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ACCREDITATION CLINICAL CASE REPORT, CASE TYPE III: TOOTH REPLACEMENT WITH AN IMPLANT



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INTRODUCTION

The replacement and restoration of missing or hopeless teeth is influenced by our ability to utilize dental implants to replace single or multiple teeth. In situations where sufficient bone is available or can be grafted, implants often are the best option. Historically, the maxillary anterior portion of the mouth has been a challenge for esthetically oriented practitioners in utilizing implants. This was the case not only in restoring the teeth, but also in maintaining natural contours in the gingival architecture, papillae, underlying and supporting bone, and the gingival contours of crowns used to restore the implants.¹ Fairly recent improvements in techniques, materials, and expertise have helped to alleviate some of these concerns. The positive influence of implants on patient hygiene, bone stimulation and retention, tissue support, and longevity has made all the effort worthwhile.

The exceptional bond strengths obtainable allow remarkable changes in appearance and function, with minimal tooth reduction.

As implant technology has progressed, porcelain laminate veneers also have begun to provide the most optimally esthetic restorations available to the cosmetic dentist today. With conservative tooth preparation and unsurpassed marginal integrity, excellent tissue response can be accomplished. The exceptional bond strengths obtainable allow remarkable changes in appearance and function, with minimal tooth reduction. As our techniques and materials have improved with time, our confidence and expectations in cosmetic results and longevity have been heightened.

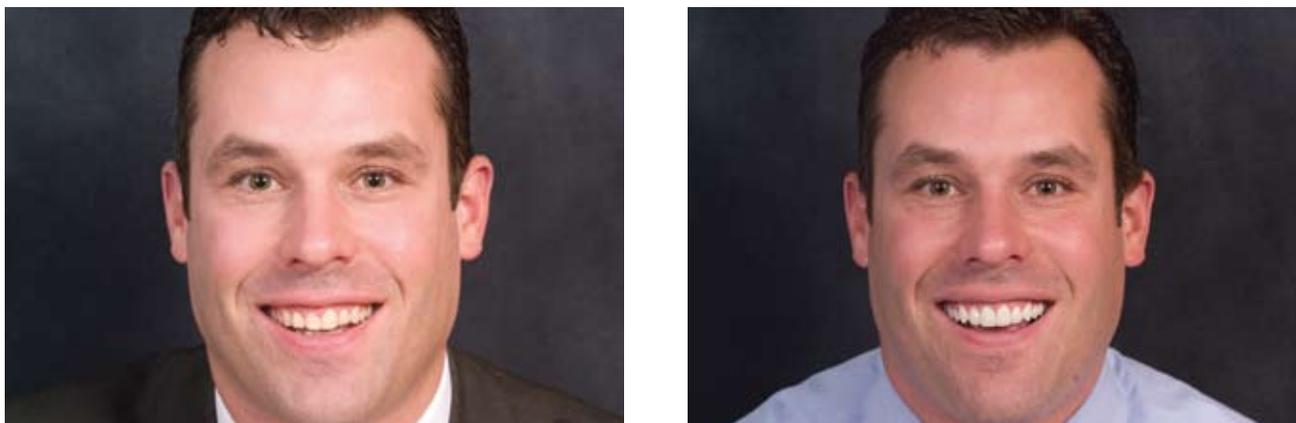


Figure 1: Full-face view, 1:10. Before; discolored and worn dentition create an aged smile. After; bright and youthful smile enhances the patient's face.

INFLUENCES ON TREATMENT PLANNING

Patient perceptions, expectations, general health, periodontal health, occlusion, condition of remaining dentition, and tooth and gingival alignments are some of the factors that influence treatment planning in these cases.² Others are tooth shapes, colors, lengths, and relative sizes. The case described here combines the use of an anterior implant restored with an all-ceramic bonded crown and custom abutment, and porcelain veneers to restore the adjacent teeth to appropriate esthetics and function.

PATIENT HISTORY

The patient was a 35-year-old male in excellent health. He was a territorial sales manager for a dental supply manufacturer. His only significant medical history was an allergy to penicillin; and knee surgery several years earlier to repair torn cartilage, a result of college football injuries. As a teenager he had suffered a traumatic injury to tooth #8 while playing basketball, and he reported that it had darkened over time. He also reported no pain associated with the tooth since initial healing

from the trauma. There was no history of endodontic therapy and the patient was not aware of the status of the vitality of the tooth. However, he was aware of the discoloration of other teeth and moderate to severe wear in his anterior maxillary and mandibular teeth (Fig 1). He also reported fracture of the mesial-incisal corner of #10, which had been restored with composite. In addition, he was interested in the replacement of his posterior amalgams.

