A Zirconia-Based Long Span Restoration Used in Restoring Anterior Esthetics with Minor Orthodontic Correction

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While functional restorations in complicated prosthodontic cases are routinely used therapeutically, they can occasionally be esthetically discouraging. The introduction of a new class of high strength, high density, and high durability materials, such as Cercon Zirconia (Dentsply), DC Zircon (Popp DCS), inVizion (Vident), and Procera Z (Nobel Biocare), has opened up possibilities previously unavailable to dental professionals. Especially in younger patients, the esthetic potential of zirconia-based systems makes them an excellent choice in routine cases.[1]

This article describes the treatment of a young victim of impact trauma, with a 6-unit anterior bridge restoration after extraction and allograft therapy. In the process of restoring function, minor orthodontic concerns had to be addressed as well, in collaboration with the dental lab. The restorative approach and system proved to be a rewarding choice.

Cercon Zirconia: About the Restorative System

Many high-strength ceramic systems have recently emerged on the dental market. Of these, Dentsply's Cercon Zirconia has proven its durability and esthetics to the dental community for a number of years.[2,3] The recent launch of Cercon Art CAD system has made the predictability of a precision fit available to dental laboratories.[4]

Cercon is indicated for a wide variety of restorations, from single units to long span bridges.[5] It is an optimal material choice for metal-free restorations because of its biocompatibility, strength, and durability.[6,7] The research about the durability of this material is very promising. A new study of subcritical crack growth in Cercon Zirconia predicts a possible 20 year life for the material.[8] The general fit of the restorations is acceptable, with a marginal gap in the range of 30 µm to 50 µm.[9,10] Cercon and other zirconia restorations are veneered with lucite-free porcelain systems for thermal expansion matching. These systems show excellent bond strengths to the zirconia base.[11]

Case Study

A man in his 20s with a prior history of impact-related trauma presented for an initial consultation regarding implant-based restorative therapy. An in-depth consultation with the patient followed and a dis-

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cussion with the referring dentist revealed that the case was somewhat challenging. The patient's current therapy included a history of failed, anterior-splinted, and composite-based restorations (Figures 1A and 1B). Some decalcification and wear was noted on the mandibular arch, but the critical maxillary issues were targeted first.

The patient had a history of a failing bone graft as well. Severe bone loss was observed in the subfrenular gingiva. On examination, it became apparent that orthodontic therapy was required for tooth No. 7, which needed to be extruded orthodontically through the alveolar process (Figure 2). The patient was otherwise in good health.

Several treatment options were considered in this case. Bone grafting (hard-tissue transplants) followed by soft-tissue grafting have been successfully used.[12,13] Applying the principles of diagnostically based therapy led to the conclusion that the predictability of the outcome would be low, because of the extent of the defect in vertical and horizontal dimensions. Distraction osteogenesis was discarded for the same reasons.[14,15] A removable prosthesis would be a clinically suitable option, but was not desired by the patient.

The patient had a high smile line, with the accompanying esthetic issues in restoration. This was complicated by the fact that tooth No. 9 was nonvital. To harmoniously match the oral environment, the darker gingival tissue also had to be taken into account.

Given the complications of this case, continuing consultation between the clinician and the lab was essential for restorative success. Being familiar with the Cercon system led us to choose an all-ceramic bridge. Full-coverage abutments were chosen over a Maryland bridge, because of concerns about the span of the bridge and adhesion. As a diagnosis and evidence-based therapy, this modality would offer a high level of predictability in a therapeutic outcome, combined with excellent performance and esthetic characteristics.[16] This therapy has been suggested for endodontically involved teeth, but is relatively new for minor orthodontic correction.[17]

Preparation and Provisionalization

As an initial step, tooth No. 9 was extracted. Preliminary impressions were taken before and after extraction to create study models. A vinyl polysiloxane impression material (Express, 3M ESPE) was used.

The stabilization and the preservation of the socket and the alveolar ridge was the next objective. This was addressed by using an allograft material (Bio-Oss, Geistlich Biomaterials), which has been shown to be an appropriate biocompatible bone derivative in fresh extraction sockets for ridge preservation.[18] A membrane for retention or packing was not used. Instead, the soft tissue was stabilized using 4-O silk sutures (Ethicon, Johnson & Johnson).

Preparation guidelines for Cercon restorations are conservative, and familiar to most practitioners placing metal-free restorations. A preparation angle of 6 degrees to 8 degrees and a flat occlusal opening angle (140 degrees) are recommended. Sharp line angles and undercuts are to be avoided.

An axial reduction of 0.8 mm to 1.5 mm and an incisal reduction of 1.5 mm to 2.0 mm were comfortably achieved in this case. These guidelines are familiar to practitioners of esthetic dentistry who place all-ceramic units. Supercoarse grit diamonds (5847KR-016, Brasseler USA) are useful for facial reductions, and coarse grit diamonds (6368-023) for occlusal reduction. Fine (8392-016) and ultrafine (3392EF-016) diamonds are used for cervical margin finishing.

