ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 12, Issue, 11, pp.14825-14828, November, 2020

DOI: https://doi.org/10.24941/ijcr.40165.11.2020

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

COMPARATIVE EVALUATION OF THE EFFICIENCY OF ADHESIVE REMNANT REMOVAL AND ENAMEL SURFACE TOPOGRAPHY USING TUNGSTEN CARBIDE BUR AND FIBRE GLASS BUR – A SCANNING ELECTRON MICROSCOPIC STUDY

***Ajay Joji James[1], Ajith R Pillai[2], Jayanth Jayarajan[3], Fawas Shaj[4], Shifa Mohammed Jabar[5] and Joseph Jose[6]**

[1]Sankeerthana, TC 30/1415(3), KRA 104(A), Pallimukku, Church lane, PETTAH P O, Trivandrum, Pin 695024, Kerala India
[2]Prof. and HOD, Azeezia College of Dental Sciences and Research
[3]Professor, Azeezia College of Dental Sciences and Research
[4]Reader, Azeezia College of Dental Sciences and Research
[5]Senior Lecturer Azeezia College of Dental Sciences and Research
[6]Senior Lecturer Azeezia College of Dental Sciences and Research

ARTICLE INFO

Article History:
Received 10th August, 2020
Received in revised form
17th September, 2020
Accepted 15th October, 2020
Published online 30th November, 2020

Key Words:
Debonding, Stainbuster,
Tungsten Carbide,
Scanning
Electron Microscope.

ABSTRACT

Introduction- Debonding of brackets following orthodontic treatment, often leaves adhesive remnant on the enamel surface even after cleaning, polishing with rotary instruments. **Aim -**This study compares the efficiency of adhesive removal using traditional tungsten carbide bur and stainbuster fibre glass bur. **Materials and Methods-** 36 premolar teeth extracted as part of orthodontic treatment from patients following debonding of brackets were selected and Adhesive Remnant Index (ARI) was measured. Based on score 1 of ARI, debonded premolars were selected.This study compares the efficiency of adhesive removal using traditional tungsten carbide bur and stainbuster fibre glass bur. The removal of adhesive remaining on the enamel surface located on right and left quadrants were done in a mesio-distal direction with tungsten carbide bur and stainbuster fibre glass bur for 20 seconds. The premolars were extracted without damaging the enamel surface. The enamel damage was analyzed based upon EDI scores under a Scanning Electron Microscope (SEM) at magnification of x500. **Statistical Analysis and Results-** The statistical test employed in the present research is chi^2 test. Score 1 surface was observed in most tooth samples with stain buster fibre glass group and EDI score 4 was observed in most tooth samples with tungsten carbide group. There is significant difference between the two burs ($p < 0.001$) as well as between four quadrants ($p< 0.001$). **Conclusions-** Stainbuster fibre glass bur was less damaging to enamel surface, removed adhesive resin remnant more efficiently and created a smoother enamel surface compared to tungsten carbide bur.

Citation: ***Ajay Joji James, Ajith R Pillai, Jayanth Jayarajan, Fawas Shaj, Shifa Mohammed Jabar and Joseph Jose.*** **2020.** "Comparative evaluation of the efficiency of adhesive remnant removal and enamel surface topography using tungsten carbide bur and fibre glass bur –a scanning electron microscopic study", *International Journal of Current Research*, 12, (11), 14825-14828.

INTRODUCTION

The aim of debonding is to mechanically eliminate the orthodontic brackets and residual adhesive remnants from the enamel surface and bring the enamel surface to its pre treatment condition, without causing any iatrogenic damage to enamel and tooth supporting tissues. The most commonly accepted technique of debonding of orthodontic brackets is attained by means of debonding pliers[1]. After debonding, removal of adhesive resin remnant is done by using various rotary cutting instruments. Rotary instruments such as burs, discs, finishing and polishing auxiliaries such as points, cups, tips and brushes are used along with slow and high speed hand pieces to remove adhesive remnants and return enamel to its pretreatment condition. Of all these rotary instruments, burs are the most common choice.

