



MICROHARDNESS EVALUATION AFTER MICROABRASION USING TWO DIFFERENT AGENTS.

Dental Science

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KEYWORDS

Introduction

Microabrasion is a non invasive, simple, cost effective method for removal of superficial enamel defects such as opacities and hyperplasia that adversely affect the esthetics of the teeth. It involves the application of an acid on the enamel of the affected tooth and abrading it with pumice 1. Earlier in 1916, Dr. Walter Kane successfully removed fluorosis stains by applying acid and heat (McCloskey 1984)2. McInnes (1966) used 5parts of 36% HCl and 30% hydrogen peroxide, and one part ether as a topical treatment. Later, Chandra and Chawla (1975) modified this treatment slightly by applying the solution with cuttle bone and sandpaper disks in a rotary instrument3. However, others (Powell and Craig 1982; Myers and Lyon 1986) have reported improvement using a calcium sucrose phosphate gel to remove stain wherein etching the teeth for 2-3 min with 37% phosphoric acid followed by a pumice abrasion with rotary instrumentation of the surface is done4. The microabrasion technique using hydrochloric acid was given by Croll and Cavanaugh and whereas technique using H3PO4 was given by Mondelli et al1.

Microabrasion is considered to be a conservative5, safe, and atraumatic procedure which removes superficial stains and produces a highly polished surface of enamel leaving it less prone to demineralization6. It is a treatment option for esthetic improvement in fluorosis stains, inactive white spot lesions, post orthodontic treatment decalcifications, hyperplasia due to trauma and infection and idiopathic hypoplasias, where the discoloration is limited to the superficial layer of dental enamel7.

Microabrasion involves the removal of enamel and this lead to surface demineralization causing a change in the microhardness of enamel and loss of mechanical properties of the tooth. There is only a limited data available for changes in microhardness of enamel after microabrasion. Thus, the aim of the present study was to evaluate, in vitro, the change in the microhardness of enamel surface after microabrasion using two different agents i.e. 18% hydrochloric acid and 37% phosphoric acid with pumice.

Materials and method: - Approval for the study was obtained from the Institutional Ethical Committee. Thirty permanent anterior teeth having a labial surface devoid of caries, restoration or cracks and indicated for extraction were included in the study. The teeth were cleaned of gross debris and placed in deionized water before the experiment was initiated. The teeth were randomly and equally divided into two groups of 15 teeth each.

Group 1- teeth treated with the slurry of 18% HCl and pumice.
Group 2 - teeth treated with the slurry of 37% phosphoric acid and pumice.

All the teeth were embedded in plaster with the labial surface of the tooth facing upwards. Freshly prepared slurry of acid and pumice, respective of the groups, was applied to the labial aspects of teeth with the rubber cup in slow rotating motion mounted on a micromotor. The baseline microhardness values were obtained in both the groups. The

microhardness was evaluated using Vicker's hardness tester. Hundred grams load was applied for 5 seconds. Three indentations were placed at an equal distance on the labial surface of the tooth. The diagonal lengths of the indentations were then measured by a scaled microscope and Vickers values were converted into microhardness values. After obtaining the baseline values, microabrasion was carried out by applying the acid and pumice for 5 sec followed by 10 seconds of washing and drying for 5-10 sec. These applications were repeated 10 times for each specimen in both the groups.

Results

The mean pretreatment VHN in the HCl group was 232 ± 32.74 and the mean post treatment VHN of enamel was 220.08 ± 33.41 . The difference was found to be significant with the p value of 0.023. The mean pretreatment VHN in the H3PO4 group was 239.08 and the mean post treatment VHN of enamel was 193.39 ± 32.73 . The difference was found to be highly significant with the p value of 0.0001.

