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EVALUATION OF THE BONDING TIME OF FLASH FREE ORTHODONTIC BRACKETS

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ABSTRACT

Objective: To evaluate and compare the bonding time of ceramic adhesive pre-coted system with conventional ceramic bracket .
Material and methods: Forty premolars extracted teeth which divided in to two groups first group contain conventional ceramic bracket as control group, second group contain ceramic flash free bracket as experimental group. In first group teeth prepared using traditional etching protocol, while group two teeth prepared using self-etching protocol. The bonding time was calculated. The bonding time was statistically compared using t-test $p<0.05$.
Results: The mean of bonding time of control group showed significant difference compared with second group ($p =0.00$).
Conclusion: Conventional ceramic brackets needs more time during putting when compared with the flash free brackets**.**

Key words: Bonding time, Conventional ceramic orthodontic bracket, Flash free bracket.

1. Introduction

In 1955, Buoncore introduced Acid-bonding technique and the concept of bonding has been developed to apply enamel in dentistry including the intertwining of orthodontic brackets[1]. Before 1970, the interrelationship between orthodontic brackets has some advantages, including ease of placement and removal, minimal soft tissue irritation and gingivitis, minimal risk of decalcification with loose band, and being more aesthetic[2] Various materials and methods are being continuously developed for bonding brackets, but in some cases the problem of decalcification is still being developed[3].
The bonding of the orthodontic brackets on the dental surfaces has improved with the advent of new products with excellent adhesive properties. Traditional system of orthodontic bracket bonding need to use of a three-step procedure includes three separate of enamel conditioner, a priming agent and resin adhesive. (Self-priming primers) try to limit the three steps to two steps,

effectively reduce chair time and increase the cost effect resulting in increased comfort and potentially reducing costs[4]

In the manual system of bracket placement the adhesive apply to the bracket base and the practitioner need to remove excess resin immediately after placement of bracket, leave this composite able to take critical area for plaque accumulation which lead to white spot lesion with long time of orthodontic treatment

To eliminate the needs for flash removal 3M company has development new adhesive system named free flash system .

The three main components to be considered for sufficient orthodontic bonding are the dental surface (morphology, Preparation of enamel) and individual orthodontic base attachment (mechanical and material properties), bonding of material itself . (3)

Until recently, while tying the orthodontic bracket the practitioner has to remove excess resin or bonding material immediately after placing the attachment using the positing instrument or a dental probe before curing of material.

In 2014, 3M and unitek (Monrovia, Calif ornia) create Flash-Free system (flash-free adhesive-coated appliance system), as a try to eliminate the need to remove Flash.

The system can be applied to any orthodontic bracket base during the manufacturing process. When pressing the enamel surface, the transparent and low viscosity resin forms a guiding border on the edges of the bracket (4).

The time required for the placement of brackets, including the clean-up of the flash (25).

Flash free orthodontic brackets are a new technology that claim to reduce the bonding time and the excess adhesive around the bracket base .

Smooth marginal surface of the adhesive in flash free brackets able to decrease demineralization around the sides of bracket (21).

To solve the problem of flash around the bracket flash free technology introduced (22).

Bracket bonding is probably the longest appointment during orthodontic treatment and reduced chair time can make work more efficient and improve patient satisfaction (23).

Enamel cleaning before acid etching is necessary for direct preparation and indirect repairs, and incisions (10,11). The discoloration and plaque accumulation are removed by dental prophylaxis with pumice powder or paste and rotating brush or a cup of rubber (12).

There are other prevention techniques, such as airflow and bicarbonate jet

polishers, which are faster and more efficient, but they can damage tissue and surface contamination **(**13,14).
The pellicle acquired is organic flake and sham, without cells, which covers cleaned tooth surfaces in a few minutes (15).
Acquired pellicle is important in tooth decay (16), especially in the demineralization /reminelization of enamel surface. The acquired pellicle is important with respect to the enamel surface response to the bacterial acid exhibit (17,18).
The first metal bracket of stainless steel have been milled and drawn on the cold and has perforated bases into which the adhesive can flow (19). Stainless steel brackets do not attach chemically with adhesive in the adhesive base but interface by mechanical interlocking (19).
The original metal pads contained only one row of holes along the outer margin of the inner surface was relatively large and smooth unable to contribute to its retention. This design was subsequently changed base to the network foil bracket, which produced the largest bond
strength and less accumulation of plaque (20). The top has been foiled into a solid metal support, this point named gobbets.
The formations of the orthodontic bracket base have been contemplated effect on the bond failure mode and have an effect on the enamel surface damage during removal of bracket.
The base can provide mechanical retention. The most common for metal brackets, mesh welded to the base of the bracket to form the structure (20).
Excess of adhesive should remove after putting of bracket and before curing (24).
A new flash-free adhesive promises to eliminate the flash removal step in bonding and to reduce bonding time by as much as 40% per bracket, with a bond failure rate of less than 2% (26).
The aimed of this study to evaluate and compare the bonding time of conventional ceramic orthodontic brackets with flash-free ceramic orthodontic brackets .

2. MATERIAL AND METHODS

2.1. *Sample*

Forty teeth upper and lower premolar teeth, which extracted for orthodontic treatment were prepared and randomly separated into 2 groups each group contain 15 teeth. These teeth are extracted relatively frequently in sever crowding orthodontic cases, making them easy to obtain. All of the teeth were collected from the orthodontic

The criteria for teeth samples were; labial surface of enamel is contact with no caries, no crack, no any enamel defect.

2.2. Brackets:

Ceramic conventional (3M unitek, Monrovia, Claiformia) brackets were used in the first group as the control group (Group 1), Ceramic flash free bracket (3M unitek, Monrovia, Claiformia) brackets were used in the second group as the experimental group (Group 2).

