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CLINICAL EVALUATION OF DIFFERENT MINIMAL INVASIVE TREATMENT MODALITIES OF MILD TO MODERATE DENTAL FLUOROSIS USING A VISUAL ANALOG SCALE

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CPP-ACFP, Dental fluorosis, In-office Bleaching, Microabrasion, VAS

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ABSTRACT

Introduction: Dental fluorosis is a chronic condition of enamel hypomineralization resulted from excessive ingestion of fluoride during tooth development. Different treatment protocols were used to improve esthetic appearance of fluorosed teeth. **Aim**: To evaluate patient satisfaction on esthetic improvement of mild to moderate fluorosed teeth after treating with different minimal-invasive treatment modalities. **Patients and Methods**: Sixteen participants were randomly assigned in 8 treatment protocols with 20 teeth at each protocol (**n=20**). (**P_1**) Opalescence boost PF 40%. (**P_2**) Opalustre. (**P_3**) MI-Paste Plus. In (**P_4**) teeth were treated with Opalustre + Opalescence boost PF 40%. In (**P_5**) Opalescence boost PF 40% + MI-Paste Plus, while in (**P_6**) Opalustre +MI-Paste Plus. Whereas (**P_7**) Opalustre + Opalescence boost PF 40% + MI-Paste Plus. (**P_8**) control. Patient satisfaction was gauged using a visual analog scale (VAS) at 4 different time points; immediately after application (T_1), 14 days later (T_2), 3 months later (T_3), and 6 months later (T_4). **Results**: All treatment protocols showed significant difference over control group at all evaluation times. Regarding treatment protocol, the highest patient satisfaction was recorded in **P_4** and **P_7**. The lowest patient satisfaction was recorded in **P_3**. Moreover, concerning evaluation time the highest patient satisfaction was recorded at T_3 and the lowest patient satisfaction was recorded at T_1. The highest patient satisfaction was recorded at 14 days evaluation of **P_4** and 6 months evaluation of **P_7**. **Conclusion**: The combined treatment protocol of Opalustre™ and Opalescence™ boost™ PF 40% provided the highest "patient satisfaction« in treating mild to moderate fluorosed teeth regardless of using MI-Paste Plus®. MI-Paste Plus® provides stability of patient satisfaction results at 6 months' follow-up.

INTRODUCTION

Dental fluorosis is an esthetic disturbance that result from interruption of enamel development particularly at maturation. Enamel fluorosis prevalence has increased in the previous two decades, corresponding to the worldwide decline in caries. This can be clarified by excessive ingestion of fluoride from drinking water or in the form of topical fluoride supplements that are incorporated in enamel during tooth development.[1]

The severity of dental fluorosis is fluoride dose-dependent. Mild fluorosis occurs as white striations or lacy lines following the perikymata, as well as hardly noticeable opacities at the incisal or cuspal borders of teeth. Post-eruptive discoloration and pitting due to attrition of friable enamel define more severe fluorosis. Non-invasive and minimal-invasive treatment protocols for mild to moderate aesthetics defects are available. For severe and pitting fluorosis, invasive treatments include veneers, laminates, or crowns.[2]

Minimal-invasive methods include bleaching, microabrasion, remineralization technology as: casein phosphopeptide amorphous calcium phosphate CPP-ACP and combination approaches. These strategies have been employed with various protocols with varying degrees of success; nevertheless, comparing efficacy in an evidence-based approach has yet to be done in order to make clinical recommendations. There are few randomized, controlled, and longitudinal clinical trials that compare the efficiency of different treatments. Restrictions of the existing trials are limited sample size and evidence indicating a moderate to high risk besides lack of comparative group.[1,2]

Thus, this study was carried out to evaluate patient satisfaction on esthetic improvement of mild to moderate fluorosed teeth after treating with different minimal-invasive treatment modalities including in-office bleaching, enamel microabrasion, remineralization and combination protocols.

