Effect of retainer design and material on the fracture resistance of three unit bridge on endodontically treated abutments

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بسم الله الرحمن الرحيم

(قالوا سبحانك لا علم لنا الا ما علمتنا انك انت العليم الحكيم)

صدق الله العظيم

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I would have never been able to be who I am or where I am
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The conventional restoration protocol for endodontically treated teeth with excessive coronal loss has been metal post and core followed by a complete crown. The use of glass fiber posts combined with the dentin bonding technique made the restoration of endodontically treated teeth more straightforward, biocompatible, and economical.[1] Initially, the post was thought to reinforce the remaining tooth structure.[2] However, several studies have shown variable results with high incidences of root fracture, indicating that excessive removal of tooth structure to place a post further weakens the root.[3]

The advent of high-strength ceramic materials and the progress made in adhesive dentistry has resulted in restoring posterior teeth without the use of a post and core.[4] Teeth with excessive coronal loss can be restored with the use of the endocrown.

The first endocrown report was made by Pissis[5] in 1995 and is known as "the monoblock porcelain technique." In 1999, Bindl and Mörmann[6] used the term "endocrown" to describe a ceramic crown which extends into the pulp chamber or the root canal orifices of an endodontically treated tooth in order to gain retention.

Endocrowns have been recommended for teeth with short clinical crowns and calcified, short, or curved root canals that make post and core restorations impossible, also can be used in patients with limited interocclusal space, which prevents adequate thickness for both the ceramic veneer and the metal or ceramic framework.[7] But if depth of pulp chamber is less than 3mm or cervical margin is less than 2 mm wide and if adhesion cannot assured, in such cases endocrowns are contraindicated.[8]

A high-performance polymer, polyetheretherketone (PEEK) has recently been introduced in dentistry. It has been used for the fabrication of implant fixtures, fixed and removable dental prosthesis frameworks, and for implant frameworks and restorative implant parts.[(9)]

A modified PEEK material containing 20% ceramic fillers (BioHPP; Bredent GmbH) can be used for the fabrication of prostheses either by injection molding or CAD-CAM procedures. The advantages of using this material are the elimination of allergic reactions, good mechanical properties, good wear resistance, good polishing properties, and low plaque affinity.[(10)]

Therefore, the concept of using the new materials to construct endocrown retained bridge is considered in the present study.

The increasing demand for esthetic restorations has led to increased acceptance of all-ceramic fixed partial dentures (FPDs) for use in posterior regions of the mouth. There are few reliable clinical studies documenting the longevity of these restorations. All-ceramic FPDs have several advantages compared to metal or metal-ceramic FPDs. Primarily, the esthetics obtained using all-ceramic restorations is unrivaled because of their increased translucency and light transmission. Other advantages include biocompatibility, less tooth reduction, low thermal conductivity, less periodontal pathology because of supragingival placement of margins, and ease of patient access for hygiene purposes.(11)

Clinical studies of all-ceramic FPDs showed comparable longevity of 90% to 93% within a 5-year observation period. This is lower than survival rates of 95% to 97.7% for metal-ceramic FPDs after 5 to 7.5 years. Despite the slightly lower survival rate, ceramic FPDs are still indicated, primarily for esthetic reasons. With greater esthetic demands from the general population, it is easier to achieve esthetic results with ceramic prostheses with less tooth reduction (1.0 to 1.5 mm) compared with that of metal-ceramic prostheses for anterior restorations (1.2 to 1.7 mm).(12)

All-ceramic restorative systems have to fulfill biomechanical requirements and should provide longevity similar to metal–ceramic restorations while providing enhanced esthetics. However, it must be taken into consideration that aging and stress fatigue in the oral environment, as well as function and para-function, all affect the longevity of all-ceramic restorations.(13-15) Therefore, it is well established in the dental literature that evaluation of all-ceramic restorations over 5 years of service is the gold standard.(16)

The connector areas are the most influential in failure. Failure rate is relatively high in three unit all-ceramic bridges around the sharp connector area. The Fixed Dental Prosthesis shape is not uniform clinically, but is a complex combination of multiple convexities and concavities that depend on the geometry and alignment of the teeth. In all ceramic resin-bonded Fixed Dental Prosthesis, the occlusogingival height of the interdental connector must be as large as possible (minimum 4.0 mm). The connector area is usually narrowly constricted for biological or esthetic reasons, which typically considers stresses relative to the average stress levels in other areas of the prosthesis. The minimal recommended connector cross section area is 12-16 mm^2. [17]

A connector thickness of at least 4 mm is recommended for ceramic products with moderate strength and toughness, and a minimum thicknesss of 1.5 mm is recommended for the overall occlusal thickness of crowns. Compared with metal-ceramic prostheses, the fracture susceptibility of some all-ceramic crowns and FPDs is greater because of several important factors: (1) relatively low tensile and flexure strength, *(2)* low to moderate fracture toughness, (3) susceptibility to crack initiation in the presence of microscopic flaws, and (4) sensitivity to tensile stress in the core structure.[18]

The shape of an FPD is not uniform. Its contour has a complex combination of multiple convexities and concavities, depending on the geometry of the teeth and their alignment. In particular, the connector area has a narrow constriction for biologic and esthetic reasons, and these sites in 3-unit FPDs represent stress concentrations relative to the average stress levels within other areas of the prosthesis.[19,20]