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Stainless steal orthodotic brackets recyc-ling (using micro–etcher)

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ABSTRACT

Aims: To evaluate the effects of the micro–etching procedure on the bracket's slot and base parameters and on the tensile bond strength of the recycled brackets. **Materials and Methods**: The sample was 20 stainless brackets grouped into; control brackets group(10) and de–bonded brackets group(10). The de–bonded brackets reconditioned with micro–etcher. the data subjected to the statistical analysis at ≤ 0.05 significant level. **Results**: demonstrated that the use of micro–etcher for recycling the de–bonded brackets do not affect the bracket's slot and base parameters whereas affected the bond strength of the recycled brackets. **Conclusion**: The micro–etcher (sand basting) is recommended for recycling the de–bonded stainless steal brackets and reuse them in orthodontic treatments

Key words: Orthodontic brackets; micro-ether; recycling.

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INTRODUCTION

Recycling appears to be an effective method for cleaning brackets after accidental debonding and facilitating the reuse of accidentally debonded attachments.[1] Recycling is considered as a solution for using the same bracket for another patient after sterilization.[2] Recycling has an economic and ecological benefit due to the cost of reused bracket below the price of new bracket.[3]

Micro–etching, this method used for removing the old adhesive from the base of de–bonded bracket in order to improve the retentive surface of the base or pad of the de–bonded bracket. This technique utilized a high speed stream of aluminum oxide particles propelled by compressed air, although initially reintroduced as a method for roughing the surface of many dental materials (etch attachment for superior Maryland bridge, etch orthodontic band for rapid cement removal from internal surface of crown and bridge prior to re–cementation).[4] Another application of micro–etcher; etches all metals amalgam, composite, porcelain repair.[5] Basudan and Al–Emran [6] studied the effect of sandblast on slot width and slot depth, inter–wing gap of reconditioned bracket, and found no effect of sandblast on them. Authers [7,8] showed that bond strength of recyclable bracket was not significant when compared with new brackets. Other researchers [9,10] disagreed with this finding, such as, Chung [9] who noticed the significant difference in bond strength between recyclable bracket that etched by sandblast when compared with the new one. This controversy required more research to ensure the right findings. The aims of this study were planned to asses the bracket dimensions of the slot's, width, depth, inter–wings gape, labio–lingual angle and the bracket's base curvature angle of the recycled stainless bracket.

MATERIALS AND METHODS

The bracket samples consisted 20 stainless steal (SS) standard edge wise (0.018 x 0.0300 of the bicuspid bracket with a single

layer mesh (foil mesh). The brackets grouped into two groups, 10 brackets for each. The first group used as control, the second group used for conducting the recycling technique. Twenty sound extracted human upper right first premolars utilized for testing the tensile strength for control and recycling groups. The teeth collected from orthodontic department in the dental school at College of Dentistry, University of Mosul. The teeth did not subjected to any pretreatment, with no detectable caries or enamel cracks and no visible hyper–plastic pits and intact buccal enamel.[11] The teeth stored in normal saline 0.9 NaCl.[12]

The second brackets group bonded on glass via orthodontic composite adhesive. The bonding process performed under a standard force 500 gm,[6] excess resin flash around the base removed with dental explorer. The bracket de–bonded by using tweezers after one hour.

Micro–etching of the de–bonded brackets achieved with Micro–etcher. The micro–etcher is designed to be held like a pencil allowing the thumb to activate the finger button control, the nuzzle holed 3 mm away from the bracket base.[13] The tip of the nuzzle moves in a mesiodistal direction in sweep technique by using a holder designed to make the nuzzle move for 6 mm mesiodistal direction, and the base of the de–bonded bracket etched for 12 seconds with aluminum oxide 50 micron particle size.[9]

The parameters (slot's; width, depth, inter–wings gap) of the bracket measured under the stereomicroscope at a constant quality and then, converted to their original values. The measurements of the slot's width of the bracket which measured by reading the distance from the tope of the internal corners of the gingival and the occlusal of the mesial wings, the slot depth measured by reading the distance of the tangent line at the internal wall of the slot and the inter–wing gap measured by reading the distance between two points at the internal corners of mesieoocclusal and distoocclusal wings (Figure 1).

