Lower Anterior Mandible Reconstruction After Resection

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Esthetic dentistry occasionally will extend beyond the limits of what esthetic dentists would term commonplace. Smile design, in most cases, involves the maxillary arch and, more specifically, the anterior 8 to 10 teeth of the maxilla. Smile design sometimes includes the involvement of gingiva and osseous recontouring to provide the proper proportions we strive for to amplify the effect of the patient's smile. In its most simple form, esthetic dentistry may only alter the shade of the teeth. In its most complex form, esthetic dentistry can provide the finishing touches on what masks an underlying plethora of anatomical problems and defects.

Each day in our practices we focus on the esthetic and restorative needs of our patients. We also must maintain a vigilance directed toward systemic diseases and their diagnosis as they present within the oral cavity, and we must be ready to aid patients and their surgeons in the treatment of extended problems arising from that disease.

The following case provides an interesting perspective on the ties that esthetic/functional dentistry can have with the talents of our colleagues in the field of oral maxillofacial medicine and dentistry. The article will begin with a surgical case report performed and written by Dr. Steven R. Schimmele, DDS, Assistant Professor of the Department of Oral Surgery, Medicine, and Pathology at the Indiana University School of Dentistry, Indianapolis, Indiana.

Case Report

Surgical Evaluation

A 55-year-old woman in excellent general health was evaluated for a leukoplakia of the anterior mandibular attached gingiva. A biopsy of the lesion, which extended from teeth Nos. 22 to 25, had been previously performed, and the diagnosis was lichen planus. Because the clinical appearance of the lesion changed after 2 years of routine follow-up, a second biopsy was performed and the results were submitted to an oral and maxillofacial pathologist for histologic diagnosis. The second biopsy revealed invasive squamous cell carcinoma (Figure 1). An otolaryngologist performed the surgical treatment that involved a marginal mandibulectomy.

The postoperative procedure was significant for soft-tissue dehiscence of the operative site and pulpal necrosis of tooth No. 27, which was subsequently extracted. The wound was treated with local measures until the bony defect was covered with healthy mucosa (Figure 2). The soft tissue was allowed to mature for 3 months after healing before any reconstructive surgery began. Histologic reevaluation of the surgically removed mandibular segment revealed substantial negative surgical margins and no evidence of bony invasion. Because of the size of the lesion (T1) and the lack of bony invasion, early reconstruction of the defect was considered.

The patient was presented with multiple reconstructive modalities including a removable or fixed prosthesis, and surgical reconstruction of the defect with autogenous bone grafting and endosseous implants. The patient wanted the most natural reconstruction and chose surgery.

> In its most complex form, esthetic dentistry can provide the finishing touches on what masks an underlying plethora of anatomical problems and defects.

Surgical Procedure

The treatment plan consisted of approaching the anterior mandible with a submental incision to optimize postoperative esthetics (Figure 3). A 3-cm incision was made, and a remaining mandibular defect of 1 cm in inferior/superior height was exposed with periosteal elevation (Figure 4). The oral cavity was not entered, decreasing the probability of postoperative infection and bone graft loss. Maximum reflection of the soft-tissue envelope was accomplished to allow elevation of the height of the residual mandible.

After the defect was exposed, three **3.8-mm cylinder implants** (***3i* Implant Innovations**) were placed. Because of the lack of soft-tissue excess and the inability to place the drill heads into the surgical defect

