

Indirect Implant-Supported Fixed Provisional Restoration in the Esthetic Zone: Fabrication Technique and Treatment Workflow

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ABSTRACT

Treatment objectives of an implant-supported fixed provisional restoration include shaping/preservation of the gingival soft tissue contour, functional and esthetic substitution of the missing dentition during postsurgical healing, and definitive prosthesis fabrication stages. Fixed provisional restoration can also serve as an esthetic and functional blueprint in the fabrication of the definitive restoration. Despite its common use and important indications, limited information is available on the various aspects of the provisional fabrication and treatment. This article presents a production technique and treatment workflow of a laboratory-fabricated, screw-retained fixed provisional restoration. Provisional restoration is fabricated using layering technique and internal stain characterization. The soft tissue profile of the working cast is modified according to the coronal contour of the diagnostic wax-up. Upon delivery, the provisional contour is reevaluated and modified as necessary. The developed emergence profile of the provisional restoration is transferred to the master cast via customized impression copings.

CLINICAL SIGNIFICANCE

Laboratory-fabricated implant-supported provisional restorations allow the esthetic and functional substitution of the missing dentition and the shaping of the soft tissue profile, and can act as a blueprint in the fabrication of definitive restorations.

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INTRODUCTION

Dental implants are routinely utilized for the support of fixed restorations in the replacement of missing and hopeless single and multiple teeth.^{1–8} It is

evident that this treatment approach allows restoration of the integrity of the dental arch, occlusal stability for the opposing arch, restoration of masticatory function, speech and esthetic substitution of the missing dentition.

Widespread acceptance of implant-supported restorations is based on their excellent success rate and several principal advantages over the tooth-borne fixed and removable treatment alternatives.^{1–8} These advantages include

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preservation of the integrity of the adjacent teeth, long-term stability of the remaining alveolar bone and overlying soft tissues, and excellent patient compliance.^{3,4,6-10}

Replacement of missing and hopeless teeth with implant-supported fixed restorations in the esthetic zone is a complex treatment.¹¹⁻¹³ It consists of a number of common treatment steps that include implant site development, implant placement surgery, provisionalization, and fabrication and maintenance of the definitive restoration.^{12,14} Despite excellent success rates, implant treatment presents with some obvious challenges in the esthetic zone. The common sequelae of tooth loss, which include resorption of the alveolar bone and apical migration of the gingival tissues, present a considerable challenge for the attainment of the ideal soft tissue esthetics.^{12,13,15} Potential deficiencies of the soft tissues can range from minor discrepancies to severe defects. Numerous treatment protocols and techniques have been developed to counteract this problem and may include immediate placement and provisionalization of the dental implants, soft and hard tissue augmentation of the edentulous ridge and extraction sites, and orthodontic site development.¹⁶⁻²²

Provisionalization is an integral part of implant treatment in the esthetic zone, and several types of provisional restorations have been described.^{12,14,23} These are soft tissue and/or tooth-supported removable prosthesis, tooth-supported fixed prosthesis, and implant-supported fixed prosthesis. The obvious goals of provisionalization include the esthetic and functional substitution of the missing dentition during treatment.^{12,23} Provisional restorations can also be utilized for the shaping/preservation of the soft tissues in the coronal portion of the peri-implant mucosa.^{14,23-27} Finally, the provisional restoration can also serve the important functions of esthetic and functional prototyping, thus acting as a blueprint in the fabrication of the definitive restoration.^{23,28,29} Selection of a specific type of provisional restoration is based on individual case requirements and chosen treatment plan. It is also obvious that some cases may require several different types of provisional restorations during the course of the treatment.³⁰

Fixed implant-supported provisional restoration is commonly utilized in the esthetic zone.^{14,23,31} In comparison with the other designs, it can fulfill all aforementioned goals of provisionalization. Because of its fixed nature and

implant support, it is an ideal restoration for the shaping of the soft tissue profile and prototyping of the definitive prosthesis. From a treatment sequence point of view, a fixed implant provisional restoration can be placed immediately following implant surgery or in a delayed protocol following appropriate healing time. Implant-supported fixed provisionals can be fabricated in a number of different ways, and several designs and production techniques have been presented in the dental literature.^{23,32-37}

The goal of this article is to present a clinical and laboratory technique for provisional fabrication (Table 1). A screw-retained provisional restoration is fabricated in the laboratory using enamel and dentin layering and internal characterization. The soft tissue profile of the working cast is modified according to the coronal contour of the diagnostic wax-up. Upon delivery, the provisional contour is reevaluated and modified as necessary. The developed emergence profile of the provisional restoration is transferred to the master cast via customized impression copings.