***Corresponding author: Ajay Joji James**
Sankeerthana, TC 30/1415(3), KRA 104(A), Pallimukku, Church lane, Pettah P O, Trivandrum, PIN 695024, Kerala India.

Clinical and laboratory studies[2] have shown that rotary instruments can change the enamel surface irreversibly by producing deep scratches or loss of enamel. Frequently, adhesive resin remnant has been found on the enamel surface, even after cleaning, finishing and polishing with rotary instruments. The most commonly used bur is slow speed tungsten carbide bur, though it removed the adhesive resin remnant efficiently, it shows increased irregularities and deeper scratches on debonded enamel surface[3,4]. Along with the development of conventional instruments, new burs that are more conservative have been designed for the enamel surface. A new composite bur stainbuster, strengthened and stabilized with zircon-rich glass fibre was primarily designed to gently remove cement, stains and colored coatings from the surface of the enamel. It has also been recommended in orthodontics for clean-up procedures following debonding,

The manufacturer defines the special characteristic of the bur comprises of fibre glass segments with abrasive power, which cover the entire working area and breaking it into small sections when they act on a hard surface, there by offering cutting sections of zircon/glass fibre in a resin matrix and in due course nonabrasiveness towards the enamel is noted. In this research two burs were evaluated and compared (Tungsten carbide bur-TC1157 and Stainbuster fibre glass bur) for their efficiency in removing the residual adhesive remnant after debonding. The effects of these burs on the enamel surface after finishing and polishing were also studied.

MATERIALS AND METHODS

36 premolar teeth (maxillary and mandibular) extracted from patients after debonding of brackets were selected for this study . Brackets were bonded on to the teeth by the usual bonding procedure following proper isolation. After 24 hours the brackets were debonded. The debonding technique here used is squeezing method [1] followed by lift off method using debonding pliers (DD001). Adhesive Remnant Index (ARI) was measured. Based on grade 1 of Adhesive Remnant Index(Less than half of the adhesive remaining on the dental enamel) the debonded premolars were categorized .Then the mouth was divided into four quadrants (maxillary right, maxillary left, mandibular right and mandibular left). A micromotor contra-angle handpiece at 30,000 rpm(USA Dental Lab MARATHON micromotor) was used for attaching the burs. The removal of adhesive remaining on the enamel surface of first premolars located on right quadrant (maxillary and mandibular) were done in a mesio-distal direction with tungsten carbide bur (Fig-1) for 20 seconds. The removal of adhesive remaining on the enamel surface of first premolars located on left quadrant (maxillary and mandibular) were done in a mesio-distal direction with stainbuster fibre glass bur(fig-1) for 20 seconds.

Fig. 1. Tungsten carbide and Stainbuster fibre glass bur

The premolars were extracted carefully without damaging the enamel surface. The specimens were maintained in artificial saliva until they were examined under scanning electron microscope (SEM) at magnification of x500.

The buccal enamel surface is sectioned longitudinally from the cusp tip to the cervical margin using a disc bur in a slow speed micromotor hand piece. Before scanning microscopic evaluation the sections are placed in hot air oven at 50^0 celsius for 2 hours to remove the presence of moisture from the tooth surface, magnetic sputtering (coating gold pellets on the surface of enamel) was done to make the tooth surfaces conductive. The enamel damage occurred was analyzed under a scanning electron microscope at magnification of x500. EDI (Enamel Damage Index) were assessed based on SEM micrographs (Fig 2, 3) and results were tabulated

