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LABORATORY

Digest

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OF HYDROTHERMAL CERAMIC-FUSED-TO-CAPTEK™ GOLD



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A Montage Media Publication



COMPREHENSIVE REHABILITATION OF SEVERELY TRAUMATIZED ANTERIOR TEETH UTILIZING A GOLD ALLOY-CERAMIC BRIDGE

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ABSTRACT

When treating the anterior region of the dental arch, aesthetics, biocompatibility, and durability are three factors which must be considered. A gold alloy coping (Captek™, Precious Chemicals, Inc., Longwood, FL), when fused to porcelain, enables clinicians to offer patients a natural-looking restoration for anterior dentition without compromising health and strength. This article presents a case in which this restorative option was utilized to restore function and aesthetics for a patient with compromised anterior dentition. The communication requirements between dental professionals in treatment planning and the fabrication of the restoration is also addressed.

The extraction of a tooth in the anterior region of the mouth is accompanied by marked resorption of the alveolar ridge¹ and may result in further functional, salivary, phonetic, and aesthetic complications. When adjacent dentition must be crowned in conjunction with the replacement of the missing tooth, the fixed treatment modalities may include single crowns supported by the remaining natural roots and an implant, or a traditional prosthesis with a pontic, supported by the adjacent dentition. To achieve an optimal treatment result, close cooperation among the restorative dentist, surgeon, and dental technician is recommended to consider diverse perspectives during each phase of the treatment process:

1. Evaluating and selecting the abutment teeth.
2. Creating a proper pontic receptor site through surgical and prosthodontic means.
3. Advance planning of the form of the rehabilitated dentition.
4. Intraoral customization to achieve the optimal design of the rehabilitated dentition.
5. Transfer of the form and color of the provisional prosthesis to the definitive prosthesis.
6. Creating a functional, natural-looking restoration to rehabilitate the damaged and missing dental tissues.

CASE PRESENTATION

A 19-year-old male patient presented with horizontal fractures of 3 maxillary incisors and 1 mandibular incisor (Figure 1). The patient presented with an anterior complete deep bite and all four damaged teeth failed to respond to vitality tests.

A radiographic examination revealed a horizontal fracture in the midroot of the right central incisor, diagnosed as irreparable.

TREATMENT PLANNING

Since the treatment alternative for the neighboring fractured central and lateral incisors involved endodontic therapy and full-coverage crown restorations, the patient was offered two restorative options:

1. Extraction of the right central incisor, placement of an implant-supported crown, and two crowns for the left central and lateral incisors.
2. Extraction of the right central incisor and a conventional fixed partial denture consisting of a pontic for the missing tooth and abutments, including the 2 remaining fractured incisors and the right lateral incisor. This option was selected by the patient.

Since the artificial teeth would exhibit a limited volume as a result of the anterior occlusal pattern, it was evident that achieving an aesthetic fixed



Figure 1. Preoperative facial view of injured anterior dentition requiring restoration.

partial denture would require severe preparation of the abutment teeth; therefore, cast posts and cores were planned. To prevent alveolar ridge resorption following the extraction, socket seal surgery was selected as the augmentation technique. To obtain a controlled crown fabrication and achieve a predictable result, several prosthodontic guidelines were followed in cooperation with the dental technician: an extraoral diagnostic waxup; duplication of the waxup to an acrylic resin intraoral provisional bridge; intraoral modifications; and transformation of the provisional diagnostic prosthesis form and color to the definitive restoration. A porcelain-fused-to-noble alloy restoration (Captek™, Precious Chemicals, Inc., Longwood, FL) was selected due to its superior biocompatibility, physical properties, and aesthetic characteristics.²⁻¹⁰

LABORATORY PHASE

An immediate impression of the fractured dentition was obtained and poured in a hard plaster model. Four teeth were fabricated according to the "Magne" technique (Figure 2), utilizing the Form-up™ Kit (Gema Diffusion, Horbourg, Switzerland).¹¹ After an evaluation of the shape and form by the patient and the operative team, the wax teeth were duplicated to an internally stratified acrylic resin bridge, in which the retainers are the right lateral, left central, and left lateral incisors. A pontic was constructed to replace the extracted right central incisor.

