ORIGINAL RESEARCH

"Comparative Evaluation of Three Different Microabrasion Techniques in Esthetic Management of Fluorosis": An *In Vivo* Study

Vatsala N Reddy[1], Priya Nagar[2], Richa Lakhotia[3], Anisha Jenny[4], Pooja H Ravi[5], Raghunath Kanugondappa[6]

Abstract

Aim: "Comparative evaluation of three different microabrasion techniques in esthetic management of fluorosis"—an *in vivo* study.

Materials and methods: A total of 48 permanent incisors in children between the age-groups of 8–12 years with Dean's fluorosis index modified criteria 1, 2, and 3 were included. The patients were randomly divided into three groups; each group included 16 samples. Group I—phosphoric acid and pumice microabrasion (37% phosphoric acid and pumice as abrasive), group II—opalustre microabrasion [6.6% hydrochloric (HCL) acid and silicon dicarbide (SiC_2)], and group III—icon etch microabrasion (15% HCL acid gel as icon etch, pumice, and resin infiltrate). Preoperative sensitivity and pulp vitality of each tooth were evaluated. Standardized preoperative photographs were captured for the evaluation of color parameters L1, a1, and b1 by Adobe Photoshop 7 software and an assessment of color enhancement was carried out. Preoperative surface roughness was evaluated with two methods like, cellulose acetate replicating tape and confocal microscope, and Epoxy resin replica obtained from the preoperative impression of teeth using additional silicone and contact profilometer. Microabrasion was done accordingly. Postoperative values of all the parameters were evaluated.

Results: Phosphoric acid and pumice showed the best color change, followed by icon etch resin infiltrate. Opalustre (6.6% HCL acid and SiC_2) and was unsuccessful as it had less concentration and was more abrasive.

Conclusion: Phosphoric acid and pumice showed the best color enhancement, followed by icon etch resin infiltrate and opalustre. Icon etch resin infiltrate showed minimal surface roughness followed by phosphoric acid and pumice and opaluster group.

Keywords: Adobe Photoshop and digital image, Cellulose acetate replicating tape, Confocal microscope, Contact profilometer, Epoxy resin replica, Fluorosis, Microabrasion, Surface roughness.

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Introduction

Esthetic dentistry is an evolving branch of dentistry concerned with enhancing dental esthetics. Esthetic dentistry includes many procedures, such as conservative restorative treatments, smile corrections and designing, orthodontic procedures, veneers, depigmentation of the gingiva, microabrasion, and so on. In this part, our line of treatment for microabrasion is efficient in the management of fluorosis. Dental fluorosis is a significant oral condition that may affect oral esthetics. Hence it is generally believed that a widely prevalent esthetic disturbance may be significant for children's perception of well-being.[1] Impaired esthetic disturbances in permanent dentition are of the greatest concern in dental fluorosis and are more predisposed to affect children who are extremely exposed to fluoride present in water between 20 and 30 months of age of the child. The critical period for fluoride over-exposure is between 1 and 4 years old only, and not be at risk during the older years.[2]

Dental fluorosis is an oral health condition described as a developmental disturbance of enamel due to excessive exposure to fluoride.[3] During tooth development, a high concentration of fluoride exposure will affect the enamel-forming cell, ameloblast, particularly in the process of enamel development.[4] Subsequent changes happening in the enamel occur due to the changes of developing enamel mineral matrix and ameloblast.[5,6] Due to increased fluoride existence during the mineralization of enamel, there is a decrease in the free calcium ion concentration in the mineralizing matrix, which inhibits enzyme proteinases from the disintegration of the matrix proteins during the maturation phase.[5,7] Consequently, the degradation of matrix proteins is delayed.[5] The occurrence of fluoride-induced retention of enamel matrix protein leads to compromised crystal growth.[5,8] Maxillary permanent incisors are teeth that are at risk of fluorosis if the child is exposed to excessive fluoride between the age-groups of 20–30 months.[9]

Conservative nonrestorative treatments, such as microabrasion and bleaching, have been advocated in the management of demineralization defects and intrinsic stains of teeth due to fluorosis. Enamel microabrasion is a significant technique in the elimination of intrinsic discoloration or texture modification to the

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defects such as enamel hypoplasia, fluorosis, and amelogenesis imperfecta.[10] The microabrasion technique eliminates the porous surface enamel and the deep stains with a gel that comprises an acid and an abrasive compound in a parallel way that dental prophylaxis with pumice and water is accomplished.

