

Vital Tooth Bleaching and Management of Post Operative Sensitivity: A Clinical Trial Evaluating the Efficacy of Different Desensitizing Materials

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ABSTRACT

Aim: To assess the efficacy of three desensitizing agents i.e., 5% sodium fluoride (NaF), 5% potassium nitrate (KNO₃) and casein phosphopeptide amorphous calcium phosphate (CPP-ACP) in reducing the post operative sensitivity after in-office vital tooth bleaching.

Methods: The cross-sectional study was conducted at Department of Operative Dentistry, Dental Section, Punjab Medical College, Faisalabad from 1st January 2016 to 30th June 2016. Thirty patients were selected as candidate for vital bleaching having mild to moderate fluorosis according to Deans' index criteria. These patients were categorized into three groups. After an in-office bleaching the first group was treated with Casein phosphopeptide amorphous calcium phosphate (CPP-ACP), the second group was treated with 5% Sodium Fluoride (NaF) varnish and the third one with 5% Potassium Nitrate (KNO₃) on the anterior teeth after being subjected to vital bleaching. The applications of desensitizing agents were continued after 10 days interval i.e. three times a month. The sensitivity was checked on alternating days using visual analogue scale (VAS) for up to one month. The mean was taken to evaluate the final results.

Results: The result is significant at p value <0.05. So the null hypothesis is rejected. There is difference in the efficacy among the three applied desensitizing agents.

Conclusion: CPP-ACP is more effective in reducing the sensitivity and the other two materials are having nearly the same efficacy.

Keywords: Casein phosphopeptide amorphous calcium phosphate, Fluoride, Potassium nitrate,

INTRODUCTION

The word aesthetics has been derived from the Greek. The term aesthetics was groomed with new meanings by the German philosopher Alexander Baumgarten in his dissertation. Viewer interpretation of beauty may occasionally be observed as taste. In dentistry the basic theme of conservation revolves mainly around the aesthetics. Tooth discoloration is one of the commonly observed presenting complaints in our society. There are a lot of reasons for this discoloration. The problem of tooth discoloration in fact may have a significant impact in one's personality. However the whiter teeth are always preferred and liked by majority of the patients despite certain variations of shades of teeth that may suit different people in a different way. The anterior teeth are usually visible during talking and smiling. Therefore these teeth are the main priority of the patients with discolored teeth to get whitened at earliest. Certain treatment modalities are available to correct the shades of discolored teeth. One of them is termed as "vital tooth bleaching". This whitening

system consists of an "in-office bleaching" and "at home bleaching"¹⁻³.

The in-office technique utilizes the hydrogen peroxide gel in range of 35%-37%. While in "at home bleaching" carbamide peroxide is used by the patients in the special trays kept in mouth over night. Whatsoever the treatment is applied; the post operated sensitivity is one of the crucial problems associated with the vital teeth bleaching. Sometimes this sensitivity may be of such a high intensity that the patient breaks the periodical regime of the bleaching⁴. Therefore, the clinician tries to treat the sensitivity at the drop of a hat. The bleaching agents cause softening of the teeth creating the micro porosities. The surface of the enamel is also altered in this way. The prevalence of sensitivity after vital tooth bleaching ranges from 18% to 78%. This may be due to small enamel defects and porosities^{1,2}.

According to American Dental Association (ADA) the bleaching is defined as a treatment involving an oxidative chemical that increases the value of teeth by altering the light reflection/absorbing of the tooth structure².

There are a number of techniques employed to minimize the sensitivity including lowering the time of the bleaching material applied and decreasing the frequency of light exposure.^{5,6} In addition, decreased concentration of bleaching agent has also been

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employed successfully reducing the sensitivity.⁷ Sometimes the usage of desensitizing materials is ensured before or after the treatment in order to reduce the sensitivity^{8,9}. There is also a frequent regime of bleaching that involves the bleaching agent having the desensitizing agents present in them.¹⁰ Casein phosphopeptide amorphous calcium phosphate (CPP-ACP) is a recently developed material related to decrease the sensitivity after vital tooth bleaching. 5% NaF (Sodium Fluoride) varnish and 5% Potassium nitrate have also good results in reducing the sensitivity. In this study these three materials were used after in-office vital tooth bleaching. The null hypothesis states that there is no difference in sensitivity reduction among these three materials. The further analysis highlights the efficacy among the three materials.

MATERIALS AND METHODS

The cross-sectional study was conducted at Department of Operative Dentistry, Dental Section, Punjab Medical College, Faisalabad from 1st January 2016 to 30th June 2016. A total 30 patients were recruited for this study between the ages of 25 to 30 years. 22 patients were females and 8 were males. These patients had fluorosis and were classified according to Dean's index as having mild to moderate type of fluorosis. Only the anterior teeth of patients were selected to be bleached. The patients were grouped into three categories. One group received the CPP-ACP treatment and in the other two groups 5% NaF varnish and 5% KNO₃ were applied respectively. All the materials were applied according to manufacturer's instructions after being subjected to the regime of an in-office vital tooth bleaching system.

Everbrite (Dentamerica, 35% hydrogen peroxide) was used. The patients were then exposed to light curing system for tooth whitening. The isolation was achieved with the liquid rubber dam provided along the kit. Three light exposure applications were applied with each having 15 minutes. After the exposure of light, the teeth under consideration were then cleaned and were followed by application of desensitizing agents i.e. CPP-ACP, NaF varnish and KNO₃ according to the group categories. The desensitizing material was applied for 20 minutes and then scrubbed and washed. The same procedure of applying the desensitizing agent was repeated after 10 days. The intensity of the sensitivity was evaluated by the Visual analogue scale (VAS) on alternating days for one month and average score was taken. The mean score of three trials was subjected to multivariate analysis of variance to determine the efficacy. The evaluation was performed according to ADA guidelines.¹¹ Data

management and analysis was performed using SPSS 16.

