

Original Research Article

Influence of Aluminum Oxide Conditioning Before Acid Etching on Tooth Surface: an Experimental Study

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Abstract

Aim of the present study, examination of enamel roughness in palatal aspect of extracted premolars by using aluminum oxide (25%, 27% and 28% μm and phosphoric acid 37%. Twenty of all samples contoured with cylindrical shape forming wax and poured with stone to form cylindrical shape and palatal surface remain fully visible and this surface cleaned and polished with plastic cup and pumice and rinsed with distal water and dried with air. Data divided to 4 group each one is 5 extracted teeth and variable assessed by picture captured before and after adding conditioning material by using camera, light microscope, analyzed by Autocad 3D max and electronic microscope with its three dimensional software. The result of this article clearly there is significant difference between groups with different conditioning materials also the pattern of enamel surface showing highly significant difference. This study approved that the palatal animal conditioned with aluminum oxide particles of 25%, 27%, and 28% μm before conditioned by acid etch result in greater scratched and introduce more regular pattern than that using of phosphoric acid only.

Key words: extracted teeth, phosphoric acid, enamel conditioning.

الخلاصة

الهدف من هذه الدراسة هو فحص خشونة الطبقة الواقية للسن المينا في سطحها الداخلي المواجه لعظم اللهاة لاسنان مقلوعة (الضواحك) باستخدام جزيئات اوكسيد الالمنيوم المتوفرة بشكل 25% و 26% و 28% وحامض الفسفوريك اسد ذو التركيز 37%. عشرين عينة اختيرت لهذا الفحص وصبت بأستخدام مادة البورك (البلاستر) لصناعة اشكال مقارنة لاسنان مع بقاء الجزء المواجه للهاة واضحا, وعندها هذه الاسنان نظفت بمادة اليومص وغسلت بالماء ونشفت وفحصت تحت المايكروسكوب قبل اضافة المواد المحضرة واخذت لها صورة باستخدام كامرة ذات تقنية عالية وقسمت الى اربعة مجاميع لكل منها خمسة اسنان وبعد اضافة المواد المحضرة حسب تعليمات المصنع اخذت صورة اخرى لكل العينات ونقبت هذه العينات لدراستها تحت المجهر الإلكتروني وبرنامجه ثلاثي الابعاد لدراسة نمط المينا والاختلافات بين المجاميع والنتائج كانت ذات اختلاف مهم وعالي بين المجاميع. وكملخص لهذا البحث فأن استخدام جزيئات الالمنيوم يزيد من خشونة سطح السن ويغير من نمطه.

Introduction

Etching of tooth surface with phosphoric acid was used at the beginning by Buonocore [1]. Since advancement in adherence of resin to tooth surface has been developed, and uses of acid etch technique in all aspect of dentistry became popular, involving orthodontics. Newman [2] was stated the use of acid etch

technique as a way to attach orthodontic brackets to the tooth surface. Acid etching technique that used phosphoric acid is most popular technique to prepare tooth surface before bracket bonding [3]. The strength of brackets bond to the tooth depend on quality and quantity of tooth etching generated by acid[3]. The ideal percentage of acid and ideal time for application for better bond and

less enamel destruction was studied by many author [4, 5]. On the other hand, to get good bond strength and minimal loss of enamel surface other procedure to prepare tooth surface have been produced like laser, [6], self-etching bond, [7] and aluminum oxide [8].

Enamel preparation is an essential step to produce excellent bond between tooth and bracket [9]. Thus evaluation of prepared enamel is very important for understanding and advancement of bonding system. [10]. Moreover placement of bracket in lingual aspect of the tooth has requested when esthetic value very important for the patient during course of orthodontic treatment. Several studies were conducted to evaluate uses of aluminum oxide before orthophosphoric acid conditioning of enamel on buccal surface and disregard palatal aspect. [11]. In regard to present study examination of enamel roughness in palatal aspect of extracted premolars by using aluminum oxide (25%, 27% and 28% μm and phosphoric acid 37%.