Enamel elimination subsequent to the microabrasion procedure is time and technique dependent.[11] The technique induces the eradication of discolored enamel and modifies the optical topographies of the enamel surface, called the "abrasion effect."[12,13] The microabrasion procedure results in abraded, lustrous, shiny, and glass-like surface of the enamel, which may reflect and refract light contrarily.[10,14]

Materials and Methods

A total of 48 permanent incisors of patients between age-groups of 8–12 years with very mild to moderate fluorosis were included. The sample size was calculated using Power Analysis & Sample Size software. Selection criteria were based on the following inclusion criteria—patients of age 8–12 years, teeth with fluorosis according to Dean's fluorosis index—modified criteria very mild,[1] mild,[2] and moderate[3] were included, lesser intensity fluorosis stains determined by transillumination were included. Exclusion criteria had teeth with extrinsic stains other than fluorosis, intrinsic stains due to enamel hypoplasia, tetracycline staining, deeper opaque stains, teeth with caries and periodontal diseases, nonvital teeth, subjects with preoperative sensitivity, and subjects with orthodontic brackets. The patients were arbitrarily divided into three groups; each group comprised 16 samples. Group I, phosphoric acid and pumice microabrasion (37% phosphoric acid and pumice as abrasive), group II—opalustre microabrasion (6.6% HCL acid and SiC_2), and group III—icon etch microabrasion (15% HCL acid gel as icon etch, pumice, and resin infiltrate) (Figs 1 to 3). Preprocedural oral prophylaxis was done. Preoperative sensitivity of each tooth was assessed by air stimulus on the tooth surface for 3 seconds with a standard dental air syringe, and value S1 was recorded (Fig. 4). Preoperative pulp vitality was done with an electric pulp tester and value V1 was recorded Fig. 5). Standardized preoperative photographs were captured with a digital camera for the evaluation of color parameters L1, a1, and b1 by Adobe Photoshop 7 software, and assessment of color enhancement was carried out by color difference ΔE*ab was evaluated (Figs 6 and 7). Preoperative surface roughness was evaluated with two methodologies—method 1—cellulose acetate replicating tape and confocal microscope (Figs 8 to 11). Method 2—epoxy resin replica obtained from the preoperative impression of teeth using additional silicone and contact profilometer (Figs 12 to 14). Microabrasion was done accordingly. Postoperative values of all the parameters were evaluated similarly to obtain S2, V2, ΔE*ab, and surface roughness averages accordingly.

In group I—phosphoric acid and pumice (37% phosphoric acid and pumice as abrasive).[15] Paste of phosphoric acid and pumice was prepared in a 1:1 volumetric ratio using a standard spoon for material dispensing. A 1 mm thick paste was applied on the labial surface of the tooth, covering the gingival third to the incisal edge of the teeth. Microabrasion was done using a contra angle micromotor with a rubber cup for 30–40 seconds at 1000 rpm. The approximate same pressure of abrasion was done by a single operator on the Seach tooth and repeated three times. Following this, the teeth were rinsed and evaluated. Finishing was done with polishing disks.[15]

In group II—opalustre microabrasion (6.6% HCL acid and SiC_2) (Fig. 10). A plastic white mac tip was attached to the opalustre syringe and a 1.00 mm layer of material was applied to the labial surfaces. Microabrasion was done using a contra-angle micromotor using a rubber cup for 30–40 seconds at 500 rpm. The same approximate pressure of abrasion was done by a single operator on each tooth and was repeated three times. Following this, the teeth were rinsed and evaluated. Finishing was done with polishing disks.

In group III—icon microabrasion (15% HCL acid gel) (Fig. 11). Plain pumice was used to clean the teeth. Teeth surfaces were etched using icon etch three times for 2 minutes each and rinsed with water. The procedure was repeated three times. A drying agent (ethanol drying agent) was applied for 30 seconds. Application of the resin infiltrate was done for 3 minutes. Excess material was removed.[16,17] Postoperative values of all the parameters were evaluated similarly to obtain S2, V2, ΔE*ab, and surface roughness averages accordingly, and the value Ra2 was recorded.[18,19] Finishing and polishing were done accordingly.

Casein phosphopeptides-amorphous calcium phosphate was applied over entire labial surface and smeared over the surface for 3–4 minutes to reduce postoperative sensitivity in groups I and II.[20] In groups I and II; complete microabrasion sessions were performed as advised by the manufacturer but recording the desired parameters was done after first appointment. Results were tabulated and analyzed statistically.

Figs 1A to C: (A) Group I—phosphoric acid and pumice; (B) Group II—opalustre; (C) Group III—icon etch resin infiltrate

Fig. 2: Instruments for the procedure

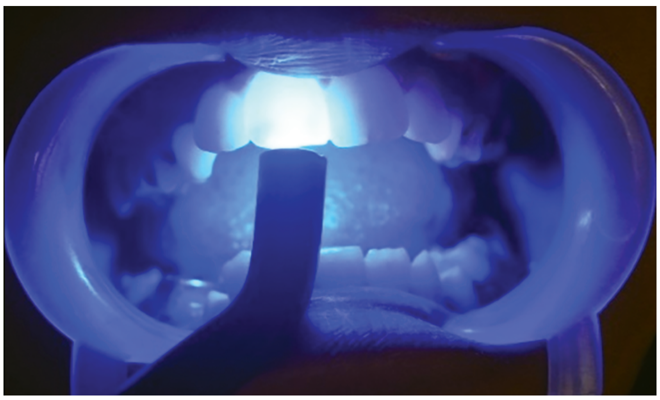

Fig. 3: Determination of the depth of stains by transillumination

Fig. 4: Determination of sensitivity using air blast with three-way syringe

Fig. 5: Evaluation of pulp vitality using electric pulp tester

Ethical and humane considerations—ethical clearance was obtained from the institutional authorities, and an informed consent copy was signed by the patients and parents.