CASE PRESENTATION

A 52-year-old female presented for a prosthodontic rehabilitation of her failing maxillary central incisors (Figures 1 and 21). These

TABLE 1. LABORATORY STEPS IN PROVISIONAL FABRICATION.

- 1. Diagnostic wax-up on the working cast
 - 1.1 Scoring of the gingival outline around the margins of the wax-up
- 2. Duplication of the working cast
 - 2.1 Fabrication of the clear vacuum- and pressure-formed matrix on the duplicate cast
 - 2.2 Fabrication of the silicone putty matrices on the duplicate cast
- 3. Carving of the subgingival soft tissue contour on the working cast
- 4. Preparation of the temporary abutments and seating on the working cast with guide pins.
- 5. Seating of the clear matrix
- 6. Injection of the dentin layer, vacuum, and pressure polymerization
- 7. Dentin cutback and application of the internal stains
- 8. Pressing of the enamel layer with the silicone matrix, vacuum, and pressure polymerization
- 9. Finishing and polishing



Figure 1. Initial presentation, intraoral view.

teeth have been previously treated with root canal fillings, full-coverage ceramometal restorations, and post restoration on the left central incisor. Clinical examination revealed adhesive cement failure between the restorations and the teeth, and root caries at the margins of the restorations. Radiographic evaluation revealed

short roots, periapical pathosis on right central incisor, and uncompromised bone levels. Final treatment plan was prepared following the assessment of the diagnostic information, treatment alternatives, cost considerations, and patient's desires. It included implant replacement of the maxillary central incisors. In regard to the potential

risks associated with the proposed treatment plan, existing clinical presentation was judged as favorable because of the presence of uncompromised gingival and bony topography, thick flat periodontal biotype, and low lip line during maximum smile (Figure 2).

The planned prosthetic design included single screw-retained ceramometal restorations. The proposed treatment sequence included immediate implant placement protocol. For the provisionalization and loading of the implants, it was decided to utilize a delayed treatment protocol. In preparation for the implant surgery, an interim acrylic removable appliance and a clear vacuum-formed surgical template were fabricated on the maxillary diagnostic cast.

Care was taken to ensure atraumatic extractions of the incisors at the time of implant surgery. Standard 4-mm-diameter, internal connection-type implants were placed immediately following teeth extractions. Implant placement was facilitated with the help of a surgical template, and good primary stability of the implants was achieved. For the preservation of the soft tissue profile and sealing of the sockets, custom healing abutments were fabricated in the following manner. Engaging, two-piece titanium temporary



Figure 2. Initial presentation, smile view.



Figure 3. Patient presentation following postsurgical healing.

abutments were seated on the implants, and a flowable-type composite was injected into the socket to fill the space between the abutments and the soft tissue. Following light-polymerization, the healing abutments were removed for finishing and polishing. The height of abutments was adjusted so their occlusal surface was flush with the tissues. Upon abutment seating, an interim denture was delivered to the patient. The intaglio surface of the denture was relieved in the area of the healing abutments. This portion of the denture was relined with a soft tissue conditioning material. No complications were encountered during the surgical stage of the treatment. Three months following implant surgery, and upon successful confirmation of the osseointegration, the patient presented for the fabrication of the provisional restorations (Figure 3).

FIXED PROVISIONAL RESTORATION

Pickup-type impression copings were attached to the implants, and complete seating of the copings was verified with a peri-apical radiograph. Implant-level impression was taken with a combination of a high-viscosity polyvinylsiloxane placed into the stock tray and a light-body polyvinylsiloxane injected around the teeth and impression copings. The series of intraoral and smile photographs was taken with the selected shade tabs. In the laboratory, implant analogues were connected to the impression copings. To prevent stone chipping at the time of model separation, a thin film of modeling wax was placed on the subgingival portion of the impression copings. The working cast was poured in type IV dental stone. Mounting and articulation of the casts on a

semiadjustable articulator was carried out using standard prosthodontic protocols.

