

**Comparison of two different materials in the treatment of enamel hypoplasia with minimal invasive technique-an in vivo study**

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**Conflicts of Interest:** Nil

**Abstract**

**Context:** In this era of minimum invasive dentistry and regenerative procedures, remineralization of teeth shows promising results.

**Aims:** To compare the remineralization efficacy of two remineralizing pastes namely Clinpro and GC tooth mousse in the treatment of hypoplastic enamel after in office bleaching.

**Methods and Material:** 20 patients with discolored, defective enamel were randomly divided into two groups- Group I, (Clinpro) and Group II (GC tooth mousse) and treated with in office bleaching. Pre and post bleaching shades for every patient was recorded with the help of tooth color comparator.

All teeth in both the experimental groups were measured pre and post treatment with prepometer to quantify the thickness of each tooth. The remineralizing pastes were

applied on the labial surface of the experimental teeth, followed by weekly interval for a period of 3 months. All patients were evaluated after 3 months and shades of the teeth were recorded with tooth color comparator for comparison with the shades recorded before remineralization procedures. The thickness of the tooth after remineralization was subjected to measurement with prepometer for comparative evaluation. Data was analyzed using SPSS version 15.0.

**Results:** The differences observed between groups were found to be statically significant ( $P = 0.029$ ) between group I & group II.

**Conclusions:** Clinpro when compared with GC tooth mousse in this study was found to be more effective in remineralization of enamel or dentine after in office bleaching.

**Keywords:** Enamel Hypoplasia, Bleaching, Remineralization, Fluoride

## Introduction

Modern dentistry has recognized esthetics and the emotional and psychological effect of improving cosmetic appearance as an integral part of dental health care. Various etiological or developmental defects that call for immediate esthetic concern and needful treatment include various tooth discolorations. Among all the discolorations, enamel hypoplasia is one of the most prevalent and severe form affecting the permanent dentition which compromises the esthetics of the patient. Enamel hypoplasia is defined as a deficiency in enamel thickness resulting from a disruption in the matrix apposition stage of tooth enamel development.<sup>1</sup>

A variable treatment option in contemporary dental practice for enamel hypoplasia depends on its type and involvement of the dental tissues, which are laminates, veneers, full crown etc.

Remineralization of defective dental tissue is being achieved with the help of different agents or techniques. Recently various agents have been in use to promote remineralization like Tooth Mousse (GC) with CCP-ACP and ClinPro (3M ESPE) 0.21% w/w sodium fluoride anti-cavity paste containing 950 ppm fluoride and functionalised tri-calcium phosphate ingredient (fTCP).

Available literature in the field of esthetic dentistry lacks evidence based post bleaching (in office) remineralization effect of remineralizing agents on discolored teeth with defects like enamel hypoplasia. Hence the present study aimed to evaluate the post bleaching (in office) remineralizing effect of two remineralizing agents i.e. Clinpro and GC tooth mousse on discolored and hypoplastic teeth.

## Material and Method

In this study 20 patients having permanent dentition with discoloured teeth, mild fluorosis and mild hypoplasia were selected. The patients were randomly divided into two groups after obtaining consent, 10 patients to be treated with Clinpro and 10 patients to be treated with GC tooth mousse.

### Pre treatment preparation

All patients were treated with routine oral prophylaxis with the help of ultrasonic scaler. Impressions of upper and lower arch were made. Spacer was given on the labial surface of the teeth in the model to provide space for remineralizing paste. Custom trays were fabricated with polyvinyl sheet in a vaccum press machine and adjusted 1 mm short from free gingival margin.

Pretreatment shade was recorded with the help of tooth color comparator in all the patients for both maxillary and mandibular teeth starting from right cuspid to left cuspid. Preoperative photographs of the teeth involved were recorded for every patient.

### Bleaching protocol

Bleaching was done with Pola office kit in all patients. Gum paste was applied and polymerized on gingival tissue to prevent injuries from bleaching agent. Bleaching agent was applied on the labial surface of the teeth, was activated by LED bleaching system teeth whitening machine and rinsed properly with water. Bleaching procedure was repeated until the desired shade was obtained. Shade was recorded by tooth color comparator which was compared with previously recorded preoperative shade.

### Pretreatment measurement of thickness of tooth

Prepometer was used for the determination of thickness of dental tissue. The tooth to be measured with prepometer was air dried and a marked with pencil on incisal 1/3<sup>rd</sup> of the labial surface. The tip of measuring electrode was

briefly dipped into physiological saline solution. The reference electrode was fixed to the lower lip and connected to Prepometer. The adjacent gingival tissues were briefly touched with the measuring electrode in order to check the electric circuit. Measurements were recorded as per the diode number displayed on measuring device for each involved tooth.

