TARGIS™/ VECTRIS™:

BRIDGING THE GAP WITH METAL-FREE ADHESIVE TECHNOLOGY

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ABSTRACT

The recent introduction of the metal-free Targis™ System (Ivoclar Williams, Amherst, NY), utilizing a ceramic optimized polymer (Ceromer™) veneering material (Targis™, Ivoclar Williams, Amherst, NY), and a fiber-reinforced composite (FRC) framework system (Vectris™, Ivoclar Williams, Amherst, NY) has improved the restorative options for replacing missing dentition in the anterior and posterior segments. The desire by clinicians and patients for a stronger, more conservative, and aesthetically predictable posterior material versus conventional porcelain to metal restorations has driven restorative options to the current advanced technology. When combined with state-of-the-art adhesive materials and techniques, highly aesthetic and functional results are achieved which exhibit predictable durability. The Targis System's clinical applications include inlay, onlay, and full-coverage crown restorations, as well as pontic bridgework. This article presents the use of the Targis™/Vectris™ materials (Ivoclar Williams, Amherst, NY) for a single-tooth replacement in the posterior region.

State-of-the-art restorative materials must fulfill a wide range of requirements. Today's patients demand aesthetic, natural-looking, and durable restorations. Moreover, quality-conscious practitioners require materials to be biocompatible and resistant to the oral conditions. Clinicians are also interested in the clinical reliability and in the technical parameters that determine the behavior of the materials in the different indications.[1] These concerns continually prompt the need for newer restorative materials which possess all the desired properties under most, if not all, clinical applications. Prior to recent advances, the only available metal-free material that could be used for single pontic replacement was In-Ceram® (Vident, Brea, CA). The utilization of this material was limited to specific areas, namely the anterior/premolar region with either minimal pontic size and/or reduced occlusal forces. The primary disadvantages of this material under normal posterior bridge conditions include the potential for fracture at the abutment-pontic connector joints from tooth mobility during function,[2] increased tooth loss due to preparation requirements, and reduced aesthetics due to the opaque alumina core material.

The standard of care in the replacement of a missing tooth with adjacent abutment teeth has long been the fixed or partial coverage metal-reinforced prosthesis. This treatment method typically exhibits long-term function, reliability, and strength. Its disadvantages often include

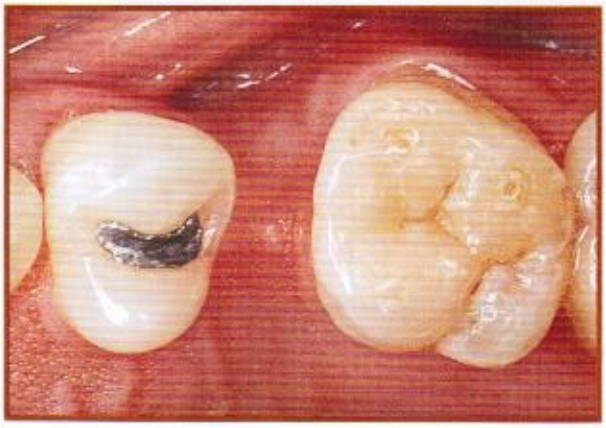

Figure 1. Preoperative occlusal view of missing maxillary second premolar.

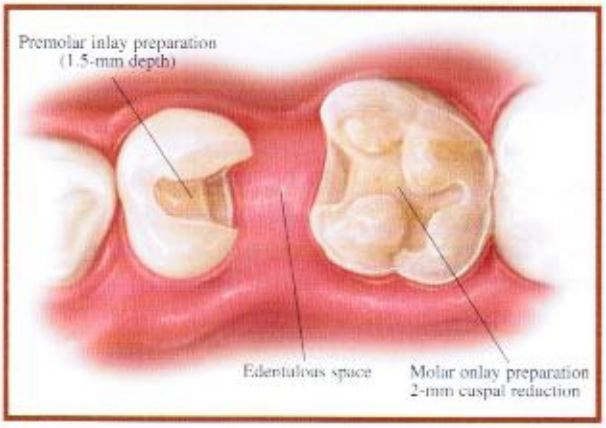

Figure 2. Illustration of the completed inlay-to-onlay bridge preparations.

