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Clinical Report

Zirconia post-pressed ceramic core-supported all-ceramic crown: Case reports and 4-year follow-up

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Esthetic restorations involving anterior teeth pose a challenge to any clinician. Increasing patient expectations and the search for metal-free restorations have led to the birth of all-ceramic restorations. All-ceramic restorations must combine the mechanical properties of metal and optical properties of ceramics to be accepted as an alternative to porcelain-fused to metal restorations. At present, zirconia-based materials stand out as the strongest, most esthetic and biocompatible material available as posts for all-ceramic restorations. All-ceramic crowns require all-ceramic post and core as foundation restoration, as they help to bring about the best possible esthetic outcome. Here, a zirconia prefabricated post was heat pressed with the core material to obtain a monobloc. This provided the foundation for the restoration of the tooth with all-ceramic crown. The article presents clinical cases and a 4-year follow-up of three cases treated using all-ceramic post/core/crown. The procedure is presented in detail.

Key words: All-ceramic crown, all-ceramic post and core, ceramic post, esthetic restorations, heat press technique, zirconia post

INTRODUCTION

Increasing patient expectations regarding the appearance of restorations test the skill of clinicians and total patient satisfaction is still a challenge in each and every case. Metal ceramic restorations have their own esthetic limitations due to the nontranslucent metal coping. This has resulted in an increased demand for all-ceramic restorations. In spite of the fact that all-ceramic materials have excellent esthetics, biocompatibility, color stability, low thermal conductivity, the popularity of all-ceramic restorations was impeded by their lack of fracture resistance.

The introduction of improved all-ceramic systems makes it possible to achieve optimal esthetics along with the necessary mechanical properties to withstand functional stresses. The potential of these materials to be bonded to enamel and dentin has also contributed to the increased application of metal-free crowns in recent years.

Endodontically treated teeth and fractured teeth often need a post and core as foundation for the final restorations. The restoration of anterior nonvital teeth with metal post and cores will defeat the very purpose of all-ceramic crown by compromising on the esthetics. Metal posts may shine through the all-ceramic crowns and thin gingiva or at the least decrease the depth of translucency of the restoration. When nonprecious alloys form the foundation, corrosion products may lead to discoloration. Presently, improved ceramic materials and porcelain bonding systems have resulted in successful metal-free restorations. This has created a need for a post-and-core system capable of combining the optical properties of ceramics and the good mechanical properties of prefabricated metal posts.

Zirconia posts are gaining popularity as an ideal all-ceramic post as they provide optical properties for post/cores similar to that of all-ceramic crowns. Zirconia was first discovered in 1789 by the German chemist Martin Heinrich Klaproth as a metal oxide (ZrO_2). Pure zirconia cannot be used in the manufacture of posts without the addition of stabilizers. Zirconium oxide is currently the strongest white-shaded ceramic. They are commonly known as yttrium-stabilized tetragonal zirconia polycrystals containing zirconium oxide (94.9%) and yttrium oxide (5.1%). Only this type of zirconium oxide provides high performance. When subjected to stress, the tetragonal crystal phase is transformed into monoclinic phase and an associated volumetric expansion (3-5%) takes place. This in turn results in the development of internal stresses opposing the opening of a crack, thereby increasing the resistance of the material to crack propagation. Therefore, stress is absorbed and no crack formation

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occurs. Zirconium oxide has been used extensively in orthopedic implants, and it is the strongest and toughest ceramic available.[1]

Zirconia-rich ceramic materials have flexural strength similar to metal and carbon fiber posts. The flexural strength is 900 MPa. They possess excellent strength and crack resistance.[2-4] They have a high elastic modulus and are less liable to fail adhesively during mastication. Zirconia posts are highly esthetic, bond satisfactorily to dentin and to build-up resin through adhesive resin-based cement. They are highly radio-opaque in comparison to other metal-free posts, and they are compatible with composite and ceramic. They can be used in direct techniques or in indirect techniques associated with heat-pressed ceramics. Their disadvantages are that they are difficult to remove from root canal if re-intervention of the canal becomes necessary, and high cost and long-term studies are not available as of now.[5,6] Zirconia posts are indicated in ideal overbite / overjet cases with a minimum of 2-3 mm of the remaining supragingival tooth structure and without any periapical pathology or sinus discharge.

