Proximal Socket Shield for Interimplant Papilla Preservation in the Esthetic Zone

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Managing the interimplant papilla is one of the most challenging tasks in anterior implant esthetics, especially when replacing a failing tooth adjacent to an existing implant restoration. This article describes the maintenance of the interimplant papilla when replacing a failing tooth adjacent to an implant restoration using the proximal socket shield procedure in conjunction with immediate implant placement and provisionalization. (Int J Periodontics Restorative Dent 2013;33:e24–e31. doi: 10.11607/prd.1346)

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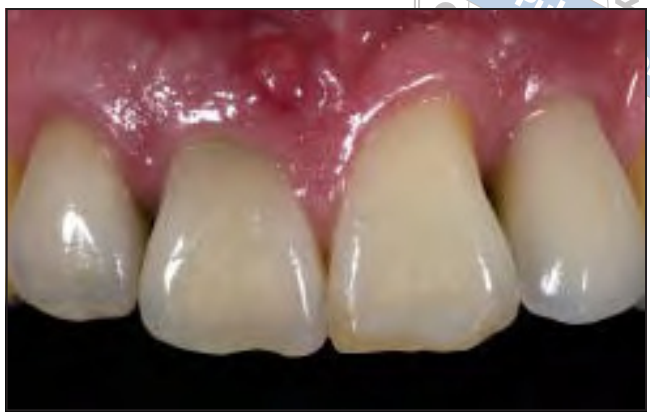
In the dentate anterior maxillary esthetic zone, there are two situations in which implants would be placed adjacent to one another: *(1)* when replacing two adjacent failing teeth and *(2)* when replacing a failing tooth adjacent to an existing implant restoration. In the former situation, alternate immediate implant placement and provisionalization (IIPP) on one failing tooth after the other has been advocated.[1] With proper timing (IIPP), spacing (interimplant/radicular distance), sequencing (alternate IIPP), and prosthetic management, the interimplant papilla can be adequately maintained.[1] However, in the latter situation, maintaining the interimplant papilla can be a challenge since it is greatly influenced by the condition of the peri-implant tissue of the existing implant and its physiologic response to the extraction of the adjacent tooth.

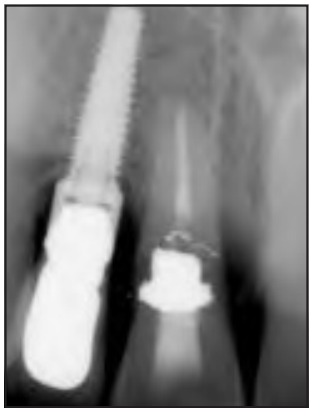
The socket shield technique utilizes the retained buccal root in an attempt to preserve the buccal bone after immediate implant placement, and promising clinical and histologic results have been reported.[2] This article describes the maintenance of the interimplant

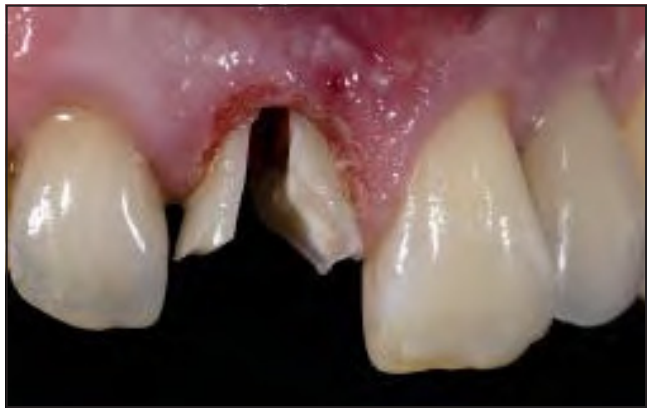
Fig 1 (right) *Pretreatment view of the failing maxillary right central incisor. Note the presence of a fistula tract at the mesial aspect of the tooth.*

Fig 2 (below left) *Pretreatment periapical radiograph of the right central incisor showing endodontic treatment with mineral trioxide aggregate.*

Fig 3 (below right) *After gingivectomy, the right central incisor was sectioned buccolpalatally.*







papilla when replacing a failing tooth adjacent to an implant restoration using the proximal socket shield (PSS) procedure in conjunction with IIPP.