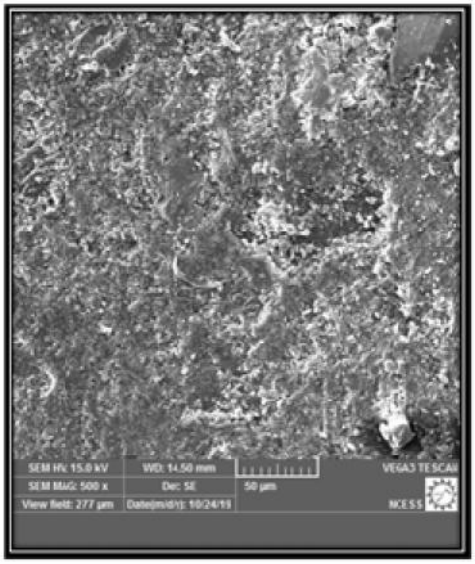


Fig. 2. SEM micrographs from tungsten carbide tooth sections

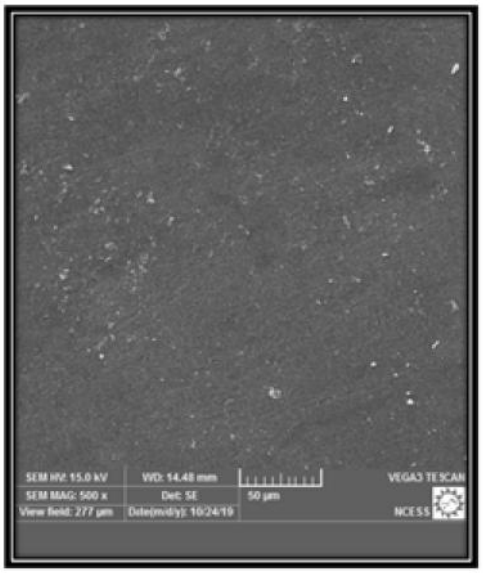


Fig. 3. sem micrographs from stainbuster tooth sections

RESULTS

The statistical calculations were performed using the Statistical Presentation System Software, SPSS Inc. 1999, New York (SPSS) for Windows version 19.0.The statistical test employed in the present research is chi^2 test There is a statistically significant difference in the Enamel Damage Index scores between the Tungsten Carbide Group and Stainbuster fibre Glass Group.($p < 0001$) Tungsten Carbide bur group showed Grade 4 of EDI which denotes unacceptable surface, large

deep scratches and deeply marked surface and the stainbuster fibre glass bur group showed Grade 1 of EDI which denotes regular surface with minor scratches and some healthy enamel (Table I, Graph I).

TABLE I

Comparison of tungsten carbide bur with fibre glass bur

Grade	FIBRE GLASS BUR		TUNGSTEN CARBIDE		Total	
	n	%	n	%	n	%
0	4	25	0	0	4	12.5
1	10	62.5	0	0	10	31.3
2	2	12.5	2	12.5	4	12.5
3	0	0	6	37.5	6	18.8
4	0	0	8	50	8	25
Total	16	100	16	100	32	100

χ^2 =28.00 df=4 p<0.001

GRAPH I

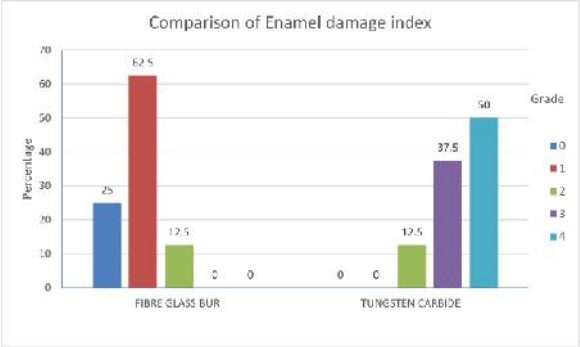


Table 2

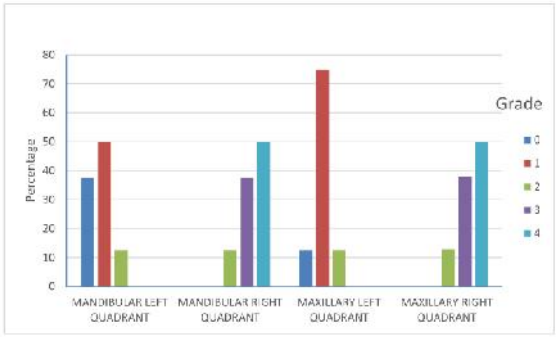
Comparison of tungsten carbide and fibre glass bur along quadrants