The null hypothesis was that there is no significant differences between enamel micro-abrasion, in-office bleaching, combination between them or using remineralizing agent after their application in esthetic improvement of mild to moderate fluorosed teeth.

PATIENTS AND METHODS

I.1 Study design

The research was a randomised controlled double blinded clinical trial with eight parallel arms and a 1:1 allocation ratio that followed the Consolidated Standards of Reporting Trials criteria (CONSORT)[3]. The study was carried out after approval of Research Ethics Committee of the faculty of Dentistry Suez Canal University (**202/2019**).

Each participant was given and signed an informed written permission form that detailed the study idea as well as their role in it in detail before enrollment in the study.

The website http://www.randomization.com was used to generate random sequences. Allocation concealment was ensured by using sequentially numbered opaque sealed envelopes (SNOSE) technique made by an independent person who wasn't involved in the sequence generation. The participants were assured to be blinded because they didn't know each other or the therapies they had received in earlier procedures.

I.2 Sample Size Calculation

To evaluate the effectiveness of various treatment options for improving the aesthetics of mild to moderately fluorosed teeth, a minimum sample size of 136 samples was sufficient to detect the effect size of 0.18, a power (1-β=0.95) of 95% at a significance probability level of $p<0.05$ partial eta squared of 0.032. A total sample size of 160 samples was applied. Each treatment group was represented by 20 samples (**n=20**).

I.3 Participants

Sixteen patients who met eligibility criteria of age range 20-35 years having at least 8 fluorosed teeth free of caries or restorations with good oral

hygiene were involved in this study. This study excluded patients having a history of hypersensitive teeth, allergies to tooth whitening treatments, pregnant or breastfeeding women, smoking habits, and present or recent bleaching product use.

II. Interventions

Using an ultrasonic scaler, each participant received oral prophylaxis prior to the interventions followed by polishing with abrasive discs and pumice. The participants of mild to moderate fluorosis (TFI 1-4) were randomly allocated in eight treatment protocols. Each protocol included twenty teeth (**n=20**). Protocol one ($\mathbf{P_1}$) 40% hydrogen peroxide in-office bleaching (Opalescence™ boost™ PF 40%, Ultradent Products, Inc., South Jordan, UT, USA). Protocol two ($\mathbf{P_2}$) 6.6% hydrochloric acid and silicon carbide microparticles microabrasion paste (Opalustre™, Ultradent Products, Inc., South Jordan, UT, USA). Protocol three ($\mathbf{P_3}$) casein phosphopeptide amorphous calcium fluoride phosphate (CPP-ACFP) remineralizing tooth crème (MI-Paste Plus®, GC America Inc., USA). In protocol four ($\mathbf{P_4}$) teeth were treated with enamel microabrasion followed by in-office bleaching. In protocol five ($\mathbf{P_5}$) in-office bleaching was applied followed by MI-Paste Plus®, while in protocol six ($\mathbf{P_6}$) microabrasion was applied followed by MI-Paste Plus®. Whereas protocol seven ($\mathbf{P_7}$) teeth were treated with microabrasion followed by in-office bleaching and lastly MI-Paste Plus®. Protocol eight ($\mathbf{P_8}$) no treatment (control). All treatment modalities were carried out in a single treatment session and in protocols using MI-Paste Plus, home-application started at the same night after treatment session.

II.1 In-office bleaching procedure

Gingival protector gel (OpalDamTM, Ultradent Products, Inc., South Jordan, UT, USA) was injected in a 4-6 mm high, 1.5-1 mm thick layer along the gingival margin, covering the cervical section of enamel by approximately 0.5 mm, light curing was done in a scanning motion for 20 seconds each arch. A 0.5-1 mm thick coating of 40% hydrogen peroxide gel (OpalescenceTM boostTM PF 40 percent, Ultradent Products, Inc., South Jordan, UT, USA) was administered on the labial surfaces of the teeth after mixing both syringes. After 20 minutes, the gel was removed using suction tip. A total of three application were performed with a total duration of 60 minutes in a single visit. At the end of bleaching procedure, teeth were rinsed and cleaned with copious amount of water and the gingival barrier was removed by a probe. Abrasive discs were used to polish teeth and potassium nitrate desensitizing gel (UltraEZ™, Ultradent products, Inc., South Jordan, UT, USA) was applied for 5 minutes.[4]

