Restoring the Partially Edentulous Patient Using Endosseous Implants and All-Ceramic Restorations: A Case Report

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Abstract

Replacing lost adjacent teeth in the esthetic zone presents clinicians with some of the most challenging decisions they will face. The achievement of optimal esthetics is further compromised when the normal volume of hard and soft tissue is lacking. As with all dental care, deliberate diagnosis and treatment planning including an analysis of hard and soft tissue as well as the smile line is necessary to achieve predictable results.

Learning Objectives

After reading this article, the reader should be able to:

- describe the different applications of all-ceramic restorations.
- explain the use of CAD/CAM technology for designing all-ceramic abutments and copings.
- discuss the different types of implant sizes and designs.

Historically a fixed partial denture with the use of abutments on the natural teeth was the only alternative for a fixed restoration. The introduction of dental implants allowed for multiple single-unit restorations, providing a treatment option that preserves bone and does not compromise additional teeth. The predictability and success of implant treatment has been well documented for both completely edentulous and partially edentulous patients.[1-5]

The increase in patients' esthetic awareness has made necessary the introduction of more esthetic restorative options including all-ceramic restorations, first introduced in 1967 by McLean.[6] More recently, ceramic implant abutments were introduced, aiding in the achievement of excellent esthetics.

For many years metal–ceramic restorations were the only alternative in esthetic restorations; however, the metal substructure of these prosthetic solutions resulted in a lack of translucency on the overall restoration because of the opacity of the material.[5,6] Increasing awareness of patient esthetics has led to the introduction of several new all-ceramic systems for fixed alternatives.[7,8] These all-ceramic restorations are fabricated using a variety of systems including Procera (Nobel Biocare), IPS Empress 2 and IPS e.max (Ivoclar Vivadent), In-Ceram (Vident), and others.

Other advances also include the use of computer-aided design/computer-aided manufacturing (CAD/CAM) implant abutments, which changed the present restorative protocols for implant dentistry. Using a 3-dimensional CAD (3D-CAD) technique, the clinician can design custom abutments and all-ceramic substructures, which along with veneering porcelain, aid in the final esthetic outcome.

Customized abutments from several materials can be fabricated with the 3D-CAD technique, enabling the clinician to fabricate individualized implant components with the desired width, height, and contour to support the adjacent tissue and duplicate the properties of natural teeth.[9-11]

This case report demonstrates the use of endosseous implants and all-ceramic, single-unit restorations to restore a patient missing multiple teeth in the esthetic zone.

Case Report

A 26-year-old man in good general health presented for treatment. His general dental health was very good, but his chief complaint about significant esthetic and functional concerns was made evident (Figure 1). The 4 maxillary incisors were extracted 5 months before his initial visit after these teeth were fractured in a baseball accident. As a result of the trauma and subsequent extractions, significant hard- and soft-tissue defects were noted at the consultation appointment. Several treatment options were presented to the patient including an additional surgical procedure to augment the edentulous ridge and increase the tissue volume in the area of the extracted teeth. The patient requested individual restorations in the edentulous area even after an explanation of the possible esthetic complications.

(Author Did this patient also recieve a crown on tooth No. 6 or 11? If yes please included metion here)

A treatment plan was developed that included the placement of 4 endosseous implants and individual all-ceramic restorations. An informed consent document detailing the patient's refusal of additional procedures to enhance the amount of bone and soft tissue was signed by the patient. Other prosthetic options were presented including a removable partial denture, a 6-unit fixed partial denture, and 3 endosseous implants with a milled titanium bar. The patient rejected all treatment options except for the 4 endosseous implants with individual all-ceramic restorations.

Figure 1—Pretreatmet view. Note the significant hard- and soft-tissue defects on the area of the maxillary central and lateral incisors.

Figure 2—Placement of endosseous implants. Note the 5.0-mm healing abutments and 1-piece implant.

Figure 3—Provisionalization with thermoplastic material and acrylic resin teeth placed after the surgery for esthetic considerations.

Figure 4—Removal of 5.0-mm healing abutments. Note the healthy soft tissue around the implants.

Treatment

Before the initial implant surgery, it was again suggested to the patient that the addition of the grafting procedures would enhance the esthetic outcome. The patient again declined. A full-thickness mucoperiosteal flap was elevated to expose the bone and 4 endosseous implants were placed, aided by the use of a surgical guide. Three 4.1 mm x 10.0 mm endosseous implants (Branemark, Nobel Biocare) were placed in the position of the maxillary central incisors and right lateral incisor, and healing abutments (Nobel Biocare), 5.0 mm in height, were delivered.

