

Fixed screw-retained interim restorations with immediate implant placement in esthetic zone: A case series with six different techniques

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Abstract Postextraction immediate implant placement in the esthetic zone is a common treatment modality. Immediate fixed interim restoration following immediate implant placement may provide excellent esthetic results to the patients and boost the clinicians' confidence. This paper demonstrates a series of six different techniques used to fabricate the customized screw-retained interim restorations following immediate implant placement with partial extraction therapy in the maxillary anterior esthetic zone. The techniques have utilized a putty index, polycarbonate shell crown, patients' existing crowns (prosthetic or natural), or laminate veneer, or fabricated in the laboratory based on the specific clinical situation. Advantages and limitations of each technique including alternative techniques or materials have been discussed. Excellent esthetic results were obtained with all six techniques using the screw-retained immediate interim restorations following partial extraction therapy and immediate implant placement.

Keywords: Immediate implant, implant esthetics, interim restoration, provisional restoration

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INTRODUCTION


Postextraction immediate implant placement in the esthetic zone has gained popularity amongst clinicians as it boosts patient satisfaction to a greater extent.^[1,2] Advanced periodontitis, unrestorable caries, fractures, and traumatic injuries are the common reasons of immediate extraction of the maxillary anterior teeth. In any of these clinical situations (especially in traumatic injuries) the unsalvageable tooth or teeth usually required to be extracted. This may give

tremendous psychological trauma to the patients, especially if it is in the esthetic zone (maxillary or mandibular anterior region). Such clinical situations need urgent replacement of the missing tooth/teeth. Immediate dental implant placement following extraction of such unsalvageable tooth/teeth is not a new concept and many clinical techniques and procedures have been well evidenced.^[1,2] The advantages of single surgical procedure, that minimizes the overall treatment time, have encouraged clinicians to immediately

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insert the implant fixtures into extraction sockets.^[1] However, various risk factors which may compromise the predictability of the esthetic results should be assessed in detail before commencing treatment procedures.^[2] Sometimes, significant tissue alterations could be observed at the surgical site which compromises clinical outcomes.^[3]

Immediate implant placement with immediate fixed interim restoration in the esthetic zone results in excellent short-term treatment outcomes in terms of implant survival and minimal change of peri-implant soft- and hard-tissue dimensions.^[4] The volumetric facial contour changes of immediately placed implants with and without immediate interim restorations were studied in 40 participants and concluded that the restorations showed better volume preservation in the esthetic zone at 1-year follow-up.^[5] Another similar study compared facial mucosal levels with and without immediate interim restorations and concluded that mid-facial mucosal marginal level and papilla height changes were minimal within groups, and no significant differences were found between the two groups.^[6] A systematic review was carried out on four studies with immediate implant placement, five studies with immediate implant restoration, and four studies with immediate loading.^[7] The authors concluded that immediately placed, restored, or loaded single-tooth implants in the esthetic zone result in similar hard and soft tissue changes compared with conventional protocols.

There are mixed results in the literature regarding the short-term and long-term peri-implant soft- and hard-tissue changes after immediate fixed interim restorations following immediate implants. Although postextraction bone remodeling will occur irrespective of the timing of the implant placement, the time saved with immediate placement and fixed immediate restoration indicated the attractive treatment option with high subjective and professional overall satisfaction.^[1,2,8] Despite the satisfactory option, the maxillary anterior region still presents a challenge for clinicians because of the inherent difficulties encountered in the interim restorations and harmonious incorporation of the definitive prosthesis into patient's dentogingival complex.^[9] The maxillary ridge has facial cortical bone that is more vulnerable to resorb as compared with the mandibular facial cortical bone because of the inherent difference in the bone density and the bone resorption pattern. Surgical and restorative techniques that can reduce the loss of hard and soft tissues that often accompany implant placement are desirable. The use of a customized interim restoration will provide a mechanism to assist the clinician in achieving the preservation of hard and soft tissue.^[10]

Different techniques have been demonstrated for single unit immediate interim restorations using resin materials^[10] or patient's own crown.^[11] This paper demonstrates a series of 6 different techniques used to fabricate customized screw-retained interim restorations following immediate implant placement in the maxillary anterior esthetic zone. The techniques have utilized a putty index, polycarbonate shell crown, patients existing crowns (prosthetic or natural), or laminate veneer or fabricated in the lab based on specific clinical situation.

