Provisional Restorations for Optimizing Esthetics in Anterior Maxillary Implants: A Case Report

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ABSTRACT

The use of implants for the restoration of anterior missing teeth has been established and documented during the past years. However, the use of dental implants in the anterior region is a technique-sensitive procedure. The placement of implants in an ideal position is often not possible because of the lack of sufficient bone. The clinical situation can be further complicated if the teeth were lost as a result of trauma and there is possible damage to the surrounding soft and hard tissues. The restoration of lost anterior teeth and maintenance of the surrounding soft tissues with adequate surgical and prosthetic techniques are a real challenge for the clinician. The aim of this article was to report the laboratory and clinical stages in the restoration of anterior maxillary teeth, which were lost as a result of trauma with implant-supported fixed partial denture. In this case, an intraoperative transfer of the impression posts allowed the construction of provisional restorations, which were inserted at implant uncoverage surgery and contributed significantly to the creation of a better emergence profile and to the final esthetic result.

CLINICAL SIGNIFICANCE

Provisional restorations are an important stage in anterior maxillary implants, allowing guided soft tissue management and creating an esthetic emergence profile.

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INTRODUCTION

The use of implants for the restoration of anterior missing teeth has been established and documented during the last years.¹⁻⁵ Implant restorations are a challenging option for the dentist and the patient because the preparation of adjacent teeth can be avoided. However, the use of dental implants in the anterior region is a technique-sensitive procedure.

The placement of implants in a prosthetically ideal position is often not possible because of the lack of sufficient bone. The clinical situation can be further complicated if the teeth were lost as a result of trauma and there is possible damage to the surrounding soft and hard tissues. An esthetic result must be achieved for the teeth and the soft tissues in order to fulfill the esthetic demands of the patient.^{6–8}

The restoration of lost anterior teeth and maintenance of the surrounding soft tissues with adequate surgical and prosthetic techniques

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AIM

The aim of this clinical article was to report the laboratory and clinical stages in the restoration of anterior maxillary teeth, which were lost as a result of trauma, with an implantsupported fixed partial denture (FPD).

CASE PRESENTATION

Initial Clinical Examination and Immediate Provisional Restoration A 50-year-old male Caucasian presented for treatment in the Graduate Prosthodontic Clinic of the University of Athens. As a result of trauma from an accident, the upper right central and lateral incisor (teeth #7 and 8) were completely luxated. The upper left central incisor (tooth #9) was partially luxated, but the root remained in the socket (Figures 1–3). As an immediate provisional restoration, the fractured teeth were bonded to the adjacent teeth with photopolymerizing resin to restore the esthetics and phonetics of the patient. A week later a removable partial denture was fabricated as an interim restortion.

Besides the restoration of the lost anterior teeth, the patient consented for a complete prosthetic treatment in the maxilla, as he was not



Figure 1. Initial clinical situation immediately after trauma. Labial view.



Figure 2. Initial clinical situation. Palatal view.



Figure 3. Radiographic examination after trauma. The apex of the upper left central incisor is left in the alveolar socket.

satisfied with the esthetic appearance of his anterior maxillary teeth. The existing restorations (splinted metal-ceramic crowns on the upper left first premolar [#12] with the second upper left premolar [#13] as a cantilever, FPD on teeth #2–6) showed marginal gaps and should be replaced. The upper left lateral incisor (#10) and the adjacent canine (#11) showed cervical abfractions that had been repeatedly restored (Figures 3–6).

Initial Clinical Steps

Thirty days after the trauma, the soft tissues appeared healthy without any sign of inflammation. Initial alginate impressions were made for the construction of study casts. Face-bow registration transfer was obtained for the mounting of the maxillary cast. A centric relation registration was used for the mounting of the mandibular cast. The centric relation record was taken with an anterior deprogrammer made of acrylic resin (Pattern Resin, GC Co., Tokyo, Japan) and bite registration material (Blue Mousse, Parkell Co., Edgewood, NY, USA).