II.2 Enamel microabrasion procedure

A rubber dam was used to isolate teeth and floss ligatures were placed around each tooth to displace rubber dam apically and to have better access. A 1 mm thick layer of an approximately 3x3 mm of 6.6% hydrochloric slurry with silicon carbide microparticles (Opalustre™, Ultradent Products, Inc., South Jordan, UT, USA) was placed on the labial surfaces of fluorosed teeth. Using rubber prophycups (Opalcups™, Ultradent Products, Inc.) attached to gear-reduction contra-angel handpiece, these surfaces were microabraded with slight pressure for 20 seconds by the same operator. After each application teeth were rinsed with water spray and checked for improvement. For mild and moderate lesions, this technique could be repeated up to five times in the same session until there was no additional improvement between two successive applications. Potassium nitrate gel (UltraEZ™, Ultradent products, Inc., South Jordan, UT, USA) was applied for 5 minutes.[5]

II.3 Remineralization procedure

In protocols using remineralizing agent, participants were instructed to apply a pea-sized amount of Casein phosphopeptide amorphous calcium fluoride phosphate crème (MI-Paste Plus®, GC America Inc., USA) on labial surfaces of fluorosed teeth using cotton swap or clean finger and left undisturbed for 5 minutes at night and after brushing their teeth for 4 weeks starting at the same night after treatment session. After using the paste, the participants were instructed to spit instead of swallowing or rinsing their teeth.[6]

III. Patient satisfaction evaluation

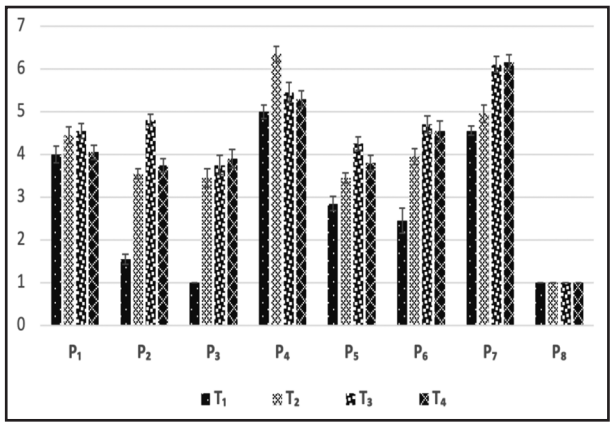
Participants were asked to score for "patient satisfaction" with the use of a visual analogue scale (VAS) ranging from 1 to 7 where "1,2" not satisfied, "3,4" slightly satisfied, "5,6" moderately satisfied and "7" very satisfied. Recordings were taken immediately after application (T_1), 14 days later (T_2), 3 months later (T_3), and 6 months later (T_4) as shown in table (1).

IV. Statistical analysis

Using Microsoft Excel 2016, data was collected, checked, edited, and organized in tables and figures. Data were checked for normality using Kolmogorov-Smirnov at 0.05. Data analyses were carried out using computer software statistical package for social science SPSS (IBM-SPSS ver. 23.0 for Mac OS) using ANOVA with repeated measures or corresponding nonparametric analyses at significance levels of 0.05. Duncan multiple range tests (DMRTs) were used to compare groups.