Case report

A 45-year-old patient presented with a failing maxillary right central incisor. The failing tooth exhibited no clinical mobility, but a fistula was noted 5 mm apical to the mesial aspect of the facial free gingival margin (Fig 1). The maxillary right lateral incisor consisted of a 5-year-old single-implant crown. The facial gingival level of the right central incisor was 3 mm coronal to that of the contralateral tooth (Fig 1). Bone sounding measurements of 4.5, 7.0, and 6.0 mm were recorded on the mesial, facial, and distal aspects of the right central incisor, respectively; a value of 4 mm was recorded on the mesial aspect of the left central incisor; and a value of 9 mm was recorded on the mesial aspect of the right lateral incisor. Radiographic evaluation of the right central incisor revealed previous endodontic treatment with mineral trioxide aggregate (ProRoot MTA, Densply) (Fig 2). The marginal bone level at the mesial aspect of the implant at the lateral incisor site was much more apical than at the distal aspect of the right central incisor, giving the appearance of an interproximal infrabony defect toward the lateral incisor (Fig 2). After the risks and benefits of several treatment options were provided, the patient consented to an implant-supported restoration.

Prior to implant surgery, a provisional shell of the failing tooth was fabricated using autopolymerizing (Jet, Lang Dental) and light-polymerizing (Gradia, GC America) acrylic resins. After administration of local anesthesia, an approximate 3-mm gingivectomy was performed on the facial gingiva of the right central incisor for pocket reduction as well as to match the gingival level to that of the left central incisor. The maxillary right central incisor was sectioned (no. 557L, Brasseler) buccopalatally (Fig 3), and the mesial half of the root was removed atraumatically without flap reflection.