For the stability of the diagnostic wax-up, an armature-like support was created on the working cast in the area of the missing teeth. Wooden pegs were placed on the implant analogues. They were connected to each other with a braided wire and self-cured acrylic. The stone cast was covered with a layer of wax separator in the area of the missing teeth. The modeling wax was flown into the socket area of the missing teeth (Figure 4). Upon completion of this step, a diagnostic wax-up of the central incisors was completed using standard laboratory protocols. Morphology of the central incisors was developed to complement the tooth form of the adjacent intact anterior teeth. The stone cast in the areas of the facial and

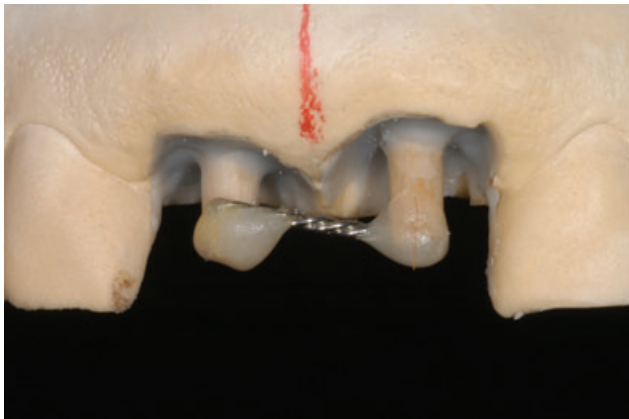


Figure 4. Armature-like support is constructed for the diagnostic wax-up; modeling wax is flown into the socket area of the missing teeth.

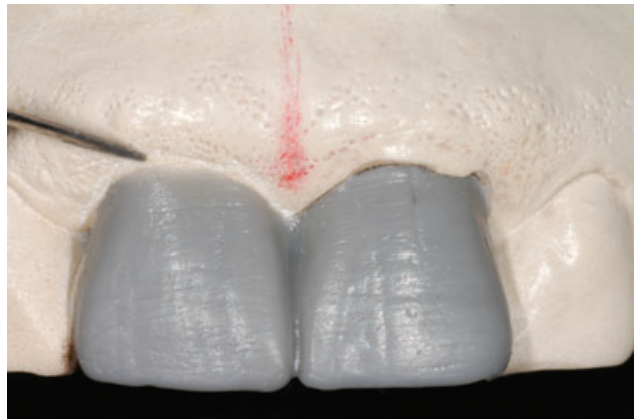


Figure 5. The stone cast is scored in the area of the gingival margins.

lingual gingival margins was scored with a sharp instrument (Figure 5).

The working cast with the completed wax-up was duplicated with the irreversible hydrocolloid impression material. Three matrices were fabricated on the duplicate cast. The first matrix of the whole arch was made from a clear vacuum and pressure-molded material (Copyplast, Scheu-Dental GmbH, Iserlohn, Germany). The other two matrices of the maxillary anterior teeth were made from a combination of low-viscosity polyvinylsiloxane impression material and laboratory putty.

The diagnostic wax-up was removed from the working cast, and stone extensions of the cast above the gingival scoring marks

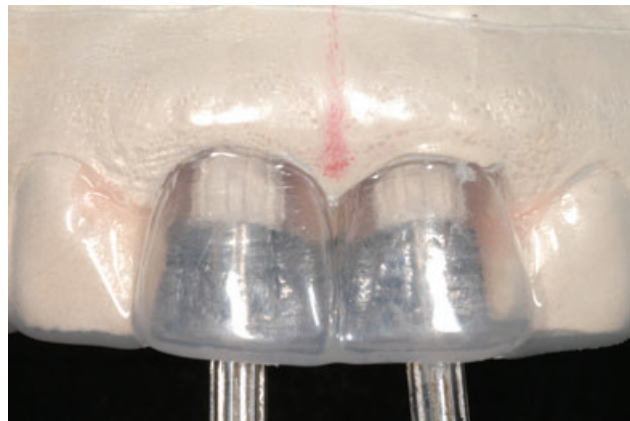


Figure 6. The clear matrix is seated over the guide pins.

were trimmed away in order to create a gradual emergence profile of the crowns. Engaging plastic temporary abutments were utilized in the fabrication of the provisionals. The height of the abutments was shortened so they extend just above the level gingival margins on the stone cast. Temporary abutments were secured on the working

cast with the impression guide pins. The clear matrix was seated over the guide pins on the working cast (Figure 6). The clear matrix was then removed from the cast, and two access holes 1.5 mm in diameter were created in the lingual area of the matrix, one for each missing tooth. The stone cast in the area of the anterior teeth

and guide pins were lubricated with petroleum jelly. The acrylic dentin power and monomer liquid (New Outline, Anaxdent GmbH, Stuttgart, Germany) were mixed together in a mixing cup and loaded into a delivery syringe. The dentin material was injected into the socket areas of the incisors. The clear matrix was immediately seated on the master cast, and resin was injected into the selected access hole of the matrix until it completely filled the areas of the missing incisors. The material was allowed to bench set until it reached a doughy stage. The whole assembly was placed into the chamber of the pressure pot, where it was polymerized following the manufacturer's recommended guidelines.

