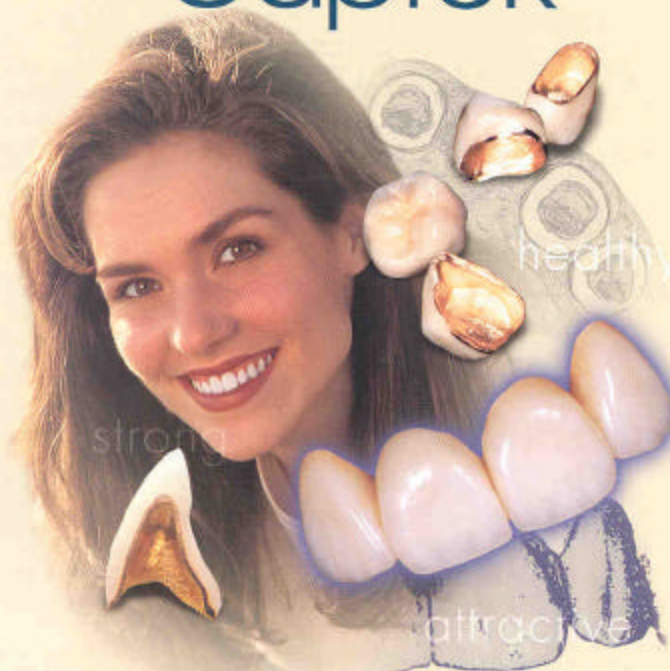


DENTAL PERSPECTIVES

A REVIEW OF THE CLINICAL APPLICATIONS OF DENTAL RESEARCH

Captek™



THE THERAPEUTIC POTENTIAL OF RESTORATIVE SURFACES THAT RESIST BACTERIAL ACCUMULATION

J. Max Goodson, DDS, PhD

BIOCOMPATIBILITY IMPLICATIONS OF FULL-COVERAGE CROWN RESTORATIONS

Neil R. Gottehrer, DDS

PONTIC SITE DEVELOPMENT AND REHABILITATION OF SEVERELY TRAUMATIZED ANTERIOR TEETH UTILIZING A GOLD ALLOY-CERAMIC BRIDGE

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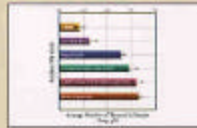


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1000 WINDHOFF AVENUE • MARIETTA, NJ 07430
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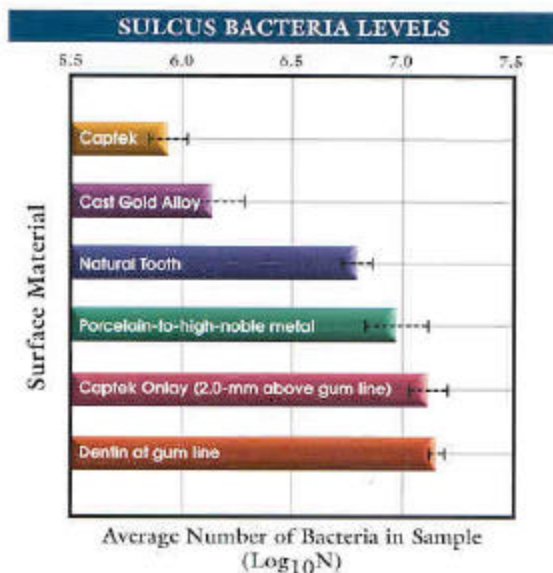


THE THERAPEUTIC POTENTIAL OF RESTORATIVE SURFACES THAT RESIST BACTERIAL ACCUMULATION

J. Max Goodson, DDS, PhD, is affiliated with the Forryth Dental Center, Boston, Massachusetts.



The role of bacteria in periodontal diseases is widely



acknowledged and accepted, and most methods of periodontal treatment are directly related to a reduction in bacterial numbers. Treatments such as scaling and root planning, pocket irrigation, intrapocket antibacterial drug delivery systems, and home care products all aim to reduce the number of bacteria on tooth surfaces adjacent to periodontal tissues. But what about the tooth surface itself? Is it not possible to create a surface that resists bacterial accumulation?

