ORIGINAL RESEARCH

Evaluation and comparison of flexural strength of abraded and polished porcelain surfaces: An in -vitro study

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Abstract

Background: The present study was conducted for evaluating and comparing the flexural strength of abraded and polished porcelain surfaces.

Materials & methods: 50 Feldspathic porcelain Vita VMK Master was selected. Fabrication of a plastic mold was done for achieving standardized blocks of ceramic. Dimension of the mold was fixed to be 35 mm x 8 mm x 5 mm. Fabrication of the samples was done with a rectangular plastic mold with perforations in the middle.Each sample was created by combining a suitable quantity of modeling fluid with porcelain powder. Tissue paper was positioned at one end of the mass to absorb extra liquid. Another set of 50 ceramic samples were prepared. Application of Glaze was done for all the samples on one side and then fired according to manufacturer conduction. The samples were tested for their flexural strength using a Universal Testing Machine. All the results were recorded in Microsoft excel sheet followed by statistical analysis using SPSS software.

Results: Mean flexural strength among specimens of abraded porcelain group was 129.6 MPa while that of polished porcelain group was 142.8 MPa. While comparing statistically, significant results were obtained.

Conclusion: Polishing of the ceramic surfaces could be a better alternative clinical step for improving the longevity.

Key words: Flexural strength, Abraded, Porcelain

Introduction

Dental ceramics are materials that are part of systems designed with the purpose of producing dental prostheses that in turn are used to replace missing or damaged dental structures. The literature on this topic defines ceramics as inorganic, non-metallic materials made by man by the heating of raw minerals at high temperatures.Ceramics and glasses are brittle, which means that they display a high compressive strength but low tensile strength and may be fractured under very low strain.[1- 3]As restorative materials, dental ceramics have disadvantages mostly due to their inability to withstand functional forces that are present in the oral cavity. Hence, initially, they found limited application in the premolar and molar areas, although further development in these materials has enabled their use as a posterior long-span fixed partial prosthetic restorations and structures over dental implants. All dental ceramics display low fracture toughness when compared with other dental materials, such as metals.[4, 5]The need for orthodontic care has increased dramatically among individuals with one or more restored teeth in recent years. Porcelain is a commonly used dental material for replacing missing teeth or restoring severely damaged teeth and deteriorating enamel surfaces. This is due to its excellent strength and durability, excellent aesthetics, and acceptable biocompatibility.[6]Hence; the present study was conducted for evaluating and comparing the flexural strength of abraded and polished porcelain surfaces.

Materials & methods

The present in-vitro study was conducted for evaluating the flexural strength of abraded and polished porcelain surfaces. Sample size for the present study was 50. Feldspathic porcelain Vita VMK Master was selected.

These samples were constructed by a usinginlay wax with dimensions of 35 mm x8 mm x 5 mm using metal mould .wax blocks are removed from metal mould and invested, burned out, and casted with

nickel-chromium dental casting alloy (Wiron(R) 99, Bego, Germany) .The metalpacking of different porcelain layers. The metal samples were cut from their sprues, leaving 2mm to facilitate easyhandling of the samples during samples were sandblasted with aluminum oxide particle to remove the excess oxide layer. A feldspathic ceramic VITA VM(R)13 (VITA, Zahnfabrik, Germany) was Medicina 2020, 56, 234 4 of 14 used for porcelain build-up.

25 samples were left unglazed and abraded with diamond bur and 25 samples were glazed using conventional methods.

The samples were tested for their flexural strength using a Universal Testing Machine. All the results were recorded in Microsoft excel sheet followed by statistical analysis using SPSS software.

Results

Mean flexural strength among specimens of abraded porcelain group was 129.6 MPa while that of polished porcelain group was 142.8 MPa. While comparing statistically, significant results were obtained.

Table 1: Comparison of flexural strength (MPa)

Flexural strength	Abraded porcelain group	Polished porcelain group
Mean	129.6	142.8
SD	21.1	23.7
p-value	0.001 (Significant)	

Discussion

Feldspathic dental porcelains are composed by an amorphous matrix (K2O-Al2O3-SiO2) with a dispersion of leucite particles and pigments obtained from metal oxides. These oxides are responsible for the reduced melting temperature of the material, and they determine the color and opacity. Low-melting point porcelains used in fixed dental prostheses have desirable properties, such as excellent aesthetics, high biocompatibility, wear strength, and highly stable chemical components, which make them the material of choice to match the natural teeth. When matching a porcelain crown with the natural teeth, the size, shape, surface texture, opalescence, and translucency of the material are important to consider. Porcelain restorations reproduce translucency and the color of natural teeth for aesthetic reasons, but clinical results may also be the result of human factors, such as proper communication between the dental professional and the technician or factors from the natural substrate.[7- 11]Mean flexural strength among specimens of abraded porcelain group was 129.6 MPa while that of polished porcelain group was 142.8 MPa. While comparing statistically, significant results were obtained. The abrasive effect of various porcelain surfaces on human enamel was studied in another study conducted by al-Hiyasat AS et al. Sixty pairs of tooth-porcelain specimens were tested under a standard load and rate in distilled water and with and without intermittent exposure to a carbonated beverage. The amount of wear of enamel and porcelain specimens was determined after 5,000, 15,000, and 25,000 cycles. After 25,000 cycles there was no significant difference in the enamel wear between glazed and polished groups, but wear produced by the unglazed groups was significantly higher ($P < .05$). Overall, exposure to a carbonated beverage significantly increased the amount of enamel wear produced by all porcelain surfaces. The finish of the porcelain surface did not influence its wear.[12]Seghi RR et al determined whether in vitro two-body wear correlated well with hardness. A modified polisher was used to abrade enamel cylinders against polished disks of commercially available dental porcelains and glass. Enamel loss after four h was measured with a micrometer. Five ceramic materials were tested, and enamel abrasion rates were correlated with Knoop hardness values. Dicor and Dicor coated with a shading porcelain were found to cause the lowest wear of enamel. These rates were statistically significantly lower than those obtained with Optec, the most abrasive material. These findings may be due to microstructural differences between the materials. Knoop hardness showed poor correlation with the results of the abrasive testing.[13]Nandagiri P et al compared the change in flexural strength of ceramic surfaces after re-glazing and polishing. There study included 40 samples of ceramic blocks that were fabricated and glazed, and then fired in accordance with the manufacturer's recommendations. The sample was randomly divided into four groups of 10 samples each. The first group was the control group with unaltered glazed samples. The second group was abraded with an extra-fine diamond bur followed by re-glazing, and the other two groups were polished with two commercially available polishing kits after abrading them with an extra-fine diamond bur. The samples were tested for their flexural strength using a universal testing machine. On the application of the F test on the means of all the groups, a value greater than 0.05 was found, which meant that there is no statistically significant difference in flexural strength values between the groups (P-value>0.05). Since the flexural strength values of the polished group were comparable to the other groups, polishing can be used instead of re-glazing for ceramic restorations.[14]

Conclusion

From the above results, the authors concluded that polishing of the ceramic surfaces could be a better alternative clinical step for improving the longevity.

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