FINDINGS

CLINICAL ISSUES

Upon performing a comprehensive examination, we discovered a multitude of dental concerns. Dental hygiene was moderate to poor, causing gingival inflammation. Most of the manifestation was gingivitis with mild Type I periodontal disease scattered locally in the posterior. There were no apparent areas of decay and the posterior amalgam restorations present were moderate in size. There was moderate to severe wear of the anterior teeth.

The patient presented with an Angle Class I posterior relationship

and 50% overbite in the anterior. Also, #8 was in function only during protrusive movements. Due to the wear in the canine teeth, the lateral anterior guidance was inadequate and the patient was in anterior group function on the working side on both the left and right. On the right, the centrals, laterals, canines, and first bicuspid were dragging and severely worn. On the left, the same situation involved centrals, laterals, and canines. The antagonistic mandibular teeth also revealed this wear pattern.

The muscles of mastication all appeared healthy and pain-free upon palpation, although the masseter muscles were firm. Both temporomandibular joints were quiet with no noises and no pain on loading in centric relation (CR). The first contact in closure in CR was in the left side second molar area, with no visual slide on squeezing other than compression of the periodontal ligaments. The patient reported no knowledge of clenching or grinding, despite the wear. Vitality testing of #8 revealed no vitality; in addition, mobility was noted.



Figure 2: Frontal smile, 1:2. Before; gingival heights are asymmetrical in the anterior and bicuspid areas. After; the gingival line follows the upper lip harmoniously.



Figure 3: Right lateral smile, 1:2. Before; #8 is discolored, especially in the gingival one-third. After; restored implant in the #8 position blends with adjacent veneers.

Radiographic examination revealed four impacted third molars, a more involved amalgam restoration on #14, and an apparent internal resorption and/or root fracture on #8. There was no periapical pathosis associated with the tooth.

ESTHETIC ISSUES

Esthetically, there were several issues apparent to both the practitioner and the patient. The teeth overall were discolored and yellow. Gingival heights were asymmetrical, both in the anterior and in the bicuspid areas (Fig 2). The buc-

cal corridors were not adequately filled. Inflamed tissue was apparent throughout, with stained plaque present at the gingivo-enamel junction. Tooth #8 was darker than the other teeth especially in the gingival one-third (Fig 3). The wear created a much older-looking smile than the patient's chronological age, as did the stained composite on #10 and the dark amalgam restorations on #19 and #30. There was also a moderate amount of crowding in the anterior teeth, which was especially visible from the lateral aspects.

DIAGNOSIS

As noted earlier, the patient presented with gingivitis and scattered, localized Type I periodontal disease. Malocclusion was characterized by an interference to CR, poor anterior guidance, and severe wear in anterior teeth as a result³ (Fig 4). The mandibular impacted third molars were negatively affecting the periodontal health in the area of tissue attachment to the mandibular second molars. Tooth #8 was suffering from internal resorption and/or root fracture. After referring the pa-



Figure 4: Left lateral smile, 1:2. Before; severe wear due to occlusal problems. After; restored incisal edges create anterior guidance.



Figure 5: Frontal retracted, 1:1. Before; lower gingival height of #8 was an advantage after implant placement. After; note the symmetrical and level gingival heights and papillae of the central incisors.

tient to an oral surgeon and perio/implantologist, all concurred that both internal resorption and a horizontal root fracture existed. (The tissue level on #8 was more incisal to the properly positioned tissue level on #9; this was an advantage, as recession and loss of tissue level can be an issue after implant placement and healing.) (Fig 5). The esthetic diagnosis was general discoloration, (especially #8), severe incisal edge wear, crowding, and asymmetrical gingival levels.

TREATMENT PLAN

The patient was interested in comprehensive treatment planning to restore health, function, and esthetic issues; however, he preferred to delay third molar extractions until the final phase. Therefore, a diagnostic wax-up was utilized to incorporate changes necessary for providing proper occlusion, anterior guidance, and esthetics; and to fabricate a surgical stent for the surgeon in placing the implant in the desired position. The treatment plan was sequenced into three phases as follows:

1. INITIAL HYGIENE PHASE

- Provide hygiene instruction and interceptive periodontal therapy, including scaling and root-planing with mini-ultrasonics and laser therapy, with follow-up evaluation.
- Equilibrate to eliminate the CR interference.⁴ Remove #8 and replace it with an immediate implant with immediate provisionalization.

