

Comparison between Phosphoric Acid and Hydrochloric Acid in Microabrasion Technique for the Treatment of Dental Fluorosis

H₃PO₄ & HCl
in Microabrasion
Technique for
Dental Fluorosis

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ABSTRACT

Objective: To compare the mean appearance score of hydrochloric acid (HCl)-pumice compound versus phosphoric acid (H₃PO₄) pumice compound in the treatment of Dental Fluorosis (DF) through microabrasion.

Study Design: Randomized Control Trial study.

Place and Duration of Study: This study was conducted at the OPD, Department of Operative Dentistry, Liaquat University of Medical and Health Sciences Hospital, Jamshoro/ Hyderabad, Sindh, Pakistan from January 2021 to June 2021.

Materials and Methods: A total of 60 teeth of mild or moderate Dental Fluorosis were selected for this study. Patients were randomly allocated into two groups: "HCl-pumice microabrasion compound" and "H₃PO₄-pumice microabrasion compound" with each group having 30 teeth. Photographs of teeth were taken pre-operatively and post-operatively and shown to an experienced clinician who evaluated a score for improvement in appearance using a visual analog scale.

Results: Acceptable improvement score was observed in 93.33% cases with slight improvement score in only 6.66% cases. The mean appearance score for Pumice-H₃PO₄ Compound and Pumice-HCl Compound were almost equal. Thus, both compounds could improve the appearance of fluorosed teeth with improvement score was slightly better for Pumice-H₃PO₄ Compound group (50%) than Pumice-HCl Compound (43.33%)

Conclusion: Both microabrasion compounds showed high success in treating enamel stains resulting from Dental Fluorosis.

Key Words: Dental Fluorosis, Discoloration, Microabrasion

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INTRODUCTION

Dental fluorosis is a condition resulting from excessive fluoride exposure on ameloblasts during enamel formation¹ resulting in a significant discoloration of teeth. This discoloration ranges from white streaks in the "mild" forms to extensive brown and black staining in the severe forms.²

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The main consequence of DF is cosmetically unsatisfactory dentition which raises aesthetic concerns in patients.³

Several techniques have been proposed to improve the appearance of discolored teeth. Teeth discolored by fluorosis or hypoplasia may be managed by performing microabrasion, enamel bleaching, resin infiltration, etch bleach and seal technique, placement of veneers, or artificial crowns. The choice among these treatments depends on the severity of the disease.⁴ Usually, enamel microabrasion is the chosen technique as it is conservative and painless technique and can yield attractive long lasting cosmetic results immediately⁵ particularly in teeth affected with mild and moderate fluorosis in which a defect is usually confined to superficial enamel.

Microabrasion involves the removal of superficial enamel and classically incorporates both 'abrasion' and 'erosion' with abrasive and acid respectively.⁶ There are two main compounds for microabrading discolored or hypoplastic teeth.⁵ These are the hydrochloric acid/pumice compound (HCl pumice) and the phosphoric acid/pumice compound (H₃PO₄ pumice).⁷

Previous studies^{8,9} show mean appearance score of 6.39 ± 0.75 ¹¹ for phosphoric acid/pumice compound and 2.4 ± 0.5 ⁹ for hydrochloric acid/pumice compound respectively which show marked variation in results in terms of mean appearance score. In addition, different studies conducted on improvement in dental appearance using microabrasion with conventional hydrochloric acid/pumice compound also show marked variations in statistics.^{9,10}

On literature search it has been observed that international studies are available on both compounds but the results are controversial. Therefore, the present study was designed to assess the actual mean appearance score of HCl pumice compound and H₃PO₄ pumice compound in the treatment of Dental Fluorosis through microabrasion which may aid in determining better dental microabrasive material which could be recommended in future.

MATERIALS AND METHODS

In this study patients having DF of mild and /moderate severity affecting maxillary anterior teeth were included however mentally handicaps and medically compromised patients, patients with high expectations, bad oral hygiene, gingival and periodontal problems and caries involving anterior tooth/ teeth were excluded. This study was conducted on 60 teeth which met the inclusion criteria. The diagnosis of DF was made by taking proper history and clinical examination of each patient and afterwards severity of DF was assessed using Dean's index and all the details of patient was recorded in the proforma attached as annexure.

Prior to treatment, informed consent was obtained and then oral prophylaxis was provided by scaling and polishing of discolored teeth. Next, pre-operative colour photographs of the teeth were taken using a digital camera (Nikon COOLPIX S4300) at a pre-established, standardized setting and focal length. Afterwards, patients were randomly allocated into two groups: "HCl-pumice microabrasion compound" and "H₃PO₄-pumice microabrasion compound" and procedure of microabrasion were applied to all teeth using similar technique but with different compound. After isolation with rubber dam, a thick layer of microabrasion compound (acid-pumice slurry) was applied over the discoloured area of the affected teeth and rubbed with a rubber cup in a low speed contra-angle handpiece for 10 seconds of each application.