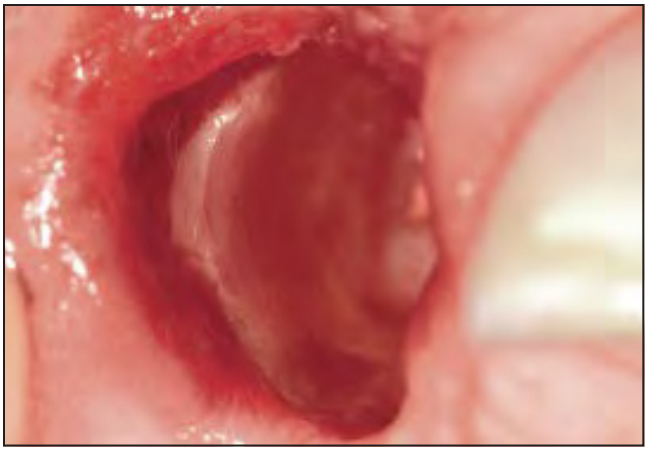


Fig 4 *The prepared root fragment.*

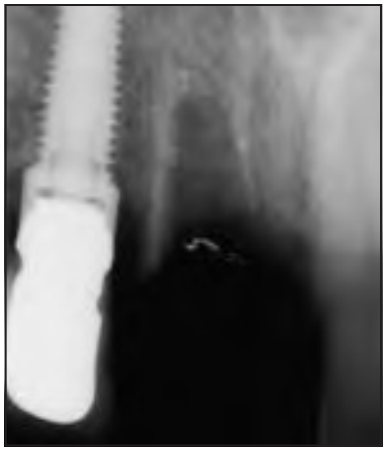


Fig 5 *Periapical radiograph of the prepared root fragment.*

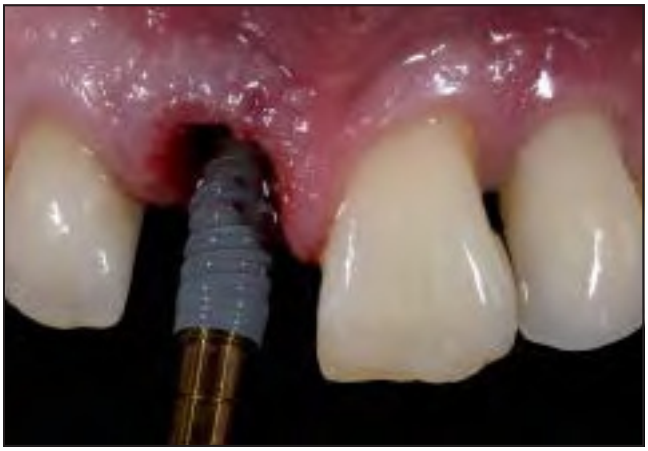


Fig 6 *Immediate implant placement after sequential osteotomy.*

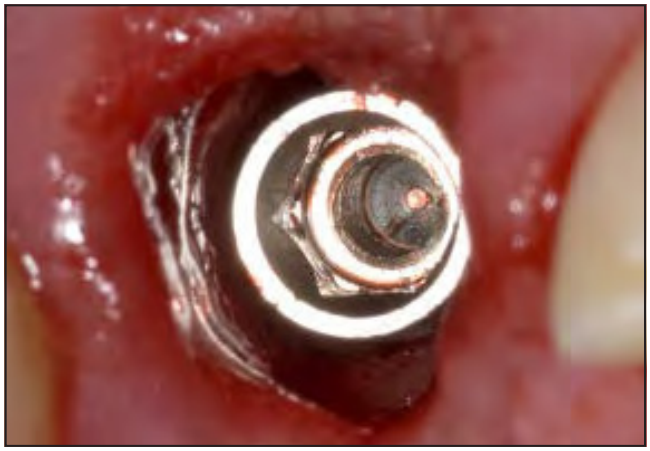


Fig 7 *Final implant position. Note the close proximity between the implant and distal root fragment.*

The crown portion of the remaining distal tooth structure was then sectioned horizontally, leaving the root with a cervical extension approximately 2 mm coronal to the distal marginal bone. Subsequently, the intaglio side of the remaining distal root fragment was hollowed out using a high-speed diamond bur (5847KR.FG.016, Komet), which created a 1.5- to 2.0-mm-thick C-shaped root fragment spanning from the distobuccal to the distopalatal line angles (Figs 4 and 5). After the mesial portion of the tooth socket was debrided and detoxified with a slurry mix of antibiotics (tetracycline hydrochloride, TEVA Pharmaceuticals) and 0.12% chlorhexidine gluconate (Peridex, Procter & Gamble), the integrity of the labial bony plate was verified using a periodontal probe. The sequential implant osteotomy was performed to achieve the following three-dimensional implant position in relation to the distal root fragment (Figs 6 and 7):

- Apico-coronally: The implant (NobelActive, Nobel Biocare) platform was placed 3 mm apical to the newly established facial gingival margin after gingivectomy. Interproximally, this resulted in the implant platform being positioned more apical to the most coronal aspect of the distal root fragment.
- Mesiodistally: The implant was placed at the center of the mesiodistal width of the definitive restoration, leaving a minimum

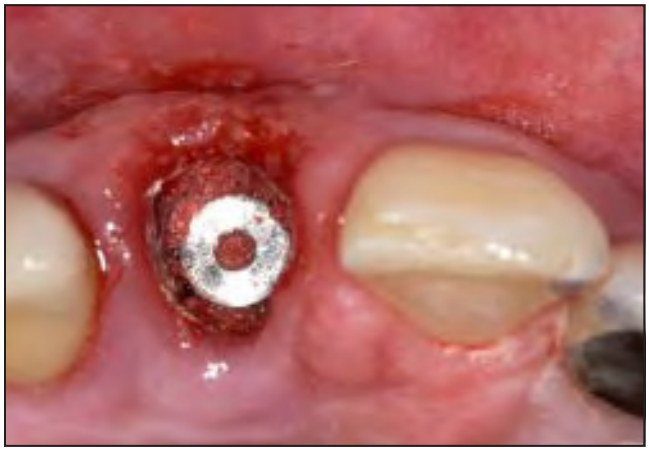


Fig 8 *Bone graft materials placed into the gaps between the implant and bony socket as well as the distal root fragment.*