#### **Clinical procedure for application of remineralizing pastes**

Clinpro was applied in two phases. In the first phase the specific paste was applied with the help of applicator on the labial surface of the teeth for three minutes and rinsed off with water. In the second phase paste was loaded in the reservoirs created on the tray and the trays were inserted in the patient mouth and kept for 5 minutes and rinsed with water. Patients were recalled after a week interval and the same treatment was repeated for a period of 3 months. Instructions were given to the patients to use remineralizing paste with a soft brush three times in a interval of eight hours and not to consume any beverage during the treatment phase. GC Tooth mousse was applied in two phases following the same procedure as Clinpro.

#### **Post treatment shade selection and measurement of tooth thickness**

In both the groups, Post treatment shade for every patient was recorded with digital shade guide. Prepometer was used to measure the thickness of tooth after remineralization as it was done in pre treatment phase for all the patients. Post treatment photographs of the teeth involved were recorded for every patient. [Fig 1 & 2]

All the recorded measurement for shade and tooth thickness (pre treatment & post treatment) were tabulated and statistically analyzed for intra and inter group comparison.

#### **Result**

Assessment of efficacy of two materials was done on the basis of their effect on dentine thickness and shade of the samples.

Before treatment mean rank order of shade in Group I was  $11.70 \pm 2.06$  (range 9 to 15) which dropped down to  $3.20 \pm 2.20$  (range 1 to 6) after treatment. On comparing the change statistically, it was found to be significant ( $p=0.005$ ).

Before treatment mean rank order of shade in Group II was  $10.90 \pm 2.47$  (range 7 to 15) which dropped down to  $6.20 \pm 2.39$  (range 3 to 19) after treatment. On comparing the change statistically, it was found to be significant ( $p=0.005$ ).

Before treatment mean rank order of dentine thickness in Group I was  $2.90 \pm 0.74$  (range 2 to 4) which dropped down to  $1.40 \pm 0.52$  (range 1 to 2) after treatment. On comparing the change statistically, it was found to be significant ( $p=0.007$ ).

Before treatment mean rank order of shade in Group II was  $2.80 \pm 0.79$  (range 2 to 4) which dropped down to  $2.30 \pm 0.67$  (range 1 to 3) after treatment. On comparing the change statistically, it was found to be significant ( $p=0.026$ ).

The results obtained in this study showed better efficacy of Clinpro (group I) (mean  $3.20 \pm 2.20$ ) compared to GC tooth mousse (group II) (mean  $6.20 \pm 2.30$ ).

#### **Discussion**

In this study 20 patients having permanent dentition with tooth discoloration, mild fluorosis and mild hypoplasia were selected. Defects have been recorded on the anterior dentition as they are easy to examine and characterized by a relatively high defect frequency.<sup>1</sup> Therefore, in the present study we targeted teeth in the anterior segment. Hargreaves *et al.* found that maxillary central incisors showed the most enamel defects.<sup>2</sup> Thus, anterior teeth,

which are developing during periods in which host resistance is low and environmental insults are great, are more likely to be hypoplastic.<sup>2</sup>

One of the most clinically accepted treatment method for discoloured teeth due to developmental defects or fluorosis is bleaching of the teeth. In office bleaching is time tested and highly successful clinical strategy for such type of tooth discoloration. Tooth sensitivity is one of the frequently reported problems after in office vital bleaching. To overcome this problem of sensitivity various desensitizing pastes are routinely used. But use of a remineralizing paste to enhance the mineralization will be of more importance to substantially reduce this problem.

In the present study, pre and post bleaching shades as well as post remineralization shades of all experimental groups were determined with the help of tooth color comparator according to the study done by McLaren et al.<sup>3</sup> Shade recording was done by two observers to avoid the bias. Shade evaluation was carried out at baseline and after completion of bleaching and remineralization treatment was performed.

It was hypothesized that the bleaching effect is a result of the degradation of complex organic molecules responsible for the discoloured teeth to the less complex molecules that results in reduction or complete elimination of discoloration.<sup>6</sup> In this present study, the change in the shade may be co-related to changes in refractive values. Spitzer and Ten Bosch showed that this phenomenon remains nearly constant between blue and red light for the refractive index of enamel.<sup>6</sup> The coloring pigments within an object will absorb various wavelengths of the light, allowing other wavelengths of light to scatter out of the object.<sup>7</sup> This selective wavelength absorption is the primary source of color.<sup>8</sup> Since blue-green lights are absorbed by yellowish chromogens inside the enamel as a

result of this complementary color relationship, the reflectance in these wavelengths is lower at unbleached teeth.

