

Immediate Implant Placement, Provisionalization, and Restoration for Single Tooth Replacement

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Background

Age at Initial Presentation: 27

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Active Treatment Completed: April 19, 2006

A female presented to the office with a chief complaint concerning the esthetics of the porcelain-fused-to-metal (PFM) crowns on her maxillary lateral incisors. The objective was to use contemporary materials and techniques to have them blend better with her natural dentition. The PFM crowns had been completed at different times during her life. She said they did not match each other or her adjacent natural tooth structure (Figure 1).

Medical History

The patient was a healthy 27-year-old female with no known medical issues.

Diagnostic Findings

Temporomandibular Joints: Within normal limits (WNL). Upon full opening, the patient's temporomandibular joints (TMJs) were free of any clicking, popping, or crepitus. Her opening path was straight, without deviation to either side.

Extraoral: The perioral presentation in the patient's pretreatment photographic survey revealed average lip dynamics when smiling naturally (Figure 2). However, upon asking the patient to show her "maximum dynamic" smile presentation, she had the capability to exhibit "high lip dynamics," revealing the full vertical dimension of her teeth and the relationship of the dentition with the gingival architecture. Therefore, the patient's treatment plan was approached with an understanding that all her dentition and any dentistry done would be on full display when the patient smiled without inhibition.

Intraoral: Clinically, the patient presented with a minimal amount of posterior restorative dentistry with four conservative amalgam restorations on teeth Nos. 2, 30, and 31. Composite restorations were present on No. 19 (O), and multiple composite restorations were on tooth No. 11. Two areas of decay—No. 6 (mesial interproximal surface) and No. 17 (occlusal fissure)—were evident.

The patient had two PFM crowns on her maxillary lateral incisors that were completed at different times in the early 1990s (13 years earlier).

In general, the patient's periodontal health was excellent. A slight amount of inflammation of the gingival tissues was present around the PFM crowns.

Occlusal Notes

Static Relationships: The occlusion exhibited Class I molar and cuspid relationships bilaterally. The overjet was 2 mm with an overbite of 10%.

When the patient's TMJs were placed in centric relation via bilateral manipulation,^{1,2} the mandible's arc of closure resulted in an occlusal contact posteriorly on the patient's left-side molars. Further closing into maximum intercuspation (MIP) could only occur with a shift of the mandible forward and to the left, approximately 1.5 mm to 2.0 mm (Figure 3). To make the centric relation arc of closure coincident with MIP, selective odontoplasty through equilibration would need to be considered to modify the offending cuspal contours.

Upon mandibular movement from MIP to the patient's right (inside out), anterior guidance was not exhibited and a balancing occlusal contact between contralateral teeth Nos. 15 and 17 was the guiding occlusal contact of the dentition. Wear facets on the second molars confirmed the guidance pattern. Upon mandibular excursion to the patient's left, a group-function working-side relationship was observed with only mild balancing interferences of the right-side second molars.

Functional: Simulated chewing with 200- μ m occlusal paper placed over the anterior teeth yielded no marks or tracks of guidance of the mandibular incisor incisal edges on the lingual surfaces of the maxillary anterior teeth. The patient's limited overbite relationship allowed a fairly unrestricted envelope of function with minimal oppositional forces exerted on the anterior teeth in MIP.

Radiographic Assessment

A full-mouth radiographic survey revealed excellent bone levels periodontally. However, the survey also revealed two areas of major concern:

1. Tooth No. 10 showed root resorption and was being retained by approximately 1 mm to 2 mm of root length and anchorage (Figure 4).

2. Tooth No. 11 pulpal tissue was diagnosed as necrotic because of the radiographic evidence of a chronic periapical abscess.

Diagnosis

Periodontal: AAP type 2

Biomechanical: Tooth No. 10, severe root resorption. Tooth No. 11, necrotic pulp with a chronic periapical abscess. Decay evident on tooth Nos. 6 and 17.

Functional: Dysfunctional occlusion.

Dentofacial: High lip dynamics exposing excellent tooth position and perfect gingival architecture.

Medical: WNL. No complicating issues to dental treatment.