CERVICAL CONTOURING CONCEPT

Following endodontic therapy for the left central and lateral incisors, gold inlay cores were prepared and cemented. The abutment teeth were prepared with circumferential deep chamfers, whereas the vital right lateral incisor was prepared with a light chamfer. The right central incisor, which would be extracted, was cut down below the free gingival margin level (Figure 3), and the diagnostic acrylic restoration was modified intraorally and chairside. The gingival portion of the pontic was adapted intraorally according to the cervical contouring concept^{3,12,13} to support the soft tissue prior to surgical procedures (Figure 4), guide its maturation postoperatively, and maintain the original soft tissue architecture throughout the treatment.

SOCKET SEAL SURGERY

Socket Seal Surgery was the preferred treatment modality for preserving and augmenting the ridge due to its proven advantages.^{12,14-17} The fractured pieces of the root were gently removed without flap elevation to minimize severing of the local vasculature (Figure 5). The socket was thoroughly degranulated and the palatal bony wall was decoricated to enhance recruitment of bone-forming cells from the endosteum. The inner aspect of the



Figure 2. Four teeth were constructed according to the "Magne" technique on a diagnostic waxup. The right central incisor is a pontic.



Figure 3. Prepared abutments and cutdown of right central incisor to be extracted to enable placement of the provisional restoration.



Figure 4. Cervical Contouring Concept is utilized to enhance the soft tissue topography of the pontic site.

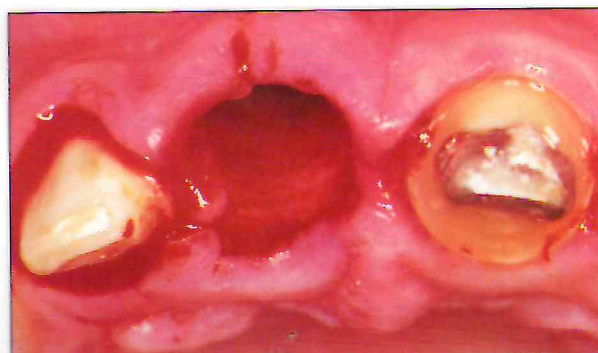


Figure 5. Nontraumatic extraction of the fractured root without the elevation of a flap.



Figure 6. In the Socket Seal Surgery, the onlay graft is placed over the demineralized freeze-dried bone allograft and sutured.



Figure 7. Facial view of abutments and pontic receptor site eight months postoperatively. The soft tissue is prosthetically guided and matured.



Figure 8. Incisal view of a "Geller" double-casted master model for creating the Captek™ framework.



Figure 9. Individual Captek™ gold composite alloy copings were fabricated.

gingival walls were de-epithelized circumferentially with a water-cooled, round coarse diamond bur to create a vascularized recipient bed.

Decalcified freeze-dried bone particles, which may exhibit osteoconductive and perhaps osteoinductive properties¹⁵ as well as prevent postoperative recession of the labial plate, were gently condensed to fill the socket bony walls. Thereafter, a 3-mm-thick round soft tissue graft was obtained from the palate and placed immediately on top of the bone graft to completely seal the socket orifice. It was gently adapted to tile surrounding vascularized gingival walls with six simple silk sutures (Figure 6). The grafted soft tissue prevented physical, chemical, or bacterial interference to the organizing blood clot and bone graft during the healing period. It also prevented collapse and shrinkage of the surrounding gingiva and interdental papillae, while enhancing the soft tissue topography of the ridge. The provisional restoration was then recemented, and the sutures were removed seven days postoperatively.

EVALUATION OF ABUTMENTS AND SOFT TISSUE

Two months postoperatively, the pontic receptor site was in an advanced stage of maturation. However, the right lateral incisor exhibited darkened color, did not respond to vitality tests, and was diagnosed to be in a stage of partial necrosis. Endodontic treatment was performed, followed by placement of an inlay core. The diagnostic acrylic restoration was readapted for evaluation of its function, aesthetics, and guidance of the pontic receptor site.

CAPTEK™-FUSED-TO-PORCELAIN PROSTHESIS

Eight months postoperatively, the soft tissue was reevaluated and determined to be sufficiently mature to proceed with the definitive restoration (Figure 7). To achieve the optimal dentogingival interface, the impression was double-casted in hard plaster stone to produce a "Geller" model (Figure 8). Three individual gold composite alloy copings (Captek) were completed (Figure 9). A separate pontic was fabricated from palladium, 2% gold, and ceramic alloy and was gold-plated to reduce oxides formation. The pontic arms were trimmed to fit between the abutments, and a small piece of the same alloy was also located between the two adjacent retainers. The interproximal connections between all components were oven-welded utilizing a powder form-connecting material mixed with liquid (Capcon®, Precious Chemicals Inc., Longwood, FL) and a solid alloy of 97% gold and 3% silver (Capfil®, Precious Chemicals Inc., Longwood, FL). This combination formed a composite alloy at the connections.