Clinicians have noted plaque formations on Captek™ (Precious Chemicals, Inc., Longwood, FL) gold composite alloy coping surfaces are greatly reduced, which has led many

researchers to speculate regarding the potential of these restorations for promoting periodontal health. This question was recently investigated by in situ analysis of bacterial accumulations using DNA:DNA hybridization methods. A preliminary investigation was conducted by taking bacterial samples from the lingual or palatal surfaces of restored and normal tooth surfaces. A comparison of bacterial accumulation on these surfaces suggested that a spectrum of results may be observed (Table). Some surfaces, such as exposed dentin, appeared to accumulate more bacteria than enamel, whereas other surfaces—such as Captek™—appeared to accumulate less bacteria than enamel. Controlled studies testing only Captek™ and normal tooth surfaces covered by Captek™ gold composite alloy copings were approximately 1/10 that found on normal tooth surfaces in the same patient's mouth.¹

The difference in bacterial counts between Captek™ surfaces and normal tooth surfaces is not trivial. These observations suggest another means of controlling periodontal disease in susceptible patients. Although studies have not been completed that test reduction in periodontal disease activity, selection of a restorative surface that minimizes bacterial accumulation should reduce risk of continuing periodontal tissue loss.



In translating this work to clinical applicability, a note of caution is in order. One would be hesitant to recommend replacement of healthy tooth structure with any restoration solely on the basis of its ability to reduce plaque accumulation. Conversely, if a restoration were required as an abutment, in splinting, or to replace lost tooth structure in a patient afflicted with periodontal disease, one might prefer a restorative material-such as the Captek™ gold composite alloy coping-that does not support dense plaque accumulation. The combination of a restoration that inhibits plaque accumulation, a program of intensive oral hygiene, and regular professional care with selective local antibacterial treatments should control advancing periodontal disease, even in patients at high risk for continuing loss of periodontal tissues.

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BIOCOMPATIBILITY IMPLICATIONS OF FULL-COVERAGE CROWN RESTORATIONS

Neil R. Gottehrer, DDS*

BIOCOMPATIBILITY IMPLICATIONS OF FULL- COVERAGE CROWN RESTORATIONS

Neil R. Gottehrer, DDS*

DENTAL RESTORATIONS HAVE BEEN CONSIDERED A MAJOR CONTRIBUTORY FACTOR IN THE ETIOLOGY OF PERIODONTAL DISEASE. DR. HAROLD LOE, IN HIS CLASSIC PAPER, DISCUSSED THE REACTIONS OF MARGINAL PERIODONTAL TISSUES TO RESTORATIVE PROCEDURES AND THE EFFECT OF THE MATERIALS UTILIZED IN RESTORATIVE DENTISTRY ON THOSE TISSUES. WHILE HE DESCRIBED SOME PROCEDURES AS BEING WELL TOLERATED, OTHERS WERE KNOWN TO ELICIT IRRITATIONAL EFFECTS. HE BELIEVED THERE EXISTED SUBSTANTIAL EVIDENCE THAT ANY KNOWN TYPE OF DENTAL RESTORATION THAT EXTENDS INTO THE SUBGINGIVAL AREA CAUSES DAMAGE TO THE PERIODONTAL TISSUE, EITHER BY PROVIDING POSSIBILITIES FOR BACTERIAL RETENTION AND/OR BY A DIRECT IRRITATIONAL EFFECT OF THE MATERIAL PER SE.¹

It has been suggested that, to be least harmful to the periodontium crown margins must be placed coronal to the gingival margin.^{1,2} However, such placement is often not practical or possible. Austin et al suggested contradictions to such placement involve aesthetics, subgingival caries, an existing subgingival restoration,





Figure 1. Traditional porcelain-fused-to-metal crowns may exhibit poor gingival margins, compromising the entire aesthetic appearance of the restorations.

or a short clinical crown.³ It is obvious, then, that subgingival margins cannot be completely avoided. With aesthetics the primary concern of the majority of patients, most margin placements are now subgingival.