Material and Methods

The sample of 60 maxillary premolars were collected from specialized dental center from patients already need orthodontic treatment. These teeth extracted and stored in distal water immediately after extraction to avoid dryness, water changed each 7 days to avoid bacterial growth. The inclusion criteria were each maxillary premolars free of caries, wear, and other noticeable defect and all teeth cleaned with tooth brush under tap water (fig 1). Twenty of all samples contoured with cylindrical shape forming wax and poured with stone (Zemack Italy) to form cylindrical shape and palatal surface remain fully visible and this surface cleaned and polished with plastic cup and pumice and rinsed with distal water and dried with air as shown in figure 1. The variable of this study was the following:

1. Lingual enamel roughness was evaluated at two time frames before and after application of phosphoric acid 37% [ER1 and ER2].
2. Average of roughness [ER3].
3. Level of roughness [ER4].

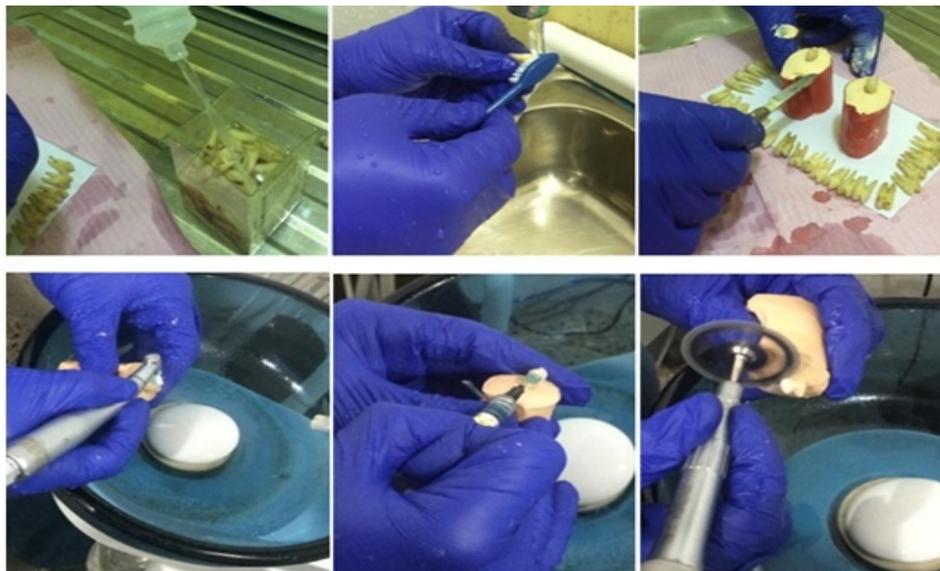


Figure 1: Sample preparation

Viewing all sample under light microscope before and after conditioning material then

captured an image for lingual aspect with Canon Power shot SD750 digital Elph (7.1

Megapixel, Japan) while it underlight microscope with 20x times objective lens, since all measurements reading was Micrometer. Assuming the spot area of measurements as square according to that choosing 4 perpendicular lines and 4 horizontal lines of total 8 lines the values of these lines were averaged to get mean value of ER3, ER4. Sample was distributed for 4 group each one has 5 teeth. Then these groups treated with different material for enamel conditioning for group one which is control group 37% phosphoric acid applied 30 second and rinsed with vigorous water for 20 seconds and dried with air as manufacturer instruction of Alpha dent, USA Company. For the other three groups conditioning achieved by aluminum oxide in three level of micrometer which are [25%, 27%, 28% μ m] by using micro etcher (chaina brand) and phosphoric acid as explained above. Therefore, another image was captured under light microscope for all specimens and data then analyzed by using Autocad with its 3D software (3D max). After that all crowns of teeth were sectioned with carbide bur (Renfert Germany) for easy positioning, then all sample scanned with electron microscope to evaluate pattern of conditioning for the enamel.

All data preparation done in Babylon city and data reading and analysis done in USA.

Results

Table 1 clarifying the descriptive statistics of enamel roughness assessments before and after application of various conditioning materials (ER1,ER2). This table showing that the mean value of enamel surface roughness before application of conditioning material (ER1) lesser than enamel surface roughness after application of conditioning material (ER2), for all groups and all conditioning materials. While Table 2 definitely showing mean and standard deviation of enamel roughness went up after application of conditioner. All conditioning material lead to increase of enamel roughness ($p < 0.0001$), but enamel roughness by sandblast procedure with different micrometer (25%, 27%, 28%) was greater than that of control group with only phosphoric acid as conditioner.