Upon removal of the clear matrix, the excess dentin material was trimmed away from the provisional

crowns (Figure 7). The outer facial surface of the crowns was cut back by approximately 0.5 to 1.00 mm. A silicone matrix was utilized in order to assure a uniform facial reduction. No incisal cutback was carried out in order to prevent excessive translucency at the incisal aspect of the crowns. Light-polymerized chromatic stains (Creactive, Heraeus Kulzer Inc., Armonk, NY, USA) were applied in the desired facial areas of the crowns (Figure 8). The screw access holes were closed with a block-out wax material. The second silicone matrix was shortened up to the incisal one-third on its lingual aspect in order to allow for the escape of the resin excess. A desired enamel combination (New Outline) was mixed with a monomer liquid until it reached a creamy consistency. The mix was then placed into the silicone matrix in the facial areas of the central

incisors (Figure 9). The silicone matrix with the enamel mix was seated onto the working cast and secured to it with the help of rubber bands. The excess acrylic material, which escaped underneath the matrix on the lingual aspect of the provisional, was removed with a brush. Polymerization was completed in the pressure pot under controlled conditions. The provisional restorations were removed from the cast, and excess acrylic was trimmed away. The provisional crowns were sectioned from each other in the area of the interproximal contact using an ultrathin separating disk. The surface of the crowns was finished and polished (Figure 10).

Provisional restorations were seated intraorally, and soft tissue response was evaluated. Initial soft tissue response included blanching



Figure 7. Provisional restoration before the dentin cutback.



Figure 8. Internal characterization of the dentin.



Figure 9. Enamel mix inside the silicone matrix.



Figure 10. Completed provisional restorations on the working cast.



Figure 11. Provisional restoration immediately following seating.



Figure 12. Smile view with the provisional restorations.

of the gingival tissues (Figure 11). Upon continuous observation, it was noted that the blanching of the tissues was not subsiding. The subgingival contour of the provisional restorations was reduced incrementally until no blanching was further observed. Access holes were closed with a temporary filling material. The patient did not report any complaints at the

24-hour recall appointment, and clinical examination revealed an uneventful soft-tissue healing. The desired emergence profile of the implant crowns was completed at the subsequent recall appointment. Recall appointments were established on a monthly basis, and good soft-tissue maturation was observed around the provisional restorations (Figures 12–14).

Three months from the provisional delivery date, the patient presented for the final impression procedure.

FINAL IMPRESSION AND DEFINITIVE RESTORATIONS

Pickup-type impression copings were customized in order to duplicate the gingival emergence profile



Figure 13. Soft tissue maturation around provisional restorations.



Figure 14. Soft tissue maturation around provisional restorations.

of the provisional. Implant analogues were set into a fast-set stone putty placed inside the medicinal cup. Several millimeters of the coronal portion of the analogues were left uncovered by the stone. The provisional restorations were removed from the mouth and seated on the implant analogues (Figure 15). In order to prevent soft tissue collapse, previously utilized healing abutments were seated intraorally. Low-viscosity polyvinylsiloxane impression material was injected up to the gingival one-third of the provisionals (Figure 16). The provisional crowns were removed and the impression copings were seated on the analogues. Flowable light-polymerized composite was incrementally injected and cured in the space developed by the provisional restorations (Figure 17). Complete seating of the impression copings was verified with a periapical



Figure 15. Provisional restorations seated on the implant analogues.

radiograph (Figure 18). Final impression was taken with a combination of high-viscosity polyvinylsiloxane placed into the stock tray and light-body polyvinylsiloxane injected around the teeth and impression copings. Diagnostic cast of the provisional and smile photographs were also sent to the laboratory.