Statistical Method

The normality assumption of the data was tested using Kolmogorov–Smirnov test. If the assumption of normality fails, then a comparison between the groups was carried out using the nonparametric test, Kruskal–Wallis test, Mann–Whitney test, and Wilcoxon Signed-rank test. If the assumption of normality was met, then a parametric test was used to compare the groups [one-way analysis of variance (ANOVA), Tukey test, and paired and unpaired *t*-test].

A *p*-value of <0.05 was considered statistically significant.

A total of 48 permanent incisors of patients aged between 8 and 12 with very mild to moderate fluorosis.

Sample sizes of 16 per group were obtained from the three groups whose means were compared. The total sample of 48 teeth attains 92% power to detect differences among the means vs the alternative of equal means using an *F*-test with a 0.05 significance level.

A one-way ANOVA test was used for statistical analysis.

Study period—the expected duration of the study was 1/2 year.

Study design—*in vivo*.

Fig. 6: Standardized digital image capture

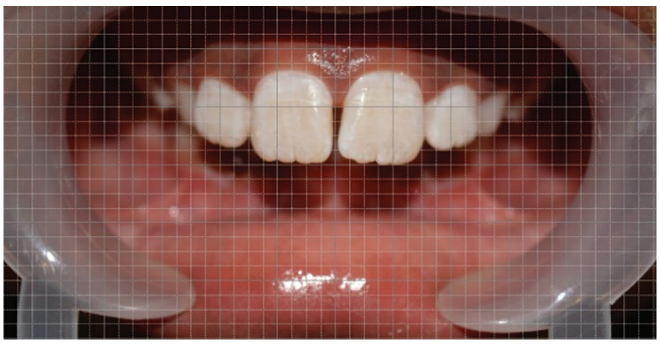

Fig. 7: Adobe photoshop for color determination

Results

The results of our current study, "comparative evaluation of three different microabrasion techniques in esthetic management of fluorosis."

Fig. 8: Cellulose acetate tape and acetone

Fig. 9: Replication of tooth surface using cellulose acetate tape

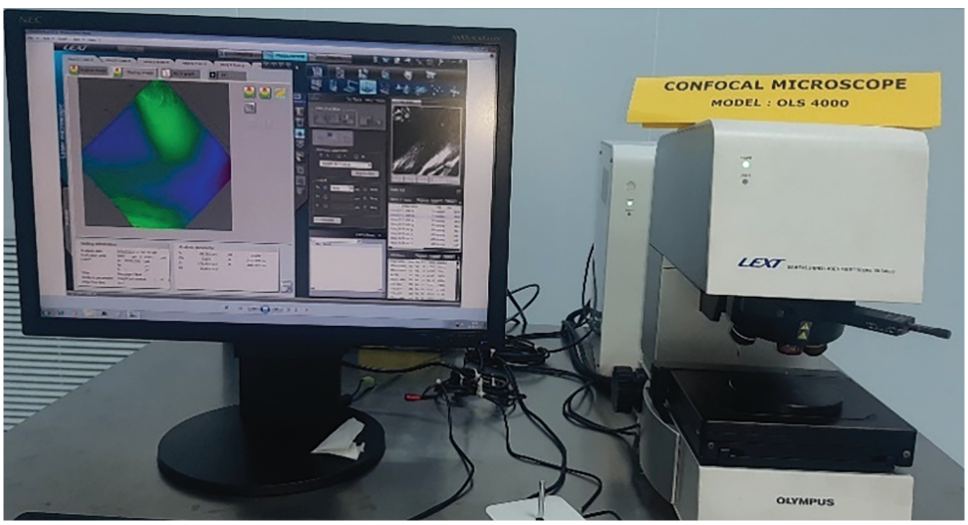

Fig. 10: Surface roughness evaluation of cellulose acetate tape using confocal microscope

The results of microabrasion were determined as intracomparison between pretreatment and posttreatment and intercomparison between all three groups.

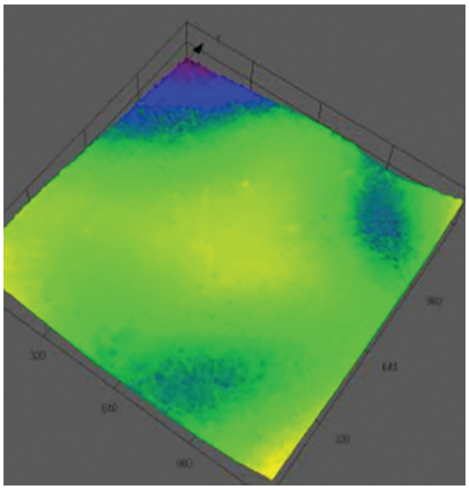

Fig. 11: Surface roughness using cellulose acetate tape and confocal microscope

Fig. 12: Epoxy resin replica of the impression

Color difference—color differences were calculated using the following equation:

ΔEab = [(ΔL*) 2 + (Δa*) 2 + (Δb*) 2]1/2. L*, a*, and b* color parameters calculated by Adobe Photoshop 7 software (Table 1), represent color difference ΔE ab parameters between three groups.