By examine data by electron microscope showing that there is no changes in morphology of enamel conditioned with acid etch only for control group. On the other hand its clarify there is uniform path of conditioning in regard to aluminum oxide with different particles and the surface were scratched and has many hump with smooth rounded edges, as shown in figure 2.

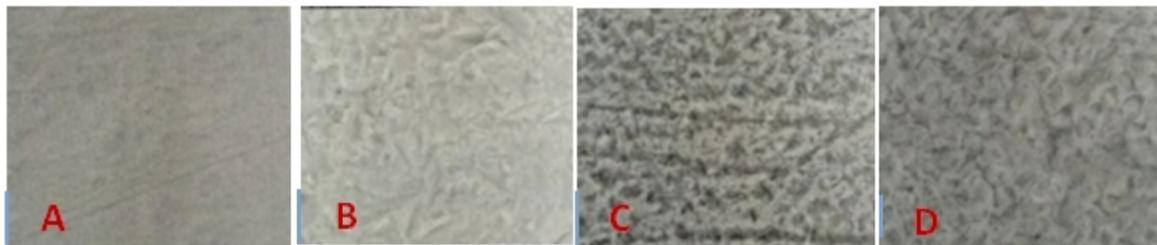


Figure2: Electron microscope picture showed that A: enamel surface, B: enamel surface treated with aluminum oxide, C: enamel surface treated by acid etch, D: enamel surface treated with aluminum oxide and acid etch.

Discussion

Enamel roughness variable is significantly went up after different conditioning materials with p value <0.0001 particularly stated the control group in which enamel conditioned by phosphoric acid 35% had less enamel roughness than the other groups that conditioned with aluminum oxide before phosphoric acid application. This come in fully agreements with Robels et al [12], and disagreed with Reisner et al [13] this is may be due to different standardization method.

Enamel conditioned with phosphoric acid alone shows no changes in morphology of enamel this come in accordance with Berk et al [6]. while there were uniform paths of conditioning in regard to aluminum oxide with different particles and the surface was scratched and has many humps with smooth rounded edges. This result disagreed with Brosh et al [14] this is may be due to different application procedure of conditioning material, and the result of our study come in accordance with Robles et al [12] in spite of different aluminum oxide particles were used in their study (27, 50, 90) and this approved that uses of aluminum oxide in different particles improve enamel roughness before using of phosphoric acid. To sum up of this study palatal animal conditioned with aluminum oxide particles of 25%, 27%, and 28% μm before conditioned by acid etch result in greater scratched and introduce more regular pattern than that using of phosphoric acid only.

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Table 1: Average and level of roughness for all groups before application of preparation materials

Average of roughness ER1 before conditioning	Mean	Standard deviation	Paired T test (P value)
Control group	0.06	0.03	<0.0001
Group 1	0.09	0.031	
Group 2	0.089	0.033	
Group 3	0.08	0.03	
Average of roughness ER1 after conditioning	Mean	Standard deviation	Paired T test(P value)
Control group	0.12	0.049	<0.0001
Group 1	0.18	0.025	
Group 2	0.21	0.059	
Group 3	0.17	0.036	
level of roughness ER3 before conditioning	Mean	Standard deviation	Paired T test(P value)
Control group	0.3	0.13	<0.0001
Group 1	0.4	0.22	
Group 2	0.42	0.15	
Group 3	0.35	0.14	
level of roughness ER4 after conditioning	Mean	Standard deviation	Paired T test (P value)
Control group	0.52	0.22	<0.0001
Group 1	0.75	0.10	
Group 2	0.91	0.31	
Group 3	0.74	0.15	

Table 2: Significant increase of roughness as showed by ANOVA.

ER3	Mean	Standard deviation	ANOVA(P value)
Control group	0.06	0.49	<0.001
Group 1	0.99	0.04	
Group 2	0.16	0.07	
Group 3	0.099	0.05	
ER4	Mean	Standard deviation	ANOVA(P value)
Control group	0.28	0.25	<0.001
Group 1	0.41	0.18	
Group 2	0.44	0.28	
Group 3	0.38	0.21	