The casts were mounted on a semiadjustable articulator (Hanau H2, Teledyne Co., Fort Collins, CO, USA) and a full diagnostic wax-up was done for all maxillary teeth (Figure 7).

Radiographic Examination Besides the initial dental radiography, a complete radiographic exam-



Figure 4. Clinical situation 1 month after trauma. Palatal view.



Figure 5. Existing restorations. Buccal view.



Figure 6. Existing restorations. Buccal view.



Figure 7. Diagnostic wax-up of all maxillary teeth.

ination was performed. From the diagnostic wax-up a provisional restoration was fabricated from autopolymerizing acrylic resin (Dentalon Plus, Kulzer Co., Werheim, Germany), and guttapercha points were inserted along the teeth axes. This restoration was used as a radiolographic splint for presurgical panoramic and computer tomography (CT) scan radiographies.

Treatment Planning Presurgical Steps

- preparation of all existing maxillary teeth (#3, 6, 10, 11, 14) and placement of a provisional restoration (FPD) made of acrylic resin
- placement of two implants in the regions of the upper right lateral incisor and the upper left central incisor (teeth #7, 9)
- 3. intraoperative transfer of the impression posts

During the Osseointegration Period

- application of guided pressure on soft tissues during the osseointegration period
- fabrication of provisional implant abutments and implant-supported FPD (#7–9)

Implant Uncoverage and Soft Tissue Healing Period

 implant uncoverage and immediate placement of implantsupported provisional restoration; soft tissue graft in the pontic area (#8)

- 2. soft tissue contouring during the healing period with guided pressure from the provisional restorations
- correction/replacement of provisional abutments and restorations with adequate guided soft tissue management

Final Steps

 construction of the final restorations on teeth and implants

Treatment Steps Teeth Preparation

All maxillary teeth were prepared at the same session with a circumferential chamfer. Provisional restorations were fabricated from autopolymerizing resin (Dentalon Plus, Kulzer Co.) with the direct technique using a thermoplastic sheet (Omnivac Sheet, Essix Machine, Essix Raintree Co., New Orleans, LA, USA) from the diagnostic wax-up (Figure 8). The root apex of the maxillary left central incisor (#9) was left in place to be extracted during implant placement.

Fabrication of Surgical Guide and Transfer Splint

After the preparation of the maxillary teeth, an alginate impression was made and a gypsum cast was poured. On this cast a vacuumformed polypropylene matrix (Omnivac sheet) was applied, which was made as a duplicate of the wax-up. Into the matrix, toothcolored autopolymerizing resin was poured and the matrix was pressed on the cast of the prepared teeth in order to fabricate a surgical guide (splint). This way the exact fit of the surgical splint on the prepared teeth was ensured. The matrix was cut to fit on the prepared teeth and guiding grooves were opened on the palatal surfaces of teeth #12 and 21.



Figure 8. Provisional restorations on all maxillary teeth.

As an intraoperative transfer of the impression posts was planned, a transfer splint from autopolymerizing resin (Pattern Resin) was also fabricated on the cast of the prepared teeth, to allow the transfer of the implant position and inclination immediately after implant placement with open flaps. The transfer splint should fit precisely on the adjacent teeth and two sufficient openings were left above the intended implant sites (Figure 9).

Implant Placement

Two weeks after teeth preparation, two implants (Frialit 2, Denstply–Friadent Co., Mannheim, Germany) were inserted at the extraction sockets of teeth #7 (diameter = 3.8 mm/ length = 15 mm) and #9 (diameter = 5.5 mm/ length = 15 mm) after raising the full thickness flap and careful atraumatic extraction of root apex #8. The implant positions and inclinations were guided by the surgical splint. The initial stability of the implants was verified with a torque-control device (Friadent surgical unit, Dentsply–Friadent Co.) and exceeded 35 Ncm.

Two impression posts of the corresponding diameter were mounted on the implants with long fixing screws. The impression posts were attached on the transfer splint with autopolymerizing resin (Pattern Resin), avoiding contact of the resin with the implant surface (Figure 10). Alternatively, a photopolymerizing flowable composite material could have been used. The fixing screws were loosened and the transfer splint was removed from the implants, with the impression posts retained on it. The implants were covered with the corresponding cover screws and the flap was sutured.