TECHNIQUES

Six different techniques in six different patients have been described for fabricating a fixed screw-retained interim restorations onto the immediate implants placed in the fresh extraction sockets in the maxillary anterior esthetic zone. All patients were treated by partial extraction therapy (also known as the socket-shield technique).^[12,13] All implants had achieved optimal primary stability of more than 35 Ncm to place immediate restorations which was measured with an adjustable torque-wrench (BioHorizons) during the surgery. All crowns were kept out of functional occlusion (in both centric and eccentric occlusion) by 32 μ m using multi-layered shim-stocks to avoid premature overloading during the osseointegration period.

Technique 1: putty index and bis-acryl resin

A 35-year-old woman reported with a history of repeated dislodgement of her prosthetic crown on the maxillary right central incisor. The tooth was endodontically treated 17 years ago and had a postcore and crown restoration. The clinical and radiographic examination revealed that the tooth was unrestorable and was indicated for extraction. A polyvinyl siloxane putty index (Affinis; Coltene) was fabricated with the existing crown that was anatomically intact before the extraction [Figure 1a]. Partial extraction therapy followed by an immediate 4.2 mm \times 15 mm sized tapered implant (BioHorizons) placement was carried out under local anesthesia. A screw-retained polyetheretherketone (PEEK) based interim abutment was placed on the implant [Figure 1b] and the hole was created in the putty index corresponding to the abutment screw access hole [Figure 1c]. The abutment screw access hole was closed with the Teflon tape and an interim abutment was picked up using a Bisacryl resin (Protemp 4; 3M ESPE) [Figure 1d]. The interim abutment was then attached to the laboratory analog and flowable composite resin (Z350 XT Flowable, 3M ESPE) was added to fill up the voids and the emergence profile was shaped using composite finishing kit. The interim restoration was finished and polished [Figure 1e] and screwed onto the implant [Figure 1f].

Technique 2: polycarbonate shell crown with bis-acryl resin

A 27-year-old woman reported with a history of trauma, leading to a fracture of her right maxillary central incisor [Figure 2a]. The root of the fractured tooth was removed with partial extraction therapy and a 3.8 mm × 15 mm sized tapered implant (BioHorizons) was placed. A PEEK-based interim abutment was placed [Figure 2b]. The polycarbonate shell crown (3M ESPE) of the most appropriate size was selected from the available stock [Figure 2c] and tried over the abutment for possible adjustments and fitting. The crown was perforated so that interim abutment popped out through it. An abutment-screw access hole was closed with a Teflon tape and a Bisacryl interim material (Protemp 4; 3M ESPE) was filled inside the polycarbonate crown and some of the material was injected over the abutment to prevent voids. Alternately flowable composite resin can be used and cured through the shell crown. The screw was loosened completely to retrieve the interim crown. After

polymerization, the excess resin that leaked out of the crown contour was trimmed off. The voids were filled-up with flowable composite resin [Figure 2d]. The restoration was finished and polished using composite finishing and polishing discs (Soflex, 3M ESPE) [Figure 2e] and the interim crown screwed onto the implant [Figure 2f].

Technique 3: prosthetic (all ceramic) crown conversion

A 55-year-old man reported with a dislodged prosthetic crown on the maxillary left canine [Figure 3a]. The tooth was endodontically treated 12 years ago and restored with an all-ceramic Lithium-Disilicate (IPS e. max) crown. Since the remaining tooth structure was nonrestorable, the tooth was removed with partial extraction therapy and 4.2 mm × 15 mm sized tapered implant (Biohorizons) was placed immediately. The PEEK interim abutment was placed on the implant [Figure 3b] and the crown was adjusted and perforated corresponding to the abutment screw access hole [Figure 3c]. The abutment was then picked up with Bisacryl resin (Protemp 4;