In the laboratory, the implant analogues were attached to the impression copings and a polyvinylsiloxane soft tissue model was created around the implant analogues. Master cast fabrication and mounting of the models to the semiadjustable articulator were carried out using standard laboratory protocols. Standard laboratory

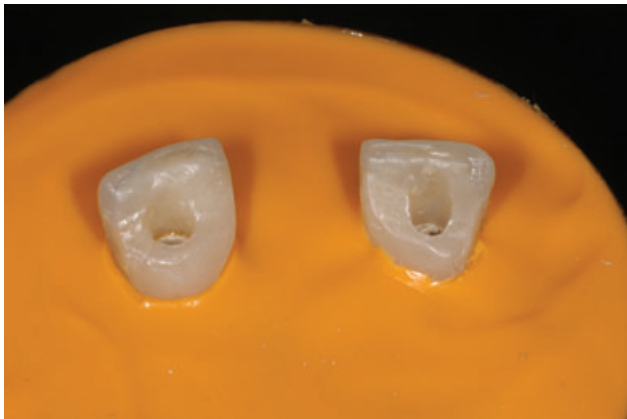


Figure 16. Polyvinylsiloxane material is injected around the provisional restorations.

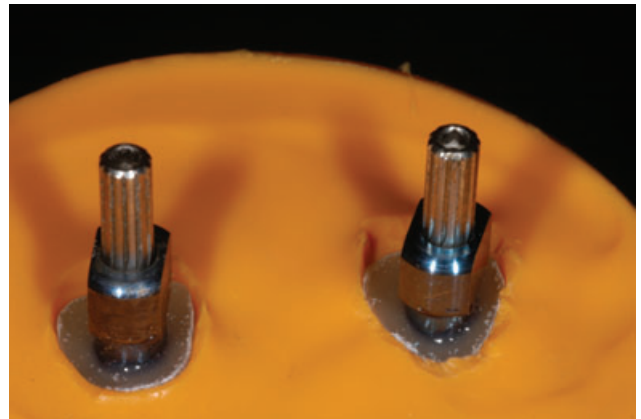


Figure 17. Flowable composite is injected and polymerized in the space developed by the provisional restorations.



Figure 18. Impression copings are seated intraorally.



Figure 19. Definitive ceramometal restorations.

protocols were utilized in the fabrication of individual ceramometal one-piece screw-retained restorations (Figures 19 and 20).

At the delivery appointment, interproximal contacts and occlusion were adjusted as necessary. Complete seating of the restorations was verified with a periapical radiograph (Figure 21). Retaining

screws were tightened to the manufacturer's recommended value, and access holes were closed with restorative composite. Definitive restorations are depicted in Figures 22 and 23.

DISCUSSION

The presented provisional fabrication technique is best applicable to situations of delayed implant

loading. It can be equally utilized for the production of single and multiple splinted or unsplinted units.

Important considerations in the production of the implant-supported fixed provisional include prosthetic design, restorative material choice, and fabrication technique. From the design point of



Figure 20. Definitive ceramometal restorations.

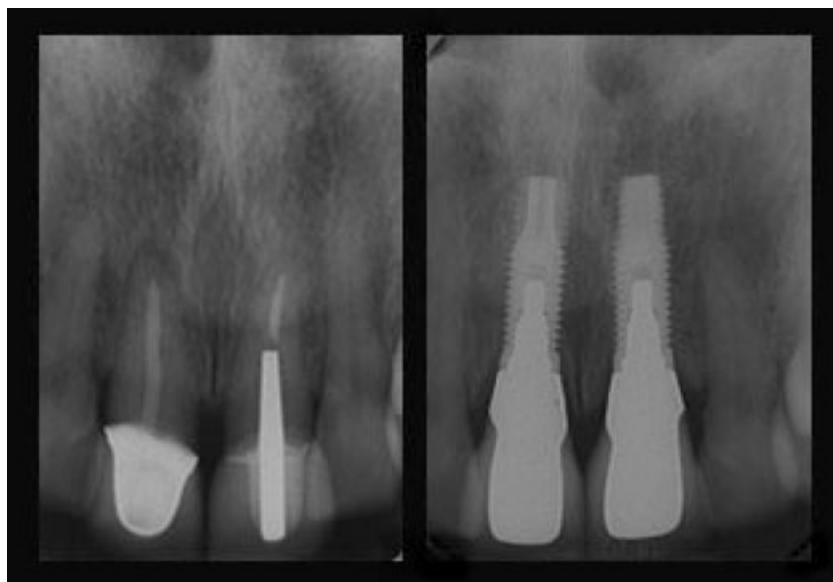


Figure 21. Periapical radiographs before and after completion of the treatment.

view, the most common options include a one-piece screw-retained provisional and a two-piece provisional, which consists of a screw-retained temporary abutment and a cemented temporary crown.^{25,32-37} It appears that both types of

designs can be successfully utilized in the esthetic zone. However, advantages of the one-piece screw-retained provisional include a more simplified design, ease of adjustments, and ease of delivery and retrieval. In addition,

complications of the cemented provisional restoration, such as incomplete removal of the temporary cement and loss of retention of the provisional, are avoided with a screw-retained provisional design. One potential critique of the screw-retained provisional restoration relates to the fact that the retaining screw access hole can compromise the esthetics of the provisional when it emerges through the facial or incisal aspect of the provisional. However, the screw access hole can be easily masked with restorative composite, and the esthetics of the provisional restoration should not be significantly compromised.