Fabrication of Implant-Supported Provisional Restorations

After implant placement and during the osseointegration period the laboratory steps for the fabrication of the provisional restorations were accomplished. The transfer splint with the impression posts was fitted on the cast of the prepared teeth after removing gypsum at the implant sites.

Two laboratory analogs of the corresponding diameter were fixed on the impression posts with the long screws and gypsum was added around the implant analogs. The labial side of the cast around the implants was formed according to the ideally desired emergence profile, and a new wax-up was performed (Figure 11).

Two provisional abutments (Protect abutments, Dentsply–Friadent Co., Mannheim, Germany) were fitted



Figure 9. The transfer splint made from autopolymerizing resin.



Figure 10. The impression posts attached on the transfer splint immediately after implant insertion.

on the implant analogs and were modified according to the desired restoration contour with silicone partial impressions (silicone keys) from the wax-up (Figure 12). On the provisional implant abutments a cement-retained provisional restoration (FPD) was fabricated.

In order to improve the esthetic appearance and minimize plaque accumulation, the labial side of the restoration was formed by using veneers from acrylic denture teeth. The veneers were attached on a silicone partial impression (silicone index) from the wax-up and the restoration was completed with heat-polymerizing acrylic resin (Figure 13).

The use of prefabricated acrylic veneers for the construction of provisional restorations is definitely a technique-sensitive and time-consuming procedure, but improved esthetic performance can be thus achieved, compared with the use of only heat-polymerizing resin. New provisional restorations were also constructed in the laboratory for the rest of the maxillary teeth.

Osseointegration Period and Implant Uncoverage

During the osseointegration period, guided pressure was applied on the soft tissues above the implants in order to enhance the formation of



Figure 11. The new diagnostic wax-up made with prefabricated veneers from acrylic denture teeth.



Figure 12. The working cast with the provisional plastic abutments and a silicone index from the new diagnostic wax-up.



Figure 13. The acrylic veneers fixed on a silicone index from the wax-up. The provisional implant-supported restoration will be fabricated from heat polymerized resin with this silicone index.



Figure 14. The soft tissue condition after guided pressure during the osseointegration period.

interdental papillae (Figure 14). The patient was examined at weekly recalls. The provisional restoration was removed and acrylic resin was added under the pontic and on the interdental areas. The restoration was fitted on the prepared teeth, and slight ischemia was caused on the soft tissues. The amount of added resin was considered adequate if the color of soft tissues returned to normal after 5 minutes of guided pressure.

The implant uncoverage procedure was initially planned to be accomplished with the use of a tissue punch, without raising a flap, thus avoiding the distraction or deformation of regenerated soft tissues.

Four months after implant insertion, the interdental papillae were formed successfully, but a horizontal soft tissue deficiency was noted at the pontic area (tooth #8). For this reason a partial thickness flap was raised for implant uncoverage. A free gingival connective tissue graft harvested from the palate was inserted in region #8 to increase tissue volume.

The provisional abutments were fixed on the implants with fixation screws, and the provisional restoration was cemented on the implant abutments with temporary cement (Temp-Bond, Kerr Hawe Co., Bioggio, Switzerland) (Figure 15). The excess cement was removed before suturing to avoid any possible tissue irritation. The flap was adapted on the provisional restoration and sutured (Figure 16).

Soft Tissue Healing

The healing of soft tissues was uneventful, but tissue shrinkage was obvious 4 weeks after secondstage surgery (Figure 17). In order to stabilize the soft tissue contour on the existing clinical situation, a new provisional restoration on new abutments was considered as necessary. An impression of the implants



Figure 15. The provisional abutments fixed on the implants at the uncoverage surgery.



Figure 16. The provisional restoration on the provisional abutments after soft tissue grafting and suturing.



Figure 17. Soft tissue condition 4 weeks after implant uncoverage.

was made with an addition-type vinyl-polysiloxane impression material (Relay, Tissy Dental Co., Milan, Italy) using the impression posts (De Trey/Friadent Co., Mannheim, Germany) of the corresponding diameter (Figure 18).