Every patient received the entire microabrasion treatment in a single appointment with a maximum of 10 applications. At the end of the treatment, 1.1% neutral sodium fluoride gel (Fluocal, Septodont, France) was applied for four minutes and then rubber dam was removed. To avoid the influence of dehydration caused by isolation of the rubber dam,

postoperative photographs were taken after one hour with the same condition as mentioned above.

Pre- and post-operative photographs of each patient were shown to clinician other than operator who was unaware of the modality of treatment given to each group of patients. Then he evaluated a score for improvement in appearance using a visual analog scale. Both compounds showed acceptable esthetic improvement as shown in pre-operative and post-operative clinical photographs. (Figures 1-4).

Data was analyzed using statistical packages for social sciences (SPSS) version-23.0. The two groups were compared for Mean Appearance Score using unpaired t test and considering P value less than or equal to 0.05 as significant.

RESULTS

During this study data from 60 teeth from 18-50 years' age range was collected with mean age in years 23.80 and SD 5.07 were recorded. Majority of patients (70%) were belonged to 18-28 age group and only 30% were from 29-39 age group with no patients 40-50 age group as shown in (Figure 5).

There was equal number of both genders in the study with male to female ratio of 1:1 but there was greater number of males in Pumice-H₃PO₄ group and greater number of females in Pumice HCl group. (Figure 6).

There were equal number of patients in mild and moderate severity categories of DF assessed by Deans index, however, more cases of mild severity were treated with Pumice-H₃PO₄ Compound and moderate severity with Pumice HCl Compound. (Figure 7).

In terms of improvement in appearance both groups showed a significant improvement in appearance after microabrasion with the mean and SD was 7.766 ± 1.33 for Pumice-HCl compound group and 8 ± 0.371 for Pumice-H₃PO₄ compound group as summarized in Table-1.

It was noticed from Table-2 that 26 out of 30 cases treated with Pumice-HCl Compound gave moderate improvement in appearance with only 4 cases reported mild improvement. In contrast, all 30 cases treated with Pumice-H₃PO₄ Compound gave moderate improvement in appearance with no any case of mild improvement. In addition, there was no any case of no improvement or exceptional improvement in both groups. The unpaired t test was applied to compare two groups for mean appearance score, and the p-value came out to be (0.04) which indicates a statistically significant level i.e. (P < 0.05).

According to Table 3, there were 30 cases of mild severity and 30 cases of moderate severity. All 30 cases of mild severity gave higher scores for improvement (7 to 9) whereas moderate severity cases reported low scores for improvement (4 to 6) in only 4 cases and in remaining 26 cases of moderate severity, higher scores for improvement (7 to 9) was noticed which means DF of moderate severity could be treated well with microabrasion.



Figure No. 1-2: Pre-Operative (A) And Post-Operative View (B) Of Microabrasion with Pumice-HCl Compound



Figure No. 3-4: Pre-Operative(A) And Post-Operative View(B) Of Microabrasion with Pumice-H₃PO₄ Compound

Table No. 1: Descriptive Statistics for Mean Appearance Score in Both Groups

Mean Appearance Score	Microabrasion Compound	N	Mean	Std. Deviation	Std. Error Mean
	Pumice-HCl Compound	30	7.7667	1.33089	.24299
	Pumice H ₃ PO ₄ Compound	30	8.0000	.37139	.06781

