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Original Research

Analysis of the effect of recycling on shear bond strength of stainless-steel bracket

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ABSTRACT:

Background: The present study was conducted for assessing the effect of recycling on shear bond strength of stainless-steel bracket. **Materials & methods:** A total of 60 freshly extracted premolars were collected. Deformed, carious and broken tooth specimens were excluded from the present study. 60 new stainless steel premolar orthodontic brackets were used. Bonding agent was applied to paper pad, and then light cure was done for 10 seconds. 60 orthodontic brackets were divided into three study groups as follows: Group 1: New orthodontic bracket with bracket base bonding agent; Group 2: New orthodontic bracket without bracket base bonding agent; Group 3: Recycled orthodontic bracket with bracket base bonding agent. The teeth were embedded horizontally in die stone in a plastic ring. This was followed by examination of specimens. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis. **Results:** Mean shear bond strength among specimens of group 1, group 2 and group 3 is 9.96 MPa, 9.45 MPa and 9.02 MPa respectively. On comparing the results were found to be statistically significant. **Conclusion:** Sandblasted recycled orthodontic brackets can be used as an alternative to new brackets which might provide cost reduction.

Key words: Stainless steel, Recycling, Brackets

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INTRODUCTION

In Orthodontics, as well as in other dental fields, there is a trend to simplify the technical procedures to reduce operative time and treatment costs. Before the 1970's, orthodontic treatment with fixed appliances was performed using stainless steel bands that were cemented to all teeth and then orthodontics brackets were welded to the bands. The technique of bonding orthodontic accessories directly to tooth surfaces has become possible after Buonocore's pioneer study. This resulted in the existence of a significantly stronger mechanical bond between restorative materials and dental enamel etched with 85% phosphoric acid for 30 seconds. The technique involving application of adhesive systems to acid-etched enamel allowed an optimal bonding of orthodontic brackets to tooth surface, which greatly improved and simplified the placement of fixed orthodontic appliances and widen the scopes and perspectives in Orthodontics.[1-3]

The failure of a bonded orthodontic bracket during the course of therapy is not an uncommon occurrence. This is usually the consequence of either patients accidentally applying inappropriate force to the bracket or a poor bonding technique. Orthodontists are commonly faced with the decision of what to do with debonded or inaccurately positioned brackets that require repositioning during treatment. Thus, a significant number of teeth must be rebonded in a busy orthodontic practice. One solution is to recycle the brackets.[4-6]Hence; the present study was conducted for assessing the effect of recycling on shear bond strength of stainless steel bracket.

MATERIALS & METHODS

The present study was conducted for assessing the effect of recycling on shear bond strength of stainless-steel bracket. A total of 60 freshly extracted premolars were collected. Deformed, carious and broken tooth specimens were excluded from the present study. 60 new stainless steel premolar orthodontic brackets were used. Bonding agent was applied to paper pad, and then light cure was done for

10 seconds. Brackets were positioned on the paper pad with gentle pressure and excess adhesive were removed with explorer followed by polymerization. The bonded brackets were separated from the paper pad using tweezers with light pressure. Brackets were stored in distilled water for 24 h at 37 degrees centigrade, and then subjected to the thermocycling test. This was followed by sandblasting under the air pressure of 90 PSI. Procedure was done until bonding resin was totally removed from the bracket base and no longer visible to the naked eye. Repeat bonding, debonding, thermocycling and sandblasting were carried out for half of these brackets (i.e.: 30). The orthodontic brackets' mesh was examined. 60 orthodontic brackets were divided into three study groups as follows:

Group 1: New orthodontic bracket with bracket base bonding agent;

Group 2: New orthodontic bracket without bracket base bonding agent;

Group 3: Recycled orthodontic bracket with bracket base bonding agent

The teeth were embedded horizontally in die stone in a plastic ring.

This was followed by examination of specimens. All the results were recorded in Microsoft excel sheet and were subjected to statistical analysis.

