UNIVERSITY TEKNOLOGI MARA

THE IMPACT OF RECONDITIONED ORTHODONTIC BRACKETS ON BOND STRENGTH

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ABSTRACT

Introduction: Orthodontic bracket bond failure is common during orthodontic treatment. Objectives: To evaluate the Shear Bond Strength (SBS) of new orthodontic brackets, and the SBS after reconditioning and repeating the reconditioning procedure for such brackets, with and without bonding; and to evaluate the bond failure rate of new and reconditioned orthodontic brackets during orthodontic treatment. Methods: A total of 120-extracted human premolar teeth and 120 premolar stainless-steel brackets were used and were randomly divided into six groups of 20 each. Five methods of reconditioning were used in each of the first five groups while the last group was used as a control. The six groups (I-VI) were subjected to shear force for half an hour until the brackets debonded. SBS was measured and the methods showing the highest SBS were selected. Two groups were selected and then reconditioned for a second time using the previous steps. The SBS of all subgroups were examined with and without the application of a primer. For the clinical experiment, a total of 60-patients were selected from the waiting list of the orthodontic clinic of the Faculty of Dentistry, UNIVERSITY TEKNOLOGI MARA, Malaysia. The patients were randomly divided into three main groups of 20-patients each. 60-sets of 3M Unitek™ Gemini Brackets were used. The first group was reconditioned using 50μm aluminium oxide particle grit-blasting before bonding, the second group was reconditioned using the Er,Cr3+:YSGG laser and the last was used as a control group. After polymerization, a .014 NiTi archwire was inserted within half an hour. Monthly follow up of all the patients were carried out for one year. The brackets' bond failure rate was recorded and calculated by percentage of failure. The results were subjected to statistical analysis to identify differences in SBS and bond failure rate. ANOVA and Tukey's post hoc test were used to identify the differences. Results: There was a significant difference between the mean SBS of the Er, Cr3+:YSGG laser, grit-blasting and control groups and the means of the SBS of each of the other three methods. There was, however, no significant difference between the mean SBS of the new bracket and the mean SBS of reconditioned brackets using Er, Cr3+:YSGG laser or grit-blasting. The mean SBS of all sub-groups were higher than the recommended range. Brackets with primer showed slightly higher SBS compared to those of brackets without a bonding agent. The ARI scores (0 and 1) were more in the groups with higher SBS, and scores (2 and 3) were more in the groups with lower SBS.Clinically, there was no significant difference between the percentage of bond failure rate of the new brackets and that of the reconditioned groups ($p>0.05$). Conclusions: Reconditioned orthodontic brackets using grit-blasting and Er,Cr3+:YSGG laser can be used following bond failure as an alternative to new brackets.

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Faisal Ismail El-Sayed Bahnasi

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INTRODUCTION

1.1 RESEARCH BACKGROUND

Malocclusion is the malalignment of teeth which affects the patient both functionally and aesthetically. A fixed appliance is used to treat malocclusion; the main component of the fixed appliance is a bracket which is attached to a tooth to enable orthodontic tooth movement during orthodontic treatment. Early bonding systems consist of brackets welded onto bands which are bonded to enamel with zinc phosphate cement. However, there are disadvantages with these techniques:

- Extensive chair-side time;
- The need of frequent screening to detect any development of caries or decalcification;
- The harmful effect on periodontal health due to irritation caused by bands and cements;
- The requirement of additional arch space to accommodate the placement of bands (Brantley & Eliades, 2000).

Currently, it is easier to bond the bracket to the tooth surface directly using adhesive materials. Efforts have been made to improve mechanical retention using various designs such as mechanical undercuts into which the orthodontic adhesive extends before polymerization. This is due to bracket bases not chemically bonding to enamel or resin (Knox, Hubsch, Jones & Middleton, 2000). Development of modern adhesive materials has led to the widespread use of bonded attachments in fixed appliances therapy.

Composite resin is the most popular orthodontic adhesive because of its good bond strength. According to Owens and Miller (2000) “If bond strength is the primary consideration for choosing an adhesive, the composite resin should be utilized.” These adhesives are used in orthodontic treatment to bond brackets to teeth surfaces.