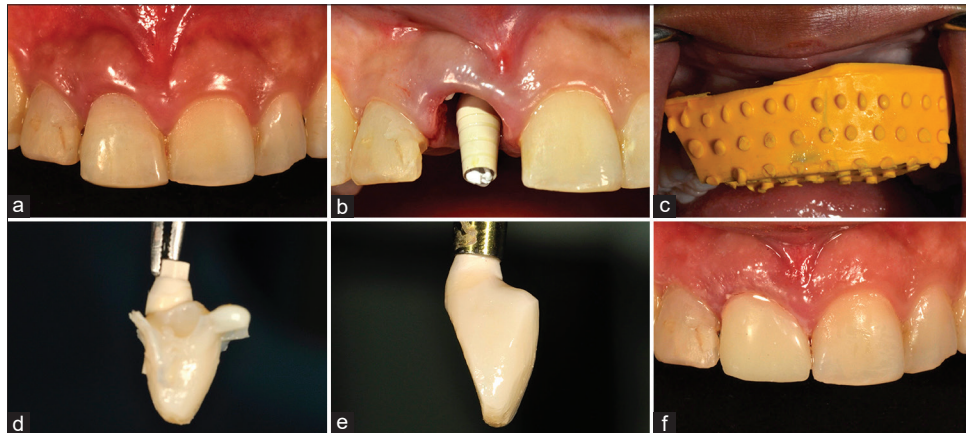


Figure 1: (a) Pretreatment view of the patient. (b) Immediate implant placed along with screw-retained polyetheretherketoe interim abutment. (c), Pick up of crown with putty index. (d), Picked-up unfinished crown. (e), Finished and polished crown. (f), Posttreatment view

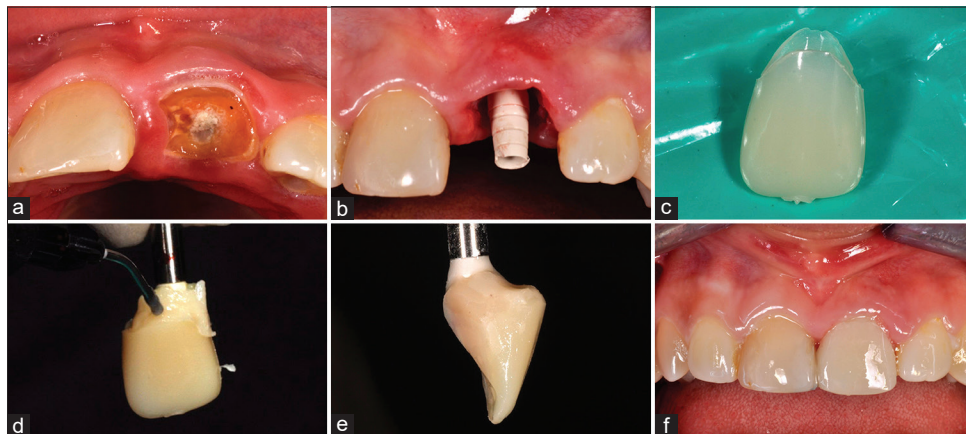


Figure 2: (a), Pretreatment intraoral view indicating fractured tooth at the gingival level. (b), Immediate implant placed along with screw-retained polyetheretherketoe interim abutment. (c), Polycarbonate shell crown for pick up. (d), Picked-up unfinished crown. (e), Finished and polished crown. (f), Posttreatment view

3M) as described in technique 3 [Figure 3d and e]. The finished and polished crown was screwed onto the implant [Figure 3f].

Technique 4: laminate veneer conversion

A 42-year-old woman reported with a veneered tooth that was fractured at gingival level during a car accident [Figure 4a]. The Lithium-Disilicate (IPS e.max) veneer was intact. Since the tooth was nonrestorable, the partial extraction therapy was carried out with the remaining root and 4.2 mm × 15 mm sized tapered implant (BioHorizons) was placed immediately in the socket. A PEEK interim abutment was placed over the implant [Figure 4b]. The veneer was carefully separated from the bonded tooth by trimming the tooth portion from the palatal aspect using the diamond rotary instruments [Figure 4c] and positioned onto the interim abutment. The height of the abutment was trimmed to accommodate the veneer [Figure 4d]. The intaglio surface of the veneer was sequentially treated with hydrofluoric acid etchant, the silane coupling agent, and the bonding agent in conventional manner. The abutment screw access hole was closed with Teflon tape and the flowable

composite resin (Z350 XT Flowable, 3M ESPE) was injected in the gap between the veneer and the abutment and on the palatal side of the abutment. The flowable composite resin was light polymerized and the whole interim crown was unscrewed and placed on the laboratory analog [Figure 4e]. The excess resin was trimmed off, finished, and polished [Figure 4f] and the crown was screwed onto the implant [Figure 4g].