The two most common types of materials utilized for the fabrication of a provisional restoration include acrylic and composite resins.^{25,32-37} Both types of materials can be successfully utilized for the provisional fabrication, and the dental literature does not indicate clear clinical superiority of one class of material over the other. It is obvious that a large number of provisional material brands exist in the dental market. However, between the group and within the group, clinical performance data is not available, and it appears that choice of the specific material is empirically based. It should also be noted that enamel and dentin materials for the layering technique are available only with selected



Figure 22. Intraoral view of the definitive restorations.



Figure 23. Smile view of the definitive restorations.

brands of provisional materials. The advantages of the New Outline provisional system include availability of the enamel and dentin shades as well as the fact that the layering technique with this material has been presented in the dental literature.³⁸

Fabrication of an implant-supported fixed provisional restoration can be carried out directly in the mouth or in the dental laboratory in a so-called indirect approach.^{32,34,36,37} Most commonly, for the direct approach, a clear vacuum-formed matrix, silicon matrix, or prefabricated resin shell is filled with a provisional material and relined over the prepared temporary abutment. The main advantage of this approach includes reduced number of clinical and laboratory steps. This approach can also be advantageous in cases of immediate provisionalization

following implant surgery because of the reduced patient-waiting time. Conversely, in the indirect approach, provisional fabrication is outsourced to the dental laboratory. Its obvious disadvantages include additional clinical and laboratory steps and associated laboratory cost. On the other hand, its advantages include a more controlled environment for prosthesis fabrication as well as reduced chair time. The advantages of the indirect approach are especially appreciated in cases where a provisional is fabricated for multiple missing teeth and/or there is a need to create a restoration that closely mimics natural tooth structure.

In the presented approach, enamel and dentin layering in combination with internal stain characterization were utilized in provisional fabrication. The advantages of the

layering technique include detailed reproduction of the tooth shade and tooth characterization.^{38–40} It is especially advantageous in the esthetic zone where adjacent teeth may present with complex characterization. However, for its success, the layering approach requires a detailed understanding of the optical behavior of the utilized materials and is somewhat technique-sensitive.

Optimizations that have been made in order to adapt the layering technique to the implant provisionals include the sequential use of the clear vacuum-formed and silicone matrices. The clear matrix allows for complete and easy seating over the guide pins. In this manner, the provisional restoration can be easily retrieved from the model. The use of a second silicone matrix allows for the precise positioning of the enamel layer. In addition,

this type of matrix can be easily compressed against the stone model in order to prevent overcontouring of the provisional. The access hole channel that emerges through the incisal or the facial aspect of the provisional must be closed with a block-out wax following the completion of dentin cutback and internal staining. Upon completion of the enamel layering, the screw access hole is drilled in the provisional and the location of the access channel is facilitated with a clear matrix. It should also be noted that the presented technique is designed for an autopolymerized acrylic resin material and may not be suitable for other provisional materials.

From the material performance point of view, special considerations should be given to the clinical scenarios where there is a risk of provisional fracture. Potential risk factors may include long-span provisional with several pontics, presence of cantilevers, unfavorable occlusion, among others. If such a risk is identified, reinforcing polymer fibers or metal framework can be incorporated into the provisional restoration.^{41,42}

Standard impression coping, which is circular in its diameter, does not mimic the ovoid root of the natural tooth. In addition, impression coping size in its horizontal cross section is usually smaller in

comparison with the natural tooth. Upon placement of the impression coping in the mouth, soft tissue quickly adapts to its contours. When transferred to the laboratory, the resultant soft tissue profile does not correspond to the desired emergence profile of the provisional restoration. Therefore, it is developed via modification of the working cast, as described in the article. For the fabrication of the definitive restoration, the developed emergence profile of the provisional is transferred to the laboratory via customization of the standard impression coping. This approach has been well presented in the dental literature, and the described technique yields an accurate duplication of the subgingival emergence profile on the master cast.^{25,37}

CONCLUSION

A fabrication technique and treatment workflow of a laboratory-fabricated implant-supported fixed provisional restoration is presented in the article. Provisional design is carried out as a one-piece screw-retained prosthesis. The provisional is fabricated using enamel and dentin layering in conjunction with an internal stain characterization. The soft tissue profile of the working cast is modified according to the coronal contour of the diagnostic wax-up. The developed emergence profile of the provisional restoration is transferred to

the master cast via customized impression copings.