Table (1) *Visual Analog Scale System (VAS)*

Visual Analog Scale (VAS)						
Improvement in appearance						
No improvement		Slight		Moderate		Exceptional Improvement
1	2	3	4	5	6	7
Changes in opaque white/brown areas						
Not at all		Slight		Moderate		Totally removed/ disappeared
1	2	3	4	5	6	7
Tooth sensitivity						
No side effects		Slight		Moderate		Severe
1	2	3	4	5	6	7
Patient satisfaction						
Not satisfied		Slight		Moderate		Very satisfied
1	2	3	4	5	6	7
Requirements for further treatments						
No need		May need		Need		
0		1		2		



Graph (1): Patient satisfaction of different treatment protocols at different time points

The "patient satisfaction" mean values of different treatment protocols (P1-P8) at different time points (T1-T4). Differences were assessed using Kruskal-Wallis, and Friedman's test. Data represented as mean ± SD standard deviation, error bars represent the standard deviation.

RESULTS

The change in **"**patient satisfaction**"** following various treatment protocols (**P_1-P_8**) and time points (**T_1-T_4**) was assessed by a two-way analysis of variance for the ranked data (table-2). Two-way ANOVA revealed that protocols and time induced highly significant changes in **"**patient satisfaction**",** and the interaction between protocols **(P_1-P_8)** and time **(T_1-T_4)** was highly significant ($p \leq 0.001$***). Differences were assessed using Kruskal-Wallis, and Friedman's test. Data represented as mean ± SD standard deviation. Means followed by **different letters** within the same column (**vertically**) are significantly different. However, means followed by **different numbers** within the same row (**horizontal**) are significantly different according to Bonferroni at 0.05.

Table (2)*Two way ANOVA followed by post hoc test for patient satisfaction mean values of different treatment protocols at different time points*

Protocol \ Time	T_1	T_2	T_3	T_4	Sign.
P_1	4.00^{B2} ±0.19	4.45^{BC1} ±0.20	4.55^{C1} ±0.17	4.05^{CD2} ±0.17	≤0.001***
P_2	1.55^{D3} ±0.11	3.55^{D2} ±0.11	4.80^{BC1} ±0.14	3.75^{D2} ±0.16	≤0.001***
P_3	1.00^{D2} ±0.00	3.45^{D1} ±0.22	3.75^{D1} ±0.23	3.90^{CD1} ±0.22	≤0.001***
P_4	5.00^{A2} ±0.16	6.35^{A1} ±0.17	5.45^{AB2} ±0.23	5.30^{B2} ±0.18	≤0.001***
P_5	2.85^{C3} ±0.17	3.45^{D2} ±0.11	4.25^{CD1} ±0.16	3.80^{CD12} ±0.17	≤0.001***
P_6	2.45^{C2} ±0.29	3.95^{CD1} ±0.18	4.70^{BC1} ±0.19	4.55^{BC1} ±0.23	≤0.001***
P_7	4.55^{AB2} ±0.11	4.95^{B2} ±0.21	6.10^{A1} ±0.18	6.15^{A1} ±0.17	≤0.001***
P_8	1.00^{D1} ±0.00	1.00^{E1} ±0.00	1.00^{E1} ±0.00	1.00^{E1} ±0.00	>0.05 ns
Sign.	≤0.001***	≤0.001***	≤0.001***	≤0.001***	

"patient satisfaction"	2-way ANOVA		
Source	df	F-ratio	Sig.
Corrected Model	31	86.4	≤0.001***
Protocol (P)	7	290.1	≤0.001***
Time (T)	3	125.9	≤0.001***
Protocols x Time (P x T)	21	12.9	≤0.001***

significant at p≤0.05; **, * highly significant at p≤0.010, 0.001, non-significant at p>0.05*

Means followed **by different letters** *within the same column (***vertically***) are significantly different. however, means followed by* **different numbers** *within the same row (***horizontal***) are significantly different according to Bonferroni at 0.05.*

In Accordance to Time

Immediately after application (T_1):

The highest "patient satisfaction" mean values were recorded in P_4, P_7 followed by P_1, P_5 and P_6 respectively. There was a significant difference ($p \leq 0.05$) between P_7,P_4 and all other treatment protocols. Also, P_1 mean value was significantly different ($p \leq 0.05$) from P_5, P_6, P_8, P_3 and P_2. The lowest "patient satisfaction" mean values were recorded in P_8, P_3 and P_2 that were significant from other protocols ($p \leq 0.05$).