The pontic was also covered by Capcon and Capfil to ensure inhibition of oxides formation on the surface and provide a warm, gold-color background for the veneering porcelain. Combined, these materials form a thick layer of high-gold, oxide-free composite metal over the surface of the pontic. Captek metal at the margins was thinned to 50 μm utilizing carbide burs and rubber wheels to produce optimal margins. Capbond® (Precious Chemicals, Inc., Longwood, FL), the ceramometal bonder, was fired at 1000° C for 2 minutes to form a layer of 97% gold microfilaments over the Captek and pontic surfaces, which would be infiltrated later with the opacous porcelain. The bond between the porcelain and the gold composite alloy framework was achieved with perfect wetting of the metal with the opaque, and the inseparable interlocking of the Capbond and the porcelain.

The Captek framework was reinserted on the "Geller" master model and trimmed to fit the hard plaster papillae and soft tissue replica. The fit was then verified intraorally (Figure 10). To obtain accurate information on the soft tissue-to-framework

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relationship (without a deflection of the periabutment tissue as manifested in the initial "Geller" model), an impression pickup was taken. The individual dies from the master model were inserted into the copings in the impression and a hard plaster was poured to serve as the new master model.^{18,19} A silicon key was made from the diagnostic provisional acrylic restoration and placed over the new master model to guide the porcelain buildup (Figure 11). The definitive porcelain-fused-to-Captek bridge margins were fabricated with Captek alloys for superior tissue response and natural illumination of the gingival margins.²⁰ Adequate color of the pontic and retainer crowns was achieved as a result of the correct background of the Captek framework (Figures 12 and 13). The definitive restoration was cemented provisionally (Figure 14) to perform further clinical and radiographic evaluation (Figure 15) prior to definitive cementation (Figure 16).



Figure 10. The intraoral fit of the Captek™ bridge framework is verified.

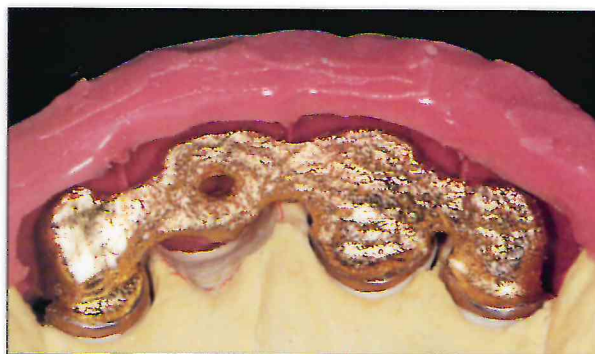


Figure 11. A silicone key from the diagnostic provisional restoration is placed to guide the porcelain buildup on the second master model.



Figure 12. View of a double image outlining Captek™ circumferential margins of the retainers.



Figure 13. Facial view of the definitive bridge restoration in which the Captek™ margins are undetectable.



Figure 14. Palatal view of the definitive porcelain-fused-to-Captek™ bridge temporarily cemented.



Figure 15. A radiograph comparison of the patient's pre- and postoperative condition was completed to confirm the restoration of the abutments and pontic augmented site.



Figure 16. Restored patient's smile with definitive bridge. Note adequate color of retainers and pontic achieved by the Captek™ system.

CONCLUSION

The prosthodontic solutions for a missing tooth in the anterior region should be examined carefully, taking into consideration the status of the neighboring dentition, hard and soft tissues in the extraction area, type and pattern of the patient's occlusion and habits, and the capability and experience of the operating dental team. It should be stressed that a conventional fixed partial denture—cemented or bonded—is a legitimate alternative in the evolving era of dental implants. In the clinical experience of the authors during the last 5 years with more than 600 Captek units, it has been noted

that there is a significant reduction of plaque accumulation and an excellent soft tissue response in the juxta-restoration gingiva of Captek restorations.

Further, in every prosthodontic treatment, careful evaluation and selection of the available techniques and materials, close cooperation between the various specialists and members of the dental team, including the dental technicians, and the complete cooperation of the patient are essential to obtain a predictable and satisfactory result. The case presented illustrates such coordination through the interdisciplinary treatment phases required to achieve the desired functional and aesthetic result.

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