Revista Mexicana de Ortodoncia

Vol. 2, No. 3 • July-September 2014
pp 166-169

ORIGINAL RESEARCH

Bond strength of brackets bonded with resin in contact with an alcoholic beverage

Resistencia al desprendimiento de brackets adheridos con resina en contacto con una bebida alcohólica

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ABSTRACT

The aim of this study was to determine the effect of an alcoholic drink (rum) in the adhesion of Transbond (3M) and Enlight (ORMCO) resins. Eighty brackets (0º) were bonded with Transbond and Enlight to healthy human teeth previously etched with phosphoric acid (37%). Each resin used its own adhesive. After bonding all teeth were immersed in physiologic serum at 7 ºC for 24 hours and then thermocycled for 500 cycles; (5-55 ºC). Forty samples were immersed in physiologic solution and the rest in the alcoholic drink for 12 days. At the end of 12 days, the force was measured in order to remove the bracket of each resin using a universal mechanical testing machine and the bond strength was calculated. The adhesion areas were observed in order to determine the failure site. The values were analyzed with ANOVA. The Enlight resin proved to have better bond strength than Transbond when both were immersed in serum but rum increased Transbond bond strength significantly. It was concluded that the medium changes the bond strength significantly. It was concluded that environment has an influence over bracket bond strength which could be an advantage for treatment since brackets have better adhesion but a disadvantage for the patients overall health.

RESUMEN

El propósito de este estudio fue determinar si las resinas Transbond (3M) y Enlight (ORMCO) sufren cambios en su adhesión al diente cuando están en contacto con una bebida alcohólica (ron). Ochenta brackets (0º) fueron adheridos a dientes premolares humanos sin caries usando Transbond y Enlight, previamente grabados con ácido fosfórico al 37%. Cada resina uso su propio adhesivo. Después de estar sumergidos en suero fisiológico a 7 ºC durante 24 horas, se sometieron a un termociclado de 500 ciclos (5-55 ºC). Se sumergieron cuarenta muestras en solución fisiológica y el resto en la bebida alcohólica durante 12 días; transcurrido este tiempo se midió la fuerza para desprender el bracket de cada resina usando una maquina universal de pruebas mecánicas y se calculó la resistencia al desprendimiento en MPa. Se observaron las zonas de desprendimiento para determinar el sitio de falla. Los valores fueron analizados con ANOVA. Se encontró que Enlight presentó mayor resistencia al desprendimiento que Transbond cuando ambos estuvieron sumergidos en el suero, pero el ron incrementó considerablemente la resistencia al desalojo de Transbond. Se concluyó que el medio influye en la resistencia al desprendimiento de los brackets, siendo una ventaja para la estabilidad de la aparatología, ya que se adhiere más el bracket, pero una desventaja para la salud.

Key words: Light curing resins, bond strength, brackets in contact with beverages.
Palabras clave: Resinas de fotopolimerizado, resistencia al desprendimiento, brackets en contacto con bebidas.

INTRODUCTION

Adhesive resins for brackets play an important role in orthodontic treatment since brackets are bonded to teeth through mechanisms that involve adhesion.[1] Adhesion is defined as the force that holds together two similar materials when in close contact.[2] It is due to chemical or physical bonds that can be affected when exposed to different environment.[3]

There are numerous problems for obtaining and preserving adhesion to dental structure. These include the aqueous nature of the oral environment, heterogeneity of tissues, the feasibility of certain dental tissues and biophysics and other restrictions imposed by the biological environment.[3] On the other hand, many factors affect bracket retention during orthodontic treatment such as the enamel surface.[4]

A conditioned enamel surface is highly reactive, specially the organic surface. However, if saliva is

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allowed to get in contact with the conditioned and dry enamel, proteins adhere to the surface and affect the adhesion characteristics and resin penetration.

Candy, fruit juices, carbonated soft drinks and diet juices lower oral pH below 5.5 affecting and damaging the adhesive materials present in the oral cavity.[5]

It is important to determine if the patient's eating habits influence or modify adhesion systems thus altering treatment. Studies have been done on how diet affects orthodontic treatment but they have focused on enamel demineralization and not on bracket bond strength. Gedalia,[6] in 1991, conducted a study on the softening human enamel subjected to an acid drink (coca-cola) using hard cheese for enamel remineralization; the intraoral test showed that exposure of the enamel for one hour in coca-cola diminished its hardness and hard cheese had a remineralization effect after 5 minutes by increasing the hardness of the enamel.

Abu Bakr[7] analyzed the effect of alcoholic beverages (whiskey), low- pH beverages (coca-cola and orange juice) and deionized water over adhesion as well as color stability. Whiskey was the beverage that affected adhesion and color the most followed by coca-cola and orange juice.

Sean Beattie[8] performed an *in vivo* study about the effect of several foods (cereal, meat, tomato sauce, chicken, rice, chocolate, orange juice, coca and milk) over dental polymers (elastic bands and latex elastics); he did not find significant differences on the patient´s daily dietary change; however there were significant differences between the used elastic bands brand (Rocky Mountain Orthodontics, 3M Unitek and American Orthodontics).

The effects of food over dental restorative polymers have been studied and several forms of degradation were found when the restorative materials were subjected to ethanol/water,[9,10] ethanol/artificial saliva,[11-13] lactic acid, citric acid, heptane and beverages such as coffee, vinegar, whiskey, coca-cola and orange juice.[7]

West[14] performed a study where he showed that a carbonated orange beverage with calcium caused less enamel loss when compared to a conventional carbonated beverage.

The aim of this study was to determine if an alcoholic beverage such as rum affects the bond strength of brackets bonded with Transbond (3M) and Enlight (ORMCO) resins.

MATERIALS AND METHODS

Eighty human premolars extracted for orthodontic reasons without restorations, fractures or caries stored in physiological serum with 0.9% sodium chloride in pyrogen-free sterile injectable Baxter water. They were kept under refrigeration (5°C) for a period no longer than two months until the total sample size was obtained.

Eighty stainless steel premolar brackets with 0° prescription (ORMCO) with a mesh base and an area of 11.5 mm^2 approximately, were adhered to the tooth crowns using Transbond XT resin (6KT batch) and Enlight (441020 batch). A LED lamp was used to cure the resins (Ultra Lume 5) which was tested using a thermal radiometer (model 200 from Demetron Research Comp.) to determine the generated heat (< 50 mW/cm^2) and a curing radiometer (model 100 from Demetron Research Corp.) to determine light intensity (400 mW/cm^2).

The teeth were divided into four groups of 20 each, they were polished with prophylactic paste free of fluoride during 10 seconds and then washed and dried with oil-free air and water for 10 seconds.

The enamel was etched with 37% phosphoric acid gel (ORMCO) during 15 seconds according to the manufacturer's instructions; they were subsequently washed with water for 10 seconds and dried with oil-free air and water for 10 seconds.

In the first (control group) and second set of teeth, ORMCO adhesive was placed according to the manufacturer's instructions. The brackets were adhered with resin Enlight and light-cured for 30 seconds.

In the third (control group) and fourth set of teeth, 3M Adhesive was placed according to the manufacturer's

Data were analyzed with a one-way ANOVA test with a < 0.05 confidence level.

Figure 1. Device for measuring bond strength.