Research Article

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Comparative Evaluation of Shear Bond Strength of Metal-Ceramic Interface Developed with Two Techniques Namely, The Conventional Technique and 3-C Bond Application

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ABSTRACT

Background: The purpose of this study is to evaluate the shear bond strength of metal-ceramic interface developed with two techniques namely, the conventional technique and 3-C bond application. To evaluate the shear bond strength at the metal-ceramic interface after application of 3-C bond with and without subjecting the test specimens to oxidation. To analyse fracture at metal-3-C bond- ceramic interface under scanning electron microscope for one specimen each from the three groups namely; Conventional 3-C bond (with oxidation), and 3-C bond (without oxidation).

Keywords: Shear bond, ceramics, 3-C bond, oxidation.

INTRODUCTION

Routine use of ceramics in restorative dentistry is a comparatively recent phenomenon, but the desire for a durable and esthetic material is ancient. Most centuries have acknowledged teeth as an integral part of youth, beauty and dignity. The unexpected loss of teeth and in particular, the anterior teeth, creates physical and functional problems, often psychological and social disturbances, as well. Bonding porcelain to dental alloys is accomplished during porcelain firing; a sintering process. Bonding is believed to result from mechanical interlocking, Van der Waals forces and chemical bonding. This study evaluates various techniques of surface treatment of base metal alloys to enhance its bond with ceramic.

METHODOLOGY

PREPARATION OF TEST SPECIMENS

A Preparation of Acrylic Patterns

B Spruing the Acrylic Tabs

A direct technique of spruing was used.

C Investing the patterns

A metal casting ring was taken and lined with one strip of asbestos –free cellulose acetate ring liner (BEGO).

D. Casting the Alloy

RETRIEVAL OF CASTING AND SURFACE PREPARATION

E. Ceramic veneering of the cast alloy tabs

The 45 samples were divided into three groups with 15 samples in each group.

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GROUP-1 (CONVENTIONAL)

In first group which was conventional one the cast specimen were subjected to oxidation firing at 980°c. All the samples of this group were coded as C-1, C-2, and C-3 respectively.

GROUP 11 (3-C BOND WITH OXIDATION)

In second group 15 specimens were subjected to oxidation as done for group one samples.

GROUP 111 (3-C BOND WITHOUT OXIDATION)

In the third group the specimens were coated with 3-C bond, without subjecting them to oxidation. The application of 3-C bond was done with the help of a jig so as to standardize the area to 8mm to 8mm

F. Testing the alloy-ceramic bond strength

G. Preparation of samples for viewing under scanning electron microscope:

RESULTS

For total number of 45 specimens 1 from each group was then studied under a scanning electron microscope.

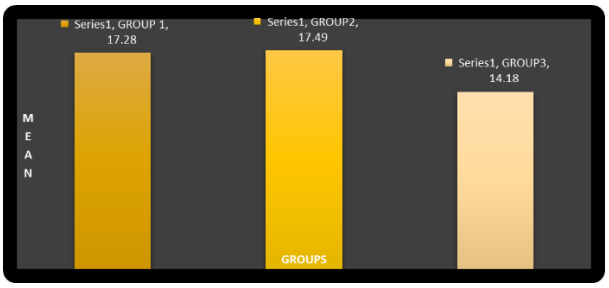
A total 45 samples were taken for evaluation of bond strength of alloy ceramic interface. They were further divided into three different groups comprising 15 samples each. These subgroups were then subjected to different surface treatments. The results were obtained from the three point flexure test carried out on the universal testing machine are tabulated in annexure 1 to 3. These depicted the data representing the load at which bond failure occurred.

On examination under scanning electron microscope to a magnification of 300X – 500X revealed that fracture of body porcelain occurred till porcelain opaque interface and did not progress beyond it. All the three specimens showed similar results.

In order to interpret the results, detailed statistical analysis was carried out using the values of bond strength.

A paired Student 't' test was used to compare the values obtained from these groups.

Graph 1: Depicts the mean shear bond strength value of the three groups, wherein a marked decrease in bond strength is seen in *Group* 3 when compared to *Group* 1 and *Group*2



Graph 1: Distribution of Groups and Their Mean Values.

DISCUSSION

Metal ceramic restorations are currently popular in restorative dentistry; notwithstanding the ideal esthetics of metal free all ceramic restorations. Researchers have adopted the direct approach of the adhesion of porcelain alloy combinations to determine the resistance to applied stress and residual stress alike. Several geometrical patterns have been used to evaluate bond strengths including tension, shear, three and four point bend tests.[8,14]

The main drawbacks with previous testing methods namely pull-through and push-through shear tests, oblique shear tests and planar interface shear tests was the difficulty in preparation and standardization of the test samples, also the thicknesses of porcelain and metal used could not be compared to those used clinically in the fabrication of metal-ceramic restorations.

CONCLUSION

Metal ceramic restorations currently represent a significant component in restorative dentistry. As a result there are a variety of opaque materials available and it becomes of increasing clinical importance to assess their compatibility with the available metal-ceramic system.

Investigators have, since long, made attempts to measure the bond between the alloy and ceramic material. There are, however, no universally accepted tests for bond strength today. The short comings of the previous tests include difficulty in

preparing and testing the samples, lack of consistency of results and a lack of correlation with clinical results. Hence, in this study the results were obtained by means of a three point bend test where the values were recorded at the initial bond failure depicted by fracture of ceramic the following conclusions could be drawn:

1. The use of 3-C bond did not improve shear bond strength as compared to conventional technique.

2. When 3-C bond was used with oxidation (though not recommended by manufacturer) the shear bond strength was improved; but was statistically insignificant, when compared to conventional technique.

3. Oxidation of metal surface is must in order to develop an adequate metal-ceramic bond irrespective of surface treatment technique used.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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