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Evaluation of Integrity of Mesh of Different Orthodontic Brackets

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الخلاصة

الأهداف: تهدف الدراسة **الى** تقييم و مقارنة تأثير جهاز التخريش الدقيق من الجيل الثاني للشكل الهندسي لمختلف قواعد الحاصرات التقويمية و مقارنتها مع الجديد. **المواد وطرائق العمل:** ثلاث مجاميع من الحاصرات التقويمية كل مجموعة تتألف من ٩ عينات (حاصرات) من التيتانيوم النقي و مجموعة ثانية من الخزف و مجموعة ثالثة من الفولاذ عديم الصدأ. تثبت جميعها بلاصق خاص للأغراض التقويمية، ثم ترفع بعد لصقها بكماش خاص بحيث يبقى اللأصق على قاعدة الحاصرة قدر الأمكان. ثم تخضع جميعها للتخريش بواسطة جهاز التخريش الدقيق وفق ابعاد و ضغط هواء واحد. ثم بعد ذلك تصور قاعدة الحاصرات جميعا بتصوير مجهري فوتوغرافي و تقارن مع صور لمثيلاتها تحت الظروف نفسها أي مع قاعدة حاصرات جديدة غير مخرمش **النتائج:** أضهرت النتائج وجود فرق معنوي بين قاعدات الحاصرات التقويمية التي خضعت للتخريش عندما قورنت مع مثيلاتها الجديدة، و أظهرت الدراسة ان الحاصرات المصنوعة من التيتانيوم النقي كانت الأكثر تأثيرا من المصنوعة من الخزف و الفولاذ عديم الصدأ. كما أظهرت الدراسة ان الحاصرات المصنوعة من الفولاذ عديم الصدأ و الخزف تأثرتا بدرجة متساوية.**ألأستنتاجات:** بينت الدراسة بينت ان جهاز التخريش الدقيق من الجيل الثاني يمكن استخدامه لأعادة تأهيل جميع الحاصرات (الفولاذ عديم الصدأ ، الخزف، التيتانيوم، الراتنجية) و انه يلعب دور كبير في زيادة خشونة الحاصرة التقويمية و بالتالي له دور ايجابي في ثبوتها على الأسنان اثناء المراحل العلاجية ،على الرغم من تأثير طفيف جدا" على شكلها.

ABSTRACT

Aims: To evaluate and compare the effect of micro etcher model II on geometrical integrity of base of variable types of orthodontic brackets after etching and compared with new bracket. **Materials and Methods:** Twenty seven brackets were divided into three groups of nine. Group one was titanium brackets, group two was stainless steel brackets and group three was ceramic brackets. Brackets had been previously bonded to glass slide with same adhesives. All groups were carefully removed with debonding plier and again all groups cleaned from the adhesive material by microetcher and the bases of all brackets examined with stereomicroscope and compared with control group. **Results:** There are significant differences between the control group and reconditioning groups "stainless steel, pure titanium and ceramic brackets". While, the stainless steel and ceramic groups have the lower percentage of deformity in geometrical integrity. Also, the reconditioned groups showed no significant difference among them.**Conclusions:** This study showed that the microetcher can be used for reconditioning for all types of orthodontic bracket bases; however, minimal damaging may be occurring in orthodontic bracket. Microetcher plays a role in roughness of base of orthodontic bracket.
Key words: Microetcher, mesh, recycling, bracket, ceramic.