After 14 days (T_2)

The highest "patient satisfaction" mean values were recorded in P_4 followed by P_7, P_1, P_6, P_2, P_5 and P_3 respectively. There was a significant difference ($p \leq 0.05$) between P_4 and all other protocols. Also, P_7,P_1 mean values were significantly different ($p \leq 0.05$) from P_6, P_2,P_5.P_3 and P_8. The lowest "patient satisfaction" mean value was recorded in P_8 that was significant from other protocols ($p \leq 0.05$).

After 3 months (T_3)

The highest "patient satisfaction" mean values were recorded in P_7 followed by P_4, P_2, P_6, P_1, P_5 and P_3 respectively. There was a significant difference ($p \leq 0.05$) between P_7 and all other protocols. Also, P_4,P_2 and P_6 mean values were significantly different from P_1,P_5,P_3 and P_8. Besides, P_1 and P_5 mean values were significantly different ($p \leq 0.05$) from P_3 and P_8. The lowest "patient satisfaction" mean value was recorded P_8 that was significant from other protocols ($p \leq 0.05$).

After 6 months (T_4)

The highest "patient satisfaction" mean values were recorded in P_7 followed by P_4, P_6, P_1, P_3, P_5 and P_2 respectively. There was a significant difference ($p \leq 0.05$) between P_7 and all other protocols. Also, P_4 mean value was significantly different ($p \leq 0.05$) from P_6, P_1, P_3, P_5 , P_2 and P_8. Besides P_6, P_1 mean values were significantly different ($p \leq 0.05$) from P_3, P_5 , P_2 and P_8. The lowest "patient satisfaction" mean value was recorded in P_8 that was significant from other protocols ($p \leq 0.05$).

In Accordance to Protocol

Protocol 1 Bleaching (P_1):

The highest "patient satisfaction" mean values were recorded at T_3 and T_2 with no significant difference ($P > 0.05$) between them. T_3, T_2 mean values were significantly different ($p \leq 0.05$) from T_4 , T_1. The lowest "patient satisfaction" mean values were recorded at T_4 and T_1 with no significant difference ($P > 0.05$) between them.

Protocol 2 Microabrasion (P_2):

The highest "patient satisfaction" mean values were recorded at T_3 followed by T_4 and T_2. T_3 mean value was a significantly different ($p \leq 0.05$) from T_4 , T_2 and T_1. The lowest "patient satisfaction" mean value was recorded at T_1 that was significant from other time points ($p \leq 0.05$).

Protocol 3 Remineralization (P_3):

The highest "patient satisfaction" mean values were recorded at T_4, T_3 and T_2 respectively with no significant difference ($P > 0.05$) between them. The lowest "patient satisfaction" mean value was recorded at T_1 that was significant from other time points ($p \leq 0.05$).

Protocol 4 Microabrasion and bleaching (P_4):

The highest "patient satisfaction" mean values were recorded at T_2 that was significantly different

($p \leq 0.05$) from other time points. The lowest "patient satisfaction" mean values were recorded at T_3, T_4 and T_1 respectively with no significant difference ($P > 0.05$) between them.

Protocol 5 Bleaching and remineralization (P_5):

The highest "patient satisfaction" mean values were recorded at T_3 followed by T_4 and T_2. T_3 mean value was significantly different ($p \leq 0.05$) from T_4 and T_2. There was no significant difference ($P > 0.05$) between T_4 and T_2. The lowest "patient satisfaction" mean value was recorded at T_1 that was significant from other time points ($p \leq 0.05$).