2. RESTORATIVE PHASE I

- Place porcelain veneers on ##4-7 and ##9-13, with a cus-

tom zirconia abutment and an all-ceramic crown to restore #8 implant.

- Whiten and reshape lower anterior teeth.

3. RESTORATIVE PHASE II (TO OCCUR LATER)

- Extract third molars.
- Replace the old amalgams with resins and porcelain inlay/onlay restorations, and place sealants on all unrestored posterior teeth.
- Place porcelain veneers on ##22-27.
- Deliver nightguard.

(The patient also will have the option of placing veneers in the lower bicuspid area, depending on his satisfaction with whitening in that area.)

This article addresses the initial hygiene phase and the first phase of restorative care agreed upon by the patient and provider.

ARMAMENTARIUM

- D-10 35-mm digital camera (Canon; Melville, NY)
- Dimension polyvinyl siloxane (PVS) impression material (3M ESPE; St. Paul, MN)
- Sam III articulator (Great Lakes Orthodontics; Tonawanda, NY)
- Polaroid camera (Kodak; Rochester, NY)
- vacuum-formed stent of wax-up (Great Lakes Orthodontics)
- Sil-Tech PVS putty (Ivoclar Vivadent; Amherst, NY)
- TSV 3.7-mm x 16-mm internal hex implant (Zimmer Dental; Carlsbad, CA)

- HLA contour provisional abutment (Zimmer Dental)
- Vitapan shade guide and Vita 3D shade guide (Vident; Brea, CA)
- 2.5x magnification loupes (Designs for Vision; Ronkonkoma, NY)
- handpieces (Midwest; Des Plaines, IL, and Adec; Newberg, OR)
- 2 % Xylocaine with 1:100,000 epinephrine (Dentsply Pharm.; York, PA)
- Nixon porcelain veneer kit (Brasseler USA; Savannah, GA)
- implant wrench .050 (3I; Palm Beach, FL)
- Odyssey diode laser (Ivoclar Vivadent)
- preparation diamonds (Brasseler USA)
- natural die stumpf guide (Ivoclar Vivadent)
- pumice (Sultan Chemists; Englewood, NJ)
- Dimension heavy- and light-body PVS impression material (3M ESPE)
- Futar bite registration material (Kettenbach Dental; Eschenburg, Germany)
- disposable brush (Centrix; Shelton, CT)
- torque wrench .050 (Vident)
- Superoxol hydrogen peroxide (Sultan Chemists)
- Luxatemp provisional material (Zenith/DMG; Englewood, NJ)
- Authentic pressable porcelain (Jensen Industries; North Haven, CT)
- Insure Clear try-in gel (Cosmedent; Chicago, IL)

- AccuFilm articulating paper (Parkell; Edgewood, NY)
- Optilux 400 curing light (Kerr/Demetron; Orange, CA)
- Consepsis scrub (Ultradent; South Jordan, UT)
- lip retractors (Hager Worldwide; Odessa, FL)
- Ultra-Etch 37% phosphoric acid (Ultradent)
- Hemaseal+Cide desensitizer (Advantage Dental Products; Lake Orion, MI) with Gluma chlorhexidine desensitizer (Heraeus; Armonk, NY)
- OptiBond bonding agents #1 and #2 (Kerr; Orange, CA)
- Insure resin cement system (Cosmedent)
- De-Ox oxygen barrier solution (Ultradent)
- #12 Bard-Parker blade (Becton Dickinson), Franklin Lakes, NJ)
- FlexiStrip finishing and polishing strips; FlexiDisc finishing discs (Cosmedent)
- finishing diamonds (Brasseler USA)
- metal finishing strips (GC America; Alsip, IL)
- Epitex finishing and polishing strips (GC America)
- diamond polish (Ultradent)
- Monobond S silane coupler (Ivoclar Vivadent)
- chlorhexidine periodontal rinse (Discus Dental; Culver City, CA)
- porcelain polishing points (Axis Dental; Coppell, TX)
- Enamelize polishing paste (Cosmedent)



Figures 6 and 7: The pre-surgical stent was converted to an esthetic immediate provisional based on the initial diagnostic wax-up, and was utilized to ensure accurate implant placement.



Figures 8 and 9: An interim contour provisional abutment was placed immediately. The initial provisional was then fabricated in order to maintain gingival contours.