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INTRODUCTION

To enhance the retention of the adhesive to the metal base of orthodontic brackets, various chemical and mechanical retentive design have been suggested . Mechanical retention was enhanced by placing undercuts in the cast bracket bases or by welding different diameter mesh wires to the bracket base as well as incorporating different designs in the mesh itself. Other innovative approaches to improve retention included using laser-structured bases, using metal plasma-coated bracket bases and fusing metalic or ceramic particles to the bases. One of the major challenges associated with the use of bracket for orthodontic treatment is the accidental dislodgement of an orthodontic bracket due to occlusal trauma or intentional removal of bracket in order to reposit it to achieve ideal occlusal goals. It is necessary either to rebond the dislodged bracket or to bond a new one.(1)

The orthodontic clinician requires a reliable method of attachment to tooth tissue.(2) The method of attachment must allow the delivery of orthodontic forces and must be sufficiently robust to withstand masticatory loads. In addition, the attachment must be aesthetic, easily removed at the end of treatment and result in minimal hard and soft tissue damage during application.The undercut in most metal bracket is provided by a brazed fine mesh.[3] However, other bracket bases carry milled undercut or sintered with porous metal powder. It has been also used to improve the bond strength of reconditioned brackets by use high – speed stream of aluminum oxide particles propelled by compressed air to remove old adhesive parts from the base of the accidentally debond bracket for increase surface roughness.[4]

Bracket base morphology can influence the retention of bracket base, this is called geometry (depth, size).[5]The purpose of this in vitro study was to evaluate and compare the effect of micro etcher model II on geometrical integrity of base of variable types of orthodontic brackets after cleaning them and compared with new bracket.

MATERIALS AND METHODS

This study test sample is composed of twenty seven brackets divided into three groups: nine pure titanium bracket roth design "0.018x0.030" bicuspid with casted integral base Rematition (Dentaurum, Germany), nine stanless steel standard edge wise "0.018x0.030" with single layer mesh "foil mesh" Ultra – minitrim (Dentaurum, Germany), and nine ceramic brackets "0.018x0.030" with retentive elongated groove (Dentaurum, Germany)

A photographed view at 20X magnification was taken for integral base of pure titanium, foil mesh of stainless steel and groove of base of ceramic bracket and views were taken for bracket by stereomicroscope and digital camera.[6]

Methods:

Step One:The three bracket groups were bonded on glass slide by following both glass slide and bracket base were coated with a thin layer of orthodontic composite (Biofix orthodontic adhesive) , then positioned on glass slide and seated under standard force 500g.[7] Excess resin flash around the base was removed with dental explorer.[8] Light was then applied for 10 seconds on proximal side to cure adhesive then bracket debonded by using plier after one hour in way by which the resin remain intact on base of bracket with crack or fragment of cured composite.[8]

Step Two: Cleaning of the debonded brackets: by using microetcher model II (Danville Engineering and Material, USA), it consists of micro handpiece air line and nozzle and hold by the tip of nozzle 3mm away from the bracket base and the tip of nozzle move mesiodistal direction sweep method by using a holder designed make the nozzle move for 6mm mesiodistal direction and the base of each debonded bracket was etched at 65 PSI 30 seconds with aluminum oxide 50 micron particle size. [9]

Then the brackets of three groups wire view under microscope at magnification 20X.[10] and photographs were taken for all the brackets at constant quality, fine and high resolution of digital camera.[11] as in figure(1) To determine how much residual adhesive remained on the mesh according to the following scale: 1= all the composite remained on the tooth, 2= more than 90% of the composite remained on the tooth, 3= more than 10% but less than 90% remained on the tooth, 4= less than 10% remained on the tooth, and 5 = no composite remained on the tooth.[12] The higher thepercentage of the open area, the better result.[13-17]

RESULTS

The descriptive analysis (minimum, maximum, mean and SD) for the four groups are listed in Table (1).The findings of this study showed the mean of the control group gave rise to the highest percentage of damaging of geometrical integrity followed by ceramic group then stainless steel group, while the pure titanium group showed the lowest value when compared with remaining groups, as in Table (2) and Figure (2). The analysis of variance (ANOVA) for the four groups showed significant difference ($p < 0.001$) among them as in the Table (3). The control group, pure titanium, stainless steel and ceramic groups showed significant difference ($p \leq 0.05$), while the stainless steel and ceramic group showed no significant difference ($p > 0.05$) Table (4).