In the area of the left lateral incisor, a single 3.0 mm x 10.0 mm endosseous 1-peice implant (Nobel Direct, Nobel Biocare) was placed because of the lack of buccolingual bone width (Figure 2). The full-thickness mucoperiosteal flap was approximated and 3.0 vicryl synthetic absorbable sutures (Ethicon, Inc) were used to close the margins and permit healing by first intention.

The provisional restoration was a thermoplastic material (Great Lakes Orthodontics) with acrylic resin teeth (Lang Dental Manufacturing, Inc) (Figure 3). After 4 months, the healing abutments were removed (Figure 4) and a closed custom tray (Triad, Dentsply International) was used to make an implant level impression of the implants after placing the impression copings (Nobel Biocare) and radiographically verifying them for fit. An abutment level impression was made for the 1-piece implant. The abutment was prepared with a 360° moderate chamfer margin, and a 00 retraction cord (Ultradent Products, Inc) was

Figure 5—Placement of closed tray impression copings and preparation of the 1-piece endosseous implant with a 360º chamfer.

Figure 6—Zirconia abutments with the proper emergence profile to accommodate for restorative material placed onto the implants and torqued to 35 Ncm.

Figure 7—Final single-unit, all-ceramic restorations, intraoral view after cementation procedure.

Figure 8—Final single-unit, all-ceramic restorations, extraoral view after cementation procedure.

placed for gingival retraction. The metal–ceramic crown on the maxillary left cuspid was removed and the tooth was reprepared with a 360º moderate chamfer margin. A 00 retraction cord was placed and an impression was make using vinyl polysiloxane material (Extrude, Kerr Corporation) (Figure 5).

Impressions

It is important to note that only 1 impression was made that incorporated the implant level impression of 3 endosseous implants, the abutment level impression of 1 endosseous implant, and the impression of the maxillary right cuspid. Making 1 impression enables the fabrication of all the necessary components up to the cementation appointment (abutments, copings, and application if veneering porcelain). If more than 1 impression is made, a subsequent impression is necessary to pick up all the copings to include them in a single solid model, incorporating possible errors during the pick-up impression procedure.

The impression of the opposing arch was taken using hydrocolloid impression material (Jeltrate, Dentsply International) and poured using type V gypsum material (Die-Keen, Heraeus Kulzer, Inc). The maxillary impression was poured using a soft-tissue moulage with pink-colored, elastic vinyl polysiloxane (Ivoclar Vivadent) and Die-Keen. Maxillomandibular relationship records as well as a face-bow transfer were made using occlusal registration wax (Aluwax Dental Products) and baseplate wax (Truwax, Dentsply International) and were transferred to a semiadjustable articulator (Hanau WideView, Water Pik Technologies).

Three custom zirconium abutments were designed with a 3D-CAD (Procera) double-scan technique. The abutments were then digitized with a touch probe scanner (Piccolo Procera, Nobel Biocare), and copings were fabricated in zirconium for the endosseous implants. The veneering porcelain (NobelRondo, Nobel Biocare) was applied to complete the esthetic portion of the crowns.

Insertion Appointment

At the insertion appointment, the healing abutments were removed and the ceramic abutments were placed and secured using 35 Ncm of torque (Figure 6) and the fit was verified radiographically. The access openings were filled with wax, and the all-ceramic crowns were placed on the abutments to verify marginal integrity, occlusal relationships, and esthetic results. The all-ceramic restorations were cemented on the zirconium custom abutments using provisional cement (Premier, Premier Dental Products). The margins of the tooth preparation and the prepared implant abutment were subgingival so marginal integrity was verified tactilely and radiographically. The left cuspid was pumiced (Whip Mix Corp) and treated with chlorhexidine (Zila, Inc), and a thin coat of resin-modified glass-ionomer cement (FujiCEM, GC America, Inc) was placed into the internal surface of the 2 remaining restorations, placed onto the abutment using finger pressure (Figures 7 and 8).

Conclusion

In this case report, the use of endosseous implants was the alternative of choice because of the limitations imposed by the patient, including the deficiency in the quantity of bone, the request for individual restorations, and the lack of interest for additional procedures. Because of limited bone quantity, different endosseous implant diameters had to be used. All-ceramic restorations were the choice to restore the endosseous implants as well as the natural teeth.