Table 1: Pre and post treatment change in Vickers hardness number in each group

Groups	Pre-treatment VHN		Post treatment VHN		p-value
	Mean	S.D.	Mean	S.D.	
HCl	232.29	32.74	220.08	33.41	0.023
H3PO4	239.08	30.88	193.39	32.73	0.0001

Discussion

The purpose of microabrasion is to use the erosive action of acid and abrasive action of pumice as an adjunct to each other to remove the superficial surface defects of enamel seen in conditions such as fluorosis, trauma, demineralization or hypocalcification defects 8. Microabrasion creates a smooth and polished texture that reduces the microbial colonization of enamel without affecting the vitality of tooth9.

Evaluation of changes produced on the surface of enamel is important as acid application has been shown to open the way for diffusion of ions and results in loss of mechanical properties of enamel. In the present study, the results obtained showed that the microabrasion procedure alters the microhardness of the enamel. A significant reduction in the microhardness of enamel was seen when teeth were microabraded with both 18% HCl and 37% phosphoric acid but H3PO4 showed a significantly higher reduction in microhardness as compared to Hcl.

According to various studies, the microhardness values after microabrasion depends on the pH of the agents used, time of application and the pressure applied during the procedure10,11. In the present study, the total time of application of both the agents was kept at 50-60 seconds with a light pressure from a rubber cup. Murrin and Barkmeier (1982) used 36% hydrochloric acid mixed with pumice applied to the enamel surface with a slowly rotating rubber cup for upto five uninterrupted minutes12. Croll and Cavanaugh (1986a, 1986b, 1986c) have advocated a regimen of upto 15 separate, 5-sec applications of

18% HCl-pumice paste followed in succession by 10-sec water rinses¹³.

The microcrystalline structure of enamel consists of crystals surrounded by a layer of tightly bound water and migration of ions is possible. The acids used in microabrasion are capable of displacing these ions after penetration into enamel and increase the level of porosity and demineralization. This also depends upon the concentration of acids and the time of application^{5,14}.

Bertolodo et al⁷ reported no significant statistical difference between abrasive agents (HCl and H₃PO₄) in terms of microhardness. They used 35% phosphoric acid and 6.6% hydrochloric acid and at these concentrations, suggested that an equalization occurs between the two agents in relation to erosive power. Conditioning pattern of the enamel is created by hydrochloric acid at this reduced concentration of 6.6% as compared to the present study where the concentration of HCl was 18%.

Ulukapa H (2007)¹⁵ compared the effect of 18% HCL and pumice with other bleaching techniques and found the mean VHN before treatment to be 352+-16.16 which fell to 308+- 54.97 after microabrasion. They found a decrease of 85.7% in hardness but after 7 days a rehardening of 99.4% occurred. They stated that enamel microabrasion done with 18% HCL resulted in a reduction in the surface microhardness until 3rd day after which it increased.

A Study done by Fragozo et al(2011)⁸ reported that the times of immersion of 24 h or even seven days after microabrasion did not increase the abraded enamel's hardness when stored in artificial saliva. In this study the specimens were stored in artificial saliva only after the microabrasion and polishing procedures so it was possible to evaluate the isolated effects of these procedures in order to determine if exposure to saliva altered the results in this phase.

Sonia et al (2009)¹ evaluated the surface roughness and enamel loss following microabrasion with 18% HCl and 37% H₃PO₄ with pumice and found that 37% H₃PO₄ produced a rougher surface but HCl produced a deeper demineralization and greater enamel loss after microabrasion. The difference in the results could be due to the different methods of application as a spatula was used to abrade the enamel surface in the previous study whereas in the present study rubber cups were used.

A selective conditioning pattern was observed when enamel was submitted to microabrasion with H₃PO₄. In contrast, HCl demineralized the enamel surface more uniformly. This non selective conditioning may be the reason for the difference in the value of microhardness of HCl as compared to H₃PO₄.

Conclusion

1. Microabrasion procedure affects the microhardness of the treated enamel
2. Both HCl and H₃PO₄ acid when used along with pumice showed a reduction in the microhardness of enamel which was significantly different from the untreated enamel.
3. Remineralizing agents/polishing agents should be applied after microabrasion to restore microhardness of enamel.

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