Original Article

The Effect of Different Soft Drinks on the Shear Bond Strength of Orthodontic Brackets

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Abstract

Objective: It is proved that acidic soft drinks that are commonly used, have an adverse effect on dental structures, and may deteriorate oral heath of our patients and orthodontic appliances. The aim of this study was to compare the effect of yoghurt drink with other soft drinks on the shear bond strength of orthodontic brackets.

Materials and Methods: Seventy-five first premolar teeth_extracted for orthodontic purposes were selected and standard twin metal brackets were bonded on the center of buccal surface with No-Mix composite. The teeth were thermocycled for 625 cycles and randomly divided_into_five groups of artificial saliva, carbonated yoghurt drink with lactic acid base, non-carbonated yoghurt drink with lactic acid base, 7 up with citric acid base and Pepsi with phosphoric acid base. In all groups, the teeth were immersed in liquid for five-minute sessions three times with equal intervening intervals for 3 months. SBS was measured by a universal testing machine with a speed of 0.5mm/min. Data was analyzed statistically by one-way ANOVA.

Results: The results showed that mean values for the shear bond strength of carbonated yoghurt drinks, non-carbonated yoghurt drinks, 7up and Pepsi groups were 12.98(±2.95), 13.26(±4.00), 16.11(±4.89), 14.73(±5.10), respectively. There was no statistically significant difference among the groups (P-value= 0.238)

Conclusion: Soft drinks used in this study did not decrease the bond strength of the brackets bonded with this specific type of composite.

Key Words: Soft Drinks; Shear Bond Strength; Bonding; Acidic Solutions

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INTRODUCTION

Direct bonding_has a main role in modern orthodontics. The advantages of this technique are easy bracket placement, acceptable clinical success rate and reduction in chair side time. Significant bond failure is reported to vary between 0.5 and 16 percent [1-4].

If disturbing factors affecting bonding diminish, it will have a positive effect on bonding strength and durability. The chemical envi-

ronment is one of the aspects of oral environment, which has an appreciable influence on the degradation of resin composites and dental erosions [3].

The term "soft drinks" refers to all kinds of drinks except alcoholic ones, either carbonated or non-carbonated [5].

These drinks may consist of various types of acids, which reduce the pH of the oral cavity. Some of these acids are tartaric acid, lactic acid, maleic acid and phosphoric acid [6].

The acid used in soft drinks is very important, for example phosphoric acid-based drinks are more effective on enamel abrasion than citric acid-based drinks [7]. Unfortunately, consumption of acidic drinks has increased continuously during the recent decades in both developed and developing countries. This willingness is more inspected in children and adolescents. The harmful effects of soft drinks on teeth include enamel erosion and dental material corrosion [8].

Intact enamel surface is crucial for bracket retention and modified enamel surface may affect this retention [9]. Caries and dental erosions cause loss of mineral components. In dental caries, elimination of minerals from the enamel subsurface occurs due to acids released from the microbial plaque, but in erosion, exposure to extrinsic acids result in demineralization [10]. Main contributing factors in the erosion progress during orthodontic treatment are poor oral hygiene, malnutrition and inadequate bonding procedures [11]. It is reported that consumption of acidic and alcoholic drinks can decrease bracket retention as a result of softening of the enamel or degradation of resin composites [12-14]. It also causes an increase in the micro-leakage under brackets [11]. Yoghurt drink is one of the traditional and common drinks in south-west Asia which contains lactic acid and it also is a valuable source of calcium. The aim of this study was to evaluate the effects of soft drink on the bond strength of orthodontic brackets.

MATERIALS AND METHODS

In this study, 75 first premolar teeth extracted for orthodontic purposes were used. In order to prevent dehydration and bacterial growth, the teeth were kept in thymol 1% solution for 48 hours.

Table 1. Shear Bond Strength in Different Groups

Groups	Number	Mean (Mpa)	SD	Mean of SE	Minimum (Mpa)	Maximum (Mpa)
Carbonated Yoghurt	15	12.98	2.95	0.76	7.45	18.98
Non Carbonated Yoghurt	14	13.26	4.00	1.07	7.04	18.51
7 Up	15	16.11	4.89	1.26	8.12	23.24
PEPSI	12	14.73	5.10	1.47	6.29	24.85
Artificial Saliva	14	13.93	3.55	0.95	9.90	21.23
SUM	70	14.20	4.18	0.50	6.29	24.85