2.3. Methodology

Power analysis was performed to determine the number of samples.
The sample size was found to be 14 for each group in the analysis of the power analysis performed with G * power 3.1 program and in the sample width analysis performed by taking 0.80 power value in 2 study groups (alpha error probability = 0.05). Statistical calculations were performed with SPSS (statistical package for the social sciences) statistical software program for windows. Student's t-test was used to assess for a statistically significant difference in mean values between test groups for bonding time.
Preparation of enamel surface for bracket bonding was as the following direction:
1- The labial surfaces of enamel were polished by pumice slurry by using rubber cup for 10 seconds.
2- Washed by air/water sparing for 15 second then dehydrated by compressed air for 10 seconds.
3- The labial surface of group one were prepared by using traditional etching protocol.
4- The labial surfaces of group two were prepared by using Transbond plus self-etching primer (3M unitek) for 5 seconds, followed by a soft bust of dry air to thin the primer.
5--All adhesive resin polymerized by used an ortholux luminous curing (3M unitek) with instant of 1600 mm/cm for 6 seconds mesial and 6 seconds distal.
6- Bonded teeth were placed in distilled water at 37°C for 24 hour to allow polymerization of bonding material.
Bonding time is the amount of time required to bond a bracket to a tooth surface, In this study the bonding time calculated by a main observer by use a stopwatch. The time was calculated after the teeth were prepared and the brackets were placed in ideal position by the practitioner. Total time was calculated in seconds.

Table 1: Mean, std Deviation of bonding time (seconds) for the control and experimental groups

Groups	*Mean*	*SD*
1	*40.1240*	*3.42772*
2	*31.0460*	*2.98343*

3. RESULTS

The mean bonding time (seconds) of conventional ceramic orthodontic bracket group (40.1240) showed significant when compared with ceramic flash free group (31.0460) (p=0.000)

4. DISCUSION

In this study using extracted teeth in which more closely approximates a clinical situation with respect to tooth architecture and morphology.

The storage media for extracted teeth used was distilled water, which considered as one of the best storage medium capable of reassuring adequate results concerning to the enamel and dentine characteristics..

The preparation of enamel surface requires polish then rises with air/water and dried with a steam of oil free compressed air. Kirmura T et al had reported that clean the tooth surface have a higher surface energy that is amenable to bonding[8]

In this study, the labial surface of enamel should be polish with no fluoride of pumice because fluoride on the surface can lower the surface energy of the adherent, decreasing the ability of the adhesive to spread.

In the present study used two different etching protocols for enamel preparation, and materials that chosen for surface preparation and adhesive were Trans bond plus self-etching primer, Trans bond XT light cured adhesive and primer. All materials are widely used as orthodontic material in modern dentistry, and used flash free brackets to evaluate bonding time and compare with conventional one.

The ortholux luminous light is optimized for orthodontic bonding, the combination of the high intensity LED lamp and the 8 mm light guide optimized for orthodontic use for an efficient curing time.

The introduced flash-free adhesive system was able to significantly reduce the time that was needed to position the bracket. (24).

Putting the bracket during orthodontic treatment may lead to increase the time of an appointment and to decrease chair time and can make work more efficient we need to decrease boning time (22).

The bonding time of the flash free bracket was faster compared with first group . The total time saved per tooth using the flash free bracket was 9.058 seconds, totally 135.87 seconds when bonded 15 teeth.

The bonding times were significantly shorter with the flash-free adhesive than with the conventional adhesive reported by Thorsten Grünheid , Brent E. Larson 2018.

FF adhesives can be a good alternative to reduce chair time in bonding appointments, Zeynep Beyza Yıldırım , Sabri İlhan Ramoğlu 2023. (25).

The average of bonding time of this study was longer comparable to bonding time reported by moon young leea, Georgios Kanavakis 2016 ,. Moritz Foersch et al 2016.

The results of study made by He Wang , Ge Feng et al 2022, Thorsten Grünheid , Brent E. Larson 2018 and Zeynep Beyza Yıldırım , Sabri İlhan Ramoğlu 2023 were similar when compared with results of this study , which are the flash free bonding system significantly reduced bonding time.

No specific protocol for placement of bracket to ideal position could be effect on the time of bonding also the clinical experience.

This study was an in vitro and the results are not necessary as that obtained in the oral environment , also more study needs to measure the bonding time.

5. CONCLUSIO

flash free bracket system no needs to remove excess adhesive, which potentially save chair time by reduce the time of bonding.

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تقيم زمن الإلصاق لحاصرات التقويم المجهزة مسبقا بلاصق التقويم

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المستخلص

الهدف: تقييم وقت الترابط ، لنظام لاصق السيراميك المطلي مسبقا بلاصق التقويم، حيت تم استخدام أربعين سنا مخلوعة نتيجة للعلاج التقويمي قسمت إلى مجموعتين حيث احتوت المجموعة الأولى على حاصرات خالية من اللصق واعتبرت مجموعة أساسية بينما احتوت المجموعة الثانية على حاصرات تحتوي على لاصق التقويم واعتبرت مجموعة دراسية، حيت خضعت المجموعة الأولى أثناء التحضير التقليدي بمراحله الثلاث أما المجموعة الثانية فاستخدم نظام التحضير الجاهز من مرحلة واحدة ومن تم احتسب وقت الترابط لكل مجموعة وتمت المقارنة بينهما إحصائيا باستخدام اختبار تي، النتائج أظهرت وجود فرق بين المجموعتين من حيث زمن الترابط حيث كانت الخلاصة أن الحاصرات التي لا تحتوي على لاصق مجهز مسبقا تحتاج إلى وقت أكثر خلال عملية الإلصاق مقارنة بالحاصرات الخالية من اللاصق.