There have been many discussions concerning where the subgingival margin should be located. Waerhaug, in a classic study, suggested that the subgingival margin facilitated the retention of plaque that would later contribute to the destruction of the periodontal structure and concluded that the full-coverage crown restoration should be finished at, or slightly above, the gingival margin.⁴ Silness, nearly 20 years later, described the subgingival margins as exhibiting greater levels of plaque, more severe gingival lesions, and deeper gingival pockets than margins even with or above the gingival crest.⁵

Stein and Glickman, contrary to Loe before and Silness after them, proposed a marginal location for the crown, which is practiced by many dentists today. They suggested that the gingival margin be located at the base of the gingival sulcus at the most coronal level of the epithelial attachment.⁶

Dr. Morton Amsterdam, in his classic treatise on periodontal prostheses, discovered that the marginal finish line was most critical and, when full-coverage restorations were indicated, should be placed within the healthy sulcus, at minimal depth, just short of the junctional epithelium or completely away, preferably on the anatomic crown. He suggested that the least desirable location to terminate a margin is just supragingival, since this represents the area of greatest plaque formation. There is a greater potential for root caries, and there exists a lack of facility to reestablish the intimate form and function of the protective capacity of the gingival unit.⁷ He also suggested guidelines which are still employed today; when considering full-coverage crown restorations, maintain a correct crown contour relationship with proper coronal contours, embrasure form, marginal fit, and periodontal health prior to and following the initiation of restorative therapy.

In view of reported gingival complications in close proximity to the margins of the restoration, Richter studied the influence of crown margins of the locations on gingival tissue. He observed 12 cast gold complete crowns on first molars. The results of the study suggested that the fit and finish may be more significant to gingival health than the location of the finish line.²

However, contrary to this finding, Mörmann et al reported in their study of gingival reaction to well-fitted subgingival proximal gold inlays, that even perfectly adapted and well-polished proximal gold inlays may result in gingival inflammation.⁸ While it is important for the crown to restore the proper form and function of the tooth, even the most precise techniques to avoid adverse effects-including proper tooth preparation, impressions, and well-fitted provisional and definitive crown restorations-may still result in gingival irritation and increased plaque retention.



PRIVATE PRACTICE, HAVERTOWN, PENNSYLVANIA.

Neil R. Gottehrer, DDS
1717 West Chester Pike
Havertown, PA 19083

Tel: 610-449-9500
Fax: 610-789-0786



Due to the significant emphasis on aesthetic dentistry, dental professional can no longer consider fabricating full-coverage crown restorations with supragingival margins. While clinicians must make every attempt to establish good periodontal health, utilize careful procedures in crown preparation and impressions, and strive to fit the ideally contoured final restoration, they must consider innovative materials which may make it possible to achieve the healthy gingival results demanded by the patient.

The gold composite alloy coping (Captek™, Precious Chemicals, Inc., Longwood, FL) and its resulting full-coverage crown restoration appears-from the preliminary data received-to reduce by 90% the number of bacteria observed on normal dentin surfaces in the same mouth. There was 96% less bacterial adhesion compared to ceramic-fused-to-noble-metal restorations. Since there appear to be significantly positive tissue responses to this material, clinicians may now be able to achieve, with greater levels of predictability, what they have always desired for their patients: an aesthetic restoration with a healthy



Figure 2. Captek™ full-coverage crown restorations facilitate the reestablishment of function, while offering a natural appearance to even the most aesthetics-conscious patients.

supporting periodontium.

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PONTIC SITE DEVELOPMENT AND REHABILITATION OF SEVERELY TRAUMATIZED ANTERIOR TEETH UTILIZING A GOLD ALLOY-CERAMIC BRIDGE

Nitzan Bichacho, DMD* • Cobi J. Landsberg, DMD† • Shlomi Silberstein, CDT‡

WHEN TRAINING 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 RESTORATION ARE ALSO ADDRESSED.



Figure 1. Preoperative facial view of traumatized anterior dentition.

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 prosthesis to restore the damaged and missing dental tissues.

† DENTAL TECHNICIAN, ORAL DESIGN, TEL AVIV, ISRAEL.

Nitzan Bichacho, DMD
 16 Miriam Hahashmonait St.
 Tel Aviv 62665
 Israel
 Tel: 011-972-3-605-4370
 Fax: 011-972-3-546-0415



CASE PRESENTATION

A 19-year-old male patient presented with horizontal crown fractures of three maxillary incisors and one mandibular incisor (Figure 1). The patient presented with an anterior complete deep bite and all four damaged teeth failed to respond to vitality tests. Consecutive radiographic examinations revealed a widening horizontal fracture in the midroot of the right central incisor, diagnosed as irreparable.