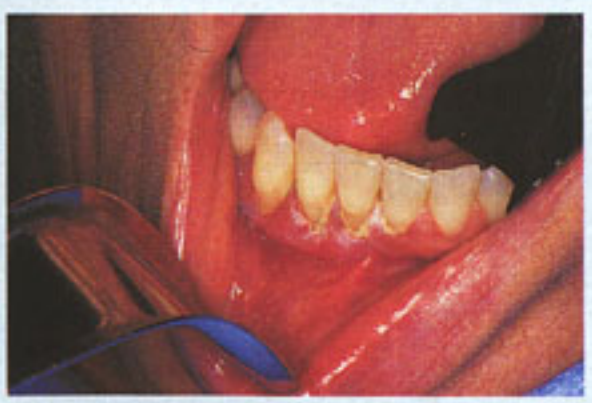


***Figure 1**—Cancerous lesion.*

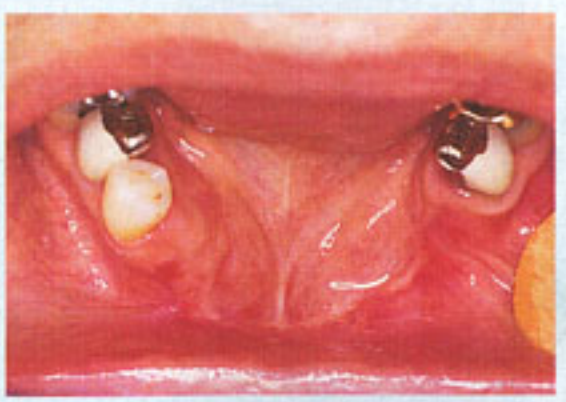


***Figure 2**—Postoperative view of resected area after healing.*

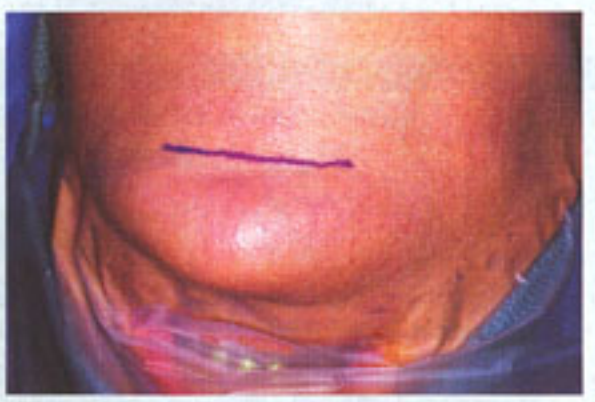


***Figure 3**—Line of proposed incision.*

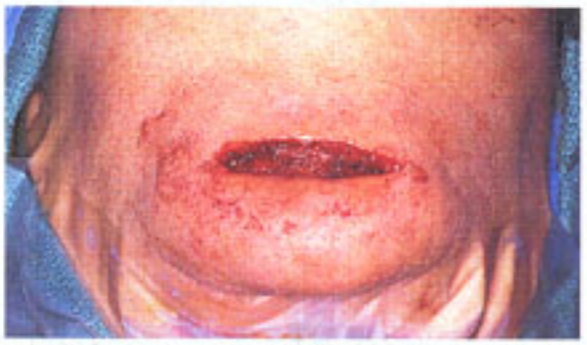
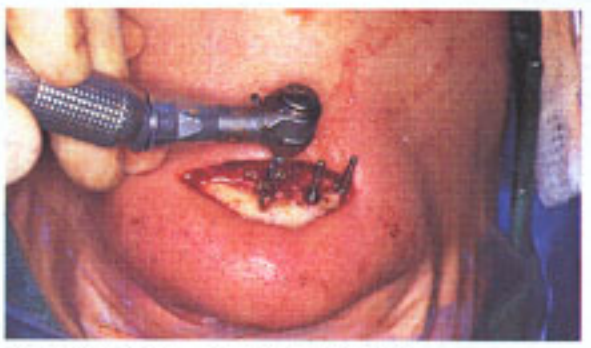
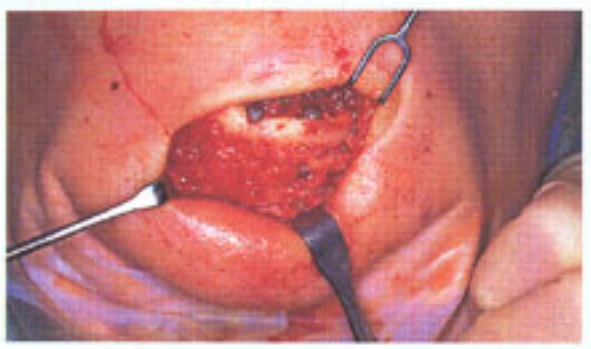


Figure 4—Incision on inferior symphyseal area of mandible.



Figures 5 and 6—Implant placement.



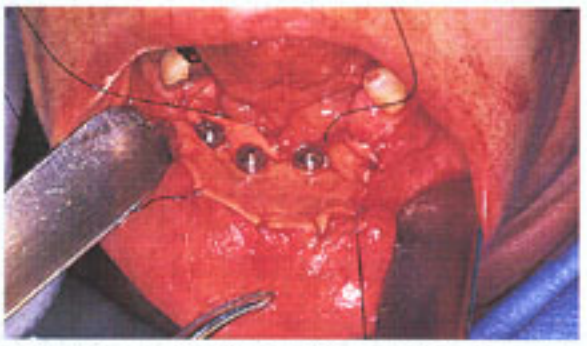


Figure 7—AlloDerm® sutured into position. Surgery in Figures 1 through 7 by Dr. Steven R. Schemmele (Indianapolis, Indiana).