Technique 5: natural crown conversion

A 46-year-old male visited with a concern of traumatic injury to anterior teeth resulted in the fracture of his maxillary right central incisor at gingival level and partial fracture of left central incisor [Figure 5a]. Since the rest of the root portion of the right central incisor was nonsalvageable, the partial extraction therapy was carried out followed by immediate 4.2 mm × 15 mm sizes tapered implant placement (BioHorizons). The Titanium interim abutment was placed [Figure 5b]. The broken natural crown was trimmed from the palatal aspect to keep the facial surface intact [Figure 5c] and positioned in relation to the interim abutment. The height of the abutment was trimmed to accommodate

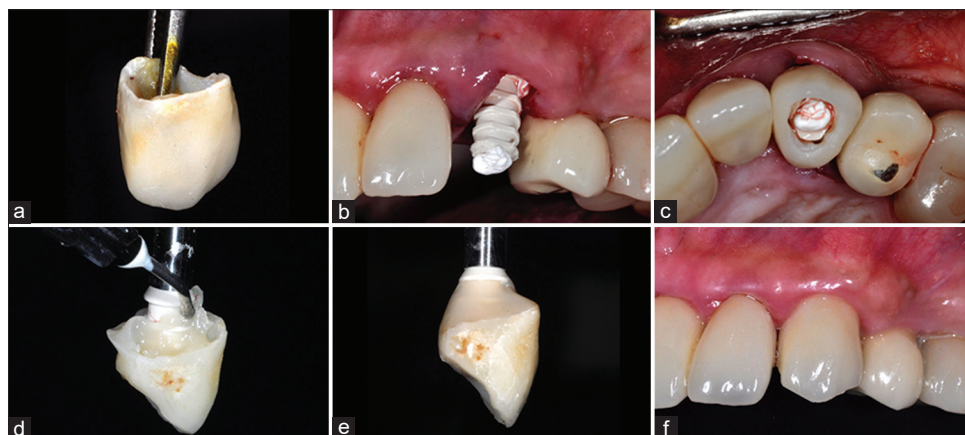


Figure 3: (a), Patient's dislodged all-ceramic crown. (b), Immediate implant placed, and screw-retained polyetheretherketoe interim abutment adjusted to fit the crown. (c), All ceramic crown adjusted and perforated for abutment screw access. (d), Minor modifications done on the picked-up unfinished crown. (e), Finished and polished crown. (f), Posttreatment view

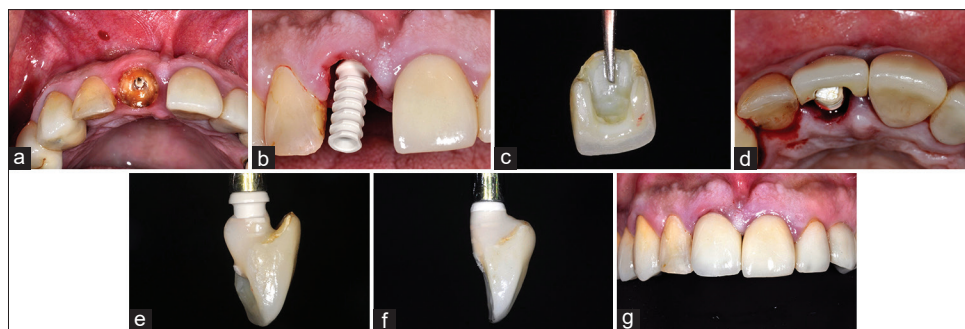


Figure 4: (a), Pretreatment intraoral view indicating fractured tooth at gingival level. (b), Immediate implant placed along with screw-retained polyetheretherketoe interim abutment. (c), Patient's laminate veneer. (d), Veneer and interim abutment adjusted. (e), Picked-up unfinished crown. (f), Finished and polished crown. (g), Posttreatment view

the crown [Figure 5d]. The crown was sequentially treated with a phosphoric acid etchant and a bonding agent and subsequently picked up along with the interim abutment using flowable composite resin similar to technique 4 [Figure 5e]. After finishing and polishing [Figure 5f], the interim crown was screwed onto the implant [Figure 5g].