Grade	MANDIBULAR LEFT QUADRANT		MANDIBULAR RIGHT QUADRANT		MAXILLARY LEFT QUADRANT		MAXILLARY RIGHT QUADRANT		Total	
	n	%	n	%	n	%	n	%	n	%
0	3	37.5	0	0	1	12.5	0	0	4	12.5
1	4	50	0	0	6	75	0	0	10	31.3
2	1	12.5	1	12.5	1	12.5	1	13	4	12.5
3	0	0	3	37.5	0	0	3	38	6	18.8
4	0	0	4	50	0	0	4	50	8	25
Total	8	100	8	100	8	100	8	100	32	100

χ^2 30.8 df 12 p<0.001

GRAPH II

Comparison of tungsten carbide and fibre glass bur along quadrants



DISCUSSION

The debonding of orthodontic attachments and removal of residual adhesive remnant from the tooth surface are operator-dependent procedures. Thus the results may probably differ among operators. Considering this, factor the same operator carried out all the clinical procedures in this study. The debonding of orthodontic brackets, finishing, detailing and polishing of the enamel surface were done inside the patients mouth as the factors such as saliva, oral hygiene, temperature, and pH can also affect the results. Whatever technique is used for debonding of orthodontic brackets there will be some amount of unavoidable enamel loss, which is corroborated by the study done by waes et al. [5]

Their study showed that there is an average loss of 7.4 microns of enamel irrespective of the bonding technique. In this study, slow speed tungsten carbide bur removed the residual adhesive remnants efficiently but showed increased irregularities and deeper scratches[3,4,6] on debonded enamel surface and stainbuster fibre glass bur showed smoothest enamel surface[7,8,9] compared to tungsten carbide bur.

A study done by Bernardi et al [10] showed that scanning electron microscopy can be used as a good investigation tool for evaluating the adhesive residual remnant and enamel surface damages. Therefore SEM was used to assess the enamel surface configurations. SEM micrographs were analyzed and categorized based upon EDI scores. SEM micrographs showed that stainbuster fibre glass bur was more efficient in cleaning the enamel surface following debonding compared to tungsten carbide bur. There is a statistically significant difference in the Enamel Damage Index scores between the Tungsten Carbide Group and Stainbuster Fibre Glass Group.($p < 0001$) Tungsten Carbide bur group showed Grade 4 of EDI which denotes unacceptable surface, large deep scratches and deeply marked surface and the stainbuster fibre glass bur group showed Grade 1 of EDI which denotes regular surface with minor scratches and some healthy enamel (Table I, Graph I).

There is a statistically significant difference in the enamel damage index scores between the left maxillary and mandibular quadrants. ($p < 0001$) The stainbuster Fibre glass bur group in the maxillary left quadrant showed highest number of Grade 1 of EDI and in mandibular left quadrant showed a Grade 0 of EDI. (Table II, Graph II) . It is assumed that the variation in the EDI scores of maxillary left and mandibular left quadrants were due to the position of the operator (right hand side) while removing the adhesive remnants.

This study has certain limitations as the scanning electron microscope evaluates the enamel surface qualitatively so future studies are needed to evaluate the debonded enamel surface quantitatively. Latest methods such as confocal laser microscopy and atomic force microscopy (AFM) are being used to obtain 3D data of enamel roughness that will help in gaining more clear information regarding the amount of enamel loss caused due to various adhesive resin removal techniques.

Conclusion

Stainbuster fibre glass bur was less damaging to enamel surface, removed the adhesive resin remnant more efficiently creating a smoother enamel surface compared to tungsten carbide bur.