CASE REPORT

A 24-year-old man reported to Meenakshi Ammal Dental College, Chennai, India, with a 1-day-old fracture of the maxillary right lateral incisor (Ellis III fracture) with pulpal exposure and excruciating pain [Figure 1]. After a diagnostic intraoral periapical radiograph was exposed, it was planned that the tooth would undergo root canal treatment, followed by the placement of all-ceramic post and core (CosmoPost® system, Ivoclar / Vivadent, Schaan / Liechtenstein) and all-ceramic crown (IPS Empress Esthetic®, Ivoclar / Vivadent, Schaan / Liechtenstein). Informed consent of the subject was obtained after the nature of the procedure was discussed and possible discomforts and risks had been fully explained.

At the first appointment, local anesthesia (lignoacaine and adrenaline injection, xylocaine 2% adrenaline 1:200000, Astra Zeneca, Bangalore, India) was administered and the access preparation to the root canal was performed under rubber dam isolation. Pulp was extirpated and cleaning and shaping of the root canal was done up to size 70 using hand instruments. Sodium hypochlorite (2.5%) (Novo Dental Products, Mumbai, India) was used as an irrigant and finally normal saline was used.

Obturation was completed in the second appointment using gutta percha by vertical and lateral condensation method using zinc oxide-eugenol as the root canal sealer. Shade matching was done using Chromoscop (Ivoclar / Vivadent, Schaan / Liechtenstein). Post space was prepared using the 1.4 mm drill provided by the manufacturer (Ivoclar / Vivadent, Schaan / Liechtenstein). Four millimeter of gutta percha was maintained apically. Tooth preparation for receiving a crown was completed with radial shoulder as the finish line. A 360° radial shoulder was prepared using a round end tapering fissure diamond. Gingival retraction was performed using cord #00 size (Ultradent Products, Utah, USA). Impressions posts are provided by the manufacturer in the CosmoPost kit. The dimension of the impression post corresponds to the size of the prefabricated CosmoPost (1.4mm in this case) [Figure 2] and the length was verified by means of an intraoral periapical radiograph. Impression was made using polyvinylsiloxane (Provil, Kulzer, Hanau, Germany). A two-step putty wash technique was followed. Impression post was picked up in the impression and sent to the laboratory for processing of the post and core build-up. In the laboratory, the prefabricated post was built up with wax to form the core. The prefabricated zirconia post was pressed with all-ceramic core using heat-pressed technique through lost wax process using dentin ingot shade [Figure 3]. The material that formed the core was a prefabricated ceramic ingot made of silicon dioxide and zirconium dioxide.

In the third visit, zirconia post pressed with all-ceramic core was tried prior to cementation under rubber dam. The fit of the post was verified and occlusal clearance was also checked. Cementation of the post and core was carried out under rubber dam isolation. Prepared post space was etched using 37% orthophosphoric acid (Total etch, Ivoclar / Vivadent, Schaan / Liechtenstein) for 1 min and dried using paper points. Simultaneously, the all-ceramic core mass was etched with 5% hydrofluoric acid (Porcelain etch gel, Ivoclar / Vivadent, Schaan / Liechtenstein) for 1 min, washed with water and air dried with air syringe and silanized with Monobond S (Ivoclar / Vivadent, Schaan / Liechtenstein). Hydrofluoric acid dissolved the glass matrix, creating microporosities.

Bonding agent (Excite DSC, Ivoclar / Vivadent) was applied on the core and prepared post space. Low-viscosity adhesive resins applied to the conditioned surface filled the microscopic areas, creating a strong micromechanical bond between the resin and the porcelain.

Dual cure composite resin (Variolink, Ivoclar / Vivadent, Schaan / Liechtenstein) was used as the luting agent. During the cementation of the all-ceramic post and core, the dual cure resin cement was inserted into the canal using a Lentulo spiral, and the post was placed with gentle pressure and cured.

After the post and core was luted [Figure 4], gingival retraction was performed with #00 size (Ultradent Products, Utah, USA); impression was made with polyvinylsiloxane (Provil, Kulzer, Hanau, Germany). Provisional restoration was fabricated using light

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Figure 1: Fractured maxillary right lateral incisor

Figure 2: Impression post (1.4 mm) supplied by the manufacturer

Figure 3: Zirconia post and heat-pressed all-ceramic core

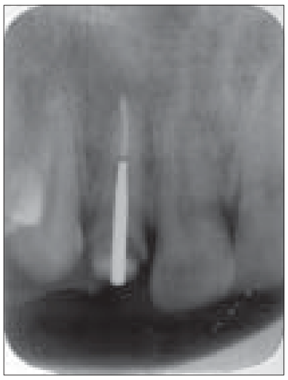

Figure 4: Radiograph showing the luted post and core

Figure 5: Completed all-ceramic crown

Figure 6: Case no 2, fractured maxillary left central incisor

Figure 7: Case no 2, post and core luted with resin luting agent

Figure 8: Case no 2, all ceramic crown luted with resin luting agent

Figure 9: Case no 3, fractured maxillary right lateral incisor

Figure 10: Case No 3, post and core luted with resin luting agent

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activated acrylic resin and luted using eugenol-free zinc oxide cement (Nogenol, GC America Inc, Alsip, IL, USA).