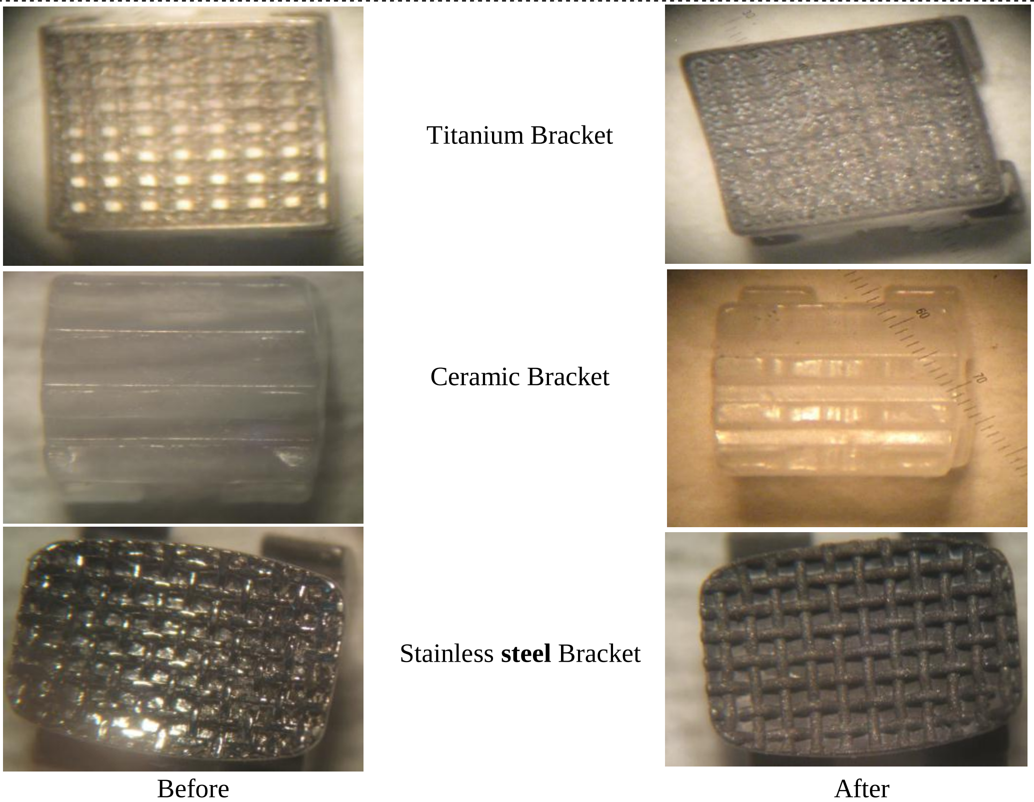

Figure (1) Different orthodontic bracket base before and after etching under stereo microscope

Table (1): The descriptive statistics of the effect of microetcher on bases of variable orthodontic brackets.

Groups	No.	Minimum	Maximum	Mean (%)	Standard deviation	Standard error
Control	9	1.00	0.1	1.000	0.000	0.000
Pure titanium	9	0.94	0.99	0.963	0.015	0.005
Stainless steel	9	0.98	0.99	0.985	0.005	0.001
Ceramic	9	0.98	0.99	0.987	0.004	0.001