Risk Assessment

Dentofacial: High

Periodontal: Low

Biomechanical: High

Functional: Low

Prognosis

The prognosis for completing the restorative dentistry, including the replacement of the PFM on tooth No. 7 and the implant/crown restoration to replace tooth No. 10, was excellent.

Concerns

The successful restoration of the future edentulous space of No. 10 would require meticulous synergy between the surgeon and restorative dentist to perform dentistry that would not induce physiologic change in the surrounding periodontium. Immediate implant placement and provisionalization would be used to maintain the existing periodontal architecture.³⁻⁶ This would be a major objective, given the high dentofacial risk brought to bear from the high-level lip dynamics. The high lip dynamics would also call for the expertise and skills of a master ceramist to skillfully fabricate dental restorations of the highest order to duplicate the optical metamerisms of the adjacent natural dentition. Presenting an additional challenge, one of the crowns would restore a natural tooth while its contralateral partner would sit upon the abutment of an implant.

Treatment Goals

1. Meet patient's esthetic objectives in replacing the anterior crowns of her maxillary lateral incisors.
2. Eliminate decay through conservative restoration and extraction of tooth No. 17.
3. Establish an occlusal scheme that would allow the patient's TMJs, muscles of mastication, and dentition to work harmoniously. Minor odontoplasty (equilibration) could make MIP and centric relation occlusion coincident.
4. Use interdisciplinary dentistry to complete an implant/crown restoration for terminal tooth No. 10 without changing the surrounding periodontium.
5. Eliminate chronic periapical abscess and sequence treatment to ensure that no residual bacteria could jeopardize the adjacent implant/crown procedure.



Figure 1 Presenting dentition with PFM crowns on teeth Nos. 7 and 10.



Figure 2 Patient smiling "normally" for photographic series.



Figure 3 Frontal view of patient in maximum intercuspation.



Figure 4 Radiograph illustrating root resorption of tooth No. 10 and a chronic periapical abscess of tooth No. 11.

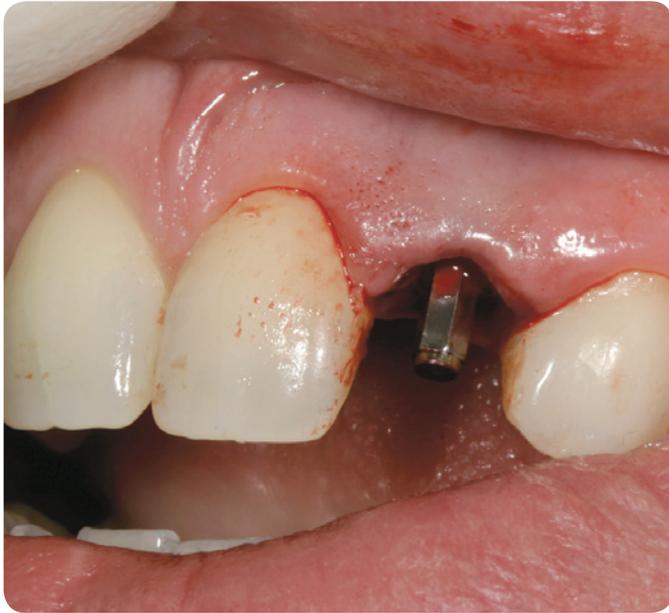


Figure 5 Patient arrived for immediate provisional the same day as implant fixture placement.

Treatment Plan

1. Endodontic treatment of tooth No. 11.
2. Full-mouth bleaching (both maxillary and mandibular arches).
3. Equilibration: laboratory and clinical.
4. Diagnostic wax-up: two units.
5. Surgeon's guide for implant fixture placement.
6. Extraction of teeth Nos. 10 and 17, with immediate implant fixture placement by maxillofacial surgeon.
7. Immediate provisionalization of immediate implant.
8. Restorative treatment: No. 6 (FML) and No. 11 (FML, incisal and lingual surface) direct composites.
9. Prosthodontic elements:
 - a. Crown restoration for natural tooth No. 7.
 - b. One custom abutment and crown restoration for the implant in the position of tooth No. 10.

