"EVALUATION OF THE ETCHING PATTERNS AFTER THREE DIFFERENT ETCHING TECHNIQUES ON BUCCAL ENAMEL" - AN IN-VITRO STUDY

Abstract

AIM: To study etching pattern of the buccal enamel after three different etching techniques that is sandblasting, conventional acid etching with 37% Orthophosphoric acid, and laser etching.

MATERIALS AND METHODS:45 healthy premolar teeth from patients requiring extraction of as part of orthodontic treatment are subdivided into 3 groups. The enamel is etched with three different etching techniques- Sandblasting and conventional etching, conventional etching and laser etching.

RESULTS: In this present study, statistical comparison of the etching patterns between the groups

reveals that in Group 4, Type II etching pattern is higher with 73.3 %and is significant as compared to other two groups. In Group 5 Type I etching pattern is higher with 53. %and is significant as compared to other two groups. And in Group 6 Type III etching pattern is

higher with 60% and is significant as compared to other two groups.

CONCLUSION air abrasion technology is an effective method of increasing the bond strength of buccal brackets to be bonded when used as an adjunct with conventional acid etching and can be effectively used clinically**:**

INTRODUCTION: Air abrasion technology makes use of a high-speed stream of aluminium oxide particles propelled by air pressure. Zachrisson found that sand blasting with a micro-etcher improves the retention and increases the bond strength. Air abrasion involves none of the drawbacks associated with conventional bonding such as toxicity of acid to oral tissues.[6]

The purpose of acid etching is to remove the smear layer and create a rough surface by demineralizing hydroxyapatite crystals on the outer surface. This topography will facilitate penetration of the fluid adhesive components into the depressions created; hence the adhesive gets locked into the surface and contributes to micromechanical retention. If a laser can achieve the above-mentioned function of acid etching, and even produce a desirable surface for bonding to a restorative material, it may be a viable alternative to acid etching.[8]

Key words: -
Etching, sand blasting, Laser etching

After acid etchingof the enamel, demineralization and susceptibility to caries sound brackets are complications of orthodontic treatment, Er: YAG laser ablation might overcome this drawback and offer other benefits like reduction in clinical time, a reduced susceptibility to moisture during etching, and bond strength similar to that of acid etching.[8]

Composite resin at present is the most effective and reliable adhesive available for bonding orthodontic attachments.[41].Although literatures exit in which thebond strength of orthodontic brackets and etching patterns after etched with 37% orthophosphoric acid etching, sandblasting and Er: YAG laser etching techniques on enamel were established, no reported study has compared the shear bond strength and evaluated the etching patterns on buccal enamel.[4]

Therefore, this study will be undertaken to evaluate and study the different of etching patterns on buccal enamel surface after etched with 37% orthophosphoric acid, sandblasting and Er: YAG laser etching

Materials and Methods:

In this study conventional acid etchant (37% orthophosphoric gel), the intraoral sandblaster Er: YAG Laser, the teeth sample will be irradiated with Er: YAG laser at 300 mJ/pulse, 10 pulses per second (pps), for 10 seconds on buccal enamel.45 extracted premolar teeth were collected for the purpose of the study and were acrylised in an aluminium cube of 12mm X 12mm in dimension. Thus, three groups (n=15) were formed.

GROUP 1: SBCE-Sandblasting and conventional etching

The teeth sample were sandblasted on the buccal enamel with a microetcher with 50-micron meter aluminium oxide particles at 70 psi for 3 sec at a distance of 5mm, perpendicular to the surface of the tooth and then etched with 37% phosphoric acid gel on buccal enamel for 15seconds. Teeth were rinsed with water for 20seconds and dried with oil free compressed air for 10seconds.

GROUP 2: CE-Conventional etching

The teeth sample enamel was etched on the buccal surfaces with 37% phosphoric acid on the buccal enamel for 15seconds. Teeth were rinsed with water for 20seconds and dried with oil free compressed air for 10seconds.

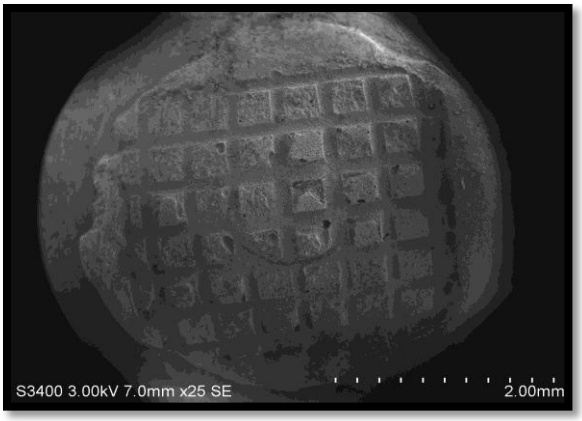
GROUP 3: LE- Laser etching

The teeth samples were etched on the buccal surfaces with Er: YAG laser with power output of 1W-2W at 300 mJ/pulse, 10 pulses per second (pps), for 10 seconds on buccal enamel

The samples from Group1, Group2, and Group3 were used for evaluation of etching patterns of buccal enamel after three different etching techniques - Sandblasting and conventional etching, Conventional etching, Laser etching respectively.

Evaluation of the etching patterns of buccal enamel under Scanning Electron microscope SEM:

After the buccal surfaces of teeth samples from group1, group2, and group3crowns were sectioned from the roots with a carborandum disc using water spray at the cemento-enamel junction. Each crown was sectioned vertically in mesio - distal direction. The sections of tooth were cleaned with water and dried with compressed air. And were mounted on the aluminium stubs using a double sticky carbon Tape and coated with Au/Pd in a BIORA Polaron E5400 High resolution sputter coater, and examined in, and evaluated for etching patterns of the enamel. Photographs were the Scanning Electron at 15kV taken at the magnification of 3.00KX.