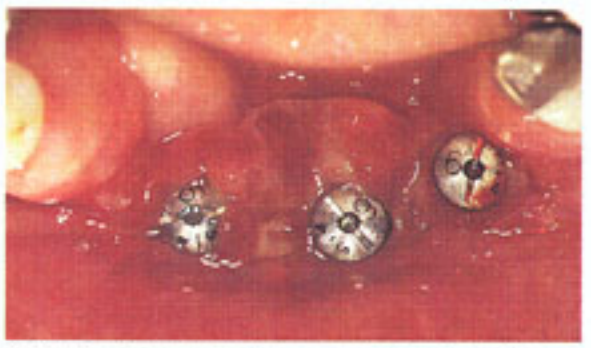


Figure 8—Unhealthy tissues around healing collars of implants.

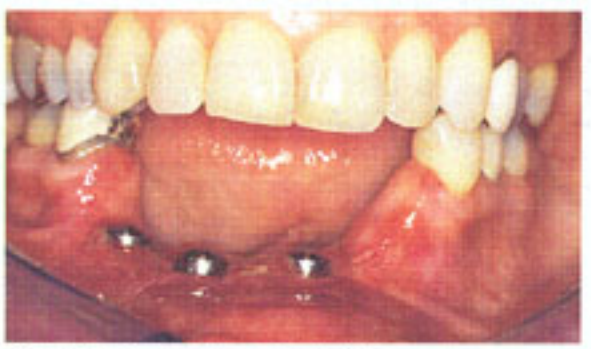


Figure 9—Remaining vertical defect.

and superior to the residual mandible, the osteotomy sites were created through the inferior border of the mandible (Figures 5 and 6). The implants were oriented with an intraoperative splint that was constructed before surgery. The maxillary borne splint contained acrylic heads that were palpable through the oral cavity, which was covered with plastic draping.

After the implants were stable and satisfactorily positioned, a cortical-cancellous bone graft harvested from the left anterior iliac crest was placed around the implants to recreate alveolar height. The bone graft was augmented with autogenous growth factors harvested intraoperatively from platelet-rich plasma in the patient's blood. The incision also allowed submental lipectomy and platysmal plication to be performed.

There were no postoperative complications and the patient was discharged from the hospital 1 day after surgery. The bone graft was allowed to heal for 3 months and after radiographic examination showed satisfactory maturation, vestibuloplasty and implant uncovery were performed. All the implants were found to be stable at the second surgery. **AlloDerm® Acellular Dermal Graft material (LifeCell Corporation)** was used as a substitute for skin or palatal mucosa during the vestibuloplasty to prevent any potential harvest site morbidity (Figure 7). The AlloDerm® was sewn into place with resorbable sutures, and a splint relined with **COE-COMFORT™ (GC America, Inc.)** was placed. The splint was held in place with a circummandibular nylon suture for 2 weeks before it was removed. The patient was then referred to a restorative dentist for prosthetic rehabilitation.

> We must be ready to aid patients and their surgeons in the treatment of extended problems arising from disease.

Esthetic and Restorative Procedure

After the lower anterior alveolar ridge had been reestablished through surgery, the challenge of attaining an esthetically pleasing and functional result remained. Communication between the attending surgeons was important during mandibular alveolar reconstruction and implant placement, and communication between the esthetic/restorative dentist and the laboratory that would fabricate the prosthesis would be just as important. Successful results come from extensive preoperative planning, and it was essential to select a laboratory that possessed the knowledge and skills to deliver quality.

Evaluation

The provisional prosthesis the patient had been wearing had irritated the tissues surrounding the implant healing collars so much that a highly edematous and hemorrhagic condition was present (Figure 8). Relief of the tissue side of the temporary prosthesis to eliminate irritation resulted in an improvement in the tissues surrounding the implants. Hygiene improvements by the patient also dramatically and positively affected the inflamed tissues.

Restoration

Even with the lower anterior mandible augmentation, the vertical height of the alveolar ridge was still deficient (Figures 9 and 10). This situation presented a challenge to fill the edentulous area to provide adequate strength and to achieve an esthetic result. Through an evaluation of mounted diagnostic models, a radiographic analysis, and a diagnostic wax-up (**Master Diagnostic Model® [MDM®], Valley Dental Arts Laboratory of Stillwater, MN**), it was determined that the implant suprastructure design would be a milled bar with a metal-ceramic overlying the bar that would be retained by three horizontal screws.

After the laboratory and dentist communication was concluded and the design was determined, the patient was scheduled for a report of the findings. The treatment plan would involve preparing teeth Nos. 18, 19, 20, and 30 for full-coverage all-ceramic **IPS Empress® crowns (Ivoclar Williams)**, and replacing the implants with the milled bar and metal-ceramic superior structure.

