ORIGINAL ARTICLE

CLARITY VERSUS INSPIRE CERAMIC BRACKET: IN VITRO COMPARISON OF SHEAR BOND STRENGTH

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ABSRACT

As the number of adults seeking orthodontic treatment has increased, the perceived need for more appealing appliances has led manufacturers to design various types of ceramic brackets. The purpose of this study was to find out and compare the shear bond strength and bond failure location of Clarity ceramic and Inspire ceramic brackets. This comparative study was conducted at department of Orthodontics, de,Montmorency College of dentistry, Lahore. Twenty five brackets of each type were bonded to 50 extracted first premolar teeth with the similar bonding system. Each bracket type was tested on a universal testing machine to find out the debonding force levels. All the teeth were examined under an optical microscope to evaluate the Adhesive Remnant Index (ARI). It was concluded that Shear bond strength and ARI scores between the Clarity and Inspire ceramic brackets are insignificant.

Key Words: *Shear bond strength, Clarity, Inspire, Ceramic bracket.*

INTRODUCTION

Bandless appliances following the advent of the acid etching technique was readily accepted.[1] Plastic brackets were introduced in 1970, but main disadvantage of these plastic brackets were discoloration and mechanical distortion. In order to solve this, plastic brackets were modified by reinforced materials to make them oral environment resistant, but this attempt was a failure.[2] In the mid 1980s, the first brackets made of monocrystalline and polycrystalline ceramic materials became widely available. As the number of adults seeking orthodontic treatment has increased, the perceived need for more appealing appliances has led manufacturers to design various types of ceramic brackets.[3] Ceramic brackets should remain on tooth surface till debonding without causing enamel fracture, different debonding methods for ceramic brackets include fine pliers, electro thermal, ultrasonic and laser.[4]

Factors that influence the bond strength are the bracket base design (retention mechanism), composition of the adhesive used for bonding, and the conditioning of the enamel. Bracket base design may allow for macro-mechanical, micro-mechanical or chemical bonding between the bracket base and the composite. Also the filler content of a specific adhesive may influence its physical performance. A high filler content may result in less cohesiveness and more adhesive failures. Finally, it is well known that both adequate cleaning of the enamel surfaces and the method of enamel conditioning are equally important in the process of obtaining adequate bond strength.

The clarity bracket is a polycrystalline, mechanically retained ceramic bracket, having metal lined arch wire slot having advantage of increased strength to withstand routine orthodontic torque forces[5] and to counter friction.[6] The bracket also incorporates a vertical slot designed to help create a consistent bracket failure mode during debonding. In studies no considerable difference were found in the results on comparison of debonding force require to debond ceramic and metal brackets.[7] The Inspire bracket is a new monocrystalline ceramic bracket that features mechanical retention. A proprietary ball base design is incorporated into the bracket to ensure bonding integrity and ease of debonding. The purpose of this research was comparison of shear bond strength and bond failure location of clarity ceramic and Transcend brackets.

METHODOLOGY

A cross sectional study was conducted on 50 brackets (25 Transcend 3M-Unitek and 25 Inspire Ormco,

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in each group), at Orthodontic department, de,montmorency, College of Dentistry, Lahore, during March 2016 to March 2017. Intact extracted first premolar teeth extracted for orthodontic reasons were selected to be bonded using light cure composite (Trans bond XT). All bonded samples were kept in normal saline at 37°C for 42 hours. Bonded teeth were left uninterrupted for 30 minutes and kept in synthetic saliva for one day at 37°C.

Inclusion Criteria

Freshly extracted first premolars

Preserved first premolars teeth with intact surfaces

Age Range: 12-18 years.

Exclusion Criteria

Decayed, broken down premolars

Patients with any previous fixed orthodontic therapy

Data Collection Procedure

Thermal cycling of all specimens was performed at temperatures from 5°C. Brackets were tested on universal testing machine, to determine the shear bond strength. Spots of bracket failure after debonding were examined in all the teeth, by using the optical microscope with 30x magnification. The quantity of residual adhesive after bracket deletion was evaluated according to the adhesive remnant index (ARI).