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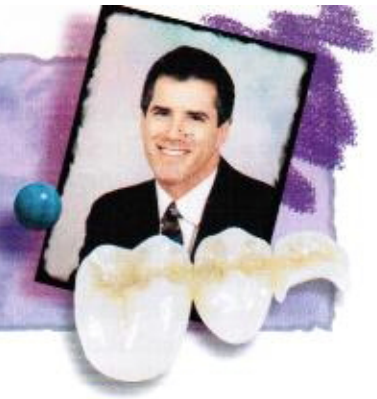

inadequate aesthetics due to the opacity of the substructure, excess removal of sound tooth structure during abutment preparation, and compromised marginal biocompatibility of the soft tissue.[3] To address these concerns, metal-free ceramic optimized polymer and fiber-reinforced composite (FRC) technology (Targis™/Vectris™, Ivoclar Williams, Amherst, NY) has been developed and evaluated in single-unit applications since 1989 and in multiple-unit single-pontic restorations since 1992.[4] The success and recent introduction of these Ceromer™ (Ivoclar Williams, Amherst, NY) materials have expanded the restorative options for replacing missing posterior dentition with the elimination of metal-reinforced substructures.

Figure 3. View of the completed inlay-to-onlay bridge preparations. Preparation guidelines have been followed to maximize the final restoration.

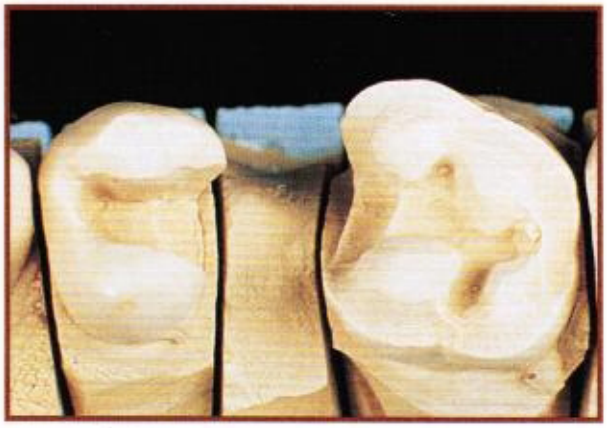

Figure 4. Occlusal view of the master die model.

SYSTEM COMPONENTS

Targis™ (Ceramic Optimized Polymer)

Developed from advanced polymer (resin) chemistry combined with ceramic (glass) fillers, Ceromers provide improved wear resistance, high strength, and superior aesthetics. Ceromers are composed of specially developed and homogeneously conditioned three-dimensional fine particle ceramic fillers of micrometer size (0.04 μm and 1.0 μm), which are closely packed (75 to 80 percent weight) and embedded in an advanced temperable organic polymer matrix with optimum light- and heat-curing potential. This glass particle component creates a restorative material which exhibits abrasion resistance, durability, high stability, and vibrant aesthetics. The polymer resin component provides for ease of final adjustments, a low degree of brittleness and susceptibility to fracturing, chairside repairs, improved polishability, and an effective bond with the luting composite. Ceromer restorations are conservative and strengthen healthy tooth structure when utilized with advanced adhesive agents and luting resins.[1,4,5]

Vectris™ (FRC)

The FRC substructure material is composed of several layers of preimpregnated, homogeneous glass fiber wafers and uniaxially oriented fiber bundles. The glass fibers are silanized to form a chemical bond with the polymer matrix. This essential fiber-matrix bond creates a synergistic effect throughout the substrate. These glass fibers (5 μm and 14 μm in diameter) are stabilized and strengthened through the copolymerization of the silane on the fibers with the methacrylate of the polymer matrix, forming a stable bond between the matrix and the fiber. Following silanization, fiber bunches are

impregnated with the same polymer matrix[1,3] as in the Ceromer. The compatibility of the Vectris™ (Ivoclar Williams, Amherst, NY) material is, therefore, ideally suited for the Targis™ (Ivoclar Williams, Amherst, NY) veneering material.

The FRC framework is a lightweight, dentin-colored, light-cured, translucent material with high strength and enhanced aesthetic properties. The flexural strength of the Vectris framework material —approximately 1000 MPa, or 10 times stronger than feldspathic porcelain—thus rivals that of a conventional porcelain-fused-to-metal (PFM) restoration.[5] Since the framework material has a modulus of elasticity similar to dentin, the strain and stability of the material during mastication are evenly distributed within the abutment teeth and FRC framework material. The translucency of the FRC framework material permits the transmission of light through the restoration and underlying tooth structure for optimum aesthetics.