Preparation

The teeth were prepared first on the right side and a unilateral bite registration (**Stat-BR™ bite registration material, Kerr® Corporation**) was taken. The teeth on the left side were prepared. The right side bite registration was then reinserted in the

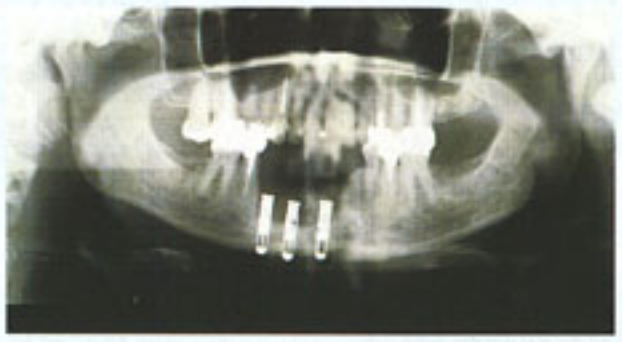


Figure 10—Radiographic view of implants and vertical defect.

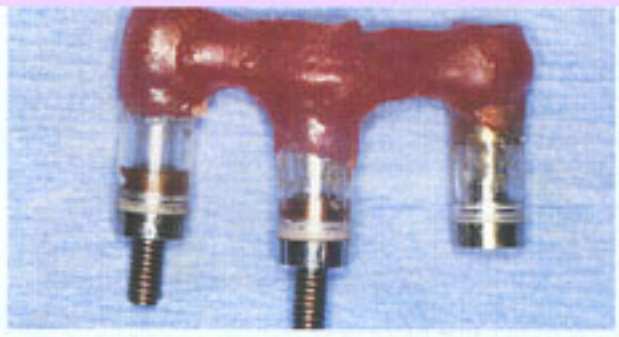


Figure 11—Resin pattern.

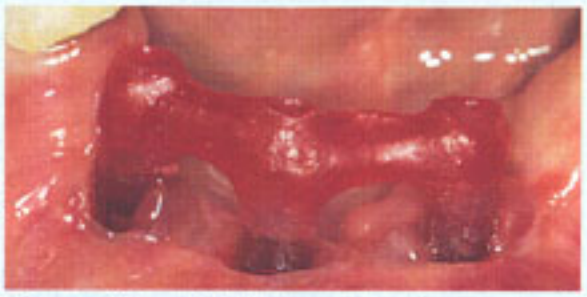
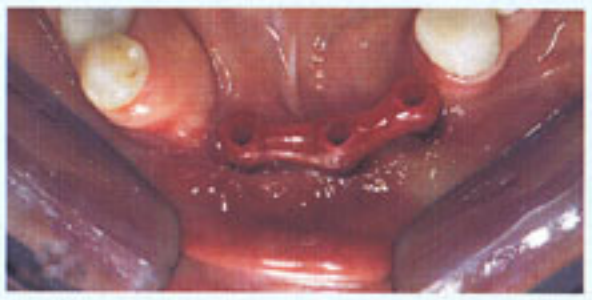
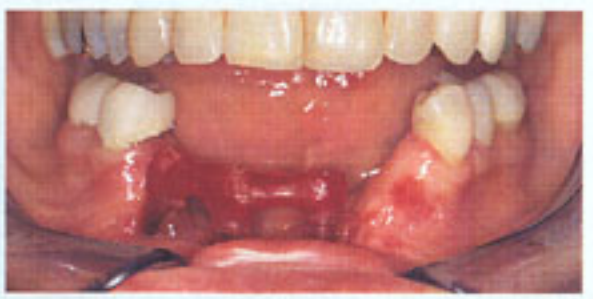
mouth as the left side bite registration was taken. Bite registrations were taken with the patient manipulated into centric relation through bimanual manipulation.[1]

Vertical dimension consistency was aided by the occlusal stop from the unprepared lower right first bicuspid. The healing collars and screws were removed from the implants before impression copings were placed. A full-arch lower impression was then taken with a polyether impression material (**Impregum®, ESPE**).

When the impression was verified for accuracy, temporization was implemented by placing provisional **Luxatemp® crowns in an A1 shade (Zenith/DMG)**. Before the provisional crowns were placed, all teeth were thoroughly cleansed with **Consepsis® Scrub (Ultradent Products, Inc.)**, rinsed, dried, coated with **Tubulicid Red (Global Dental Products, Inc.)**, and allowed to set for 60 seconds.

The preparations were dried with clean, dry air and then liberally coated with **Consepsis® soap (Ultradent Products, Inc.)** before the provisional crowns were cemented into place with zinc phosphate cement.[2] The healing collars and screws were placed back on the implants to stabilize the tissue.