Statistical Analysis

The data was analyzed in Statistical Package for the Social Sciences software package (SPSS) 19. Statistical analysis was used to evaluate means, standard deviations, minimum and maximum values. Chi square test was applied to evaluate the existence of differences between two groups.

RESULTS

Mean values and Comparison of the shear bond strength and Adhesive Remnant Index scores of the Clarity and Inspire ceramic Brackets are shown in Table 1 and 2. The result of present research showed that both Clarity and Inspire brackets got equal mean shear bond strength and Adhesive Remnant Index scores. The mean shear bond strengths exceeded the values that are considered clinically optimal.

DISCUSSION

Various researchers have studied bonding strengths of different brackets and the results differ noticeably.[8-10] Numerous studies have evaluated the bond strengths of ceramic brackets bonded to enamel. The results vary considerably, depending on the retention mechanism, the geometric form of the bracket base, the composition of the adhesive, and the condition of the enamel surface.

Retief[11] reported enamel fractures on debonding with bond strengths of 13.73 MPa. Bowen and Rodriguez reported that the mean linear tensile strength of enamel is 14.51 MPa.[12] The mean shear bond strength of the Clarity brackets reported in the present study is higher than the previously reported.[13,14] Webster et al[15] evaluated the bond strengths of metal brackets bonded to enamel with Transbond XT adhesive and found values that are higher than those reported in the present study, although metal brackets were used. The result of present research showed that both Clarity and Inspire brackets got equal mean bond strength values. These results are similar to previously reported international studies.[14,16]

It is advisable to follow the manufacturers' instructions when debonding ceramic brackets. Debonding of the Clarity brackets is done in a novel way. Both mesial and distal wings of the bracket slot are squeezed towards each other. This causes vertical breakage of the Clarity bracket base according to a vertical line that is scored in the manufacturing process in order to reduce the resistance of the bracket base against this type of vertical fracture. This can be seen as a built-in protection mechanism against enamel damage at debonding. Key factors influencing shear bond strength includes bracket base morphology, composition of the adhesive, condition of the enamel surface, filler content of a specific adhesive and isolation methods while bonding.[17] Adhesive forces at the enamel-adhesive and

TABLE 1: COMPARISON OF THE SHEAR BOND STRENGTH (MPA) OF THE CLARITY BRACKET AND INSPIRE CERAMIC BRACKET

	N	Minimum	Maximum	Mean	S.D	Variance
Clarity	25	11.37	35.54	22.2786	4.7909	26.366
Inspire	25	10.15	24.15	17.4234	3.2889	12.123

P value 0.247

TABLE 2: ADHESIVE REMNANT INDEX (ARI) OF THE CLARITY BRACKET AND INSPIRE CERAMIC BRACKET AFTER DEBONDING

Brackets	N	ARI score 1	ARI score 2	ARI score 3	ARI score 4	ARI score 5
Clarity	25	56	5	1	0	0
Transcend	25	54	4	2	0	0

P value 0.318

adhesive-bracket interfaces also affects bond strength test.[18,19] There are local studies available on shear bond strength of the Self etchant primer system,[20] bracket de-bonding during active orthodontic treatment,[21] and effect of bleaching on shear bond strength of orthodontic brackets,[22] but no local data was available on comparison of mean shear bond strength and Adhesive Remnant Index scores of Clarity and Inspire brackets. The result of present research showed that both Clarity and Inspire brackets got equal ARI values that is similar to results by previous reported study on comparison between the two ceramic brackets.[23]

Further research is recommended with large sample size to determine the debonding character of clarity brackets when removed with instruments designed especially for this purpose.

CONCLUSION

We could not demonstrate any significant score differences in shear bond strength and ARI between the Clarity and Inspire ceramic brackets.

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1 Saif ur Rehman:	Title, abstract, written and critically reviewed the manuscript
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3 Muhammad Burhan Hayat:	Critically reviewed the manuscript, & data collection.
4 Muhammad Imran Khan:	Analysis and interpretation of data.
5 Waheed ul Hamid:	Main supervisor, Has approved the final version.