosa, papilla integrity, and facial gingival levels. However, achieving favorable soft- tissue aesthetics remains a clinical challenge due to potential complications such as soft-tissue recession, loss of interdental papillae, or mucosal color mismatch. These issues are commonly associated with bone remodeling and the loss of the periodontal ligament following traditional extractions. The socket-shield technique mitigates these limitations by maintaining the natural periodontal attachment apparatus, thereby preserving the blood supply to the facial plate and ensuring stable gingival architecture [22]. Key parameters for evaluating the success of the socket- shield technique include implant survival rate, incidence of biological complications (such as infection or shield mobility), and prosthetic complications (such as misfit or esthetic discrepancy) [23]. These outcomes can be monitored through regular clinical and radiographic examinations, including cone-beam computed tomography (CBCT), which assists in assessing bone volume, implant integration, and shield stability [24]. In the literature, an implant is considered “survived” when it remains functional and free of mobility one year after loading [22]. Studies have consistently reported high survival rates for implants placed using the socket-shield technique, with minimal marginal bone loss and superior soft-tissue preservation compared to conventional immediate implant placement. The socket-shield concept demonstrates particular promise in preserving both “pink” and “white” aesthetics by maintaining the entire attachment system, thus allowing complete alveolar ridge preservation. This approach not only minimizes the need for grafting materials but also supports a natural emergence profile, critical for long-term esthetic harmony. However, patient-specific factors must always be considered, as complex clinical scenarios—such as two adjacent root stumps, a root stump adjacent to an edentulous space, or the presence of a neighboring implant—pose significant challenges to surgical precision and shield stability. Each of these cases requires a tailored treatment strategy based on anatomical considerations, soft- tissue thickness, and prosthetic requirements. Overall, the socket-shield technique represents a paradigm shift in implantology toward biologically Dr. iven tissue preservation rather than post-extraction reconstruction. When performed with careful case selection, precise instrumentation, and adherence to established clinical protocols, the technique provides predictable, long-term results with enhanced esthetic integration

CONCLUSION:

The socket shield technique is a valuable method in implant dentistry for preserving peri-implant soft tissues and safeguarding the buccal bone structure. This approach presents a feasible treatment option for enhancing facial bone and gum architecture stability. Nonetheless, it is important to note that preparing the root fragment during the procedure can be challenging. This comprehensive examination provides a detailed exploration of the rationale, clinical procedure, outcomes, and potential complications associated with the socket shield technique. It is essential to exercise caution when employing the socket shield approach in clinical settings, and long-term monitoring is imperative.

CONFLICT OF INTEREST: NIL

AKNOWLEDGEMENT: NIL

REFERENCES:

1. Salama H, Salama MA, Garber D, Adar P. The interproximal height of bone: A guidepost to predictable aesthetic strategies and soft tissue contours in anterior tooth replacement. *Pract Periodontics Aesthet Dent.* 1998;10:1131–41.
2. Hürzeler MB, Zuhr O, Schupbach P, Rebele SF, Emmanouilidis N, Fickl S, et al. The socket-shield technique: A proof-of- principle report. *J Clin Periodontol.* 2010;37:855–62.
3. Jung RE, Ioannidis A, Hämmerle CHF, Thoma DS. Alveolar ridge preservation in the esthetic zone. Periodontol 2000;77:165– 75.
4. Maiorana C, Poli PP, Deflorian M, Testori T, Mandelli F, Nagursky H, et al. Alveolar socket preservation with demineralised bovine bone mineral and a collagen matrix. J Periodontal Implant Sci. 2017;47:194– 210
5. Amler MH, Johnson PL, Salman I. Histological and histochemical investigation of human alveolar socket healing in undisturbed extraction wounds. J Am Dent Assoc 1960;61:32-44.
6. Schropp L, Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12-month prospective study. Int J Periodontics Restorative Dent 2003;23:313-23.
7. Gharpure AS, Bhatavadekar NB. Current evidence on the socket-shield technique: a systematic review. J Oral Implantol. 2017;43:395–403.
8. Aslan S. Improved volume and contour stability with thin socket-shield preparation in immediate implant placement and provisionalization in the esthetic zone. Int J Esthet Dent. 2018;13:172–83
9. Araújo MG, Lindhe J. Dimensional ridge alterations following tooth extraction. An experimental study in the dog. J Clin Periodontol 2005;32:212-8.
10. Botticelli D, Berglundh T, Lindhe J. Hard-tissue alterations following immediate implant placement in extraction sites. J Clin Periodontol 2004;31:820-8.
11. Araújo M, Linder E, Wennström J, Lindhe J. The influence of Bio-Oss Collagen on the healing of an extraction socket: an experimental study in the dog. Int J Periodontics Restorative Dent 2008;28:123-35
12. Lekovic V, Camargo PM, Klokkevold PR, Weinlaender M, Kenney EB, Dimitrijevic B, et al. Preservation of alveolar bone in extraction sockets using bioabsorbable membranes. J Periodontol 1998;69:1044-9
13. Kumar, P. R., & Kher, U. (2018). Shield the socket: Procedure, case report and classification. *Journal of Indian Society of Periodontology*, *22*(3), 266–272. https://doi.org/10.4103/jisp.jisp_78_18
14. Bäumer D, Zuhr O, Rebele S, Hürzeler M. Socket shield technique for immediate implant placement - clinical, radiographic and volumetric data after 5 years. Clin Oral Implants Res. 2017 Nov;28(11):1450-1458
15. Gluckman H, Salama M, Du Toit J.A retrospective evaluation of 128 socket-shield cases in the esthetic zone and posterior sites: Partial extraction therapy with up to 4 years follow-up. Clin Implant Dent Relat Res. 2018 Apr;20(2):122-129.
16. Zhu YB, Qiu LX, Chen L, Gao M, Yu HJ, Wang J. Clinical evaluation of socket shield technique in the maxillary anterior region.Zhonghua Kou Qiang Yi Xue Za Zhi. 2018 Oct 9;53(10):665-668.
17. Bramanti E, Norcia A, Cicciù M, Matacena G, Cervino G, Troiano G, et al. Postextraction dental implant in the aesthetic zone, socket shield technique versus conventional protocol. J Craniofac Surg. 2018 Jun;29(4):1037-1041
18. Hinze M, Janousch R, Goldhahn S, Schlee M. Volumetric alterations around single-tooth implants using the socket shield technique: preliminary results of a prospective case series. Int J Esthet Dent. 2018;13(2):146-170.
19. Han CH, Park KB, Mangano FG. The modified socket shield technique. J Craniofac Surg. 2018 Nov;29(8):2247- 2254
20. Anas B, Shenoy KK. Socket shield technique - A neoteric approach in ridge preservation. Sch J Dent Sci. 2017;4:125– 8.
21. Mujawar S, Devkar N, Vibhute A, Deshpande M, BuDr. uk V. Socket shield technique: a review. Int J Recent Sci Res. 2018;9:27612–5
22. Lin, Xi, et al. "Socket shield technique: a systemic review and meta- analysis." *Journal of Prosthodontic Research* 66.2 (2022): 226-235.

Indira
EDUCATION

Publisher:
PRIYADARSHINI DENTAL COLLEGE AND HOSPITAL
Tiruvallur, Tamil Nadu
Website: https://indiraedujournals.in
Email: journal@indiraeducational.org