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REFERENCES

1. Lekholm U, Gunne J, Henry P, et al. Survival of the Branemark implant in partially edentulous jaws: a 10-year prospective multicenter study. *Int J Oral Maxillofac Implants* 1999;14(5):639–45.
2. Naert I, Koutsikakis G, Duyck J, et al. Biologic outcome of implant-supported restorations in the treatment of partial edentulism. Part I: a longitudinal clinical evaluation. *Clin Oral Implants Res* 2002;13(4):381–9.
3. Naert I, Koutsikakis G, Duyck J, et al. Biologic outcome of implant-supported restorations in the treatment of partial edentulism. Part 2: a longitudinal radiographic study. *Clin Oral Implants Res* 2002;13(4):390–5.
4. Lekholm U, Grondahl K, Jemt T. Outcome of oral implant treatment in partially edentulous jaws followed 20 years in clinical function. *Clin Implant Dent Relat Res* 2006;8(4):178–86.
5. Romeo E, Lops D, Margutti E, et al. Long-term survival and success of oral implants in the treatment of full and partial arches: a 7-year prospective study with the ITI dental implant system. *Int J Oral Maxillofac Implants* 2004;19(2):247–59.
6. Naert I, Koutsikakis G, Duyck J, et al. Biologic outcome of single-implant