Table 1 shows ΔE ab, which represented the mean color difference with the group I (phosphoric acid and pumice) 18.38, followed by group III (icon etch resin infiltrate) 16.78, and lastly, group II (oplasture) 10.1. Values of each sample were evaluated pre and postoperatively to obtain the difference.

Fig. 15 shows a comparison of the mean color difference between the study groups.

This showed that the phosphoric acid group showed significant and best results according to color difference parameters. As has been proved by many studies over the years, phosphoric acid with pumice has proven to be an excellent microabrasive of choice. The reason behind this could be an excellent etching effect followed by good penetration power resulting in an effective bleaching effect.

Pumice powder also has a good cleaning effect, probably aiding in the best results. Icon etch resin infiltrate, being the latest

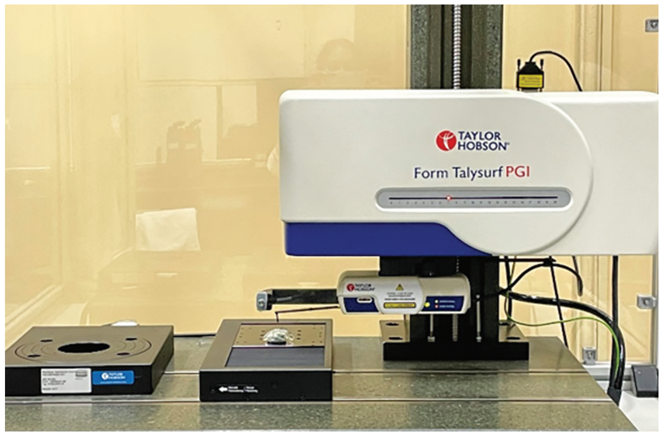

Fig. 13: Evaluation of surface roughness of epoxy resin replica

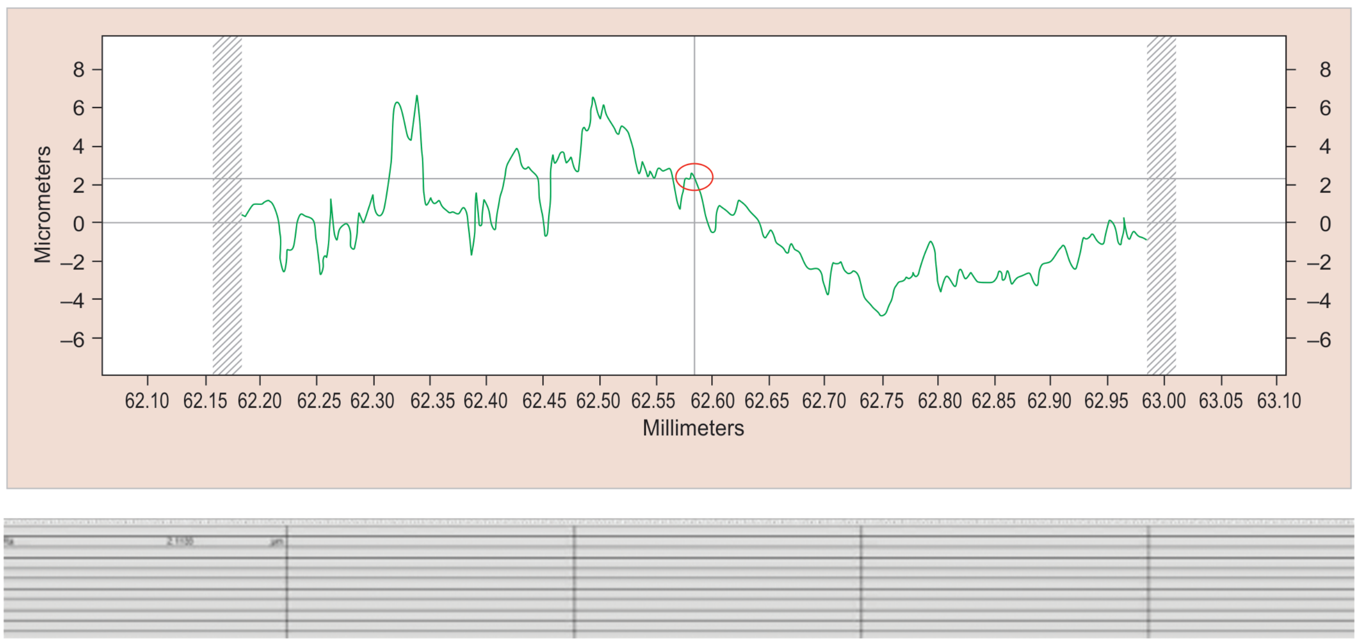

Fig. 14: Result of the evaluation

material in the market containing a higher concentration of HCL (15%) along with pumice, showed results that were nonsignificant to group I (phosphoric acid and pumice). This shows that Icon could be an excellent replacement for phosphoric acid, given the lesser etching effect compared to phosphoric acid. The damage to the enamel would be lesser. The mean difference is 1.60 and the *p*-value is 0.002. There was a very significant result between group I (phosphoric acid and pumice) and group II (opaluster—6.6% HCL) with SiC_2 as an abrasive. The low concentration of HCL could be the cause. The mean difference is 8.28 with a *p*-value <0.001. There was also a significant difference between groups II and III, with the mean difference being 6.68 and *p*-value of <0.001. This showed the concentration of 6.6% HCL was proven not so effective as compared to 15% HCL. Also, pumice was a better abrasive than SiC_2.

