Effect of chlorhexidine and APF on shear bond strength using stainless steel brackets – an in vitro comparative study

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ABSTRACT

Fixed orthodontics appliance can be caries risk for patients. These patients exhibit changes in oral micro flora such as a lower pH environment, increased retentive sites for microbial plaque, and retention of food particles, which may lead to increased proportions of salivary mutans streptococci (MS).

Aims and objectives: To analyze the effect of 0.2% chlorhexidine mouthwash & 1.23% APF on shear bond strength.

Material and method: Group A (control group) – in the control group, the etchant (37% phosphoric acid) is applied on the buccal surface for 15 seconds then rinsed with water spray for 10 seconds & dried with air spray. Group B (chlorhexidine group) – The teeth are etched with 37% phosphoric acid then 0.2% chlorhexidine is painted on to the etched enamel with the brush for 20 seconds and is left to dry for 30 seconds. Group C (APF) – the crowns of the teeth are immersed in 1.23 APF gel for 4 minute after acid etching. The bonding was done and the shear bond strength was tested using Instron machine.

Conclusion: Brackets bonded without chlorhexidine have revealed comparatively lower SBS values as compared to control group brackets. Use of conventional bonding revealed comparatively higher SBS value in dry conditions as compared to APF 1.23% in wet conditions. Stainless brackets,

Key word: bonding material, shear bond strength, Stainless brackets, enchants

INTRODUCTION

The bonding of orthodontics brackets to teeth was introduced in 1964. This procedure incorporated the use of acid-etch technique to better adhere the bracket to enamel.

Fixed orthodontics appliance can be caries risk for patients. These patients exhibit changes in oral micro flora such as a lower pH environment, increased retentive sites for microbial plaque, and retention of food particles, which may lead to increased proportions of salivary mutans streptococci (MS). Despite recent advances in orthodontic material and technique enamel decalcification and white spot lesion formation continue to pose problems for patient treated with fixed orthodontic appliances. In these cases, to eliminate and/or minimize the caries risk, preventive efforts should concentrate on the suspension of cariogenic microflora by chemotherapeutic agents. Therefore various means are being researched to preserve enamel morphology without altering the bond strength of the orthodontic bracket to the enamel.

The two main method that are used for preventive effort. 1. Suspension of cariogenic microflora by the use of chlorhexidine.

Increasing the resistance of tooth to decay by using fluoride i.e. APF gels Chlorhexidine (CHX) is the most potent documented antimicrobial agents against mutans streptococci and dental caries. It is commercially available in the forms of mouth rinse, gel, and varnish. Studies of high and low concentrations of chlorhexidine have been reported to reduce the number of mutants streptococci in plaque and saliva, and investigators have concluded that the use of 0.12% chlorhexidine mouth rinses could be beneficial for orthodontic patients in achieving improved oral hygiene. Evidence of the efficacy of chlorhexidine in biofilms was reported by Prattenet al. The literature suggests that the use of 1% CHX gel significantly decreases mutants streptococci levels. It is suggested that chlorhexidine combined with thymol in...
a varnish could have the following effects: a desensitizing effect on the teeth, lower bacterial activity in plaque while maintaining an ecologic balance, have excellent adsorption to the tooth surface, and are well tolerated.

According to Bulent Catalbas, chlorhexidine can be used as 2% solution, gel(1%), & mouthwash(0.2%)⁷. Techniques varying from decreasing etching time & concentration to using prophylaxis agents containing fluoride have been evaluated. There are various method of application of fluoride such as use as 13,500ppm fluorinated pumice 2500ppm fluoride paste, 1.23% APF gel⁹. Fluorides react with enamel surface more resistant to demineralization & tooth decay⁸,¹⁰. Factors that influence bond strength include contaminants such as saliva, fluorides, oils & some other agents. Certain topically applied fluoride could significantly reduce bond strength by disrupting the formation of enamel tags. However if pumice & fluoride solution are used following acid-etching shear bond strength is not significantly affected¹¹,¹².

Bond strength of the orthodontic brackets are influenced from various factors & studies are being done to determine the best possible combinations of materials involved to maintain optimum bond strength & the enamel integrity during orthodontic treatment.

A continuous search is on for better adhesives, simpler procedure, & materials that will bond effectively in the presence of saliva and chemotherapeutic agents such as APF gel.

The observation from previous studies led us to conduct study to compare bond strength of the orthodontic brackets following application of Chlorhexidine mouthwash & APF fluoride gel.