The patient's provisional partial denture continued to be used to fill the edentulous area of the anterior mandible. A face-bow record using the **PROTAR Articulator System (KaVo USA)** and a full-arch maxillary impression were taken. The bite registrations, the face-bow record, the maxillary impression, 35-mm slides (1:1 and 1:2 magnification—full-face views), the diagnostic wax-up, shade require-

***Figures 12 through 14**—Views of resin pattern in place intraorally.*

ments, and color mapping were all sent to the laboratory.[3]

Laboratory Procedures

A polyether impression was poured in **Fuji Rock® EP (GC Lab Technologies)**, and **Gingi-tech® (Ivoclar Williams)** was used for the soft-tissue material. A resin bar was constructed using **Pattern Resin™ (GC Lab Technologies)** attached to implant abutments **(Impact UCLA-type, Vita Zahnfabrik, Germany, dist. in US by Vident™)** (Figure 11). The resin bar with the abutments was returned to the dental office and tried on the patient to verify fit (Figures 12 through 14). Periapical radiographs were taken to ensure complete implant abutment seating before the resin bar/abutment unit was returned to the laboratory.

> Successful results come from extensive preoperative planning, and it was essential to select a laboratory that possessed the knowledge and skills to deliver quality.

The prosthesis was waxed to full contour using **Bego milling wax (BEGO Bremer Goldschlagerei Wilh. Herbst GmbH & Co.)**. **Solaro 3® alloy type (Metalor Dental USA Corporation)** was used and the case was milled from full contour to a

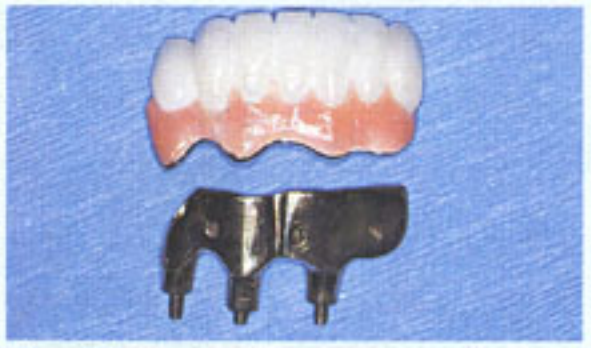


***Figure 15**—Facial view of restorative complex.*

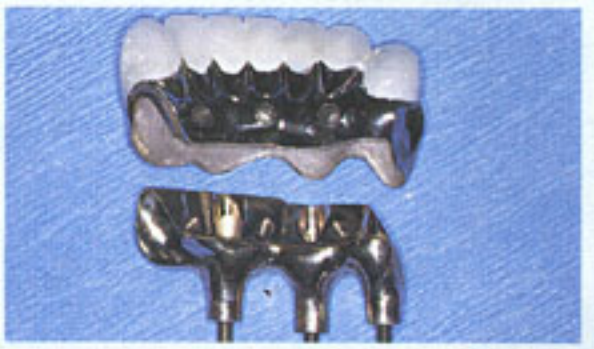


***Figure 16**—Lingual view of restorative complex.*

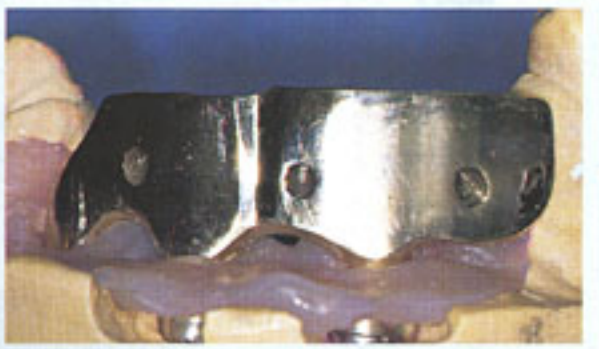


***Figure 17**—Facial view of milled bar on model.*

bar at a 4° taper using an **F1 milling machine (Degussa/Ney)**.

An MDM® wax-up was fabricated over the bar for try in before the superior structure was designed and cast as a sleeve to fit over the milled bar. Horizontal retention screws also were placed from the lingual aspect within the design.

Final placement of the implant prosthesis marked the beginning of a time the patient could again smile and function in a way she once had.

Ceramics

The porcelains used were **IPS Classic™ (Ivoclar Williams)** in shade 110 opaque and gingival shade with opal S2 incisal, and **Surprise AD-1 (Jensen Industries)** was used in the interproximals for depth. After trimming the body porcelain and shaping the lobes with a brush, **T5 (polar) Vita® Omega 900 (Vita Zahnfabrik, Germany, dist. in US by Vident™)** was applied over the opal S2 for translucency. **Vita® Omega 900 T8 and T9 (translucent orange) (Vita Zahnfabrik, Germany, dist. in US by Vident™)** was then overlayed at the gingival half to give depth and warmth to the shade.