TREATMENT

PERIODONTAL THERAPY

The periodontal therapy was completed and followed up to the satisfaction of both clinicians, and then a limited equilibration was performed. Tooth #8 was removed by the periodontist atraumatically and a 3.7-mm x 16-mm internal hex implant was placed with the aid of platelet-rich plasma and peri/implant grafting (Figs 6 & 7). An interim contour provisional abutment was placed immediately (Fig 8), and the pre-surgical stent was converted

to an esthetic immediate provisional based on the initial diagnostic wax-up (Fig 9). The importance of an immediate provisional restoration at the time of placement (in conjunction with a minimally invasive surgical protocol) is paramount in the maintenance and sculpting of the soft tissue emergence profile at the free gingival region of the implant restoration. In addition, arching and crown lengthening were performed in the anterior and bicuspid areas.⁵ After three months of healing, the patient was ready for the restorative phase.

Prior to preparation, the tissue response to the surgery was followed closely. After one month a new provisional was fabricated incorporating contours to further shape the tissue for proper emergence contour from the implant.⁶ Two weeks prior to preparation, another minor contour adjustment was made to the provisional in order to “push” the tissue to a better and more symmetrical gingival level.⁷ In the words of the periodontist, Dr. Paul Petrunaro:

“The importance of an immediate provisional restoration at the time

of placement, in conjunction with a minimally invasive surgical protocol, is paramount in the maintenance and sculpting of the soft tissue emergence profile at the free gingival region of the implant restoration. The contour of the provisional must take into account the planned mesial and distal line angles of the final restoration, in addition to proper contact point relationships to the interproximal height and bone. The immediate esthetic provisional restoration serves to maintain the pre-extraction soft tissue contours, create the proper space maintenance for minimally invasive bone grafting techniques, and guide epithelization of the implant/gingival sulcus to a mature implant/gingival complex."

PREPARATION

Shade mapping was executed prior to preparation and documented with photographs. (In addition, the patient had previously visited the laboratory to verify shades and characterization.)

Anesthetic was administered. The teeth were initially prepared with depth cuts in three planes: The gingival one-third, middle one-third, and incisal one-third. A round-end diamond was used to reduce remaining tooth structure to these depths, again holding the burr in three distinct planes of reduction.⁸ Uniform reduction was accomplished and chamfer marginal finish lines were carried right to the free gingival margin. Interproximal finish lines in the contact areas were carried to the mesial-lingual and distal-lingual areas in order to aid in correcting color. A reduction guide was used and measured with a periodontal probe to ensure uniform reduction as dictated by the diagnostic wax-up.

Shades of the prepared teeth were taken with the stumpguide and doc-

umented with photographs. These shades were equivalent to ND-7 for #6 and #11 and ND-2 for the rest. Fine finishing strips were used interproximally to slightly open the contacts to maximize visualization and finishing by the dental laboratory. The teeth were rinsed, dried, and smoothed with fine finishing diamonds. The provisional crown and abutment were removed last to ensure minimal collapse of the tissue during the impression. The abutment and provisional crown were placed back into the implant in the proper hex position without the screw tightened for the impression; afterwards, an implant analog was attached, prior to the pouring of the models. This gave the ceramist the exact copy of the emergence profile created by the abutment and crown.⁹

The esthetic diagnosis was general discoloration...severe incisal edge wear, crowding, and asymmetrical gingival levels.

After further rinsing and drying of the preparations, an impression was taken with a combination of light-bodied PVS material syringed over the teeth, and a heavier-bodied material in a stock tray. The impression was removed, inspected, and set on the bench. The crown and abutment were removed from the implant and placed carefully back into the impression to ensure proper position. The impression was poured immediately and the crown and abutment recovered upon the setting of the stone. The interim abutment was placed back into the implant and the old provisional crown was cut back so as to save the established contours at the tissue level. This was

done so as to be able to make a fresh clinical crown while the provisionals for the other teeth were being fabricated.

Provisionals were fabricated utilizing a putty matrix of the wax-up.¹⁰ After trimming and polishing, the provisional occlusion was checked and adjusted in centric, protrusive, and lateral excursions. Because we were not restoring the lower anterior teeth at this time, we informed the patient that we would enameloplasty the lower teeth in order to accommodate proper function with the provisionals and the final restorations until the lower teeth were completed in Phase II. A facebow, opposing model, CR bite, and stick bite were taken and the stick bite was photographed for the laboratory. The provisionals were placed with interim cement and the occlusion was double-checked.

The patient was given postoperative instructions and was asked to return to the office in three days. At that time, photographs and an impression were taken of the approved provisionals for laboratory usage.

LABORATORY COMMUNICATION

The laboratory prescription described the porcelain veneer restorations and the design for the custom abutment and all-ceramic crown. They were to be pressed, cut back, and layered with feldspathic porcelain to provide ultimate control in color, characterization, and translucency.