The patient was temporized on the same visit, using a self-curing bisacryl material (Luxatemp, Zenith DMG). In using bisacryls, it is important to remember that these materials are hydrophobic. It is imperative that there is minimal moisture at the margins in fabricating these provisionals. The use of a double cord technique, with the provisional fabricated with the cord in place for soft-tissue retraction, combined with active drying, can contribute to better results.

A visible light-curing, urethane dimethacrylate-based resin (Triad, Dentsply Prosthetics) in a gingival shade was used to close the vertical dimension in this provisional. The gingival area was characterized with lavender and ochre stains designed for an indirect composite system (belleGlass, Kerr). A sealer (Palaseal, Heraeus Kulzer) was used on the

provisional to enhance its glaze. The attention paid to esthetic provisionalization is a reflection of the longer than average service life of the provisional—about 3 months.

Laboratory Process

The study models and diagnostic wax-ups that were created helped to fine tune the fabrication of the bridge during the different steps (Figure 6). Once the decision for a 6-unit anterior all-ceramic bridge as the restoration was made, the lab was able to fabricate a framework. The case was challenging on many levels, given the vertical opening to be managed, and the slight obturation on tooth No. 7.

The framework was uniquely designed to address these challenges. We chose a hygienic-pontic design to allow the patient better access for routine at-home oral care. The connector dimensions were slightly exaggerated vertically, to make up some of the height. The orthodontic obturation was addressed with a combination of framework design and porcelain application.

Cercon is available in both shaded (approximately A3) and nonshaded neutral colors (Figure 7). The nonshaded version was picked for the high value target shade. The framework was tried in after extraction and allograft therapy, to visually evaluate the vertical opening to be managed. The try-in was successful and suggested a further modification of the framework design.

Based on the vertical opening,

Figures 1A and 1B—Patient at initial consultation and after treatment was completed.

Figure 2—Labial view of required orthodontic modification.

Figure 3—Extraction site packed with allograft, and tooth reduction for bridge.

Figure 4—Zirconia restorations require relatively conservative tooth reduction.

Figure 5—Patient after provisionalization with view of gingival characterization.

Figure 6—Study model with diagnostic wax-up.

Figure 7—Shaded and neutral zirconia frameworks.

Figure 8—After a bite-in trial, the framework was redesigned for additional vertical dimension.

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the marginal aspect of the Cercon framework was redesigned to extend into the gingival area, to cosmetically enhance the restoration (Figure 8). This is an unusual step, but a relatively low-risk option given the low stresses expected in the anterior area.

The patient was judged to be a 2M1 shade on the Vita 3D Master Shade Guide. This shade was approximated by blending A1 and A2 dentin shades in the Ceramco PFZ veneering porcelain, over an A1 liner, with A2 opaceous dentin used for esthetic modifications. An opal light incisal was used. The PFZ porcelain is inherently leucite free, and consequently a low level of antagonist wear is expected. A tissue tint shade (reddish pink) was used to cover the labial aspect of the framework, to blend in with the patient's characterized dentition. Some stains were also used to characterize the area for blending (Figures 9A and 9B).


Figures 9A and 9B—Labial and lingual views of restoration.


Figures 10A and 10B—Facial views of restored smile.


Figures 11A and 11B—Figures comparing restorative situation before and after therapy.

Placement

At placement, the provisional was removed and it was polished with rubber cups that contained a premixed slurry of pumice and 2% chlorhexidine (Consepsis, Ultradent). The preparation was rinsed and lightly air dried, and the prepared teeth were isolated from the adjacent dentition.

The teeth were then conditioned with a mild 1-step primer (ED Primer, Kuraray), which obviated the need to subject the teeth to acid etching. This reduced postoperative sensitivity. The internal surface of the Cercon restoration was microetched with 50 µm aluminum oxide. Such high strength ceramics have no demonstrated chemical mechanism of adhesion to resin cements, and physical micromechanical retention has been shown to be more than sufficient. Unlike in the case of weaker, glass infiltrated ceramics, silanation has not been shown to be effective.[19,20] A self-curing adhesive resin with an anaerobic setting mechanism (Panavia 21, Kuraray Dental) was used to lute the bridge in place.

The esthetic outcome was very much to the authors' and to the patient's satisfaction. Images in Figures 10A and 10B show different views of the restoration in situ. Especially in comparison to the situation before treatment (Figures 11A and 11B), the outcome was a significant improvement in form and function.

Summary

This article described the restoration of function and esthetics after impact-related trauma in a young patient. A relatively novel approach of using a long-span bridge was chosen, following extraction and allografting. This was a diagnostically based therapeutic modality that required extensive collaboration between the dentist and the lab. It was a practical approach to addressing some minor orthodontic issues as well. The choice of the proven Cercon zirconia restorative system facilitated this therapy, and provided optimal esthetic results and functionality. This demonstrates the versatility of the system in unusual cases as well as routine restorations.

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