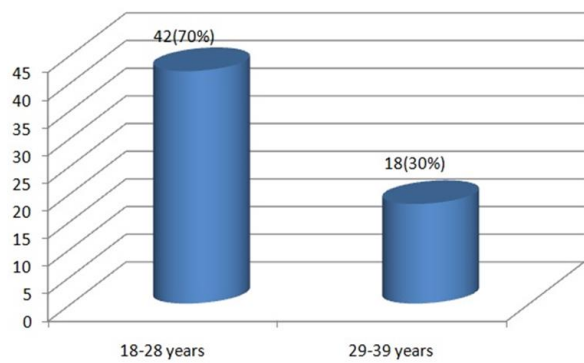


Figure No.5: Age Distribution

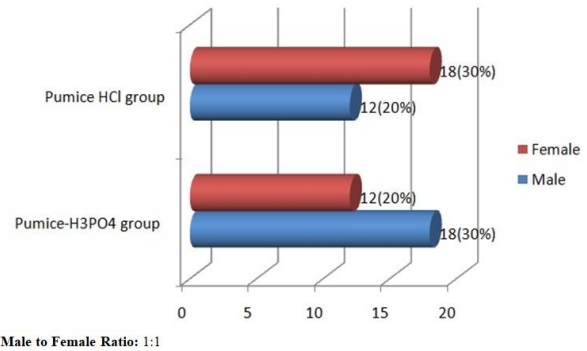


Figure No.6: Gender Distribution in both Groups N=60

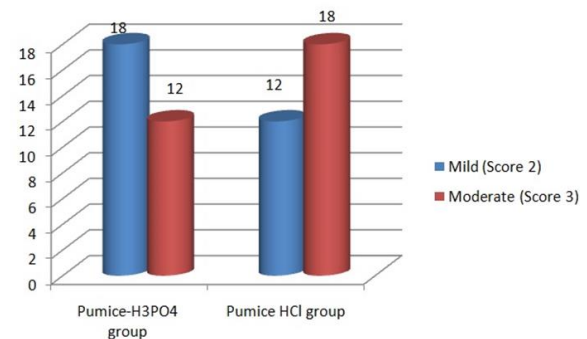


Figure No.7: Dean's Index Score in Both Groups N=60

Table No. 2: Mean Appearance Score in Both Groups

Mean Appearance Score	Microabrasion Compound		Total	P-Value
	Pumice-HCl Compound	Pumice-H ₃ PO ₄ Compound		
No Improvement (0-3)	0(0%)	0(0%)	0(0%)	0.04
Slight Improvement (4-6)	4(6.66%)	0(0%)	4(6.66%)	
Moderate Improvement (7-9)	26(43.33%)	30(50%)	56(93.33%)	
Exceptional Improvement (10)	0(0%)	0(0%)	0(0%)	
Total	30(50%)	30(50%)	60(100%)	

t= -2.112

Table No.3: Stratification of Mean Appearance Score with Respect to Dean's Index Score

Dean Index Score	Mean Appearance Score		Total	P-Value
	Slight Improvement (4-6)	Moderate Improvement (7-9)		
Score 2(Mild)	0(0%)	30(50%)	30(50%)	0.04
Score 3(Moderate)	4(6.66%)	26(43.33%)	30(50%)	
Total	4(6.66%)	56(93.33%)	60(100%)	

t= 2.112

DISCUSSION

Endemic fluorosis is a major problem in many third world countries, and its consequence is discoloured dentition which raises an aesthetic concern among patients. The global prevalence of DF is 32% and its incidence in Pakistan is also significant (12%), with majority of cases belonged to mild and moderate severity.¹¹

Patients who seek treatment for the aesthetically objectionable fluorosis would like to consider the most conservative treatment option for the improvement of their smile. Microabrasion is one of the minimal invasive dental procedures that yields satisfactory results, particularly in cases of mild and moderate fluorosis.¹²

The present study was conducted to assess the actual mean appearance score in mild to moderate fluorosis through micro abrasion techniques with 18% HCl Pumice slurry and 37% Phosphoric acid, Pumice slurry similar to the study of Sheoran et al,¹³.

The results of present study showed good outcome with microabrasion in both genders with scores for improvement achieved was slightly higher in females compared to males in contrast to the findings of Wong and Winter¹⁴ who stated that gender was not related to aesthetic outcome.

Among the 60 treated teeth in present study, it was observed that higher scores of VAS scale for improvement in appearance was achieved in mild category comparative to moderate category of Dental Fluorosis as was observed in the studies by Celik¹⁵ and Train. In our study, there were 30 cases of mild severity and 30 cases of moderate severity.

In the present study equal numbers of cases were treated with Pumice-H₃PO₄ compound and Pumice-HCl compound. Pumice-H₃PO₄ compound reported moderate scores for improvement (7-9) in all 30 cases. However, Pumice-HCl compound reported moderate scores for improvement (7-9) in 26 out of 30 cases and slight scores for improvement (4-6) in remaining 4 cases. These slight scores for improvement (4-6) were seen in moderate severity cases. So it could be said that remarkable improvement in appearance was noticed in all 30 cases of mild severity and 26 out of 30 cases of moderate severity. Thus the present study support the statement of Croll TP that microabrasion can

successfully treat both mild as well as moderate stains of DF.

Analysis of the results by unpaired t test revealed that both compounds showed a significant improvement in appearance after microabrasion. In this study VAS scale scores obtained for Pumice-H₃PO₄ Compound was slightly higher comparative to Pumice—HCl Compound which may be due to high percentage of mild fluorosis cases around 30% in Pumice-H₃PO₄ Compound group compared to 20% of similar cases in Pumice—HCl Compound group.

The mean and SD was 7.766+_{1.33} for Pumice-HCl compound group and 8+_{0.371} for Pumice-H₃PO₄ compound group. The unpaired t test was applied to compare two groups for mean appearance score, with the p-value to be (0.04) which indicates a statistically significant level i.e. (P <0.05)

The mean appearance score of HCl pumice compound and H₃PO₄ pumice compound were almost equal as in the study of Sheoran et al.¹³ Thus, both compounds could improve the appearance in mild as well as moderate Dental Fluorosis however, according to the present study conducted, Pumice-H₃PO₄ Compound could be preferred to Pumice—HCl Compound in treating moderate severity cases of Dental Fluorosis as it yielded moderate improvement scores in all of moderate severity cases.

CONCLUSION

Both microabrasion compounds showed high success in treating mild and moderate Dental Fluorosis. Microabrasion technique could be considered as the first treatment option when trying to improve the esthetics of teeth that present with mild or moderate intrinsic stains as it is a simple, safe, atraumatic, minimally invasive single visit procedure with high success rate.

Author's Contribution:

Concept & Design of Study: Madiha
 Drafting: Feroze Ali Kalhoro, Waqas
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 Revisiting Critically: Madiha, Feroze Ali Kalhoro
 Final Approval of version: Madiha, Madiha Zaighum

Conflict of Interest: The study has no conflict of interest to declare by any author.

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