Phase I: Endodontics

A prerequisite for the successful implant placement to replace tooth No. 10 was the elimination of the chronic

periapical abscess of tooth No. 11. Endodontic therapy was completed immediately to allow the elimination of the lesion and healing of the periapical area.

Two months after the endodontic therapy, the patient presented with swelling and tenderness in the apical area of No. 11. At that time, periapical surgery was undertaken to definitively eliminate the chronic periapical abscess. A semilunar flap was reflected that did not involve the keratinized attached gingiva. Identification of the lesion location was facilitated by a visible perforation of the buccal plate of bone. Access was achieved, the apical lesion was curetted, and an apical retrograde restoration was placed. Subsequent to this procedure, the area healed uneventfully, allowing immediate implant placement for tooth No. 10, 4 months after periapical surgery of tooth No. 11.

Phase II: Laboratory

Additional diagnostic aids for treatment planning and sequencing were obtained during the data collection appointment, which was scheduled after the new patient examination. Data included a photographic series, a maxillary arch registration (face-bow or Kois Dento-Facial Analyzer System [Panadent, Colton, CA]), a centric relation bite registration, and polyvinylsiloxane (PVS) impressions.

Taking study model impressions with PVS allows the fabrication of multiple casts that exhibit definitive first-pour accuracy. From these casts, a multitude of laboratory procedures can be completed after case acceptance, such as laboratory equilibration of the mounted study models, a diagnostic wax-up to visualize the contemplated final prosthodontic result, fabrication of a surgeon's guide, construction of a provisional matrix for direct provisional fabrication, and the fabrication of whitening trays for at-home bleaching by the patient.

Phase III: Basic Restorative

After the periapical surgery and while waiting for the implant and prosthodontic phases of treatment, the patient performed at-home bleaching procedures. A laboratory equilibration on mounted models confirmed that the balancing side interferences could be eliminated and MIP and centric relation occlusion could be made coincident with minimal tooth structure removal. After verification in the laboratory, the patient underwent the surgical procedure.

Phase IV: Surgical

Healing from the periapical surgery of tooth No. 11 was evident 4 months after surgery. Teeth Nos. 10 and 17 were extracted at the maxillofacial surgeon's office. A narrow-platform NobelReplace™ Select implant fixture (Nobel Biocare™, Göteborg, Sweden) of 13 mm in length was placed at the extraction site of tooth No. 10. The patient was then directed to the author's office for immediate provisionalization (Figure 5).



Figure 6 Placement of the rubber gasket onto the NobelReplace Select Immediate Implant Abutment.



Figure 7 Conservative filling of the tooth form with bis-acryl temporary material.

Phase IV: Prosthodontic

The prosthodontic phase of the treatment plan consisted of two different stages.

The first stage was the fabrication of a provisional restoration for the immediately placed implant to serve the patient's esthetic needs and to allow the periodontium to maintain its presenting morphology.

This was done on the day of surgery in a direct manner (Figure 6 through Figure 11). Communication from the treating surgeon to the restorative dentist confirmed an implant fixture placement torque force equal to 35 Ncm. A Nobel immediate abutment to fit the narrow platform NobelReplace Select implant was hand tightened onto the fixture.

Using a condensation silicone laboratory putty matrix formed on the diagnostic wax-up, the restorative dentist conservatively placed bis-acryl temporary material (Luxatemp®, DMG, Hamburg, Germany) into the form of tooth No. 10. Care was taken not to overfill the tooth form with acrylic so as to eliminate the chance of any temporary material invading the surgical site upon the seating of the matrix.

Upon the initial set of the temporary material surrounding the rubber gasket sitting on the immediate abutment, the temporary (acrylic material and the rubber gasket) was removed and low-viscosity composite resin was used to fill the resulting gingival voids formed because of the conservative amount of acrylic used. After filling the voids, the crown form was trimmed to approximate the anatomic shape of the clinical crown of tooth No. 10.

