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Microscopic Evaluation of three Enamel Preparation Processes for Dental Restorations

KEYWORDS: Phosphoric Acid, Air Abrasion, Phosphoric Acid and Air Abrasion and enamel.

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ABSTRACT *Adhesive systems in dentistry, are constantly in a process of change in order to reduce problems of recurrent caries such as prolonging dental treatments of minimally invasive enamel, therefore the combination of different materials and techniques to potentiate this effect has emerged. Phosphoric acid has traditionally been used, and the air abrasion system has currently been implemented which is aluminum oxide particles applied by pressure. This paper evaluates microscopically etched enamel whether this tissue with the combination of phosphoric acid and air abrasion increases. It is then that 30 randomly premolars were used, and three study groups: group A was formed with 10 samples that were etched with 37% phosphoric acid for 15 seconds and was the controlled group; 10 samples of abrasive air with particles of 25 microns for 30 seconds were applied to group B and acid etching and application of air abrasion; in the same conditions as above, it was performed to group C which were observed trough the metallographic microscopic (Carl Zeiss) at 500X and analyzed by the AnalySIS software. Group A showed an engraved Type III; Group B presented an engraved Type I, and Group C presented an engraved Type III. Through the present study it was demonstrated that the combination of microscopically air abrasion and phosphoric acid, a dominant etching uniformity pattern is obtained, this leads to generate greater mechanical lock that can ensure durability in adhesive dental restorations with greater preservation of tooth enamel.*

INTRODUCTION

Adhesion is the intimate union that exists between two surfaces of different chemical nature by interfacial forces, these forces are of two types, the first chemical and/or electrostatic and mechanical latter. The mechanics that can be from geometric effect, or rheological effect could not be considered adhesive but rather mechanical lock. While the first chemical and/or electrostatic of Elementary Valence (Ionic, Covalent and Metallic links) or Secondary (Van der Waals Forces, London Dispersion Force and hydrogen bond), are considered adhesive due to their contribution to the covalent bonds of carbon chemistry. Therefore, adhesion is the attraction between the surfaces of two bodies, even with a different chemical composition. For this reason, it is convenient to distinguish between adhesion and cohesion, which is the attraction between the parts of the same body.

Adhesion has favorably contributed to cutting edge dentistry, due to it has given way to the use of new alternative techniques with minimal invasion to the tissues of the tooth particularly to the enamel surface because restorations must achieve a good seal and remain attached to the tooth with new bonding systems. When lack of adhesion between the material and the enamel, microfiltration or marginal leakage is presented, which is the entry of oral fluids and food into the space between the tooth and the restorative material.

The ability to prevent microfiltration is important, as it will prevent the formation of the caries process and marginal fractures of the restorative material. To address this problem, the enamel surface has to be prepared with phosphoric acid to form the etching pattern and use adhesives as

a retention mechanism which is the traditional method, other mechanisms are currently used to create mechanical retention and the combination of different materials to potentiate it is being made. The air abrasion device was developed between the 40s and 50s and after several years of being in disuse it was reintroduced for dental practice in recent years. The mechanism of action is based on the kinetic energy obtained by the association of compressed air jet streams with abrasive particles of aluminum oxide, which enables the wear of hard surfaces. Being chemically stable, non-toxic aluminum oxide is used; it has no affinity for water, which it makes it dry and moisture-free. The particle sizes of aluminum oxide are 25, 27, 27.5 and/or 50 microns, the smaller the particle, the lower the air pressure required for wear of tooth enamel. (Peruchi, 2002).

One of the advantages of the use of air abrasion is that it does not produce pressure, vibration or overheating of the tooth while being prepared; as a result, it reduces fear and anxiety in the patient as it is not necessary to anesthetize and it is a minimally invasive procedure, which is among the demands of the population today.

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OBJECTIVE

To evaluate microscopically flat enamel surfaces if the engraved Type III pattern is increased to generate higher mechanical retention in this tissue, with the combination of phosphoric acid and air abrasion.

MATERIALS AND METHODS

30 extracted premolars for orthodontic indications were used and placed in artificial saliva to prevent dehydration stored at room temperature until use. Once the simple was collected, it was dried with sterile gauze and mounted in a paraffin block for the area in observation could remain perpendicularly to the metallographic microscope objective (Carl Zeiss) at 500X without filter and analyzed by the AnalySIS software. The enamel surface was cleaned with wet pumice paste and Dentsply rubber cups at low speed for 15 seconds, washed with water from the triple syringe and dried at the same time. Three study groups were formed randomly, from Group A 10 samples were etched with phosphoric acid gel at 37% of the commercial 3M for 15 seconds, the acid was removed by applying air and water pressure from the triple syringe for 10 seconds and it was the controlled group. From Group B, 10 samples were applied with Rondo Flex 2013 air abrasion with particles of 25 microns by 30 seconds with gentle movements in a uniform manner, and to Group C, acid etching and application of air abrasion under the same conditions was performed according to what was mentioned before.