PREPARATION GUIDELINES

The preparation design and technique are important for the fit accuracy, aesthetics, and the long-term durability of the restoration. The Targis System guidelines are similar to the preparation protocol for other indirect resin and all-ceramic systems, with some modifications.[6] For Targis/Vectris inlays and onlays, the preparation depth should be a minimum of 1.5 mm in the fissure area, with an isthmus width of 1.5 mm. The axial walls of the proximal box should be flared slightly (60° to 80° cavosurface angle) and the enamel margin should not form an acute angle. For onlay and full-coverage crown restorations, the cuspal reduction should be a minimum of 2.0 mm, in addition to a 1.5-mm reduction in the fissure areas and occlusal third of the axial walls. All internal line angles should be rounded and a deep chamfer or shoulder preparation of 1.0 mm to 1.5 mm at a 90° to 120° angle should be placed supragingivally. For full-coverage crown restorations, when preparing the cervical dentin area, the margin can be prepared at 90°. In cervical enamel, a flat bevel of 10° to 30° will improve the acid-etch pattern. Feathered edges, beveled shoulders, long bevels, and undercuts should be avoided.[1]

When preparing an inlay/onlay bridge fabricated from the Ceromer and FRC materials, additional isthmus depth and width space must be created to accommodate the thickness of the combined FRC Pontic and Frame material (Ivoclar Williams, Amherst, NY). This additional space is necessary to achieve intracoronal strength at the fissure area and optimal aesthetics. The modified guidelines for isthmus depths should be 2.0 mm to 2.5 mm; isthmus width for premolars should be 1.5 mm to 2.0 mm; and molar isthmus widths should be 2.5 mm to 3.0 mm for the Ceromer and FRC framework. These parameters ensure the optimum stability of the prosthesis during occlusion, when combined with maximum supragingival occlusal-cervical reduction of the proximal boxes to no more than 1.0 mm to 1.5 mm from the cemento-enamel junction.[4]

CASE PRESENTATION

A 35-year-old male patient presented with a missing maxillary left second premolar. The premolar abutment had a small occlusal amalgam restoration and the first molar abutment was non-restored (Figure 1). Both abutment teeth were periodontally stable and in excellent restorative condition. Due to the nature of the patient's occlusion, there was no posterior opposing occlusal contact except on the lingual cusp of the second molar. The patient also had limited interabutment space as a result of slight

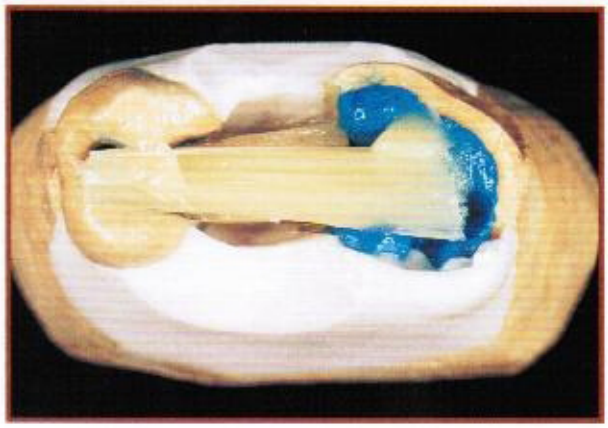

Figure 5. View of the placement of the Vectris Pontic fibers into the silicone key to span the entire bridge length.

Figure 6. Completed Vectris Pontic and Frame materials post-processing in the Vectris VS1 curing unit.

abutment tilting which prevented the placement of a dental implant as a restorative option. The patient was an ideal candidate for a Ceromer and FRC inlay-to-onlay bridge, which would also contribute to the improved occlusion of the first molar.

Prior to the preparation sequence, shade selection was determined. Local anesthesia was then administered and the abutment teeth were prepared according to the guidelines previously described (Figures 2 and 3). Final impressions and a bite registration were taken and an antibacterial solution (Tubulicid® Blue, Global Dental Products, North Bellmore, NY) was applied to the cavity preparations and lightly air-dried. An inlay/onlay temporary material (Fermit™, Ivoclar Vivadent, Amherst, NY) and a single-component, light-cured resin (Fermit™-N, Ivoclar Vivadent, Amherst, NY) were placed in the premolar and molar abutments, respectively, contoured, then light-cured for 40 seconds as the temporary material. Postoperative instructions were given to the patient.