Table 2 represents the intercomparison between group I (phosphoric acid and pumice), group II (opalustre), and group III (icon etch) by the surface replication of tooth surface using cellulose acetate replicating tape with a confocal microscope.

Fig. 16 shows the comparison of mean pre and postsurface roughness confocal microscope between the study groups.

The mean surface roughness (SR) change for group I was 10.42, for group II was 16.44, and for group III was only 1.99. This clearly shows that group I (phosphoric acid and pumice) showed very good color change, but the surface roughness increased to dangerous levels, which could be the cause of stains from food colors or natural agents soon enough. The etching effect of phosphoric acid was no doubt an important color change but also might have damage to the enamel layer.

Group II (6.6% HCL with SiC_2) also had a surface roughness of 16.44; maybe SiC_2, which is harder abrasive with more abrasive action, was the cause of the enamel layer being abraded.

Table 1: Color difference

Sample number	*Group I*	*Group II*	*Group III*
1	18.671	9.3949	15.465
2	19.857	8.213	15.726
3	17.153	10.264	15.57
4	18.873	11.097	16.267
5	17.582	11.097	19.986
6	18.673	8.1184	16.941
7	19.478	10.264	15.488
8	18.882	8.394	18.388
9	16.622	10.157	18.746
10	17.574	9.442	16.503
11	19.379	10.501	15.322
12	18.063	10.221	15.563
13	19.065	12.189	16.888
14	19.121	12.156	17.936
15	16.065	11.151	17.333
16	19.063	8.944	16.328
Mean	18.38	10.1	16.78

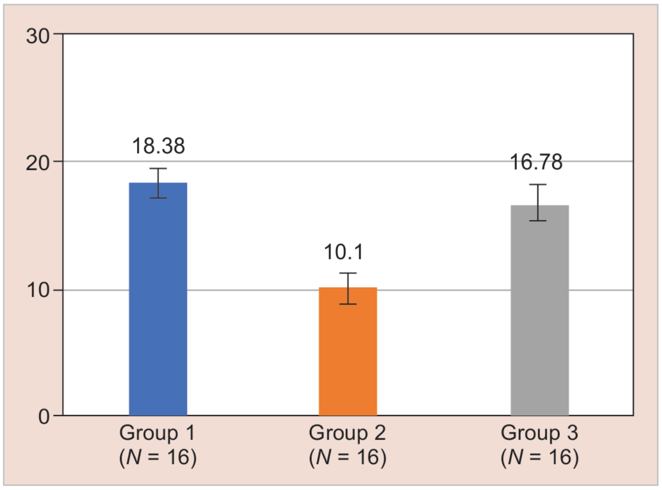

Fig. 15: Comparison of mean color difference between the study groups

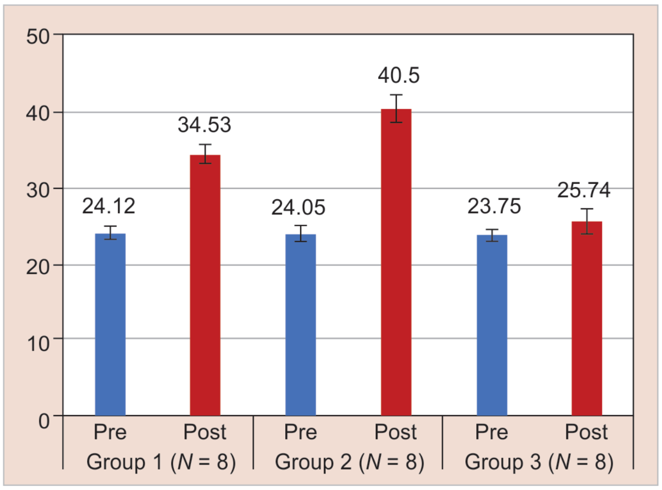

Fig. 16: Comparison of mean pre and postsurface roughness confocal microscope between the study groups

Table 2: Surface roughness by confocal microscope (pre–post)