The second stage of prosthodontics consisted of fabrication of the permanent crowns for covering natural tooth No. 7 and the abutment of the implant No. 10. Because of the forgiving occlusion (10% overbite) yielding very little lateral force onto the maxillary anterior incisors, a decision was made to take the fixture-level impression 12 weeks after fixture placement.

To facilitate communication between the dental office and laboratory, an image showing the sounding of the adjacent alveolar crest of the natural tooth was taken (Figure 12). Knowing where the alveolar crest is on the adjacent tooth provides the laboratory technician with critical information to locate the interproximal contact.⁷ The interproximal contact should be no more than 4 mm from the adjacent interproximal alveolar crest of the natural tooth to eliminate the possibility of an open cervical embrasure.^{7,8}



Figure 8 The underside of the provisional showing negative voids and the apical aspect of the provisional indicated by the edge of the gasket.



Figure 9 Addition of low viscosity composite to fill gingival-most aspect of the provisional.



Figure 10 Trimming the apical-most areas of the provisional unit to create natural tooth contours.



Figure 11 Immediate provisional showing its final morphology before polishing.

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The final crowns and custom abutment for the implant were delivered from the laboratory and seated 5 months after implant placement (Figure 13).

At the seating appointment for the crowns, proper abutment seating of the zirconia abutment onto the implant fixture was verified radiographically before full tightening. The abutment screw was then tightened in graduations of force equal to 10 Ncm, 20 Ncm, and finally 32 Ncm. Each crown was then tried in to check the fit of the restoration, esthetic appearance,

and functional adaptability to the patient’s occlusal scheme. Having fulfilled all the objectives for seating from the dentist’s perspective, the patient’s approval was then sought and obtained for mutual consent to seat the restorations.

An increment of Fermit N (Ivoclar Vivadent, Inc, Amherst, NY) was placed and light-cured into the implant’s screw head, and the crowns were cemented with a self-etching resin cement (RelyX™ Unicem, 3M ESPE, St. Paul, MN). A final accounting included cement removal, occlusal adjustment, and radiographic confirmation of total cement removal (Figure 14).

Commentary

This treatment illustrates the benefits that can be derived when an interdisciplinary communication is meticulously used between the restorative dentist, treating specialists, and laboratory technician. All aspects of this treatment plan were visualized before any treatment was initiated, making it very easy for the treatment sequence and the respective responsibilities of each party to be easily scripted and understood.

This case also illuminates how a patient’s confidence affects lip retraction upon smiling and how important it is for the treating dentist to know the patient’s maximum lip dynamic capabilities when analyzing pretreatment images for treatment planning. When comparing before-and-after treatment images, the patient expressed different lip dynamics when asked to “smile naturally.” After her confidence was restored with the new restorations, she exhibited greater natural lip retraction upon smiling (Figure 15 through Figure 20). Acknowledging the potential for and planning for high lip dynamics ensured that the dentistry completed would be acceptable in every smile presentation.

Lastly, it should be acknowledged that two positive factors were involved in this treatment plan. First, the extraction site



Figure 12 Sounding the alveolar crest of the adjacent tooth for identifying the apical-most aspect of the interproximal contact.



Figure 13 Custom zirconia abutment and two zirconia crowns.



Figure 14 Radiograph of the implant, custom abutment, and crown assembly after seating.

of the resorbed root would have yielded a more favorable surgical site for immediate implant placement because of the existence of more bone. However, the author performs the same technique after the extraction of full-rooted incisors without complication.

Second, the patient's natural occlusion exhibited very little overbite and hence the occlusal forces on the immediate provisional were minimal. Care must be taken to contour an immediate implant provisional to eliminate any forces on it while osseointegration of the implant is occurring. A deeper anterior occlusal scheme would make it more likely that the provisional would be more undersized than the provisional seen in this case study.

Acknowledgements

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Figure 15 through Figure 17 After images of patient's natural smile illustrating higher-level lip dynamics.



Figure 18 Frontal view of patient's dentition in MIP after treatment.



Figure 19 Close-up view showing favorable gingival response to treatment.



Figure 20 Close-up view of implant/crown illustrating favorable periodontal response, closed cervical embrasures, and none of the gingival inflammation seen in the patient's before images.