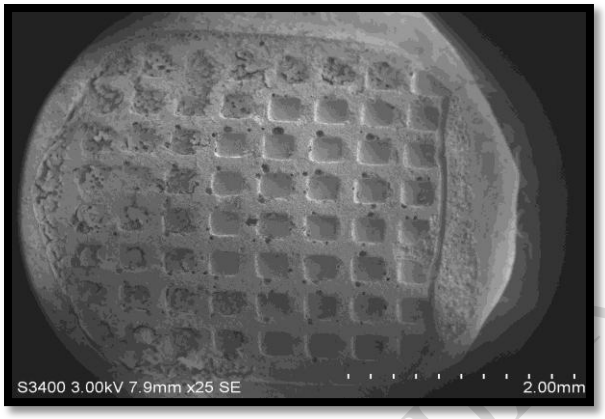


FIG 4: 25X SCANNED IMAGE IN SEM (GROUP 1) **FIG 5: 25X SCANNED IMAGE IN SEM (GROUP 2)**

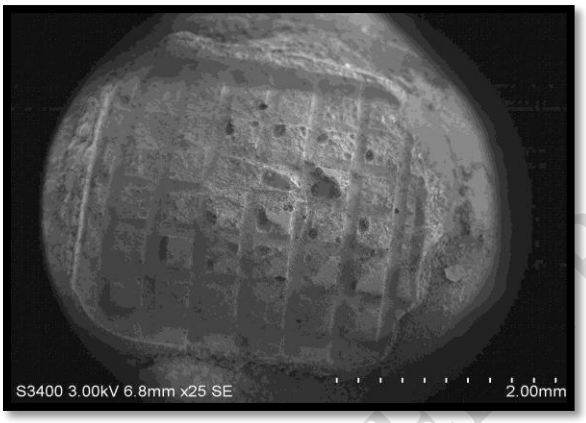


FIG 6: 25X SCANNED IMAGE IN SEM (GROUP 3)

Results:

Table 1: Analysis of Etching pattern

Etching * Group Cross tabulation						
			Groups			Total
			Group 1	Group 2	Group 3	
Etching pattern	Type I	Count	3	8	2	13
		% within Group	20.0%	53.3%	13.3%	28.9%

	Type II	Count	11	6	4	21
		% within Group	73.3%	40.0%	26.7%	46.7%
	Type III	Count	1	1	9	11
		% within Group	6.7%	6.7%	60.0%	24.4%
Total		Count	15	15	15	45
		% within Group	100.0%	100.0%	100.0%	100.0%

Table:2

Symmetric Measures			
		Value	Approx. Sig.
Nominal by Nominal	Cramer's V	.473	.001
N of Valid Cases		45	

In this present study, statistical comparison of the etching patterns between the groups reveals that in Group 1, Type II etching pattern is higher with 73.3 %and is significant as compared to other two groups. In Group 2 Type I etching pattern is higher with 53. %and is significant as compared to other two groups. And in Group 3 Type III etching pattern is higher with 60% and is significant as compared to other two groups.

Discussion:

Rashmi Issar et al.,[4] conducted study in the year 2016, the objective of the study was to evaluate and compare the etching pattern of Er: YSGG and conventional etching on extracted human and dentin specimen. It revealed Type III etching pattern after laser etching, while Type I etching pattern (described by Silverstone et al.,) [6] after conventional acid etching. This observation concurs well with our present study.

Guilherme Carpena et al., [5] conducted a study in the year 2007; the objective was to discuss aspects of enamel bonding with the acid-etching technique and to explain the characteristics of the hard tissue. It revealed that SEM study showing the enamel etching pattern type I (described by Silverstone et al.,) [6]after a 32% phosphoric acid etch applied for 15 seconds which supports our study.

Berrios Quina and Toledo Porto Neto[4]et al., conducted a study in the year 2001, the objective was to assess the etching patterns after air abrasion and conventional acid etching. The buccal surfaces of the third molars using 27µm aluminium oxide particles followed by 37 % orthophosphoric acid particles, found more of type II and type III

patterns than type I etching pattern (described by Silverstone et al.,) [5] which supports our present study.

Torun Ozer[13] conducted a study in the year 2008, the objective was to assess the shear bond strength, surface characteristics, the ARI of teeth prepared for bonding with (Er, Cr: YSGG) laser etching, and to compare laser etching phosphoric acid etching and self-etching primer. SEM evaluation showed Type I etching pattern (described by Silverstone et al.,)[6], a more preferential etching pattern was seen with 1.5W laser irradiation and type II etching pattern

Conclusion:

The etching patterns (described by Silverstone et al.,)[6]:

In Group1 (sandblasted and conventional etched) -Type II etching pattern is higher with 73.3 %, in Group5 (conventional etched)-Type I etching pattern is higher with 53.3%.and in Group6 (Laser etched)-Type III etching pattern is higher with 60%.

On comparing the mean etching pattern in enamel between Group1 (sandblasted and conventional etched), Group2 (conventional etched) and Group 3 (laser etched) by Cramer's V test there was a statistically significant difference between the three groups ($p<0.05$).

Hence air abrasion technology is an effective method of increasing the bond strength of buccal brackets to be bonded when used as an adjunct with conventional acid etching and can be effectively used clinically

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