	Group I		*Group II*		*Group III*	
SMP number	*Preoperative*	*Postoperative*	*Preoperative*	*Postoperative*	*Preoperative*	*Postoperative*
1	24.562 µm	34.106 µm	23.047 µm	43.833 µm	24.432 µm	28.140 µm
2	23.645 µm	34.041 µm	24.831 µm	39.491 µm	23.388 µm	26.928 µm
3	23.502 µm	36.555 µm	24.215 µm	40.755 µm	23.574 µm	26.147 µm
4	22.755 µm	34.720 µm	22..962 µm	39.592 µm	24.049 µm	24.205 µm
5	24.857 µm	32.441 µm	24.064 µm	42.155 µm	24.671 µm	26.089 µm
6	25.703 µm	33.854 µm	23.989 µm	39.156 µm	23.486 µm	23.711µm
7	24.143 µm	34.823 µm	25.820 µm	40.919 µm	22.613 µm	23.723 µm
8	23.783 µm	35.735 µm	23.499 µm	38.071 µm	23.780 µm	26.968 µm

Table 3: Surface roughness by contact profilometer (inter group comparison)

	Group I		*Group II*		*Group III*	
Sample number	*Preoperative*	*Postoperative*	*Preoperative*	*Postoperative*	*Preoperative*	*Postoperative*
1	4.4755 µm	6.8222 µm	1.0085 µm	6.0924 µm	2.0085 µm	3.0924 µm
2	6.525 µm	6.907 µm	4.4145 µm	5.3389 µm	2.4145 µm	2.3389 µm
3	5.017 µm	7.0577 µm	2.5919 µm	8.7756 µm	3.5919 µm	3.7758 µm
4	4.415 µm	4.7 µm	1.1812 µm	6.0963 µm	1.1612 µm	2.0973 µm
5	3.935 µm	5.6481 µm	1.1125 µm	5.9083 µm	3.1125 µm	2.9083 µm
6	2.348 µm	4.993 µm	3.9758 µm	4.0804 µm	4.9258 µm	5.0864 µm
7	4.097 µm	5.146 µm	3.3941 µm	8.3571 µm	4.6941 µm	5.3471 µm
8	8.182 µm	9.276 µm	3.0805 µm	7.1135 µm	4.0805 µm	4.1135 µm

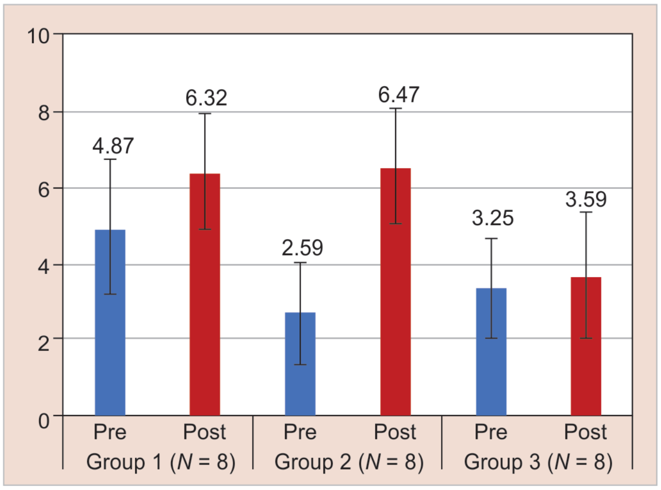

Fig. 17: Comparison of mean pre and postsurface roughness contact profilometer between the study groups

Group III, although 15% HCL was used; but as it is very well known that the etching effect of HCL is not as much as phosphoric acid; that was probably the reason it was not as effective in color change as phosphoric acid, although it has found to show comparative and nonsignificant results. Because pumice was probably the abrasive, the enamel layer damage was not as severe as it was done prior to the application of Icon etch is 15% HCL as a separate component not used as a mixture of abrasive and etchant, and replication was done after resin infiltration and curing procedure.

The use of cellulose acetate replicating tape and confocal microscope added a practical way of evaluation of surface roughness *in vivo* and showed almost accurate surface evaluation with tooth surfaces as it was a replica of most of the tooth surface abraded.

Table 3 shows the intercomparison between group I (phosphoric acid and pumice), group II (opalustre), and group III (icon etch) by the surface replication of tooth surface using epoxy resin replicating the impression of tooth surface and contact profilometer.

Fig. 17 shows the comparison of mean pre and postsurface roughness contact profilometer between the study groups.

The mean SR change for group I was –1.44, for group II was –3.88, and group III was –0.35 only.

The phosphoric acid group with the advantage of color enhancement also had a limitation of increased surface roughness with a mean of –1.44. This signifies the amount of loss of enamel which was evaluated in a single appointment of microabrasion. Also pointed out that there was a significant amount of enamel layer lost, which on further appointments, would likely damage even more and could cause sensitivity as an additional effect due to the higher concentration of the phosphoric acid.

Group II (6.6% HCL with SiC_2) also had a surface roughness of –3.88. SiC_2, which is harder abrasive with more abrasive action, was the cause of the enamel layer being abraded. This combination could not show either enhancement in color as a comparison with the other two groups but had a major effect on the surface topography of enamel. Further use in subsequent appointments could affect with an increase in sensitivity also.