The selection of the gingival porcelain shades was significant to the esthetics of the prosthesis. When there is not a lot of depth

***Figure 18**—Lingual view of milled bar on model.*

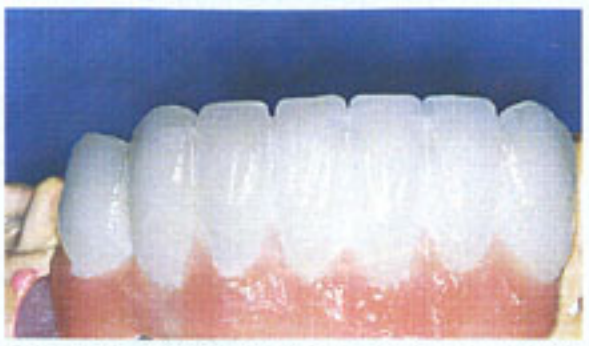


***Figure 19**—Facial view of metal-ceramic superior structure seated on milled bar on model.*

***Figure 20**—Lingual view of metal-ceramic superior structure on model.*

for the gingival porcelain on an implant bridge, the tissue area is opaqued with a pink and red-brown modifier, and for this case **Vita® Omega Artist Line Set II-Gingiva (Vita Zahnfabrik, Germany, dist. in US by Vident™)** was used. Because of the amount of tissue, it was important to use a combination of gingival shades for natural esthetics, so the G2 and G4 shades were selected from the Vita® Omega Artist Line Set. The dark G4 shade was used in the papilla and cervical areas and blended with the light G2 shade around the root areas, then applied in the depressions.

The case was returned to the dental office, the upper and lower casts were placed into the PROTAR articulator, and all crowns were placed on models. The milled bar suprastructure and the metal-ceramic superior structure were evaluated for fit (Figures 15 and 16). The milled bar suprastructure was placed on the lower model and attached with screws (Figures 17 and 18). The metal-ceramic superior structure was placed over the milled bar and attached with three horizontal screw components from the lingual (Figures 19 and 20).

Evaluation of the fit and passive placement of all screw components was critical before clinical try-in. It provided the dentist the opportunity to evaluate the feel for what is correct in the placement and position of all screw components.

All provisional crowns were removed and the preparations were cleansed. Each IPS Empress® unit was tried in and the marginal fit verified. A rubber dam was placed and each preparation was cleansed with Consepsis® Scrub and dried with clean, dry air before being etched with 37% phosphoric acid for 15 to 20 seconds, rinsed thoroughly, and lightly dried but not desicated.[4]

Tubulicid Red was then applied and lightly scrubbed into the preparation surfaces to give them a moist appearance. **Prime & Bond® NT™ (DENTSPLY® Caulk®)** bonding agent was then liberally applied and thoroughly brushed in all aspects of the preparation surfaces. The bonding agent was allowed to set for 20 seconds so the acetone component of the bonding agent could evaporate. The preparations were then lightly dried and the bonding agent was light-cured with an **Apollo Elite PAC Light (Dental/Medical Diagnostic Systems, Inc.)** light. All IPS Empress® units had been acidified and [illegible] before the units were ready for the luting resin (**Variolink® II in a yellow shade, Ivoclar Vivadent**).[5] Each unit was filled and placed into position and any excess was removed before they were spot tacked with the Apollo Elite PAC Light. Glycerine was lightly coated along all of the exposed margins, and the interproximal areas were gently flossed with **Glide Floss® (W.L. Gore & Associates)**.[6] Final curing was initiated with the Apollo Elite and a wide curing tip. The rubber dam was then removed and minor clean up was completed.

Because of the moisture and inherent smoothness of the ceramic restorations, it is sometimes difficult to attain a clear reading with the articulating paper in occlusion evaluation. I have found that if the articulating paper is lightly coated with petroleum jelly, the markings on the ceramic surfaces are more

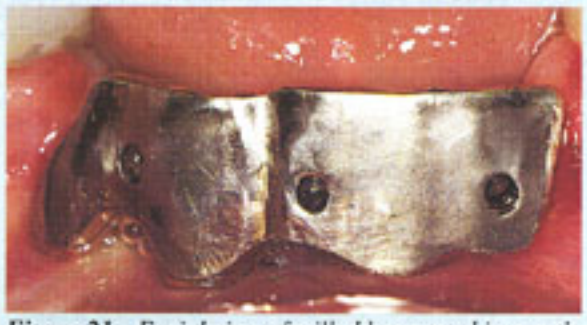


Figure 21—Facial view of milled bar seated in mouth.

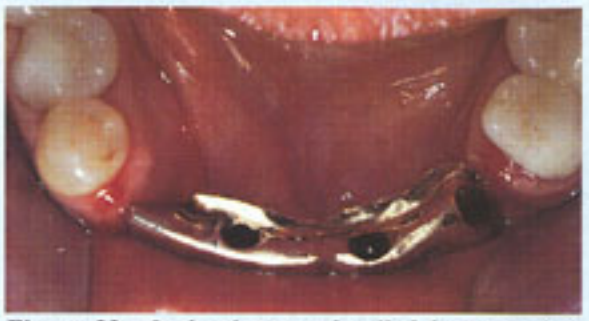


Figure 22—Occlusal view of milled bar seated in mouth.