The use of fluorides following bleaching had shown to restore the surface hardness of softened, bleached enamel.<sup>9</sup> In addition, the attempt to reduce the demineralization of bleached enamel has been successfully accomplished by means of adding fluorides to bleaching agents.<sup>11</sup> A fluoridated bleaching gel can also reduce the time needed for bleached enamel hardness to recover as compared to unfluoridated gel<sup>12</sup> by means of the fluoridated hydroxyapatite and calcium fluoride formation, which are favorable to the remineralization process of the tooth surface.<sup>13</sup> In the present study, source of fluoride has been Clinpro tooth crème whereas calcium and potassium sources are from both Clinpro and GC tooth mousse therefore no supplementary fluoride therapy was administered to patients.

In the present study, prepometer was used to measure the pre and post remineralization thickness of each involved tooth. Values recorded in the present study can be clinically co-related on the basis of changes in the shades (chroma, hue, and value) after the remineralization and also on the scores changes. Prepometer was used in accordance to the study conducted by Gente *et al.*<sup>14</sup>

Clinpro remineralizing agent contains an innovative functionalized tricalcium phosphate (fTCP) ingredient that, has shown to boost remineralization performance relative to fluoride-only systems. Many studies have shown that combinations of calcium and fluoride can significantly boost remineralization relative to either mineral alone.<sup>22</sup> In the present study, Clinpro showed better results as compared to GC tooth mousse which may be due to f-TCP and its deeper penetration into the subsurface lesion.

TCP has also been considered as one possible means for enhancing levels of calcium in plaque and saliva.<sup>23</sup> According to the manufacturer, this organically modified TCP technology operates best as a remineralizing agent at neutral or slightly alkaline pH which can be appreciated in the results of this present study.<sup>24</sup>

GC tooth mousse, another remineralizing agent was applied in group II patients. It comprises of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) which is a nanocomplex of calcium ions, phosphate ions and hydroxide ions stabilized by casein phosphopeptides. The CPP allows high concentrations of calcium, phosphate and fluoride ions to be stabilized in a metastable solution in a form that is bioavailable for the promotion of remineralization.<sup>25</sup> Remineralization of enamel subsurface lesions involves diffusion of ions through the lesion's surface layer and then deposition of the ions into crystal voids of the demineralized enamel of the lesion. In GC tooth mousse the used nano-sized particles (20 nm in size, with granular dimensions up to 100–150 nm)<sup>26</sup> as well as the calcium arising from storage solution followed a concentration gradient (with the solution higher than the subsurface lesion), thus leading to the remineralizing effect in deeper lesion parts.<sup>21</sup>

It has been proposed that the anticariogenic mechanism of CPP-ACP is due to localization of ACP at the tooth surface which then buffers the free calcium and phosphate ion activities, thereby helping to maintain a state of supersaturation with respect to the enamel, hence, reducing demineralization and promoting remineralization. Various studies have shown that higher concentration of CPP-ACP elicits higher remineralization.<sup>27</sup>

Rose R K investigated the effects of casein phosphopeptides (CPP) in reducing demineralization and enhancing remineralization in tooth enamel by measuring

its effects on calcium diffusion. The study showed that by providing a large number of possible binding sites for calcium, 0.1% CPP-ACP reduces the calcium diffusion coefficient by about 65% at pH 7 and 35% at pH 5. Thus, CPP-ACP provides a large calcium reservoir and reduces the diffusion of free calcium. This is likely to restrict mineral loss during a cariogenic episode and provide a potential source of calcium for subsequent remineralization.<sup>28,29</sup>

In the present study, the change in shade (darker to lighter) after remineralization was directly proportional to the amount of remineralization that can be attributed to the fact that more the mineralization on the tooth surface, maximum is the value of reflectance and changes in optical property.

Within the limitations of the present study like wider range of age distribution among the patients and its related physiologic effect on the tooth structure and selection of variety of etiological factors and subjective variations during home application of the remineralizing pastes, it can be concluded that remineralizing paste like GC tooth mousse and Clinpro is found to be clinically effective in treating enamel defects, discoloured teeth after bleaching procedure.

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## Legends Figure



FIG 1: Pre & post treatment photograph (Group 1- Clinpro)



FIG 2: Pre & post treatment photograph (Group 1-GC Tooth Mousse)