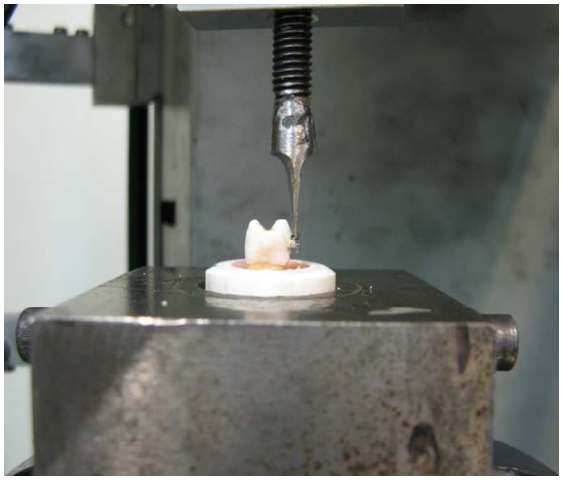

Fig1. Tooth mounted in the universal testing machine

All teeth had intact buccal surface, without any filling, caries or hypoplastic lesions and none of them were exposed to chemical agents such as hydrogen peroxide before.
First, the teeth were cleansed by pumice paste using bristle brush, then irrigated and dried with gentle air. Standard twin metal brackets (Dentaurum, Pforzheim, Germany) were bonded on the center of the buccal surface with No-Mix composite (unite, 3M, Unitek, USA). One operator did all the procedures. Then the specimens were immersed in distilled water for 24 hours.

Table2. PH measurement of soft drinks and their acidity

Type of drink	Type Of Acid	PH	Acidity
Pepsi	Phosphoric acid	2.95	0.51
7 up	Citric acid	3	0.21
Carbonated Yoghurt	Lactic acid	3.37	1.33
Non-Carbonated Yoghurt	Lactic acid	3.71	0.67

The teeth were thermocycled for 625 cycles (equal to 3 months) [16] and randomly divided into five groups of artificial saliva, carbonated yoghurt drink with lactic acid base, non-carbonated yoghurt drink with lactic acid base (Khoshgovar, Mashhad, Iran), 7 up with citric acid base and Pepsi with phosphoric acid base.
In all groups, the teeth were immersed three times in liquid for five-minute sessions with equal intervening intervals for 3 months. In each interval, after a thorough irrigation of the specimens, they were stored in artificial saliva. To prevent the release of gas from carbonated drinks, we used new liquids every 2 or 3 days. After this period, each tooth was fixed in silicone mold filled with self-cure acryl and the vertical slots of brackets were kept parallel to the vertical rod of surveyor.
To prevent overheating during the setting of acrylic resins, molds were placed in water. The pH of the drinks (acidic ions) was measured. These measurements were performed 3 times for each drink and the mean for the results was re ported.
The acidity of drinks was also measured by titration test. This test was done by means of phenolphthalein to find acidic molecules (ionized or non-ionized)
Shear bond strength (SBS) was measured by Zwick/Z250 with a speed of 0.5mm/min [17]. Deboning force was measured in Newton then converted to Mega Pascal (MPa).
The surface area under the base of bracket was 9.8mm^2 [10]. Data were analyzed statistically by one-way ANOVA.

RESULT

The results showed that mean values for the shear bond strength of carbonated yoghurt drinks, non-carbonated yoghurt drinks, 7up and Pepsi groups were 12.98 (±2.95), 13.26 (±4.00), 16.11 (±4.89) and 14.73 (±5.10) MPa, respectively. There was no statistically significant difference among the groups (P = 0.238) (Table 1). The pH and acidity of the drinks is

shown in Table 2. All the drinks had acidic pH (PH<7). PH of artificial saliva was 7.4.

DISCUTION

The aim of this study was to evaluate and compare the effects of acidic soft drinks such as Pepsi with a phosphoric acid base, 7up with a citric acid base, carbonated and non-carbonated yoghurt drinks with lactic acid base on the shear bond strength of orthodontic brackets.Acidic soft drinks may have two concomitant effects on the bond strength of orthodontic brackets. Acidic soft drinks can directly deteriorate the structure of adhesive materials. On the other hand, they may cause erosive lesions on the enamel surface around the brackets that may decrease the bonding strength [18-20]. The results indicating minimal difference in SBS among the groups in our research (P>0.05) were similar to Navaro's study [5] and different from Ulsoy's and Oncag's studies [10,11]. SBS of the 7up group was slightly greater than the Pepsi group. These results can be explained by the studies showing that drinks with a phosphoric acid base have greater erosive potential than citric acid-based drinks. Citrate in low dosages decreases the acidogenicity of the dental plaque and it is recommended as a way to reduce the cariogenicity of non-alcoholic soft drinks [6]. Ulsoy showed that soft drinks with a low pH, a phosphoric acid base and a citric acid base could decrease the SBS of the brackets. The reason for the difference between our study and theirs may be the type of composite used in the studies. The composite used in the two latter studies were Transbond XT (light cure), but in our study, it was Unite (self cure), so it may be concluded that Unite composite is more resistant against acid compared to Transbond XT [21]. In addition, the results showed that lactic acid has no significant effect on SBS, which was similar to Hobson et al.'s study [12]. One prominent conclusion from our study was the high level of acidity in yoghurt drinks (carbonated and non-carbonated).

Although pH is lower in Pepsi and 7up, the percentage of aggregated acidic molecules are greater in yoghurt drinks and it may be one of the reasons explaining the lower SBS in yoghurt drinks.

CONCLUSION

With regard to the results, it is determined that soft drinks used in this study have no significant adverse effect on the bond strength of the brackets bonded with Unite.

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