The zirconia abutment was to be fabricated to follow the tissue contours we had established for support of the tissue and proper emergence contours. We also requested that the clinical crown portion of the abutment be shaped exactly like

the veneer preparation on the adjacent central incisor. The color was to match the dentin stump shade of the other central incisor, in order to help achieve matching color and value in the final restorations. Included with the prescription were the impression, opposing impression, initial photographs, shade photographs, bite registrations, face-bow, photographs of dentin shades, photographs of approved provisionals, and an impression of the provisionals. The laboratory also had their shade verification on record.

INSERTION AND FINISHING

The veneers and crown were inspected on working and soft tissue solid models for integrity of margins, contacts, and passive fits. An incisal putty guide was fabricated from the provisionals and checked against the incisals of the finished restorations to ensure adherence to our specifications. All aspects appeared acceptable.

The patient was given anesthetic, and the provisionals were removed with pressure from a scaler between the margin of the provisional material and the prepared tooth. The interim abutment was removed from the implant and the final abutment was placed to ensure that all specifications had been met. The preparations were pumiced, rinsed thoroughly, and dried. The restorations were tried in; first, individually to ensure fit and marginal integrity, and then together to observe contacts and relative contour in the mouth. The patient was extremely happy with the color, value, characterization, and translucency of the restorations. A clear try-in gel was placed in the veneers for further evaluation. The color was very pleasing and the patient was allowed to view the ve-

neers in the chair, at a mirror on the wall standing upright, and at a window with natural light. Although the patient was happy with all views, the practitioner perceived a slight difference in value with the central incisors and the other anterior veneers. After employing several try-in gels it was determined that the best overall match would be accomplished by using clear luting resin for all teeth except #8 and #9, and using a white opaque luting resin for these two teeth.

The team approach...along with careful planning and communication, enabled us to achieve optimal results.

The abutment was torqued with 20 N.cm of pressure. The veneers and crown were carefully cleaned with cotton pellets and water, dried and decontaminated with phosphoric acid, rinsed, dried, and silanated. A thin layer of filled resin was coated over the silanated surface, air-thinned, and covered to protect from polymerization from ambient light. The prepared teeth were isolated with lip retractors, scrubbed with chlorhexidine, rinsed, and dried. A 37% phosphoric acid gel was applied to the teeth for 12 seconds. The teeth were rinsed, dried, and coated with desensitizer for decreased sensitivity possibilities and re-wetting of the dentin. The excess was blotted and the teeth were saturated with several coats of dentin primer.¹¹ After 20 seconds the excess was dried with a light warm moisture-free air spray and cured for 20 seconds. The teeth were then coated with a thin layer of partially filled resin. The luting resin was placed into the veneers. The veneer on #9 and crown

on the abutment at #8 were placed simultaneously. This was followed by placement of #6 and #7, #4 and #5, #10 and #11, and #12 and #13.

The veneers were placed on the teeth with light, even pressure until fully seated and the excess luting resin removed with brushes, explorer, and resin applicator. Initial curing was a spot tack from the lingual. The remaining resin was removed with brushes, explorer, and floss. Curing was commenced at that point from the lingual to pull the resin toward the light and into the dentin. The margins were covered with oxygen-barrier gel to prevent an oxygen-inhibited layer. Each veneer and the crown was cured for 90 seconds from all angles. Further excess cement was removed with a #12 blade interproximal carver and fine finishing strips.

The lingual margins were blended and refined with fine finishing diamonds. The interproximal areas were refined with fine finishing strips both metal and plastic. Occlusion was evaluated and adjusted in centric, protrusive, and lateral excursions. All surfaces were smoothed and polished with rubber porcelain polishing points and finished with porcelain polishing paste. The patient was seen one week later for a postoperative appointment to refine occlusion, esthetics, and comfort. All appeared acceptable at that time. He was supplied with a nightguard to protect his investment.

SUMMARY

This case was extremely rewarding because it was a transformation for the patient and a great learning experience for the practitioner. There were many challenges in the diagnostic, treatment planning, and

clinical aspects of this case. However, the team approach of the periodontist, laboratory, and restorative dentist, along with careful planning and communication, enabled us to achieve optimal results.

Just as many of us in dentistry have practiced what we preach and have had our mouths restored, this dental manufacturer's representative believed in our profession and chose to improve his smile. His desire to maximize his appearance and health allowed us to plan and deliver excellent care, exceeding his expectations.

Acknowledgments

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