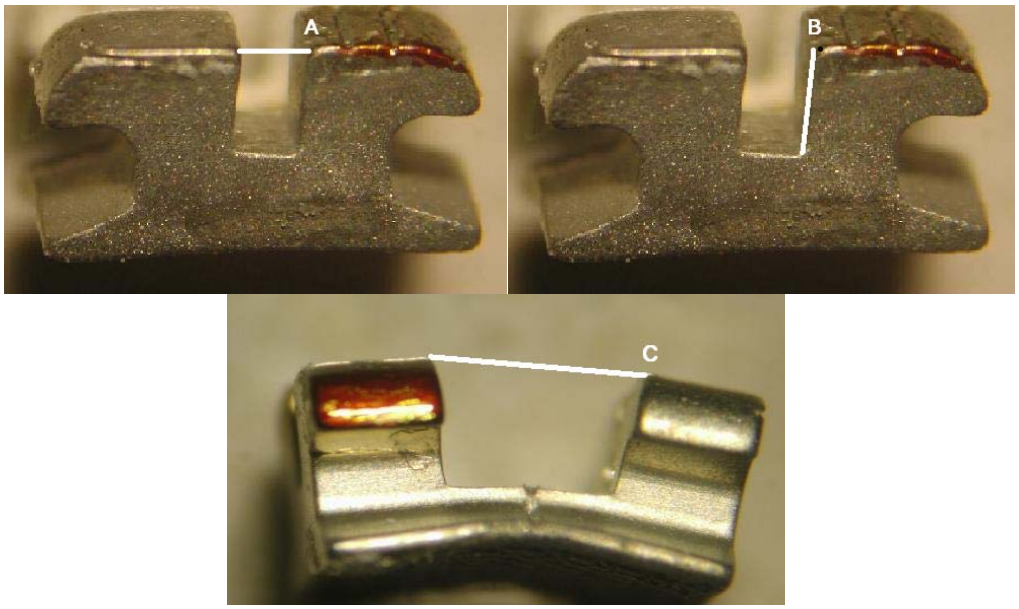

Figure (1): The stainless steal bracket's dimensions: (A) slot width , (B) slot depth , (C) Inter–wings gap.

The labiolingual angle measured by the intersection of the tangant lines of the internal surfaces of the mesio–oclclusal wing and the occluso–gengival floor of the slot and the bracket's base curvature angle found by the intersection of the tangent lines of the mesial and distal slops of the bracket's base, these angles measured on the magnified photographs (20X) (Figure 2).

Figure (2): The stainless steal bracket dimension: (D) labio–lingual angle, (E) bracket base curvature angle.

Preparation of the crown of the tooth conducted to measuring the tensile bond strength of the control and recycled bracket groups. The crown of the tooth mounted in the metal ring, the middle third of the buccal surface oriented to be parallel with analyzing rod of surveyor.[14,15] All the samples immersed in normal saline to prevent dehydration of teeth and left for 24 hours in the incubater at 37centegrad degrees.

The tensile bond strength of the control and recycled bracket specimens tested by the using the universal testing machine, the tensile bond strength performed at speed 0.5 mm/minute. The reading took through the gage. This force measured in kilogram; then, the force converted by mega–Pascal (MPa).

The analysis of the data included the descriptive (mean, standard deviation, minimum and maximum values) and the variance (student t–test at ≤ 0.05 significant level).

RESULTS

The descriptive statistics that includs mean, standard deviation, minimum and maximum value of bracket's slot, width, depth, inter–wings gap and labio–lingual angle, the bracket bass curvature angle and the tensile bond strength of the control and recycled brackets demonstrated in Tables (1 and 2). All the measurements show no significant differences at 0.05 significant level between both brackets samples except the tensile bond strength display increase significantly in the control group (Table 3).