Technique 6: laboratory fabricated or indirect

In situations, where the patient can wait for couple of days to receive fixed interim restoration or already using removable partial denture, a laboratory fabricated interim restoration can be planned. The maxillary right central incisor of a 65-year-old male was fractured at the cervical level [Figure 6a]. The root was removed with partial extraction therapy and an implant (Biohorizons) of size 4.2 mm × 15 mm was placed immediately in the socket [Figure 6b]. A closed tray (alternately open tray can be used) impression of the implant was made [Figure 6c]. The final stone cast was fabricated, and an interim crown was fabricated with composite resin in the laboratory [Figure 6d]. The interim crown was screwed onto the implant [Figure 6e].

DISCUSSION

All the screw-retained interim restorations were replaced with functional definitive restorations after 4–6 months of osseointegration period. All provisional crowns revealed esthetically pleasing peri-implant mucosal contour without any clinically evident difference between any 2 techniques [Table 1]. Even though all patients were treated by partial extraction therapy,^[12,13] the restorative techniques remain the same for conventional extraction and immediate implants placement (with or without bone grafts). The advantages and limitations of each technique are summarized in Table 1. Anterior tooth extractions typically require the execution of single-unit prostheses using composite resins or polymers like Bisacryl resins. In the first technique, the putty index was used to copy the external surface form of the crown. In situations of damaged crown structure, a waxed-up cast can be used to prepare the index. The use of thermoformed sheet can be another alternative option for the putty index [Table 1]. However, it needs an extra step of fabrication of a stone cast for the adaptation of the thermoformed sheet. The second technique utilized a polycarbonate shell

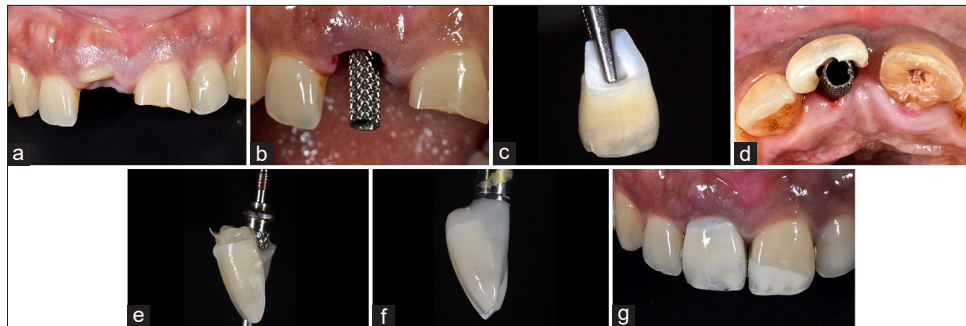


Figure 5: (a), Pretreatment intraoral view indicating fractured tooth at the gingival level. (b), Immediate implant placed along with screw-retained interim abutment. (c), Coronal portion of patient's fractured natural tooth. (d), Natural crown portion and interim abutment adjusted. (e), Picked-up unfinished crown. (f), Finished and polished crown. (g), Posttreatment view

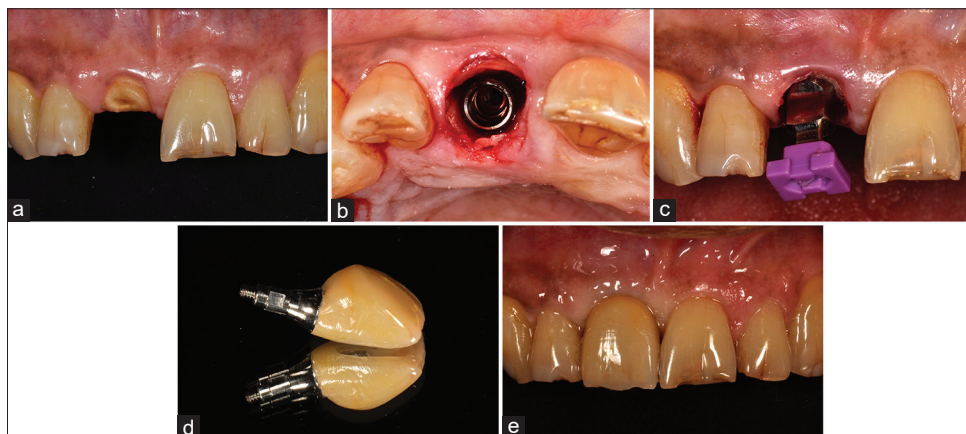


Figure 6: (a), Pretreatment intraoral view indicating fractured tooth at the gingival level. (b), Immediate implant placed. (c), Impression coping placed. (d), Finished and polished crown fabricated completely in lab. (e), Posttreatment view