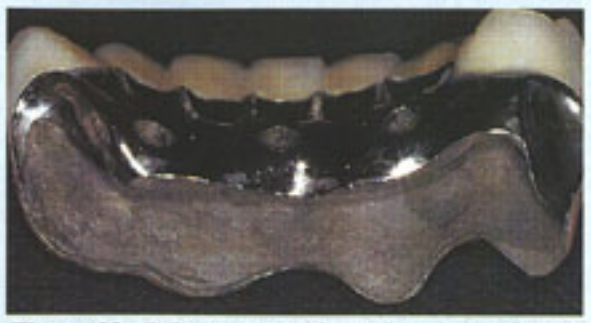


Figure 23—Inferior view of metal-ceramic superior structure.

easily discernable, which makes adjusting easier and more accurate.

Delivery of the Implant Structures

The implant screws and healing collars were removed from each of the three implants. The areas were thoroughly cleaned with Consepsis® and gently rinsed. The milled bar suprastructure was gently placed into the prepared sites (Figures 21 and 22). The middle screw position was placed first and slightly tightened, then the left and right screw positions. Each screw position was slightly tightened and rotated to the next position with the Impac torque wrench until all screws were completely seated and secured to the proper torque.

Periapical radiographs were taken at each implant position to verify that the suprastructure was completely seated into the implants. The metal-ceramic superior structure (Figure 23) was then placed over the milled bar to verify passive fit and alignment with the horizontal screw positions located on the lingual aspect of the prosthesis. Each of the horizontal screws were slightly tightened and rotated to the next position until all were completely seated and secured to the appropriate torque.

Slides of the completed lower arch restoration clearly show the significant changes in the patient's mouth by placement of the implant/ restorative/esthetic design (Figures 24 and 25). Lip support, tooth position, alignment, and color were all taken into consideration in the esthetic design of this case. The significant loss of bone and soft tissue as a result of the surgical resection had forced the lower lip to lose support and fall lingually. The restorative design provided excellent dental esthetics and function, and also improved facial esthetics by supporting the lower lip.

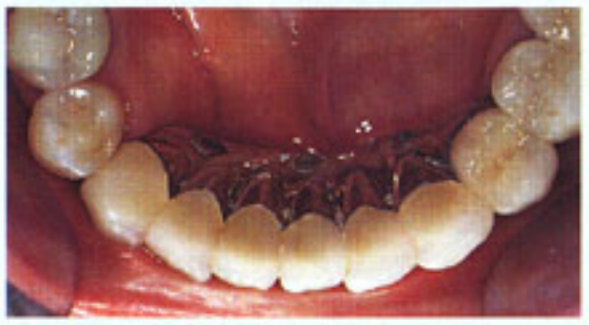


Figure 24—Lingual/occlusal view of seated complex.

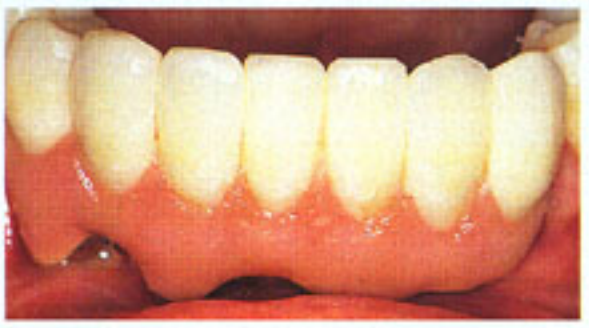


Figure 25—Facial view of seated complex (1:1 magnification).

Figure 26—Postoperative full-face view.

Conclusion

Final placement of the implant prosthesis signaled the end to a long surgical and restorative process for the patient spanning more than 2 years. It marked the beginning of a time the patient could again smile and function in a way she once had. But mostly, it reaffirmed the importance of the professional interrelationships of surgeons, laboratory technicians, and esthetic/restorative dentists and the knowledge specific to each, which work in concert to bring health and smiles to the patients we treat together (Figure 26).