RESULTS

A total of 60 specimens were analysed and were divided into three study groups as follows: Group 1: New orthodontic bracket with bracket base bonding agent; Group 2: New orthodontic bracket without bracket base bonding agent; and Group 3: Recycled orthodontic bracket with bracket base bonding agent. Mean shear bond strength among specimens of group 1, group 2 and group 3 is 9.96 MPa, 9.45 MPa and 9.02 MPa respectively. On comparing the results were found to be statistically significant.

Table 1: Statistical results

Study group	Mean	SD
Group 1	9.96	2.8
Group 2	9.45	2.3
Group 3	9.02	1.9
p- value		

DISCUSSION

Bonding in orthodontics has undergone several facelifts since its inception into orthodontics. One of the commonly faced problems during treatment is of bracket dislodgement. The clinician can recycle or re-condition these brackets for reuse.There are many options available for recycling orthodontic brackets. Some of the in-house methods such as thermal (direct flaming only or Buchman method) or mechanical methods (sandblasting, green stone, and tungsten carbide bur) offer a more realistic, simple, and cost-effective alternative.[7- 10]Hence; the present study was conducted for assessing the effect of recycling on shear bond strength of stainless steel bracket.

A total of 60 specimens were analysed and were divided into three study groups as follows: Group 1: New orthodontic bracket with bracket base bonding agent; Group 2: New orthodontic bracket without bracket base bonding agent; and Group 3: Recycled orthodontic bracket with bracket base bonding agent. Mean shear bond strength among specimens of group 1, group 2 and group 3 is 9.96 MPa, 9.45 MPa and 9.02 MPa respectively. On comparing the results were found to be statistically significant. In a previous study conducted by Bahnasi FI et al, authors compared Shear Bond Strength (SBS) of new, recycled and repeated recycled stainless steel orthodontic brackets with and without bracket base primer. 120 extracted human premolar teeth and 120 premolar stainless steel orthodontic brackets were divided into six groups for 20 teeth each. Orthodontic brackets of four groups were sandblasted with 50 mm aluminum oxide powder and half of them were recycled for second time. Light cure orthodontic adhesive primer was applied for half of total brackets. Light cure composite was applied for all brackets and polymerization was carried out. Groups 1–6 were subjected to a shear force within half hour to simulate as done clinically with a universal testing machine (Shimadzu Trapezium X) until the bracket debond. The results of this study demonstrated that the mean SBS of all groups were more than that recommended by Reynolds in 1975, there was no significant difference between new and recycled brackets. Only one group (repeated recycled without bond) has significantly lower SBS.[11]Khanal PP et al compared the effect of different methods of recycling stainless steel orthodontic brackets on shear bond strength. One hundred twenty human premolars extracted for orthodontic purpose were randomly divided into four groups. Standard MBT (0.022″) brackets were bonded on the buccal surface of all samples with light cured adhesive primers using an LED curing unit for 10 seconds. Group I was assigned as control, and the brackets of Group II, Group III, and Group IV were subjected to recycling by flaming, flaming with sandblasting, and flaming with ultrasonic cleaning, respectively. The recycled brackets were rebonded, and final debonding of all brackets was performed using a universal testing machine at a crosshead speed of 0.5 mm/min and shear bond strength was determined. The highest shear bond strength was obtained with Group I (10.35 ± 0.46 MPa), followed by Group III (9.36 ± 0.55 MPa) and Group IV (5.97 ± 0.66 MPa), and the least value was obtained with Group II (4.30 ± 0.55 Mpa). Significant differences among the groups were detected by analysis of variance. Tukey's post hoc multiple comparison test showed that the shear bond strength of each group was significantly different from one another. Shear bond strength of new brackets was

significantly higher than that of the recycled brackets.[12]

CONCLUSION

Sandblasted recycled orthodontic brackets can be used as an alternative to new brackets which might provide cost reduction.

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