Table 1: Different techniques used to fabricate interim restorations onto immediate implants with their alternatives, advantages, and limitations

Techniques used	Alternative techniques or materials	Advantages	Limitations
Technique 1: Putty index and Bisacryl resin	Thermoformed template	Quick Transparent with good visibility during pick up of interim restoration	No visibility during pick up of interim restoration Need waxed-up cast if tooth anatomy not intact Need duplicated cast to adapt the thermoformed sheet
Technique 2: Polycarbonate shell crown with Bisacryl resin	With flowable composite resin Cellulose-acetate crown forms	Quick Varieties of sizes and shapes available Well finished and polished surface	Need to keep in stock Need careful finishing
Technique 3: Prosthetic crown conversion		Esthetic Quick	Need to keep in stock Limited sizes or shapes available
Technique 4: Laminate veneer conversion		Esthetic Quick	Limited to the specific patient who need extraction of tooth with prosthetic crown
Technique 5: Natural crown conversion		Esthetic Quick	Limited to the specific patient who need extraction of tooth with the veneered crown
Technique 6: Lab fabricated or Indirect		Reduced chair time Well-formed, finished, and polished restoration	Limited to specific patient who needs extraction of tooth with natural crown Need additional impression procedure Cannot be immediately restored need to wait for consuming Lab cost involved

crown, available in stock. Alternately transparent flexible Cellulose-Acetate crown forms can be used. These crown forms need to be removed after polymerization.

The resin-based interim restorative materials, however, may not always provide promising esthetic results. Use of patient's original crown portion, (natural crown or restored either with prosthetic crown or laminate), if can be used, may provide good esthetic results as the original tooth shape and color is maintained.^[11] This may also boost the patient's confidence. The use of coronal portions of patients' original teeth has been utilized for immediate implant interim restorations in technique 3 (with all-ceramic crown), technique 4 (with veneered crown), and technique 5 (with natural crown). Excellent esthetic results were achieved, and patients left home with their own original coronal portion fixed onto the implants. In some clinical situations, the patient can return for the interim restoration within 24–72 h after surgery and thus, the laboratory fabricated interim restoration can be planned. The laboratory fabricated interim crown was described in technique 6 that has provided excellent esthetic results [Figure 6e].

The alternative options to the fixed interim restorations could be any of the following including the removable partial dentures, Essix retainers, or bonding the resin-tooth to adjacent teeth. However, to maintain the hard and soft tissue form and esthetics, fixed interim restoration can be preferred. The cement-retained implant interim restorations can also be used alternatively. However excessive cement, if logged in the crestal region, could be potential irritant to the healing tissues. Occlusal

consideration is an integral parameter of any implant treatment. This becomes even more critical especially with the maxillary anterior region as the contours of are important aspect of the anterior guidance in mandibular movements.

Partial extraction therapy was used to treat all six patients.^[12,13] Recent developments involving partial root retention minimize the negative effects of extraction and offer enhanced buccal tissue contour in these cases.^[13] However, each step of the treatment from tooth extraction to the definitive restoration should be performed meticulously to achieve a good esthetic outcome. One of the most critical parameters in immediate implant placement is primary stability. Fixed interim restoration can only be tried in situations where the primary stability of the implant is in clinically acceptable limits (usually more than 35 NCm). The selection of relatively longer implants may facilitate increasing primary stability in such situations. In most of the patients described, we have used 15 mm length of the implants for the same reason.

SUMMARY

This report demonstrated six techniques using screw retained immediate interim restorations following partial extraction therapy and immediate implant placement. The fabrication techniques have utilized a putty index, polycarbonate shell crown, patients' existing crowns (prosthetic or natural), or laminate veneer or fabricated in the laboratory based on the specific clinical situations. Excellent esthetic results were obtained in all six patients treated.

Declaration of patient consent

The authors declare that they have obtained consent from patients. Patients have given their consent for their images and other clinical information to be reported in the journal. Patients understand that their names will not be published and due efforts will be made to conceal their identity but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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