Group III, although 15% HCL was used, as it is very well known that the etching effect of HCL is not as much as phosphoric acid; that was probably the reason that it was not as effective in color enhancement as phosphoric acid, although it was found to show comparative and nonsignificant results compared to other the two groups. Because with the pumice, which was the abrasive used probably, the enamel layer damage was not as severe because abrasion was done prior to the application of icon etch (15% HCL) as a separate component not used as a mixture of abrasive and etchant and replication was done after resin infiltration and curing procedure.

In the case of a contact profilometer, an impression was used to have an accurate evaluation of the positive replica of teeth samples, which was obtained as an epoxy resin replica from the pre and postoperative impression obtained. This also helped to evaluate and compare the noncontact measurement using a confocal microscope.

Table 4 showed the mean difference between the pulp vitality was not significant within the group. Vitality evaluation was mainly done to exclude nonvital teeth and to find any significant damage to the pulp tissue post microabrasion. None of the methods had such undesirable effects on the teeth samples, which could have affected the sensibility of teeth, such as loss of vitality heat produced by the microabrasion or the concentration of phosphoric acid. Table 5 showed the mean difference between the Dentin hypersensitivity was not significant within the group. Sensitivity evaluation was mainly done to evaluate postmicroabrasion sensitivity. None of the methods had significant postoperative sensitivity. The mean difference between the Dentin hypersensitivity was not significant within the group. Sensitivity evaluation was mainly done to evaluate postmicroabrasion sensitivity. None of the methods had significant postoperative sensitivity.

Discussion

The phosphoric acid group showed significant results according to color difference parameters. Phosphoric acid with pumice

Table 4: Mean preoperative and postoperative sensitivity scores

Group	*Preoperative (S1)*	*Postoperative (S2)*
Phosphoric acid	1.8	1.5
Opalustre	1.3	0.8
Icon etch	0.8	0.5

Table 5: Mean preoperative and postoperative vitality scores

Group	*Preoperative (V1)*	*Postoperative (V2)*
Phosphoric acid	21	17
Opalustre	13.6	18.6
Icon etch	25.25	25.8

has proven to be an excellent microabrasive of choice. Icon etch resin infiltrate, being the latest material containing a higher concentration of HCL (15%) along with pumice, showed results that were nonsignificant to the group I (phosphoric acid and pumice). This shows that Icon could be an excellent replacement for phosphoric acid, given the lesser etching effect compared to phosphoric acid. The damage to the enamel would be lesser. The mean difference is 1.60 and the *p*-value is 0.002. There was a very significant result between group I (phosphoric acid) and group II (opaluster—6.6% HCL) with SiC_2 as abrasive. The difference is 8.28 with *p*-value of <0.001. There was also a significant difference between groups II and III, with the mean difference being 6.68 and a p-value < 0.001. This showed the concentration of 6.6% HCL was proven not so effective as compared to 15% HCL. Also, pumice was a better abrasive than SiC_2. Dogra et al.,[21] conducted a study in which the white spot lesion area was recorded and treated with a DMG icon. L*, a*, b* values of tooth shade and white spot lesion spectrophotometrically using VITA Easyshade. ΔEab value of color change was found to be <3.7 in most of the samples after resin infiltration. The evaluation in our current study was through a standardized photograph and Adobe Photoshop.

The surface roughness was evaluated by the surface replication of the tooth surface using two methodologies cellulose acetate replicating tape with a confocal microscope and Epoxy resin replicating the impression of the tooth surface and contact profilometer. The mean surface roughness change for group I was 10.42, for group II was 16.44, and for group III was only 1.99.

The etching effect of phosphoric acid was no doubt an important color change but also might have damage to enamel layer. Group II (6.6% HCL with SiC_2) also had a surface roughness of 16.44, maybe SiC_2, which is harder abrasive with more abrasive action was the cause of the enamel layer is abraded. Group III, although 15% HCL was used; but as it is very well known that the etching effect of HCL is not as much as phosphoric acid; that was probably the reason it was not as effective in color change as phosphoric acid, although it has found to show comparative and nonsignificant results. Because pumice was probably the abrasive, the enamel layer damage was not as severe as it was done prior to the application of icon etch that 15% HCL as a separate component not used as a mixture of abrasive and etchant, and replication was done after resin infiltration and curing procedure. Rath and Raghunath,[22] conducted a study to explore the efficacy of cellulose acetate peels in reproducing microscopic arrangements of teeth. Acetate peels magnificently reproduced most of the microscopic tooth particulars which were better than those observed in ground tooth sections. Henceforth, this technique could be advocated as a quick, long-lasting and reasonable substitute, or addition to repetitive thin ground sections of dental hard tissues. So, our current study evaluated surface roughness with cellulose acetate tape and confocal microscope. Ijbara et al.,[23] described a study where applicability of replication sheets in recording wear-induced topographies on human enamel surfaces. The sheets replicated wear structures successfully with compatibility to usage with multiple microscopes. Acetate sheets have the potential for enamel wear replication.

The intercomparison between group I (phosphoric acid and pumice), group II (opalustre), and group III (icon etch) by the surface replication of tooth surface using epoxy resin replicating the impression of tooth surface and contact profilometer. The mean SR change for group I was −1.44, for group II was −3.88, and group III was −0.35 only.

