

Viscous acid etching agent

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ABSTRACT

The acid etching effect of a new viscous 35% phosphoric acid dissolved in glycerol and known 35% gel phosphoric acid agent were investigated in vitro on 40 sound extracted premolars using concise orthodontic adhesive in bonding stainless orthodontic brackets. The results showed no significant difference in bond strength between the two etching agents at 0.05 significant level. But samples etched with viscous phosphoric acid have higher numerical value. This finding was supported by the clinical investigation on 10 orthodontic patients in which the number of failure brackets was 8 for viscous phosphoric acid etching agent and 12 for gel phosphoric acid agent after 11 months of treatment.

Key words: Viscous acid etching, orthodontic adhesive, stainless brackets, bond strength, rebond strength.

الخلاصة

تأثيرات الحمض المخرش اللزج الجديد المتكون من 35% حامض الكبريتيك المذاب في الكليبيرول والعامل المخرش المعروف المتكون من 35% جيل حامض الفوسفوريك درست مختبرياً على (40) اربعون سن ضاحك سليم مقلوع باستخدام المادة اللاصقة (concise orthodontic) في لصق الحاصرة التقويمية. اظهرت النتائج بعدم وجود اختلاف معنوي في القوة الرابطة بين العاملين المخرشين بمستوى معنوي 0,05 ولكن النماذج التي خرشت في الحمض اللزج كانت اعلى رقمياً .
لنتائج قد اكدت بالفحص السريري عند معالجة عشر حالات تقويم اسنان ان عدد الحاصرات التقويمية الفاشلة (8) عند استخدام الحمض المخرش اللزج و (12) اثنا عشر بحالة الحمض المخرش الجيل بعد احد عشر شهرا من العلاج .

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INTRODUCTION

Condition of the enamel surface prior to bonding the orthodontic brackets is an essential step for achieving good bond strength and is done by roughening the enamel surface to provide enough retention of the bracket via bonding material.

Many types of acids with different concentrations were investigated to perform sufficient enamel etching. Buoncore (1955)⁽¹⁾ was the first to use acid etching technique. He found that application of 85% ortho phosphoric acid to the enamel surface for 30 seconds can increase the adhesion of acrylic to tooth enamel. Furthermore Gwinntt and Matsui (1967)⁽²⁾ revealed that etching the enamel surface with 50% phosphoric acid for 60 seconds created a tremendous surface area available for bonding and open up pores in the enamel into which the adhesive can flow and polymerize. In 1974 Retief⁽³⁾ tested three acid solutions: 50% phosphoric acid, 50% phosphoric acid attenuated with 7% zinc oxide and 50% citric acid and found that the attenuated phosphoric acid produce marked bond strength. The most retentive condition was proved to exist when the surface enamel was etched with phosphoric acid solution in concentration ranged between 20-50%⁽⁴⁾. Also Retief *et al.* (1976)⁽⁵⁾ examined 37% phosphoric acid, 10% pyruvic acid and 20% lactic acid as etching agents for 90 seconds. They revealed that the use of 10% pyruvic acid had bond strength equal to the 37% phosphoric acid.

Nowadays the acid etching agent (phosphoric acid) is treated with gelatin material for better application on the enamel. But the agent is susceptible to hardening and decrease of activity with storage.

This study is an attempt to treat the phosphoric acid with glycerol to alter the acid solution into viscous acid as an alternative to the gel phosphoric acid agent with the advantage of maintaining the viscosity of the acid etching agent for a long time.

MATERIALS AND METHODS

Pure phosphoric acid and glycerol purchased from Fluka chemicals (Germany) were used in this study to prepare 35% phosphoric acid in glycerol (w/w) (viscous acid). 35% gel phosphoric acid was used for comparison. Concise orthodontic adhesive (3M Unite K, U.S.A.) and stainless orthodontic brackets (T. P. orthodontics U.S.A.) and Universal Compression Machine (Soil test Co., Inc. U.S.A.) for bond strength measurement.

The sample is 40 sound extracted human premolars divided into two groups of 20 teeth stored in 70% ethanol. The teeth were cleaned and mounted in polyvinyl ring in up right position by using the syrveyer. The sample teeth were polished, then the first group was etched with the viscous while the second group was etched with the gel acid for 60 seconds. The brackets were bounded to the etched enamel using concise orthodontic adhesive under constant pressure of 100 gm.

The shear bond strength in Mega Pascal (MPA) of the prepared sample was measured using Universal Compression Machine.

Clinical investigation were done on 50 orthodontic brackets which bonded to the enamel using viscous etching acid and another 50 orthodontic brackets bonded using gel acid etching and the number of failure brackets in both groups through eleven months were recorded.

The data obtained from the first and second group were subjected to statistical analysis to find descriptive analysis (mean and standard deviation) and compare between the groups using student t-test at $P < 0.05$ significant level.

RESULTS AND DISCUSSION

The mean shear bond strength of the bonded brackets to the enamel etched with viscous acid was higher in value than that of enamels etched with gel acid (table 1). But the t-test showed no significant difference between the two agents (table 2).

Table (1) The mean shear bond Strength in Mega Pascal (Mpa) of the samples etched with viscous phosphoric acid and gel phosphoric acid

Type of etching agent	Samples No.	Mean	Standard Deviation
Viscous phosphoric acid	20	13.8	2.4
gel phosphoric acid	20	12.9	2.8

Table (2) Comparison of Shear bond Strength of the Sample etched with viscous and gels phosphoric acid by student's test

Type of the adhesive	Sample No.	Viscous phosphoric acid Mean bond Strength in Mpa.	gel phosphoric acid Mean bond Strength in Mpa.	t-value	PR	Sig.
Concise orthodontic adhesive	20	13.8	12.9	2.64	> 0.05	N.S.

Such increase in the value of shear bond strength for teeth etched with viscous acid were 50 orthodontic brackets were bonded using viscous acid whereas the other 50 were treated with gel acid and follow for eleven months. The number of failure brackets for cases treated with viscous acid were 8, whereas those treated with gel acid were 12, which clearly indicate that viscous acid gave us much better bonding strength (table 3).

Table (3) Clinical evaluation of the etching agents

Agent	No. of brackets	No. of failure brackets
35 % Viscous Phosphoric acid	50	8
35 % gel Phosphoric acid	50	12

CONCLUSIONS AND SUGGESTIONS

The viscous phosphoric acid is not susceptible to hardening with time as the gel acid and gives better etching with cheaper cost. Thus it is recommend for use in orthodontics and conservative dentistry.

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