A working cast was poured from extra-hard stone material with a gingival mask (soft tissue mask), reproducing the exact soft tissue condition. The gingival mask was modified by trimming to the desired shape according to the intended emergence profile (Figure 19).

The new provisional abutments (Tempbase abutment made of titanium, provided by the manufacturer for the implant insertion) were used instead of the previously used plastic abutments and were modified with photopolymerizing resin in order to support the peri-implant tissues with guided pressure (Figure 20). A new cementretained provisional FPD was fabricated on the modified temporary implant abutments (Figure 21).

The new provisional restoration was placed on the implants and guided pressure was applied in the interdental areas in order to enhance the regeneration of the papillae (Figure 22). The patient was examined at weekly recalls for a period of 6 weeks. In each recall



Figure 18. An impression is made for the fabrication of new provisional restoration.



Figure 19. The soft tissue masque is trimmed to the desired shape.



Figure 20. The metal-reinforced provisional abutments are modified in the cervical area with flowable photopolymerizing resin.



Figure 21. The new modified provisional abutments fixed on the implants.

session, photopolymerizing resin was added in the interdental and in the pontic areas in order to reform the papillae with guided pressure.

Construction of the Final Restoration

After stabilization of the soft tissues (Figure 23), a final impression was made with an addition-type

polyvinyl-siloxane impression material and the final metal-ceramic restorations were fabricated (Figures 24–26). The final restoration included independent cementretained FPDs on the implants and on the remaining teeth. The total treatment time was 9 months, and the final result fulfilled the patient's functional requirements and esthetic expectations and remained stable, as verified at the regular 6-month recalls (Figures 27–29).

DISCUSSION

The restoration of anterior maxillary implants often requires soft tissue management in order to improve the esthetic result.^{17,18} Prosthetic ally-driven implant placement facilitates the integration



Figure 22. The new provisional restoration immediately after insertion. Note the difference of the soft tissue contour as it was created with the former restoration.



Figure 23. Soft tissue condition after healing period of 4 weeks and before the final impression.



Figure 24. The metal framework try-in.



Figure 25. The final restoration after insertion in the mouth.



Figure 26. The final restoration after insertion in the mouth.



Figure 27. The final restoration and the soft tissue condition at the first-year recall. A stable clinical result.



Figure 28. The final restoration and the soft tissue condition at the first-year recall. A stable clinical result.



Figure 29. The final restoration and the soft tissue condition at the first-year recall. A stable clinical result.

and harmonization of the restoration with the adjacent teeth.¹⁹

The placement of implants 6 weeks after tooth extraction (or traumatic loss, as in this case) prevents resorption of the alveolar bone with adequate soft tissue coverage over the extraction sockets.^{20,21} In this case, the extraction of the root apex of tooth #9 was performed at the same time of implant placement in this site in order to minimize surgical sessions and avoid any further trauma in this area.

The intraoperative transfer of the impression posts offers the possibility of immediate placement of the implant-supported provisional restoration at implant uncoverage, allowing better tissue adaptation during the healing period. A better emergence profile can thus be achieved.^{22,23} For the same reason, guided pressure was applied both during osseointegration and soft tissue healing periods, aiming at the correction of the soft tissue contour.^{24,25}

Further tissue corrections could be achieved by the modification of the implant abutments and the placement of a new provisional restoration.^{26–29} The use of a free gingival

graft at the second-stage surgery facilitates the formation of an attached gingival zone and enhances the creation of the desired emergence profile.^{24,30–32} The interdental contact points, however, must extend apically both in the provisional and the final restoration in order to support the regeneration of the papillae.^{12,24,33,34}

Immediate loading of the implants could have been considered as necessary if the adjacent teeth were intact, and a removable provisional restoration might have caused increased pressure on the periimplant soft tissues.^{35–37} In the present case, however, the delayed loading was considered as the safest approach. The implant uncoverage surgery was also preferred in order to allow proper soft tissue handling.

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