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Gujjarlapudi et al.,[24] led a study to evaluate dimensional precision, surface detail reproduction, and transverse strength of three die materials like epoxy resin (Diemet-E), resin-modified gypsum (synarock), and conventional type IV gypsum (ultrarock) are investigated. Epoxy resin exhibited advantages in dimensional accuracy, surface detail replication, and transverse strength and is nearest to the standards of accurate die material.

Erdur et al.,[25] evaluated the surface roughness of enamel after debonding with various types of burs. The samples were evaluated at pretreatment (on sound enamel) (T1) and posttreatment (T2) by a profilometer. They found that the high-speed bur initiated the extreme irregularity values, and the stain buster bur caused the least roughness values in all the parameters (Ra, Rz, and Rq). In our current study, epoxy resin was used as a replicating material for the impressions, and contact profilometer was used to obtain accurate results of roughness and to compare with noncontact evaluation using confocal microscope.

Cadenaro et al.,[17] measured the morphological features produced *in vivo* by two in-office bleaching agents on enamel surface roughness by means of a noncontact profilometric analysis of epoxy replica. In our current study, the surface roughness was evaluated by the surface replication of tooth surface using two methodologies cellulose acetate replicating tape with confocal microscope and epoxy resin replicating the impression of tooth surface, and contact profilometer. Evaluation results were, accordingly Icon etch, showed least surface roughness, followed by phosphoric acid and opalustre.

The mean inter-comparison between groups I and II presented very significant mean difference of 2.43 with a p-value of 0.005. Comparision between groups II and III also had a significant mean difference of −3.53 and p-value of <0.001. Intercomparison between groups I and III didn't have a significant mean difference, and it was −1.10 and p-value of 0.271. The reason behind evaluation of surface roughness is to find the abrasive effect of the combination of both the acid component and the abrasive particles to define the loss of enamel surface, its morphology, and enamel becoming a retentive structure for any kind of stains to accumulate surface evaluation adds to the importance for evaluation.

The mean difference between the dentin hypersensitivity was not significant within the group. Sensitivity evaluation was mainly done to evaluate postmicroabrasion sensitivity. None of the methods had significant postoperative sensitivity. The mean difference between the dentin hypersensitivity was not significant within the group. Sensitivity evaluation was mainly done to evaluate postmicroabrasion sensitivity. None of the methods had significant postoperative sensitivity. The Schiff scale was used for evaluation of dentine hypersensitivity in our current study, and it was determined as no significant difference was observed between preoperative and postoperative sensitivity after first setting of microabrasion. Rocha et al.,[26] in their study determined that the visual analog, numerical, verbal evaluation, face pain, and Schiff scales were precise for dental hypersensitivity (DH) diagnosis and should be used for DH assessment. The Schiff scale evaluated good sensitivity and specificity values in the diagnosis of DH and should be the preferential scale in assessing DH. Deshpande et al.,[27] Along with microabrasion, an advanced approach of application of casein phospho peptide-amorphous calcium phosphate crème on the tooth and remineralization was carried out, thereby decreasing postoperative sensitivity of the treated tooth. Based on the results of this case report, it can be determined that this technique is efficient and can be considered a minimally invasive procedure and was also advocated in our study.

Murri Dello Diago et al.,[28] conducted a study to evaluate the efficacy of erosion infiltration treatments with resin in children with a strong hypersensitivity and also to develop a minimally invasive diagnostic–therapeutic pathway for young molar incisor hypomineralization (MIH) patients. Sensitivity was verified with the Schiff scale and Wong Baker face scale and was reevaluated at 12 months follow-up. Patients described lower sensitivity values at the end of the treatment. The treatment of erosion infiltration with icon resin was a minimally invasive preventive treatment that considerably improves hypersensitivity in permanent molars with MIH.

The mean difference between the pulp vitality was not significant within the group. Vitality evaluation was mainly done to exclude nonvital teeth and to find any significant damage to the pulp tissue post microabrasion. None of the methods had such undesirable effects. Coutinho et al.,[29] evaluated the increase of pulp chamber temperature induced by different light sources in in-office bleaching with Hydrogen Peroxide 35% and with a smaller temperature increase and consequently, less sensitivity. Mainkar and Kim,[30] lead a systemic review on assessment of pulp vitality. Electric pulp tester displayed high accuracy when testing vital teeth (specificity = 0.93) but low accuracy when assessing nonvital teeth (sensitivity = 0.72).

Conclusion

Esthetic alteration of teeth with mild to moderate fluorosis can be accomplished by minimally invasive treatment using microabrasion. The techniques in our current study presented comparative and favorable results with patient satisfaction without hindering the vitality and sensitivity of the teeth in all three different methods. Phosphoric acid and pumice showed the best color enhancement, followed by Icon etch resin infiltrate. Opalustre (6.6% hydrocloric acid and SiC_2) was unsuccessful as it had less concentration and was more abrasive. Phosphoric acid should be used cautiously. Icon etch resin Infiltrate is a good replacement for phosphoric acid with minimal abrasive.

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