Protocol 6 Microabrasion and remineralization (P_6):

The highest "patient satisfaction" mean values were recorded at T_3, T_4 and T_2 respectively with no significant difference ($P > 0.05$) between them. The lowest "patient satisfaction" mean value was recorded at T_1 that was significant from other time points ($p \leq 0.05$).

Protocol 7 Microabrasion, bleaching and remineralization (P_7):

The highest "patient satisfaction" mean values were recorded at T_4 and T_3 with no significant difference ($P > 0.05$) between them. T_4 and T_3 mean values were significantly different ($p \leq 0.05$) from T_1 and T_2. The lowest "patient satisfaction" mean value was recorded at T_1 and T_2 with no significant difference was recorded ($P > 0.05$) between them.

Protocol 8 Control (P_8):

The lowest "patient satisfaction" mean values were recorded at all time points with no significant difference ($P > 0.05$) between them.

DISCUSSION

Dental fluorosis is a chronic condition of hypomineralization, where enamel development is disturbed by high levels of fluoride.[7] The earliest sign in mild cases of dental fluorosis is thin white opaque lines extending through perikymata caused by increased subsurface porosity. While in moderate cases chalky white appearance may extend through the entire tooth with lose of transparency.[8]

In-office bleaching can remove brown or yellow stains present intrinsically or extrinsically through oxidizing the strongly pigmented double-bond carbon ring compounds (chromophores) into colorless hydroxyl groups.[9] Enamel microabrasion removes the outer 25-200μ of surface enamel, thus it may be effective in removing superficial white opacities or brown stains.[10] Remineralization of enamel subsurface porosities of fluorosis using CPP-ACFP provides higher reservoir of bioavailable calcium, phosphates and fluorides ions that precipitates newly formed crystals in subsurface porosities.[11]

Although visual analog scale (VAS) records are influenced by participants' perceptions and choices, it remains the most common qualitative method used to evaluate the efficiency of dental fluorosis treatment protocols on esthetic improvement and patient satisfaction in most trials.[12,13]

Slight and moderate patient satisfaction were observed in all treatment protocols other than control group. The highest satisfaction was recorded in treatment protocols of combining microabrasion and in-office bleaching regardless of using CPP-ACFP. Slight patient satisfaction was noticed in all other treatment protocols.

Slight patient satisfaction was observed in protocol of applying CPP-ACFP only on mild and moderate fluorosed teeth. This may be due to the

limited penetration of CPP-ACFP into subsurface enamel porosities, even in mild lesions which were not fully recovered and still have different surface morphology than sound enamel after 3 months of remineralization by CPP-ACP.

These results came in agreement with **Dai. *et al*,** who found that even mild lesions weren't fully recovered and still have different surface morphology than sound enamel after 3 months of remineralizing by CPP-ACP. [14] Our results came in disagreement with **Farzanegan. *et al*,** who found that no significant difference in color improvement of white spot lesions between sodium fluoride and ACP.[15] This conflict might have resulted from application of ACP as mouthwash lacking casein, so the reaction was undermined by the rapid formation of calcium phosphate phase rather than diffusion into subsurface lesion when stabilized by casein.

Similarly, slight patient satisfaction was recognized after in-office bleaching or combined protocol of in-office bleaching and CPP-ACFP with no difference between them. Although in-office bleaching was effective in masking very mild and mild opacities, in moderate non-pitted forms, masking of underlying white blemishes wasn't satisfactory even after yellow and brown stains were removed. Also, neutral in-office bleaching didn't enhance penetration of CPP-ACFP into subsurface porosities.

Our results were in accordance with, **Shanbhag. *et al*,** and **Gugnani. *et al*,** who reported that in-office bleaching seemed to be very effective in very mild and mild forms of fluorosis. Although in moderate non-pitted forms yellow and brown stains were removed, masking of underlying white blemishes wasn't satisfactory. [1,12] Also, in accordance with, **Kutuk. *et al*,** who informed that the use of CPP-ACP desensitizing agents restored enamel microhardness, but it did not affect bleaching efficiency.[16] Our results were in discordance with, **Horning. *et al*,** who testified that the use of bleaching agent increased enamel permeability, regardless of the bleaching technique. [17] This conflict may be a result of the difference in materials used. In their study, they used bleaching products with acidic pH, whereas in our study we used a neutral bleaching product.