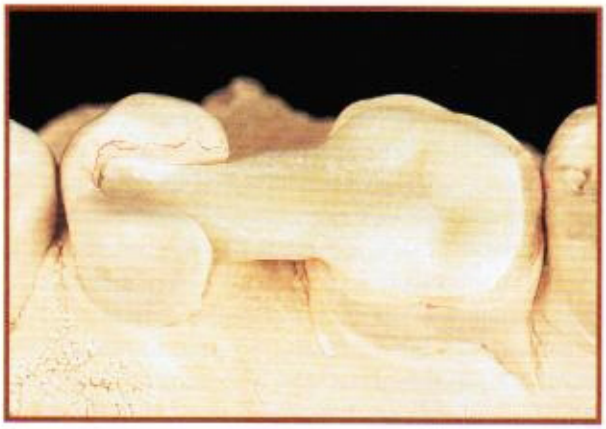

Figure 7. Final cutback of the Vectris Pontic and Frame materials on the master model.

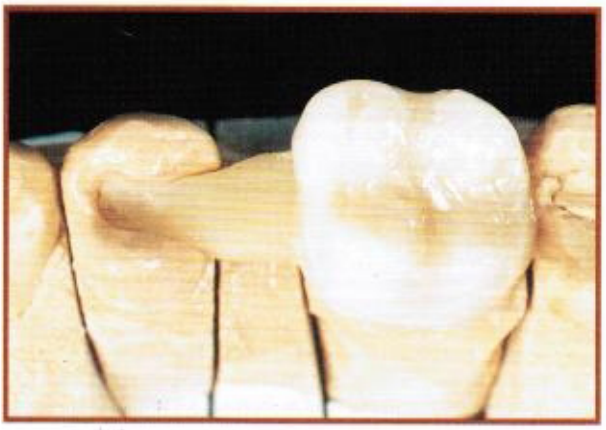

Figure 8. View of Targis Ceromer layering buildup on the molar abutment.

LABORATORY FABRICATION

The final master die model (Figure 4) was fabricated. The initial step in the formation of the final bridge consisted of waxing a bar-like pontic between the two abutments on the stone model. A silicone key was then formed around the bar-like pontic and the wax was removed. The FRC Pontic material (Vectris™, Ivoclar Williams, Amherst, NY) was positioned on the occlusal portion of the silicone key model (Figure 5) and placed in the proprietary curing unit (Vectris™ VS1, Ivoclar Williams, Amherst, NY) which combines light, heat, pressure, and deep vacuum draw to produce a highly accurate and void-free substructure. After completion of the pontic processing, the pontic bar was removed, trimmed, and replaced into position for the application of the overlay material (Vectris™ Frame, Ivoclar Williams, Amherst, NY). The model was returned to the curing unit for the final adaptation of the fiber-reinforced composite Frame material to the Pontic material (Figure 6). The framework was then trimmed in preparation for the application phase of the Ceromer material (Figure 7). The minimum dimensions of the finished framework should be 2.0 mm in diameter for pontics and 0.3 mm to 0.5 mm for abutment framework thickness.

A wetting agent (Targis™ Wetting Agent, Ivoclar Williams, Amherst, NY) was applied to the framework and subsequent layering of the Ceromer base; dentin, occlusal, and characterization composites were incrementally applied with the proprietary curing material (Targis™ Quick Curing Light, Ivoclar Williams, Amherst, NY) until the final restoration contours were completed (Figure 8). Final polymerization of the restoration was achieved in the proprietary light-curing unit (Targis™ Power Unit, Ivoclar Williams, Amherst, NY) which utilizes light and infrared heat (95° C). The restoration was then adjusted, contoured, and finished to harmoniously blend with the abutment teeth and surrounding dentition (Figure 9). All margins were verified for accuracy prior to try-in.

FINAL CEMENTATION

The restoration was tried in to verify aesthetics, anatomical form, marginal integrity, occlusion, and the proximal contact. Upon verification, a rubber dam was placed to prevent potential microleakage which would compromise the definitive bond of the restoration.[7] For inlay-to-onlay bridge cementation, the author utilized a modified rubber dam isolation technique whereby, upon placement of the rubber dam onto the abutments, a slit was made from the distal of the anterior abutment to the mesial of the posterior abutment, and the dam was inverted to expose only the pontic ridge area.