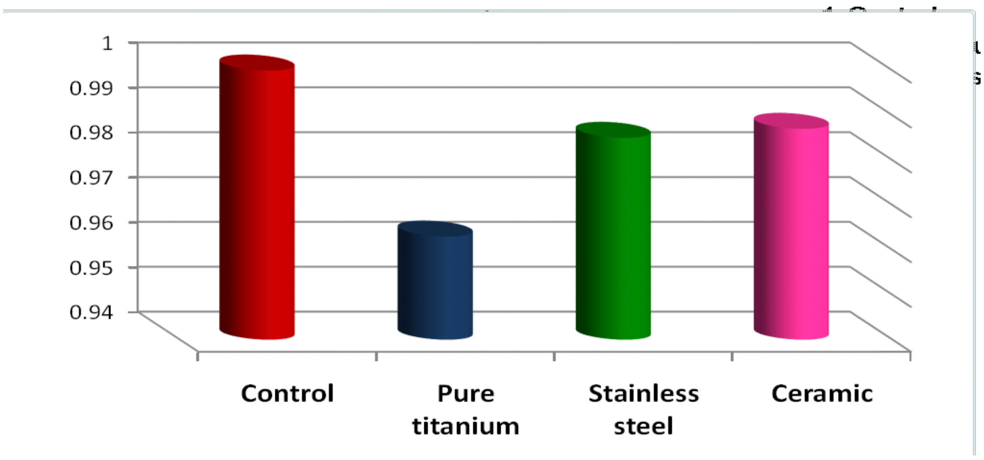

Figure (2): Comparison demonstrated the effect of micro-etcher on bases of variable orthodontic brackets.

Table (2): T – test comparison of the effect of micro-etcher among groups of bracket

Groups	Mean (%) ± SD	T - value	*p*- value	Sig.
Control **Pure titanium**	1.00 ± 0.000 0.96 ± 0.015	7.333	0.000	**S**
Control **Stainless steel**	1.00 ± 0.000 0.98 ± 0.005	8.222	0.000	**S**
Control **Ceramic**	1.00 ± 0.000 0.98 ± 0.004	8.315	0.000	**S**

S: Significant difference at $p \leq 0.05$

Table (3): The analysis of variance (ANOVA) among bracket groups for determining the effect of microetcher on variable base of brackets for the four groups

	Sum of Square	df	Mean Square	F- value	*P*
Between groups	0.006	3	0.002		
Within groups	0.002	32	0.000	30.844	< 0.001
Total	0.008	35			

Different letters mean significant difference at $p \leq 0.05$

Table (4): Duncan's multiple range test among bracket groups for determining the effect of microetcher on variable base of brackets for the four groups.

Groups	No.	Mean (%)	Standard error	Duncan's group
Control	9	1.000	0.000	A
Pure titanium	9	0.963	0.005	B
Stainless steel	9	0.985	0.001	C
Ceramic	9	0.987	0.001	C

Different letters mean significant difference at $p \leq 0.05$

DISCUSSION

Aluminum – oxide blasting technique was originally intended to enhance the mechanical retention of new and debonded brackets as well as to prepare enamel surface. Aluminum oxide air – abrasion has been proved a good option for reconditioning of orthodontic bracket, easy technique can be performed in dental office, gave good benefit from the economic view and time consuming.

The result of this study showed statistically difference between the new and etched brackets, this result is in agreement with Basudan and Al – Emran, Mete and Selim). [7, 18] This finding is clearly due to the facts that the Al_2O_3 sandblasting of bracket base creates an effective micro – roughened surface on the bracket base, which increase the area for bonding adhesive in comparison to the new bracket, however, causing very minimal damaging for geometry of bracket base.

The present finding also differ from those of Stenyo *et al*. [19] and Seema *et al*. [20] who found that there is no statistically significant difference between the geometry of the base of new bracket and etched brackets.

The finding of this study disagrees with Sunna and Rock.[21] who found no significant difference between conditioned or etched and new bracket, while this study agree with Oonsombat *et al.*[22] , Bishara *et al*.[12] and Wheeler *et al*.[23] who all found a significant difference between new and sandblasted brackets.

CONCLUSIONS

This investigation revealed that the micro – etcher can be used for reconditioning of all types of orthodontic bracket base. However, minimal damaging may be occurring on orthodontic bracket base as loss of luster especially when stainless steel bracket, where etched and more time consuming need. The more complex base design was etched as double mesh soldered in stainless steel bracket. While, less time consuming when ceramic bracket was used because it has elongated retentive groove only.

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