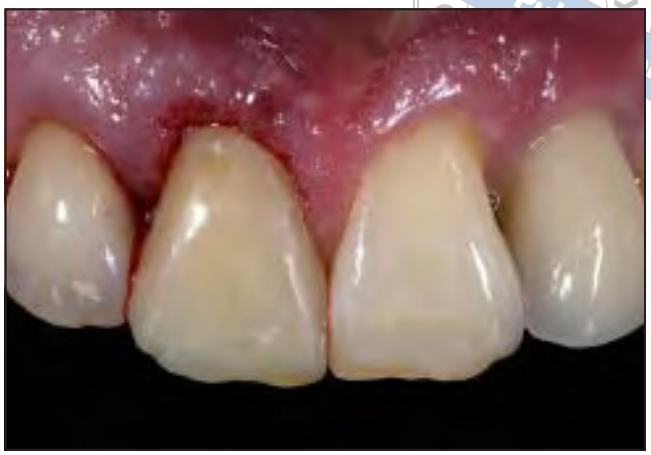


Fig 9 *Provisional restoration cemented into place.*

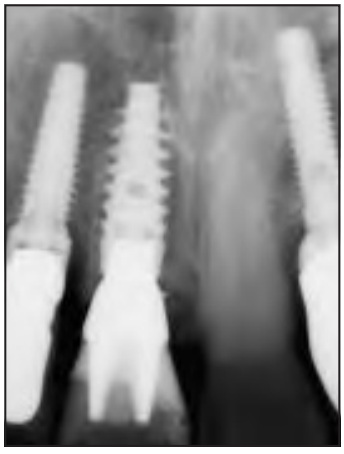


Fig 10 *Periapical radiograph of the implant placed using the PSS technique with IIPP.*

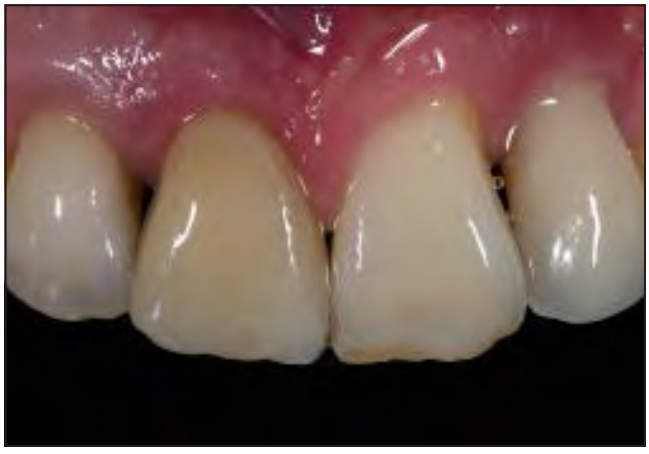


Fig 11 *Provisional restoration 2 weeks after delivery.*

of 2.0 mm between the implant and root of the adjacent teeth. This might result in contacts between the implant and distal root fragment.

- Labiopalatally: The implant was placed along the palatal wall of the extraction socket for primary stability, leaving a gap of at least 1.5 mm between the implant and buccal bone.

After the zirconia abutment (Procera Esthetic Abutment, Nobel Biocare) was adjusted to the proper dimensions, it was hand-tightened onto the implant. The provisional shell was relined with light-polymerized acrylic resin (Ultradent Products) and adjusted to clear all centric and eccentric functional contacts. Bone graft materials (Bio-Oss, Osteohealth and Puros, Zimmer) were placed into the gaps between the implant and bony socket as well as the distal root fragment (Fig 8). A subepithelial connective tissue graft was placed and secured between the labial gingiva and bone (6-0 Chromic gut suture, Ethicon).[3] The provisional restoration was cemented using provisional cement (IRM, Dentsply) (Figs 9 to 11).

Appropriate antibiotics and analgesics were prescribed. The patient was instructed not to brush at the surgical site but to rinse gently with 0.12% chlorhexidine gluconate (Peridex) and follow a soft diet for 2 weeks. The patient was advised against functional activities at the

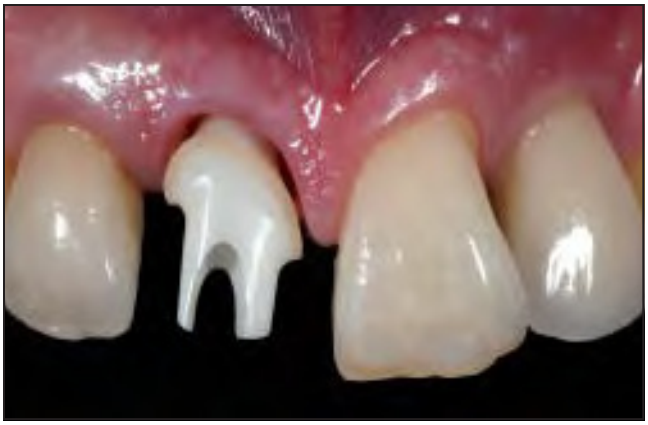


Fig 12 *Placement of the custom zirconia abutment. Note the optimal emergence profile and marginal contour for a harmonious gingival architecture.*