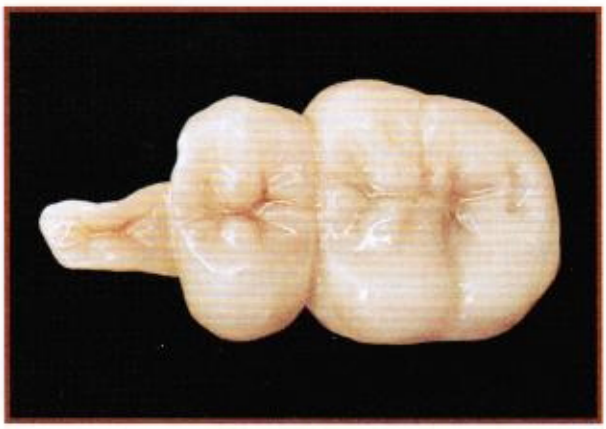

Figure 9. Final Targis/Vectris inlay-to-onlay bridge.

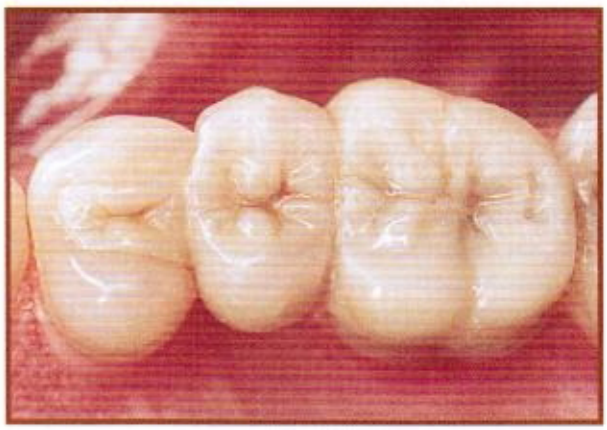

Figure 10. View of the final bridge two weeks postplacement demonstrates excellent aesthetics and occlusal morphology.

This prevents improper seating of the bridge due to the resistance of a taut rubber dam between the abutments.

The restoration and abutment preparations were prepared for cementation using an adhesion protocol and material armamentarium identical for final cementation of all-ceramic restorations. Upon placement of the restoration, subsequent excess luting cement removal, and prior to final polymerization, a surface de-oxygenating agent (De-Ox™, Ultradent Products, South Jordan, UT) was applied over all cavosurface margins to eliminate the incomplete curing of the resin luting cement from oxygen inhibition. Final photopolymerization was then initiated for 1 minute on each of the buccal, occlusal, and lingual surfaces.

Finishing and occlusal adjustments were performed in a conventional manner, and the restoration was polished. The final restoration (Figure 10) demonstrates excellent aesthetics and restored occlusal function on the maxillary left first molar.

DISCUSSION

Until recently, the metal-free restorative options for replacing missing single posterior teeth were limited to conventional PFM or gold bridges, dental implant therapy, or Maryland-type bridges. All-ceramic bridge restorations were limited in use due to the increased susceptibility of fracture in stress-bearing areas, especially in the molar region. With the advent of the Targis System including the FRC component, single- and multiple-tooth replacements are possible with predictable and reliable results. The infusion of resin into the FRC during the manufacturing process, which is impossible to accomplish chairside, distinguishes the Targis System from the majority of other fiber systems.[8] The Targis System has expanded clinicians' treatment alternatives and provided their patients with the confidence of increased strength and aesthetics when restoring missing posterior dentition without the use of metal reinforcement.

CONCLUSION

Although long-term validation of this restorative material is not yet available, its use in dentistry appears promising. The trend to eliminate metal-reinforced single- and multiple-pontic posterior restorations has been increasing over the last decade, and many clinicians have questioned the use of metal substructures as a result of the appearance-related expectations of the patients. The demand for less aggressive treatment modalities in these posterior regions has prompted ethical dental manufacturers to develop newer technologies, which will not only satisfy the patients' requirements, but withstand occlusal forces and exhibit long-term durability. The Targis System, which combines aesthetics and strength, represents a significant advance in metal-free, adhesive technology.

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