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ORIGINAL RESEARCH

Biaxial flexural strength of dental ceramic specimens- An in-vitro Study

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ABSTRACT:
Background: The evolution of all-ceramic systems for dental restorations has been remarkable in last three decades. The present study evaluated the biaxial flexural strength of dental ceramic specimens after etching with 9 % HF acid. **Materials & Methods:** The present study was conducted on 30 glass ceramic specimens were fabricated from three commercially available leucite based core ceramic material (1) Esthetic Empress, (2) Cergo and (3) Performance Plus. Thirty ceramic disc specimens were fabricated for each group from wax patterns. Biaxial flexural strength of specimens was tested. **Results:** The mean biaxial flexural strength in group I was 161.3 MPa, in group II was 152.7 MPA and in group III was 126.2 MPa. The difference was significant (P< 0.05). **Conclusion:** Authors found that maximum Biaxial flexural strength was found with Esthetic Empress followed by Cergo and Performance Plus.
Key words: Biaxial flexural strength, Cergo, Performance Plus

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INTRODUCTION

The evolution of all-ceramic systems for dental restorations has been remarkable in last three decades.[1] Processing techniques novel to dentistry have been developed, such as heat pressing, slip-casting and computer aided design computer aided machining (CAD-CAM). Concurrently, all-ceramic materials have been developed to match dental requirements, offering increasingly greater performance from a mechanical standpoint.[2] As opposed to metalceramics, all-ceramics contain a significantly greater amount of crystalline phase, which is about 35–99 vol%. This higher level of crystallinity is responsible for an improvement in mechanical properties through various mechanisms, such as crystalline reinforcement or stress induced transformation.[3]

One of the most important changes in this scenario was the introduction of monolithic restorations produced from high-strength ceramics, like zirconia. This concept per se is not new, since ceramic materials have been used for a relatively long time for the production of monolithic restorations, but it was only when zirconia started to be used to produce full-contour crowns that dentists and technicians became more confident to indicate a ceramic material for crowns and bridges in the posterior region.[4]

The interest of dentists, dental technicians and patients in all-ceramic materials is rapidly increasing as stronger and tougher materials are developed and commercialized along with novel processing technologies. Currently, a wide range of materials and systems are available. However, relatively little is known about their microstructure and toughening mechanisms and their relationship to the mechanical properties of the corresponding ceramic.[5] The present study evaluated the biaxial flexural strength of dental ceramic specimens after etching with 9 % HF acid.

MATERIALS & METHODS

The present study was conducted with the aim of assessing biaxial flexural strength of dental ceramic specimens. It comprised of 30 glass ceramic specimens were fabricated from three commercially available leucite based core ceramic material (1) Esthetic Empress, (2) Cergo and (3) Performance Plus. Thirty ceramic disc specimens were fabricated for each group from wax patterns. For obtaining specific diameter of disc, a

stainless steel die was prepared measuring 15 mm in diameter and 1.5 mm in thickness. Molten inlay wax was flown into the die and wax discs were formed according to the specific dimensions.

Ten specimens from each ceramic group were etched with 9 % HF acid gel for 2 min, washed in running water and then cleaned ultrasonically for 15 min in distilled water. Biaxial flexural strength of specimens was tested. Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant (P< 0.05).