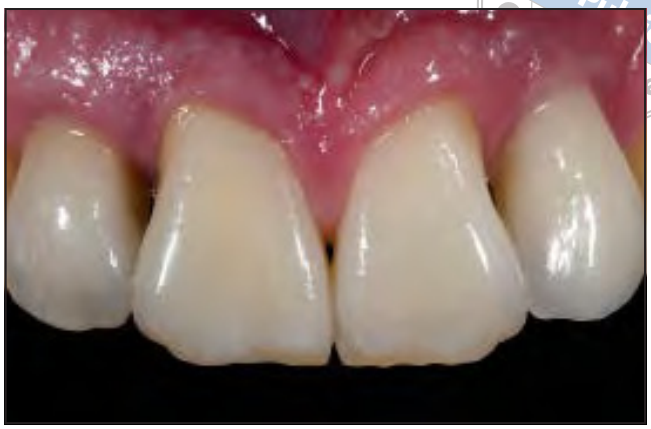


Fig 13 *Definitive restoration 1 year after placement. Note the maintenance of the interproximal peri-implant papilla.*

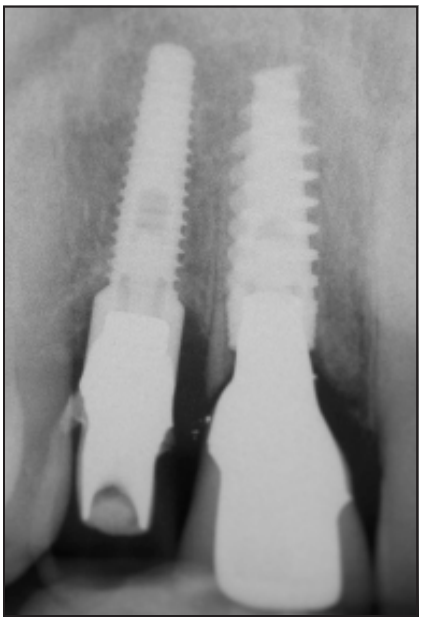


Fig 14 *Periapical radiograph of the definitive restoration.*

implant site for the duration of the implant healing phase (6 months).

The final polyvinyl siloxane impression of the implant was made 6 months after implant surgery. A customized zirconia abutment (Procera, Nobel Biocare) (Fig 12) and a new composite resin provisional restoration designed to simulate the gingival architecture of the contralateral tooth (left central incisor) were fabricated. The abutment was tightened onto the implant using 35 Ncm of torque, and the provisional restoration was placed. Once a harmonious soft tissue architecture was achieved (2 weeks), the definitive all-ceramic crown (Procera) was fabricated and cemented using composite resin cement (RelyX Unicem, 3M ESPE). Clinical and radiographic follow-up at 1 year showed satisfactory esthetic results with a well-maintained interimplant papilla between the central incisors (Figs 13 and 14).

Discussion

For an anterior single implant, the interproximal papilla is dictated by the bone and attachment levels of

the adjacent teeth.[4] This is because the level of the implant platform is positioned according to the facial bone level, and since most available dental implants are uniplanar (flat), the implant platform is usually apical to the proximal bone level. In addition, long-term maintenance of the proximal bone coronal to the implant platform has been shown to be more of an exception than the rule,[5] even with use of implants with scalloped[6] or unmatched (platform-switched) platforms.[7,8] As a result, the proximal implant marginal bone level is often more apical than that of the adjacent natural teeth, creating the appearance of an infrabony defect toward the implant. While the periimplant marginal (vertical) bone change is expected to be minimal after the first year of function,[9] the bone loss in the horizontal direction seems to be time-dependent. This horizontal bone loss would lead to a decreased interproximal bone height despite the stable marginal bone levels of both the implant and adjacent tooth. Subsequently, the longer the implant has been in function, the thinner the bone adjacent to the natural tooth would become, increasing its susceptibility to resorption when subjected to surgical trauma (eg, tooth extraction or implant placement). Therefore, once the adjacent tooth is extracted, proximal bone loss can be expected followed by papillary recession since the papilla level is dependent on the proximal bone level. Interproximal reconstructive procedures involving hard and soft tissue augmentations have been advocated to restore the esthetic tissue architecture. Nevertheless, these procedures are strenuous, and their esthetic outcomes are not predictable.[10–13]