Acknowledgments

The author would like to thank Chuck Maragos, CDT, and the staff at Valley Dental Arts, Stillwater, Minnesota, for their excellent work on the prosthesis; Dr. Steve Schimmele, Oromaxillofacial Surgeon, Indiana University School of Dentistry, Indianapolis, Indiana, for the surgical procedure for this case; and my supporting staff: Beverly, Marilyn, Debra, Heather, Laurie, Lisa, Amanda, and LSJC. ■

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Product References

Product: 3.8 mm cylinder implants
Manufacturer: 3i Implant Innovations
Address: 4555 Riverside Drive
Palm Beach Gardens, FL
33410
Phone: 800.342.5454
Fax: 407.840.2660

Product: AlloDerm®Acellular Dermal Graft
Manufacturer: LifeCell Corporation
Address: One Millenium Way
Branchburg, NJ 08876
Phone: 908.947.1100
Fax: 908.947.1200

Product: Apollo Elite PAC Light
Manufacturer: Dental/Medical Diagnostic Systems, Inc.
Address: 200 North Westlake Boulevard, Suite 202
Westlake Village, CA
91362
Phone: 800.399.0999
Fax: 805.374.1966

Product: Bego milling wax
Manufacturer: BEGO Bremer Goldschlagerei Wilh. Herbst GmbH & Co.
Address: Technologiepark Universitat Wilhelm-Herbst-Str. 1
28359 Bremen Germany
Phone: 494212028-0
Fax: 494212028-100

Product: COE-COMFORT™
Manufacturer: GC America, Inc.
Address: 3737 West 127th Street
Alsip, IL 60803
Phone: 800.323.7063
Fax: 708.371.5103

Product: Consepsis® Scrub
Consepsis® soap
Manufacturer: Ultradent Products, Inc.
Address: 505 West 10200 South
South Jordan, UT 84095
Phone: 800.552.5512
Fax: 801.572.0600

Product: FI milling machine
Manufacturer: Degussa/Ney
Address: 3950 South Clinton Avenue
South Plainfield, NJ
07080
Phone: 800.221.0168
Fax: 908.754.6300

Product: Fuji Rock® EP
Pattern Resin™
Manufacturer: GC Lab Technologies
Address: 15750 South Bell Road, Suite 1C
Lockport, IL 60441
Phone: 888.301.5757
Fax: 708.301.2191

Product: Gingitech®
IPS Classic™
IPS Empress®
Manufacturer: Ivoclar Williams
Address: 175 Pineview Drive
Amherst, NY 14228
Phone: 800.533.6825
Fax: 716.691.2285

Product: Glide®Floss
Manufacturer: W.L. Gore & Associates
Address: 3750 West Kiltie Lane, P.O. Box 900
Flagstaff, AZ 86002
Phone: 800.437.8181
Fax: 520.774.3525

Product: Impact UCLA-type implant abutments
Vita®Omega 900 T5, T8, T9
Vita®Omega Artist Line Set II-Gingiva
Manufacturer: Vita Zahnfabrik, Germany, dist. in US by Vident™
Address: 3150 East Birch Street
P.O. Box 2340
Brea, CA 92621
Phone: 800.828.3839
Fax: 800.848.2726

Product: Impregum®
Manufacturer: ESPE
Address: 1710 Romano Drive
Norristown, PA 19404
Phone: 800.782.1571
Fax: 610.239.2329

Product: KaVo PROTAR Articulator System
Manufacturer: KaVo USA
Address: 340 East Main Street
Lake Zurich, IL 60047
Phone: 800.323.8029
Fax: 847.550.6825

Product: Luxatemp®
Manufacturer: Zenith/DMG
Address: 242 South Dean Street
Englewood, NJ 07631
Phone: 800.662.6383
Fax: 201.894.0213

Product: Master Diagnostic Model®(MDM®)
Manufacturer: Valley Dental Arts Laboratory
Address: 1745 Northwestern Avenue
Stillwater, MN 55082-0205
Phone: 800.328.9157
Fax: 651.439.2855

Product: Prime & Bond® NT™
Manufacturer: DENTSPLY® Caulk®
Address: 38 West Clarke Avenue
Milford, DE 19963
Phone: 800.LD.CAULK
Fax: 302.422.3480

Product: Stat-BR™
Manufacturer: Kerr® Corporation
Address: 1717 West Collins Avenue
Orange, CA 92867
Phone: 800.537.7123
Fax: 800.537.7345

Product: Solaro 3® alloy type
Manufacturer: Metalor Dental USA Corporation
Address: 255 John L. Dietsch Boulevard
North Attleboro, MA 02761
Phone: 800.554.5504
Fax: 508.695.3447

Product: Surprise AD-1
Manufacturer: Jensen Industries, Inc.
Address: 50 Stillman Road
North Haven, CT 06473
Phone: 800.243.2000
Fax: 203.239.1015

Product: Tubulicid Red
Manufacturer: Global Dental Products
Address: P.O. Box 537
North Bellmore, NY 11710
Phone: 516.221.8844
Fax: 516.785.7885

Product: Variolink®II
Manufacturer: Ivoclar Vivadent
Address: 175 Pineview Drive
Amherst, NY 14228
Phone: 800.533.6825
Fax: 716.691.2285