- restorations as tooth replacements: a long-term follow-up study. *Clin Implant Dent Relat Res* 2000;2(4):209–18.
7. Gotfredsen K. A 5-year prospective study of single-tooth replacements supported by the Astra Tech implant: a pilot study. *Clin Implant Dent Relat Res* 2004;6(1):1–8.
8. Moberg LE, Kondell PA, Kullman L, et al. Evaluation of single-tooth restorations on ITI dental implants. A prospective study of 29 patients. *Clin Oral Implants Res* 1999;10(1):45–53.
9. Krennmair G, Piehslinger E, Wagner H. Status of teeth adjacent to single-tooth implants. *Int J Prosthodont* 2003;16(5):524–8.
10. Pjetursson BE, Karoussis I, Burgin W, et al. Patients' satisfaction following implant therapy. A 10-year prospective cohort study. *Clin Oral Implants Res* 2005;16(2):185–93.
11. Belser U, Buser D, Higginbottom F. Consensus statements and recommended clinical procedures regarding esthetics in implant dentistry. *Int J Oral Maxillofac Implants* 2004;19(Suppl):73–4.
12. Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. *Int J Oral Maxillofac Implants* 2004;19(Suppl):43–61.
13. Belser UC, Schmidt B, Higginbottom F, Buser D. Outcome analysis of implant restorations located in the anterior maxilla: a review of the recent literature. *Int J Oral Maxillofac Implants* 2004;19(Suppl):30–42.
14. Sadan A, Blatz MB, Salinas TJ, Block MS. Single-implant restorations: a contemporary approach for achieving a predictable outcome. *J Oral Maxillofac Surg* 2004;62(9 Suppl 2):73–81.
15. Grunder U, Gracis S, Capelli M. Influence of the 3-D bone-to-implant relationship on esthetics. *Int J Periodontics Restorative Dent* 2005;25(2):113–9.
16. Wöhrle PS. Single-tooth replacement in the aesthetic zone with immediate provisionalization: fourteen consecutive case reports. *Pract Periodontics Aesthet Dent* 1998;10(9):1107–14.
17. Kan JY, Rungcharassaeng K, Lozada JL. Immediate placement and provisionalization of maxillary anterior single implants: 1-year prospective study. *Int J Oral Maxillofac Implants* 2003;18(1):31–9.
18. Kan JY, Rungcharassaeng K, Lozada JL. Bilaminar subepithelial connective tissue grafts for immediate implant placement and provisionalization in the esthetic zone. *J Calif Dent Assoc* 2005;33(11):865–71.
19. Nasr RF. Current methods for soft tissue enhancement in the esthetic zone. *Atlas Oral Maxillofac Surg Clin North Am* 2006;14(1):39–49.
20. Becker W, Dahlin C, Lekholm U, et al. Five-year evaluation of implants placed at extraction and with dehiscences and fenestration defects augmented with ePTFE membranes: results from a prospective multicenter study. *Clin Implant Dent Relat Res* 1999;1(1):27–32.
21. Hernandez-Alfaro F, Pages CM, Garcia E, et al. Palatal core graft for alveolar reconstruction: a new donor site. *Int J Oral Maxillofac Implants* 2005;20(5):777–83.
22. Gonzalez Lopes S, Olmedo Gaya MV, Vallecillo Capilla M. Esthetic restoration with orthodontic traction and single-tooth implant: case report. *Int J Periodontics Restorative Dent* 2005;25(3):239–45.
23. Priest G. Esthetic potential of single-implant provisional restorations: selection criteria of available alternatives. *J Esthet Restor Dent* 2006;18(6):326–38.
24. Phillips K, Kois J. Aesthetic peri-implant site development. The restorative connection. *Dent Clin North Am* 1998;42(1):57–70.
25. Gamborena I, Blatz MB. Transferring the emergence profile of single-tooth implant restorations. *Quintessence Dent Technol* 2004;27:119–31.
26. Kinzer GA, Kokich VO Jr. Managing congenitally missing lateral incisors. Part III: single-tooth implants. *J Esthet Restor Dent* 2005;17(4):202–10.
27. Kois JC, Kan JY. Predictable peri-implant gingival aesthetics: surgical and prosthodontic rationales. *Pract Periodontics Aesthet Dent* 2001;13(9):691–8.
28. Donovan TE, Cho GC. Diagnostic provisional restorations in restorative dentistry: the blueprint for success. *J Can Dent Assoc* 1999;65(5):272–5.
29. Magne P, Magne M, Belser U. The diagnostic template: a key element to the comprehensive esthetic treatment concept. *Int J Periodontics Restorative Dent* 1996;16(6):560–9.
30. Kan JY, Rungcharassaeng K, Oyama K, et al. Computer-guided immediate provisionalization of anterior multiple adjacent implants: surgical and prosthodontic rationale. *Pract Periodontics Aesthet Dent* 2006;18(10):617–23.
31. Lindeboom JA, Frenken JW, Dubois L, et al. Immediate loading versus immediate provisionalization of maxillary single-tooth replacements: a prospective randomized study with BioComp implants. *J Oral Maxillofac Surg* 2006;64(6):936–42.
32. Priest G. Developing optimal tissue profiles implant-level provisional restorations. *Dent Today* 2005;24(11):96,98,100.
33. Tselios N, Parel SM, Jones JD. Immediate placement and immediate provisional abutment modeling in anterior single-tooth implant restorations using a CAD/CAM application: a clinical report. *J Prosthet Dent* 2006;95:181–5.
34. Ganddini MR, Tallents RH, Ercoli C, Ganddini R. Technique for fabricating a cement-retained single-unit implant-supported provisional restoration in the esthetic zone. *J Prosthet Dent* 2005;94(3):296–8.
35. Mitrani R, Phillips K, Kois JC. An implant-supported, screw-retained, provisional fixed partial denture for pontic site enhancement. *Pract Periodontics Aesthet Dent* 2005;17(10):673–8.
36. Leziy SS, Miller BA. Developing ideal implant architecture and pontic site. *Quintessence Dent Technol* 2007;30:143–53.
37. Shor A, Janakievski J, Heindl H. Implant replacement of the maxillary central incisor: clinical and laboratory technique. *Pract Periodontics Aesthet Dent* 2006;18(10):633–5.

38. Magne M, Magne P, Cascione D, Munck I. Optimized laboratory-fabricated provisionals. *Dent Dialogue* 2006;5(2):68–76.
39. Dietschi D. Layering concepts in anterior composite restorations. *J Adhes Dent* 2001;3(1):71–80.
40. McLaren EA. The skeleton buildup technique: a systematic approach to the three-dimensional control of shade and shape. *Pract Periodontics Aesthet Dent* 1998;10(7):587–97.
41. Vallittu P. Flexural properties of acrylic resin polymers reinforced with unidirectional and woven glass fibers. *J Prosthet Dent* 1999;81(3):318–26.
42. Uzun G, Keyf F. The effect of fiber reinforcement type and water storage on strength properties of a provisional fixed partial denture resin. *J Biomater Appl* 2003;17(4):277–86.

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