When the condition of the failing tooth is suitable, a preservative approach such as IIPP,[14–16] ridge preservation with socket seal surgery,[17] or root submergence[18] (followed by a cantilevered prosthesis) have been recommended to minimize interproximal papilla loss between a failing tooth adjacent to an anterior single implant. While these methods may mitigate the extent of proximal tissue loss, they do not eliminate it. A new restoration on an existing implant with a longer proximal contact area is often necessary to compensate for the papillary deficit. On the other hand, a proactive approach involving orthodontic extrusion of the failing tooth has also been suggested to alleviate interimplant papilla loss.[19] Although improvement of the hard and soft tissue architecture, both facially and interproximally, of a failing tooth is evident after such a procedure, it is not sustainable after tooth extraction and implant placement, especially at the proximal aspect. This is because the thin ledge of proximal bone isolated on the side of the failing tooth, developed as a result of the extrusion, usually cannot be maintained following tooth removal and implant placement.

It has been shown that buccal root fragment retention (the socket shield technique) in conjunction with immediate implant placement is able to preserve the buccal bony plate while allowing the implant to achieve osseointegration without inflammatory or resorptional response regardless of the proximity between the implant and retained root.[2] In this patient, the PSS technique in conjunction with IIPP was used, leaving a portion of the root fragment adjacent to an existing implant restoration. Besides the potential preservation of the proximal bone, the presence of a coronal portion of the root fragment with supracrestal cementum (2 mm above the proximal bone), where dentogingival fibers are attached, also contributes to the preservation of the level of the interimplant papilla.

While PSS is a technique-sensitive procedure that requires immaculate execution, its success depends even more on proper case selection, ie, the condition of the failing tooth. To avoid future complications from the retained root fragment, the tooth and periodontal apparatus on the PSS side of the failing tooth must be healthy with no evidence of pathology (eg, internal/external root resorption, perforation, infection, or fracture). The prepared proximal root fragment must occupy the complete root length with a minimum 2-mm supracrestal portion. It should follow the outline of the socket and be of uniform thickness (1.5 to 2.0 mm)—thick enough for longevity (strength/durability) and yet thin enough to not interfere with implant placement. Therefore, tapered implants may be beneficial when performing the PSS procedure.

Nonetheless, roots that are narrow in the mesiodistal dimension (< 6.5 mm), significantly tapered, or tilted mesiodistally may not be ideal for the PSS procedure since these conditions would interfere with proper proximal root fragment preparation and implant placement. Although implant–root fragment contact has not been shown to be detrimental to the PSS technique,[2] the use of this technique for a failing tooth with apparent mobility or widened periodontal ligament is not recommended since it may increase the risk of the root fragment being inadvertently dislodged during extraction, implant osteotomy, or future function.

It should be noted that even though a satisfactory result was achieved using PSS in conjunction with the IIPP procedure, this case report had a short-term follow-up (1 year). A histologic study of buccal root fragment retention (socket shield technique) in conjunction with immediate implant placement has shown that there were connective tissues (junctional epithelium and formation of new cementum) interposed between the coronal root fragment and implant, while the more apical portion of the root fragment, which was in direct contact with the tips of the implant threads, was covered by a cellular type of cementum.[2] Magnified views of the tips of the implant threads also demonstrated their integration in the newly formed cementum interposed between dentin and the implant without evidence of fibrous tissue.[2] These findings seem to suggest the presence of normal peri-implant soft tissue and intimate contact between the implant and root fragment. Nevertheless, long-term maintenance of this peri-implant soft tissue condition and stability of this hard tissue "integration" have not been documented. Furthermore, risk of coronal root fragment fracture during function has not been assessed. Therefore, immaculate oral hygiene as well as close and frequent monitoring must be exercised.

Conclusions

Maintaining interimplant papillae is one of the most challenging tasks in anterior implant esthetics. This case report demonstrates the benefits of the PSS procedure with IIPP in maintaining both the bone level and dentogingival fibers attached to the proximal supracrestal cementum, which are instrumental in the preservation of the interimplant papilla. Nevertheless, this is a technique-sensitive procedure with limited long-term evidence. Along with proper case selection and execution, close monitoring in larger-scale studies is needed to further substantiate the validity of this procedure.

Acknowledgment

The authors reported no conflicts of interest related to this study.

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