The all-ceramic crown was fabricated in the laboratory using staining technique (IPS Empress Esthetic®, Ivoclar / Vivadent, Schaan / Liechtenstein). Ingots made of leucite-reinforced glass-ceramic were used, which demonstrates high flexural resistance. Characterization was performed using the stain material supplied by the manufacturer.

In the fourth visit, the all-ceramic crown was tried on the core and checked for marginal fit, occlusion and esthetics. Gingival retraction was performed before cementation to enable the removal of the excess luting agent. Final cementation was carried out using dual cure composite resin (Variolink, Ivoclar / Vivadent, Schaan / Liechtenstein) [Figure 5]. This restoration has been followed up for the last 4 years.

DISCUSSION

Zirconia post is designed to be used with resin cement and composite core material. However, lately, the use of IPS Empress core (Ivoclar) has been advised to overcome the disadvantages of a less-rigid, large composite resin.[7] The chemical bonding of bis-GMA-based composite to zirconia is difficult to achieve and therefore the bond must rely on macromechanical retention only. Improved results have been reported with glass ceramics as the core material. For this, the lost wax technique is used and glass ceramic (IPS Empress Cosmo) is heat pressed over the zirconia post. The glass ceramic contains 15 wt% ZrO_2 and a good adhesion between glass ceramics and ZrO_2 posts has been reported.[8]

The CosmoPost® system (Ivoclar / Vivadent, Schaan / Liechtenstein) used here is a zirconia prefabricated post system in which zirconia forms the radicular portion of the post to which a wax pattern of the core is formed. This waxed core is processed in the laboratory using the heat-pressed technique. The pattern is processed using lost-wax technique and IPS Empress Cosmo Ceramic® (Ivoclar / Vivadent, Schaan / Liechtenstein) is injected into the mold to generate the all-ceramic post and core as a single unit. This technique allows for a high level of adaptation to the remaining tooth structure. The ceramic core offers excellent dimensional stability, a strong bond between the post ceramic and core ceramic and forms an integral post and core structure, which acts as a monobloc.

Two more cases were treated in the same way. The teeth involved were maxillary left central incisor [Figures 6-8] and maxillary right lateral incisor [Figures 9 and 10]. All the subjects were male patients whose age ranged between 20 and 30 years.

None of the cases followed in this study showed fracture, debonding, change in esthetic qualities or periapical pathology over a period of 4 years. Owing to the high content of zirconia, fracture of post and core was not observed in this study. With improvements in the adhesive luting cements, adhesive failures of the restoration have become a thing of the past.

CONCLUSION

All-ceramic systems (posts and cores and crowns) offer a promising alternative to the restoration of anterior teeth with metallic cast posts and porcelain fused to metal crowns. The esthetic results obtained by the use of all-ceramic systems are exceptional. High success rates could be achieved in this study over a period of 4 years; a final judgment would definitely require a long term study.

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REFERENCES

1. Rosenblum MA, Schulman S. A review of all-ceramic restorations. J Am Dent Assoc 1997;128:297-307.
2. Ardlin BI. Transformation-toughened zirconia for dental inlays, crowns, bridges: Chemical stability and effect of low-temperature ageing on flexural strength and surface structure. Dent Mater 2002;18:590-5.
3. Christel P, Meunier A, Heler M, Torre JP, Peille CN. Mechanical properties and short-term *in vivo* evaluation of yttrium-oxide-partially-stabilized zirconia. J Biomed Mater Res 1989;23:45-61.
4. Wegner SM, Kern M. Long-term resin bond strength to zirconia ceramic. J Adhes Dent 2000;2:139-47.
5. Koutayas SO, Kern M. All-ceramic posts and cores: The state of the art. Quintessence Int 1999;30:383-92.
6. El-Mowafy O, Brochu JF. Longevity and clinical performance of IPS-Empress ceramic restorations: A literature re view. J Can Dent Assoc 2002;68:233-7.
7. Fernandes AS, Dessai GS. Factors affecting the fracture resistance of post-core reconstructed teeth: A review. Int J Prosthodont 2001;14:355-63.
8. Oblak C, Jevnikar P, Kosmac T, Funduk N, Marion L. Fracture resistance and reliability of new zirconia posts. J Prosthet Dent 2004;91:342-8.

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