TREATMENT PLANNING

Since the treatment option 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 two remaining fractured incisors and the right lateral incisor. This option was selected by the patient.

Since the artificial teeth in this case would exhibit a limited volume as a result of the anterior occlusal pattern, it was evident that achieving an aesthetic fixed partial denture would require severe preparation of the abutment teeth; therefore, cast posts and cores were planned. To prevent alveolar ridge resorption following in 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 "Magna" 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 operative team, the wax teeth were duplicated to internally stratified acrylic resin bridge, in which the retainers are the right lateral, left central, and left lateral incisors. A pontic was constructed to



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



Figure 3. Precast abutments and outlines of right central incisor for the acrylic resin transitional prosthesis of the provisional restoration.



Figure 4. Cervical contouring concept is utilized to enhance the soft tissue topography of the pontic site.

an



replace the right central incisor to be extracted.

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 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 selected modality for preserving and augmenting the ridge, as previously demonstrated.^{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 decorticated to enhance recruitment of bone-forming cells from the endosteum. The inner aspect of the gingival walls was de-epithelized circumferentially with a water-cooled, round coarse diamond bur to create a vascularized recipient bed.



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



Figure 7. Facial view of abutments and pontic receptor site eight months postoperatively. The soft tissue was prosthetically guided and has been maturing.



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



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

Decalcified freeze-dried bone particles (Miami Tissue Bank, Miami, FL), 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 3.0-mm-thick round soft tissue graft was obtained from the plate and placed immediately on top of the bone graft to completely seal the socket orifice. It was gently adapted to the 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 gingival 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 significantly 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 "Gellar" 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 97% gold and 3% silver (Capfil®, Precious Chemicals., Longwood, FL). This combination formed a composite alloy at the connections.



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



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



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



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

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.





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



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

Capbond® (Precious Chemicals, Longwood, FL), the ceramometal bonder, was fired at 1000°C for two 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 “Gellar” 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 relationship (without the cord deflection of the periaabutment tissue as manifested in the initial “Gellar” 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).

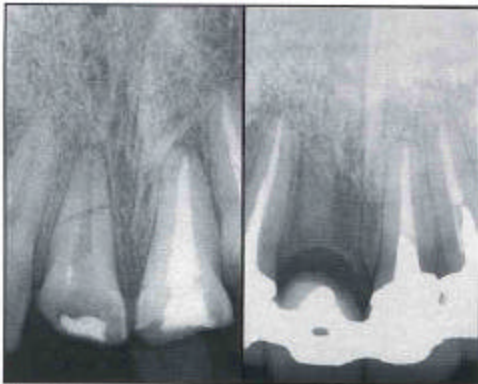


Figure 15. A radiograph comparison of the patient's pre- and postoperative condition. Note the site of the right central incisor.



Figure 16. Restored anterior segment with definitive bridge 18 months postcementation. Note adequate color of retainers and pontic shape.



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 term. It should be stressed that a conventional fixed partial denture-cemented or bonded-remains a legitimate alternative in the evolving era of dental implants. In the clinical experience of the authors during the last six years with more than 700 Captek™ units, it has been noted that there is a significant reduction of plaque accumulation and an excellent soft tissue in the juxta-restoration gingival of Captek™ restorations.

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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The clinical photography utilized to illustrate this article will be reprinted in August 1999 in the journal of *Practical Periodontics & Aesthetic Dentistry* as part of a more comprehensive presentation.



THE LEADERS AGREE . . .

The Strength Behind the Smile

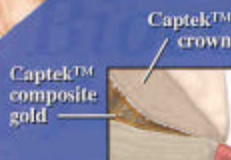
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- Approximately 1/10 of the bacteria found on natural tooth surfaces were present on Captek surfaces*
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- Results suggest that Captek metal surfaces may be a preferred surface in restoration of abutments with periodontal disease affliction*



Dentistry courtesy of Nitzan Bichacho, DMD

*Goodson M, Shober I, Imber S, Som S. Captek alloy reduces dental plaque accumulation. Presented at the International Association of Dental Research General Session; March 11, 1999; Vancouver, Canada.

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Captek™ — a division of Precious Chemicals, Inc.
2957 State Road 434, Suite 100 • Longwood, Florida 32779
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