Table(1): Descriptive statistic of the stainless steal control bracket group.

Bracket Parameters	No.	Mean± SD	Minimum Value	Maximum Value
Slotwidth*	10	0.466± 0.000	0.466	0.466
Slot depth*	10	0.760± 0.000	0.760	0.760
Inter–wing gap*	10	1.260± 0.000	1.260	1.260
Labio–lingual angle**	10	90.000± 0.0047	89.99	90.01
Baseangle**	10	110.000± 0.000	110.000	110.000
Tensile strength#	10	18.284± 1.997	13.96	19.600

*Measurement in millimeter; **Measurement in degree; #Measurement in mega–Pascal; No.: Number of the bracke

Table(2): Descriptive statistics of the stainless steal recycled brackets group.

Bracket Parameters	No.	Mean± SD	Minimum Value	Maximum Value
Slot width*	10	0.466± 0.000	0.466	0.466
Slot depth*	10	0.760± 0.000	0.760	0.760
Inter–wings gap*	10	1.260± 0.000	1.260	1.260
Labio–lingual angle**	10	90.000± 0.005	89.990	90.010
Baseangle**	10	110.000± 0.000	110.000	110.000
Tensile strength#	10	13.066±1.329	10.780	15.480

*Measurement in millimeter; **Measurement in degree; #Measurement in mega–Pascal; No.: Number of the bracke

Table(3): Analysis of t– test for the stainless steal brackets; the control and recycled groups.

Bracket Parameters	Sample Brackets	No	Mean± SD	t– value	Siginficant
Slot width*	**Control**	10	0.466±0.000	0.000	No significant
	Recycled	10	0.466±0.000		
Slot depth*	**Control**	10	0.760±0.000	0.000	No significant
	Recycled	10	0.760±0.000		
Inter–wing gap*	**Control**	10	1.260±0.000	0.000	No significant
	Recycled	10	1.260±0.000		
Labio–lingual angle**	**Control**	10	90.000 ± 0.000	0.000	No significant
	Recycled	10	90.000 ± 0.000		
Base angle**	**Control**	10	110.00 ± 0.000	0.000	No significant
	Recycled	10	110.00 ± 0.000		
Tensile strength#	**Control**	10	18.284 ± 1.997	1.658	significant
	Recycled	10	13.066 ± 1.329		

*Measurement in millimeter; **Measurement in degree; #Measurement in mega–Pascal; No.: Number of the bracke

DISCUSSION

There was no significant difference of the slot's width, depth, inter–wing gape and labio–lingual angle of stainless steal (SS) bracket treated with etcher, when compared with control method. This obviously can be explained on the grounds that the bracket slot width did not affect by the blasting process due to that the surface was away from the blowing nuzzle of the micro–etcher. The non significant difference effect on those parameters were in accordance with Basudan and Al–Emran[6] who found that the sandblast had no effect on dimensions of the bracket's slot. There was no significant differentce of bracket's base curvature angle of the reconditioned SS bracket when compared with control bracket. This can be attributed to the fact that the base of the metal bracket fabricated of alloy has enough resistance to the all influences applied by recycling method.

A significant reduction of tensile bond strength of the recycled SS bracket detected when compared with control method. This can be explained on the grounds that the base of the recycled brackets that treated with etcher method lost significant retention area when compared with retentive area of the base of control method. The results concerning the comparison of recycled bracket with control brackets agreed with authors [3,8,16] who found that the bond strength of metallic recycled bracket not significant decrease when compared with bond strength of control bracket. However, the results disagreed with Basudan and Al–Emran [6] who found that the bond strength decrease significantly when compared with control brackets.

CONCLUSION

The micro–etcher (sand basting) is recommended for recycling the de–bonded stainless steal brackets and reuse them in orthodontic treatments. because this procedure has no significant effects on the bracket dimensions and give acceptable value of the bond strength.

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