The use of endosseous implants has dramatically changed dentistry, providing a great variety of options for restoring partially and completely edentulous patients. Endosseous implants have proven to be a good alternative for replacing single or multiple teeth; ceramic abutments and all-ceramic crowns help attain long-term success as well as excellent esthetics. The use of 3D-CAD technology has contributed to the predictability of restorations. C

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Product References

Products: Procera, Branemark, healing abutments, impression copings, Nobel Direct, 3D-CAD Procera, Piccolo Procera, NobelRondo
Manufacturer: Nobel Biocare
Location: Yorba Linda, California
Phone: 800.993.8100
Web site: www.nobelbiocare.com

Products: IPS Empress 2, IPS e.max, pink-colored vinyl polysiloxane
Manufacturer: Ivoclar Vivadent
Location: Amherst, New York
Phone: 800.533.6825
Web site: www.ivoclarvivadent.us

Product: In-Ceram
Manufacturer: Vident
Location: Brea, California
Phone: 800.828.3839
Web site: www.vident.com

Product: vicryl sutures
Manufacturer: Ethicon, Inc
Location: Somerville, New Jersey
Phone: 800.255.2500
Web site: www.ethicon.com

Product: thermoplastic material
Manufacturer: Great Lakes Orthodontics
Location: Tonawanda, New York
Phone: 800.828.7626
Web site: www.greatlakesortho.com

Product: acrylic resin teeth
Manufacturer: Lang Dental Manufacturing Inc
Location: Wheeling, Illinois
Phone: 800.222.5264
Web site: www.langdental.com

Products: Triad, Truwax, Jeltrate
Manufacturer: Dentsply International
Location: York, Pennsylvania
Phone: 800.877.0020
Web site: www.dentsply.com

Product: 00 retraction cord
Manufacturer: Ultradent Products, Inc
Location: South Jordan, Utah
Phone: 888.230.1420
Web site: www.ultradent.com

Product: Extrude
Manufacturer: Kerr Corporation
Location: Orange, California
Phone: 800.537.7123
Web site: www.kerrdental.com

Product: Die-Keen
Manufacturer: Heraeus Kulzer, Inc
Location: Armonk, New York
Phone: 800.431.1785
Web site: www.heraeus-kulzer-us.com

Product: occlusal registration wax
Manufacturer: Aluwax Dental Products
Location: Allendale, Michigan
Phone: 616.895.4385
Web site: www.aluwaxdental.com

Product: Hanau WideView
Manufacturer: Water Pik Technologies
Location: Newport Beach, California
Phone: 800.525.2020
Web site: professional.waterpik.com

Product: Premier
Manufacturer: Premier Dental Products
Location: Plymouth Meeting, Pennsylvania
Phone: 888.670.6100
Web site: www.premusa.com

Product: pumice
Manufacturer: Whip Mix Corporation
Location: Louisville, Kentucky
Phone: 800.626.5651
Web site: www.whipmix.com

Product: chlorhexidine
Manufacturer: Zila, Inc
Location: Phoenix, Arizona
Phone: 866.945.2776
Web site: www.zila.com

Product: FujiCEM
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1. **Historically, what was the only alternative for a fixed restoration?**
   a. bridge and bonding
   b. CAD/CAM ceramics
   c. fixed partial denture with abutments
   d. gold crown and amalgam

2. **Dental implants provide a treatment option that:**
   a. increases patients' esthetic awareness.
   b. preserves bone and does not compromise additional teeth.
   c. takes less time.
   d. is to be used for edentulous patients only.

3. **The predictability and success of implant treatment has been well documented for:**
   a. completely edentulous patients.
   b. partially edentulous patients.
   c. both A and B
   d. none of the above

4. **For many years, what were the only alternatives in esthetic restorations?**
   a. gold-fused-to-porcelain crowns
   b. porcelain-fused-to-metal crowns
   c. all-ceramic restorations
   d. metal–ceramic restorations

5. **The metal substructure of metal–ceramic restorations resulted in:**
   a. a lack of translucency on the overall restoration.
   b. darker shading.
   c. poor color matching ability.
   d. difficulty placing the restoration.

6. **Using a 3-dimensional, computer-aided design (3D-CAD) technique, the clinician can design:**
   a. life-like restorations.
   b. custom abutments and all-ceramic substructures.
   c. full sets of dentures.
   d. crowns.

7. **Customized abutments from several materials can be fabricated:**
   a. with the 3D-CAD technique.
   b. in a sintering furnace.
   c. by sending the case out to a laboratory.
   d. all of the above

8. **If more than 1 impression is made, why is a subsequent impression necessary?**
   a. to make sure no errors are picked up
   b. to have another impression to compare them with
   c. to pick up all of the copings to include them in a single solid model
   d. to cut down on the amount of chair time for the patient

9. **Endosseous implants have proven to be a good alternative for replacing:**
   a. single or multiple teeth.
   b. chipped or cracked ceramic restorations.
   c. porcelain-fused-to-metal crowns.
   d. partial dentures.

10. **Ceramic abutments and all-ceramic crowns help attain long-term success as well as:**
    a. a proper fit.
    b. provide an alternative to root canal.
    c. provide the patient with a better shade match.
    d. excellent esthetics.

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