REFERENCES

1. Dr. Haris khan. Text book of orthodontic brackets selection, placement and debonding by
2. Zachrisson, B.U. and Büyükyilmaz, T.:chapter 14 bonding in orthodontics. In: Orthodontics Current Principles and Techniques. T.M. Graber, R.L. Vanarsdall and K.W.L. Wig (eds.), pp..Philadelphia, Elsevier, 2005;14: 579-659
3. Çaöry Ulusoy, Comparison of finishing and polishing systems for Residual resin removal after debonding . J Appl Oral Sci. 2009; 17(3): 209–215.
4. Harjoy Khatria, Rajat Mangla, Hemant Garg, Ramandeep Singh Gambhir.Evaluation of enamel surface after orthodontic debonding and cleanup using different procedures: An in vitro study. Journal of Dental Research and Review 2016;3(3):88-93
5. Van Waes H , Matter T, Krejci. Three-dimensional measurement of enamel loss caused by bonding and debonding of orthodontic brackets. Am J Orthod Dentofacial Orthop. 1997;112(6):666-9.
6. Zachrisson, B. U., and Arthun, J.Enamel surface appearance after various debonding techniques, Am J Orthod.1979; 75: 121-137.
7. Göksu Trakyali, Fulya Özdemir and Tülin Arun. Enamel colour changes at debonding and after finishing procedures using five different adhesives. European Journal of Orthodontics 2009;31:397–401
8. Emire Aybüke Erdur *et al*. Evaluation of Enamel Surface Roughness after Various Finishing Techniques for Debonding of Orthodontic Brackets. Turk J Orthod 2016; 29(1): 1-5
9. Shah *et al*. Comparative evaluation of enamel surface roughness after debonding using four finishing and polishing systems for residual resin removal—an in vitro study Progress in Orthodontics 2019; 20(18):1-10
10. Sara Bernardi, Maria A. Continenza, Guido Macchiarelli *et al*. Microscopic evaluation of the enamel surface after debonding procedures: An ex vivo study using scanning electron microscopy. microscopie 2018; 29:7190
11. Bishara SE, Fehr DE. Comparisons of the effectiveness of pliers with narrow and wide blades in debonding ceramic brackets. Am J Orthod Dentofacial Orthop. 1993 Mar; 103(3):253-7.
12. Bishara SE, Trulove TS. Comparisons of different debonding techniques for ceramic brackets: an in vitro study. Part II; findings and clinical implications. Am J Orthod Dentofacial Orthop.1990; 98:263-73.John Gwinnett *et al*, Microscopic evaluation of enamel after debonding: Clinical application,Am J Orthod 1977;71(6):651-665
13. Amol C Mhatre *et al*, Enamel Surface Evaluation after Removal of Orthodontic Composite Remnants by Intraoral Sandblasting Technique and Carbide Bur Technique: A Three-Dimensional Surface Profilometry and Scanning Electron Microscopic Study. J Int Oral Health. 2015; 7(Suppl 2):34–39.
14. Su MZ, Lai EH, Chang JZ, Chen HJ, Chang FH, Chiang YC, Lin CP. Effect of simulated debracketing on enamel damage. J Formos Med Assoc. 2012;111(10):560-6
15. Antonio Gracco *et al*. Bracket base remnants after orthodontic debonding. Angle Orthod. 2013;83:885–891
16. Hosein I, Sherriff M, Ireland AJ. Enamel loss during bonding, debonding, and cleanup with use of a self-etching primer. *Am J Orthod Dentofacial Orthop*. 2004;126(6):717-24.
17. Knösel M *et al*. 2010. Impulse debracketing compared to conventional debonding. *Angle Orthod*. 80(6):1036-44
18. Andrews J *et al*. 2016. Comparison of traditional orthodontic polishing systems with novel non-orthodontic methods for residual adhesive removal. *Aust Orthod J*. 32(1):41-7.
19. Oliver RG. The effect of different methods of bracket removal on the amount of residual adhesive. Am J Orthod Dentofacial Orthop. 1988;93(3):196-200.
20. Adriana Arbutina, *et al*. 2018. Assessment of enamel surface after application of tungsten carbide.Contemporary Materials; IX−2:137-143

****