RESULTS

The F-statistic ratio is 16.78088 which is greater than the critical value i.e., 3.3541. So the null hypothesis (H₀) is rejected. The p-value is 0.000018 which is less than 0.05. The result is significant at $p < 0.05$ (Table 1).

DISCUSSION

Tooth discoloration is a common phenomena present in our population. A number of reasons have been reported for this discoloration. One of them is Dental Fluorosis. Fluorosis is a developmental defect of the teeth that result from the increased levels of fluoride (more than 2ppm) exposure to the teeth during developmental stages. Mostly this is due to the high concentration of fluoride in the drinking water of a specific area. Depending upon the nature and type of fluorosis, certain restorative techniques have been developed to overcome this anomaly. In case of mild to moderate discoloration, bleaching of teeth gives best results improving the aesthetics. It has been observed clinically that vital tooth bleaching make teeth sensitive. This sensitivity is sometime so intense that patient is unable to continue further applications of the bleaching procedure. In this study we used three different desensitizing agents after the vital tooth bleaching.

Several studies have been carried out on postoperative sensitivity after vital tooth bleaching. CPP-ACP is a remineralizing agent. It is easy to use and may be applied either by the patient or by the professional^{12,13} and also it has the potential to reverse the caries. It is applied topically on the teeth surface. This makes teeth less sensitive. It acts by binding to the protein and deposition of calcium and phosphate ions that block the dentinal tubules. Much of the available literature on CPP-ACP deals with the question of reduction of sensitivity. According to Khoroushi, CPP-ACP has the ability to compensate the loss of flexural strength of enamel and dentine that may occur during the bleaching. It has also been used as combination with the hydrogen peroxide and carbamide peroxide. This combination of CPP-ACP along the bleaching agents has exhibited decreased sensitivity, an investigation done by Gamma.¹⁴ Being a remineralizing agent CPP-ACP interferes the oxidizing molecules penetrating the tooth surface^{15,16}.

According to a study where KNO₃, NaF and CPP-ACP were used after vital tooth bleaching, no significant difference was observed^{10,17,18}. A little clinical research data is available regarding the efficacy of desensitizing agents in reducing the post operative sensitivity after vital tooth bleaching.

Therefore in terms of success ratio in reducing the post operative sensitivity needs further investigation to conclude the material giving the best desired output. Traditionally it has been argued that fluoride can be used as treatment of sensitivity. During past 30 years much information has been gathered about the role of fluoride in dental health. The fluoride is incorporated into the enamel and makes fluorapatite crystallites. These crystallites are even stronger and resistant to caries. The mechanism involved is the blocking or occlusion of the dentinal tubules. This blockage reduces the dentinal permeability and hence the sensitivity. Due to the bleaching some micro porosities are created into the tooth surface. The use of fluoride makes a layer of calcium fluoride that blocks the dentinal permeability. It is available in the form of gel and varnishes. Potassium Nitrate (KNO_3) is also a desensitizing agent that has been

used since long. It is an integral part of many tooth pastes, dentifrices and mouth washes^{6,13}

Peacock et al have observed that K^+ ions concentration above 8mM to 16mM around the axons is required for depolarization.⁵ The combination of KNO_3 and Na-monofluorophosphate has been thought to reduce the sensitivity after in office vital tooth bleaching these days. However, this combination has been given a different result by Silverma et al⁶ concluding that the combination being of no much value in reducing the sensitivity. In our study, the application of 5% KNO_3 for twenty minutes after the bleaching exhibited marked decrease in sensitivity. Haywood et al⁴ were at odds with other researchers^{19,20} and claimed that the topical application of KNO_3 for thirty minutes was equally effective in reducing the sensitivity in nearly 90% of the patients.

Table 1: Statistical analysis for treatments

Treatments Type	CPP-ACP	5% Sodium fluoride	5% Potassium nitrate	Total
Observations N	10	10	10	30
Sum $\sum x_i$	33.0000	51.0000	57.0000	141.0000
Mean \bar{x}	3.3000	5.1000	5.7000	4.70
Sum of squares $\sum x_i^2$	115.0000	275.0000	329.0000	719.0000
Sample variance S^2	0.6778	1.6556	0.4556	1.9414
Sample Std. Dev S	0.8233	1.2867	0.6749	1.3933
Std. dev. of mean	0.2603	0.4069	0.2134	0.2544

Analysis of Variance (ANOVA)

Groups	Sum of squares	Degrees of freedom	Mean square	F statistic	P Value
Treatment	31.2000	2	15.6000	16.7809	< 0.05
Error	25.1000	27	0.9296		
Total	56.3000	29			

CONCLUSION

Desensitizing agents exhibit marked reduction in sensitivity after vital tooth bleaching. It has conclusively been shown that CPP-ACP exhibit pronounced reduction in sensitivity after vital tooth bleaching. The other two materials also showed good significance but with minor difference in between them. In term of efficacy, there is no significant difference between sodium fluoride varnish and potassium nitrate application. In future, it might be possible to use a different innovative material regarding the postoperative sensitivity. Nevertheless, till now, we should prefer what is best and having up to the mark efficacy.

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