**MATERIALS**

1. 45 Extracted teeth.
2. Physiologic saline solution or 0.1%(wt/volume) thymol.
3. Prophylactic cup & pumice paste.
4. 0.2% Chlorhexidine mouthwash.
5. 1.23% APF gel.
6. Enamel etchant -37% phosphoric acid.
7. ORMCO(enlight) LCR.
8. Stainless steel orthodontic brackets.
9. Universal testing machine.

**METHOD**

- 45 M/F extracted patient were bonded with ORMCO enlight.
- The 45 teeth are then divided into three groups of 15 teeth each.
- Group A (control group) – in the control group, the etchant(37% phosphoric acid) is applied on the buccal surface for 15 seconds then rinsed with water spray for 10 seconds & dried with air spray. The etched surface become chalky white in appearance. Enlight bonding system is used to bond the stainless steel brackets to the tooth.
- Group B(chlorhexidine group) – The teeth are etched with 37% phosphoric acid then 0.2 % chlohexidine is painted on to the etched enamel with the brush for 20 seconds and is left to dry for 30 seconds. The buccal surface of the teeth is washed with water spray for 10 seconds then dried. The sealants is applied and the bracket bonded same as above.
- Group C(APF) – the crowns of the teeth are immersed in 1.23 APF gel for 4 minute after acid etching. The buccal surface of teeth is washed with water spray for 10 seconds then dried. The sealants is then applied and the bracket bonded.

**AIMS & OBJECTIVES**

- To analyze the effect of 0.2% chlorhexidine mouthwash & 1.23% APF on shear bond strength.
- To compare the shear bond strength of stainless steel brackets to etched enamel with enamel treated with 0.2 % chlorhexidine and 1.23% acidulated phosphate fluoride.

**RESULT AND DISCUSSION**

Bonding in clinical dentistry give the excellent patient satisfaction. Even in moisture condition there are number of bonding agents which provide enough strength to hold the brackets. However different base plays very important role in bonding strength. As various brackets are made with metal injection molding of stainless steel (AISI 316 L) and sintering to theoretical density. The smooth surface of bracket base is then treated with a sufficiently powerful NdYAG
laser to create retentions for the adhesive. The laser beam is scanned over the base surface, melting and evaporating the metal and burning hole-shaped retentions in the bases2.

In this study, an in vitro bond strength characterization was chosen due to the relative simplicity, increased reliability of simulating debonding techniques and mode of application of shear force using chlorhexidine and APF. Shear bond strength was tested because most masticatory forces are of a shearing nature.

Mean values of Group A, B and C revealed that Group A comprising brackets bonded with conventional bonding primer in dry conditions has the highest shear bond strength (13.34±0.4 MPa) as compared to Group B (12.34±0.5 MPa) comprising chlorhexidiene and Group C (8.97±0.5MPa) comprising APF 1.73%). There is comparatively insignificant difference of shear bond strength between Group A and C.

Mean I

Mean values of Group A, B and C revealed that Group A comprising brackets bonded without chlorohexidine in dry conditions has the highest shear bond strength (13.34±0.4 MPa) as compared to Group B (12.34±0.5 MPa) comprising with chlorohexidiene group and Group C (8.97±0.35MPa) comprising comprising APF 1.73%

Mean values of Group A, B and C revealed that Group C comprising brackets bonded with in wet conditions has the lowest bond strength (8.97±0.35MPa.) as compared to other Groups.

Mean A

In a study on bond strength comparison of moisture-insensitive primers, Schaneveldt and Foley showed the shear bond strength with Transbond XT (14.82 ±2.62MPa) and MIP after saliva contamination (12.23 ±2.53MPA).

Mean B

Zeppiere et al in their study on effect of saliva on shear bond strength of an orthodontic adhesive used with moisture-insensitive and self-etching primers revealed that when the brackets were bonded with Transbond XT adhesive the control group: etch, dry, Transbond XT primer had the highest mean shear bond strength (21.3±6.8 MPa), followed by MIP group in a dry field (20.7±5.0 MPa). No significant difference was found between these two groups. Saliva contamination significantly lowers the bond strength of bonding material (15±3.0 MPa) but it is clinically acceptable.

The data in this study revealed that chlorohexidine used with enlight bonding agent had significant lower shear bond strength in moisture contaminated field than under dry testing conditions. This finding is similar to those of Webster et al. and Hobson et al. But all these findings have confirmed that use of MIP in moist condition has given adequate SBS of above 8 MPa and is clinically acceptable.

CONCLUSION

1. Brackets bonded without chlorohexidine have revealed comparatively lower SBS values as compared to control group brackets.
2. Use of conventional bonding revealed comparatively higher SBS value in dry conditions as compared to APF 1.23 % in wet conditions.

REFERENCES


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