RESULTS

Table I Distribution of patients

Group I	Group II	Group III
Esthetic Empress	Cergo	Performance Plus

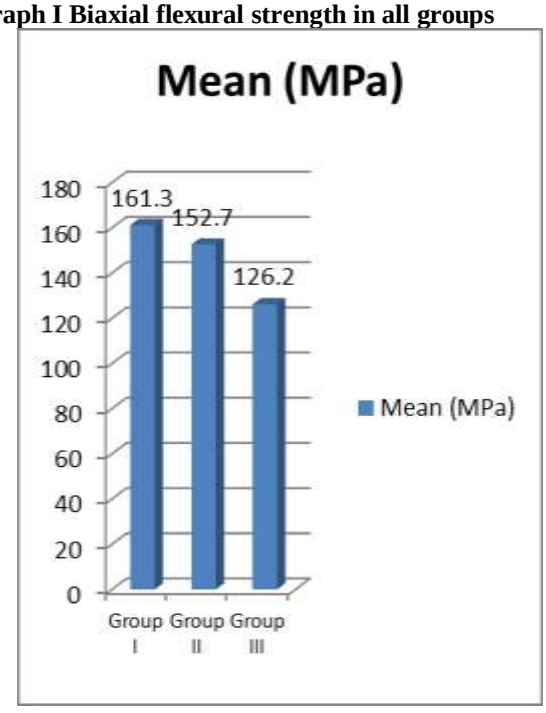
Table I shows that group I comprised of Esthetic Empress, group II Cergo and group III had Performance Plus.

Table II Biaxial flexural strength in all groups

Groups	Mean (MPa)	P value
Group I	161.3	0.02
Group II	152.7	
Group III	126.2	

Table II, graph I shows that mean biaxial flexural strength in group I was 161.3 MPa, in group II was 152.7 MPA and in group III was 126.2 MPa. The difference was significant (P< 0.05).

Graph I Biaxial flexural strength in all groups



DISCUSSION

New microstructures have also been developed by the industry in order to offer ceramic and composite materials with optimized properties, i.e., good mechanical properties, appropriate wear behavior and acceptable aesthetic characteristics.[6] Examples of these novel microstructures are lithium silicate glass-ceramics reinforced with zirconia and a composite constituted of a polymer-infiltrated ceramic.[7] The latter uses an innovative processing technique in which a porous ceramic block is infiltrated with a UDMA-based polymer, as opposed to traditional resin composites produced by means of adding ceramic fillers to a polymer matrix. The main advantage of this material is that it is easier (faster) to be machined by CAD-CAM techniques, and its elastic modulus is closer to that of tooth tissues.[8] The present study evaluated the biaxial flexural strength after etching with 9 % HF acid.

In this study, group I comprised of Esthetic Empress, group II Cergo and group III had Performance Plus. Gurram et al[9] included thirty discs of each material which were divided into three groups of 10 discs each. Biaxial flexural strength (30 discs,) Biaxial flexural strength for samples treated with 9 % HF acid (30 discs) and fracture toughness (30 discs) were evaluated. Core material Performance Plus had the lowest biaxial strength of 124.89 MPa, Cergo had strength of 152.22 MPa and the highest value of 163.95 was reported for Esthetic Empress. For samples treated 9 % HF, Performance Plus had the lowest biaxial strength of 98.37 MPa, Cergo had strength of 117.42 MPa and the highest value of 143.74 was reported for Esthetic Empress. Core material Performance Plus had the lowest fracture toughness of 1.063 MPa, Cergo had strength of 1.112 MPa and the highest value of 1.225 was reported for Esthetic Empress. The results shows that Esthetic Empress had better mechanical properties compared to Cergo had Performance Plus in relation to the parameters tested.

We found that mean biaxial flexural strength in group I was 161.3 MPa, in group II was 152.7 MPA and in group III was 126.2 MPa. One factor that affects the translucency of dental ceramics is the restoration thickness. In general, the lower the thickness, the higher the translucency of a ceramic restoration, therefore, it is mandatory that translucency data is always reported accompanied by the material thickness. Hooshmand et al[10] concluded that a durable resin–ceramic bond could be obtained by using an appropriate silane application without the need for HF acid etching the ceramic surface, confirming the earlier observation. Mechanical strength is an important property that determines the performance of brittle materials. Ever since HF acid etching was first suggested as a ceramic surface pretreatment for resin bonding, many different etching periods have been advocated and used. The manufacturer's recommended etching time for cementation of the IPS Empress ceramic restorations with a luting resin is 60 s and for IPS Empress 2 is 20 s; however, the most profound ceramic surface roughness and the highest bond strength data at the ceramic– resin interface have been obtained by 2-min HF acid etching.

CONCLUSION

Authors found that maximum Biaxial flexural strength was found with Esthetic Empress followed by Cergo and Performance Plus.

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