After performing this procedure in the samples, the planar surfaces were observed in the metallographic microscope.

The morphology of the enamel surface was evaluated on a scale of nominal rate for acid enamel etching patterns, according to the Silverstone criteria (1975) (Types I, II and III) and Galil and Wright (1979) (Types IV and V) defined as follows: Type I) Characterized by preferential removal of the prisms centers. Type II) The peripheries of the prisms are preferentially removed. Type III) Prisms centers and peripheries were characterized by an indiscriminately erosion. Type IV) A surface with holes and uneven marks is observed. Type V) There is no evidence of prisms characterized by a smooth surface. (Figure 1).

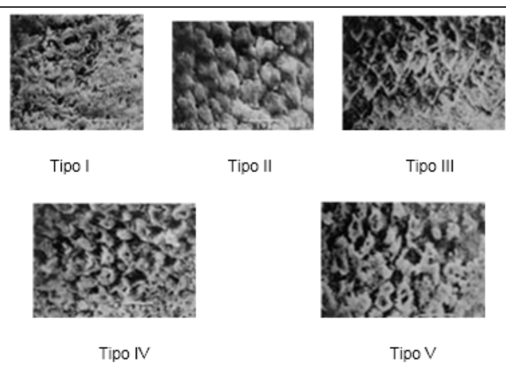

Fig. 1 Types etching tooth enamel. Taken Melendez et al., 2002

In the dental area, the optimum engraved pattern is Type III and it is the one that was evaluated in this study.

Each sample was evaluated by quadrants (A, B, C and D) and given a value of 1 in the quadrant with engraved Type III. (Figure 2 and Table 1).

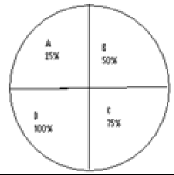

Fig. 2 Design quadrant

Quadrants	assigned value
A	1
B	2
C	3
D	4

Table 1 Value assigned by quadrant

RESULTS

The 500X images show unfiltered differences in the dental enamel surface by using the analyzed etching techniques. The engraved Type III was observed in group A in 7 samples corresponding to 70%, in addition to this, 3 samples showed different engraved pattern (Figure 3). In 20% of the samples it was observed an engraved Type III in Group B, the mentioned engraved was observed in 7 samples recorded in 3 quadrants, although in 1 sample it was presented in 2 quadrants (Figure 4). And the C group presented an engraved Type III in 90% of the samples; only 1 was presented in 3 quadrants with engraved Type III. (Figure 5).

The engraved Type III pattern was found in most of the samples of the three groups, particularly in Group A, and thus samples were analyzed by the ANOVA test. (Table 2-3).

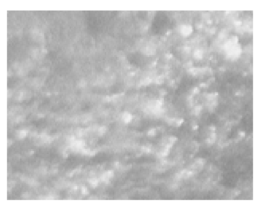

Fig. 3 Group A. Phosphoric acid 37% for 15 sec

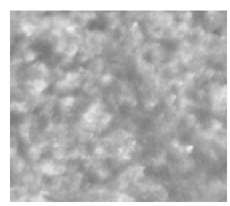

Fig. 4 Group B. air abrasion 25 microns for 30 sec

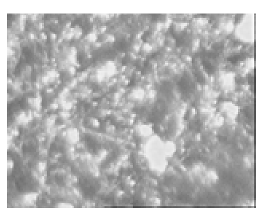

Fig. 5 Group C. Air abrasion immediately Phosphoric Acid

Sample Number	Phosphoric Acid	Air abrasion	Air abrasión and Phosphoric Acid
1	4	3	4
2	4	4	4
3	4	3	3
4	3	3	4
5	3	4	4
6	4	2	4

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7	4	3	4
8	4	3	4
9	4	3	4
10	3	3	3
Media	3.66	3.05	3.77
DS	0.45	0.53	0.40

Table 2

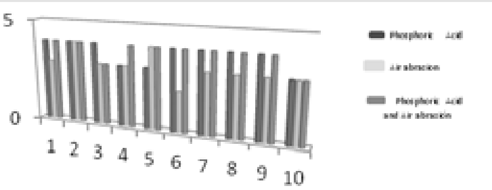

Table 3

CONCLUSIONS

With the present study it is microscopically demonstrated that with the combination of air abrasion and phosphoric acid a dominant pattern of engraved Type III with uniformity is obtained, this leads to generate greater mechanical lock that promotes adhesion of dental restorations and so there is less chance of microfiltration and caries problems, furthermore, it will ensure the durability and longevity of dental restorations due to an increase of the micro mechanical retention with a minimum invasion to dental enamel, without the need to cut or abrade the tissue with the turbine or any hand piece; besides the use of local anesthesia in order to carry out this kind of procedures, as a result, it provides the patient more comfort and reliability in his/her dental rehabilitation.

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