Higher satisfaction was recorded by patients treated with microabrasion at 3 months that may be attributed to the mechanism of microabrasion as it removes superficial enamel opacities and allows for subsurface porosities remineralization, despite that patient satisfaction withdrawn at 6 months. On combining microabrasion and CPP-ACFP patient satisfaction was preserved at 6 months without relapse and that may result from the superiority of CPP-ACFP in remineralization of subsurface porosities over natural saliva and color improvement increased with time after microabrasion and CPP-ACP.

Our results were in consonance with, **Celik. *et al*,** who found that the severity of fluorosis affected the clinical performance of microabrasion except for removing brown opacities, thus it may become difficult to remove all opacities in moderate cases of fluorosis with no additional treatment.[18] Also, in consonance with, **Gençer and Kirzioğlu,** who stated that color improvement increased with time after treatment with microabrasion and CPP-ACP and no difference was detected during the 3rd and 6th months follow-up.[19] Our results were in dissonance with, **Hasija. *et al*,** who described that microabrasion was effective for all severities of dental fluorosis. This conflict may be a result of using different materials, as in their study they used prepared pastes of higher hydrochloric acid concentration 18% HCL and pumice with the same duration and number of applications as 6.6% HCL and pumice microabrasive types. [20]

Combined protocols of microabrasion and in-office bleaching regardless of using CPP-ACFP recorded moderate patient satisfaction which was the highest on comparing to the other protocols. This may be explained by the whitening effect of in-office bleaching in giving uniform tooth color and masking deep enamel opacities of moderate fluorosis after removal of superficial enamel by microabrasion until remineralization of these deep opacities occurs. As a result of the limited diffusion of natural saliva minerals to the depth of enamel opacities, relapse in patient satisfaction was noted at 3 and 6 months follow-up when the whitening effect of in-office bleaching withdrawn and little less pronounced white line opacities reappeared on the surface of few moderate fluorosed teeth. Whereas patient satisfaction lasts till the end of the study on combining microabrasion, in-office bleaching and CPP-ACFP.

These results came in confirming to **Baltacioglu and Muduroglu,** who reported that the combination of microabrasion and bleaching procedure provided faster non-invasive results alternative to veneers in treatment of moderate fluorosed teeth and the patients were highly satisfied after all steps. [21] The limitation of this study is that they didn't record long-term stability of results. Also, in confirming to **Yildiz and Celik,** who found that the clinical appearance and patient satisfaction was high even in two years follow-up study of combining microabrasion and in-office bleaching with the use of CPP-ACFP for 3 months post-treatment. They suggested that combined protocol of microabrasion and in-office bleaching should be considered as the first treatment option of not only mild and moderate fluorosis but severe fluorosis as well. [22] These results came in disconfirming to **Gupta. *et al*,** who informed that in-office bleaching with 35% H_2O_2 and combined protocol of microabrasion followed by bleaching were equally effective in treatment of mild and moderate fluorosis. This conflict could have resulted from differences in methodology, in their study the bleaching gel was activated with a light-emitting diode during treatment session. [23]

The null hypothesis of the present study was rejected as it was found that patient satisfaction achieved after combination treatment protocols of microabrasion and in-office bleaching regardless using CPP-ACFP was the highest on comparing to other treatment protocols.

CONCLUSION

The combined treatment protocol of Opalustre™ and Opalescence™ boost™ PF 40% has the highest patient satisfaction in treating mild to moderate fluorosed teeth regardless of using MI-Paste Plus®. Whereas, Using MI-Paste Plus® provides stability of patient satisfaction at 6 months' follow-up.

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