

Original Research

Assessment of remineralization efficacy of different agents on artificially induced white spot lesions in primary teeth

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ABSTRACT:

Background: The present study was to evaluate the remineralization potential of hydroxyapatite (HA), casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACPF) and tricalcium phosphate (FTCP) on artificially induced white spot lesions in primary teeth. **Materials & Methods:** 45 mandibular molars were randomly divided into 3 groups. Each group comprised of 15 teeth. Group I comprised of casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACPF), group II had tricalcium phosphate (FTCP) and group III had hydroxyapatite (HA). DIAGNOdent readings and scanning electron microscope (SEM) energy dispersive X-ray (EDX) analysis were carried out at baseline. **Results:** The mean DIAGNOdent readings at baseline was 3.3, 2.5 and 4.8, post demineralization reading was 10.9, 11.5 and 10.3 and post- remineralization was 5.0, 4.8 and 4.4 in group I, II and III respectively. The difference was significant ($P < 0.05$). **Conclusion:** Remineralization efficacy of casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACPF), tricalcium phosphate (FTCP) and hydroxyapatite (HA) on artificially induced white spot lesions in primary teeth were comparable.

Key words: DIAGNOdent, Tricalcium phosphate, White spots.

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INTRODUCTION

Enamel white spot lesions are the earliest macroscopic evidence of enamel caries in which the enamel surface layer stays intact during subsurface demineralization, but without any intervention, cavitation will take place.¹ In the first stage of enamel demineralization, removal of interprismatic mineral content takes place subsequently followed by a well-defined surface layer formation that constitutes an early carious lesion. The progression of the early enamel lesion is a slow process, and this early lesion is reversible through the process of remineralization (RML).² Chemical demineralization of teeth is caused by acidic attack through two primary means: dietary acid consumed through food or drink/drugs and microbial attack from bacteria present in the mouth.² During an acidic attack, or a typical demineralization regime, chemical dissolution of both the organic and inorganic matrix components takes place.³ Enamel of primary

teeth is less mineralized, exhibits a greater diffusion coefficient, and consequently more susceptible to acid dissolution compared to enamel of permanent teeth.⁴ Early childhood caries which affects the primary dentition frequently manifests as white spot lesions, and aggressive preventive therapy for remineralization of these lesions is essential for their reversal.⁵ The present study was conducted to assess the remineralization efficacy of casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACPF), tricalcium phosphate (FTCP) and hydroxyapatite (HA) on artificially induced white spot lesions in primary teeth.

MATERIALS & METHODS

This study was conducted among 45 mandibular molars of both genders in pedodontics department. Institutional ethical committee approved the study.

Teeth were randomly divided into 3 groups. Each group comprised of 15 teeth. Group I comprised of casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACPF), group II had tricalcium phosphate (FTCP) and group III had hydroxyapatite (HA). DIAGNOdent readings and scanning electron

microscope (SEM) energy dispersive X-ray (EDX) analysis were carried out at baseline. The samples were subjected to the test agents after inducing white spot lesions. Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Distribution of samples

Groups	Group I	Group II	Group III
Material	CPP-ACPF	FTCP	Nano-HA
Number	15	15	15

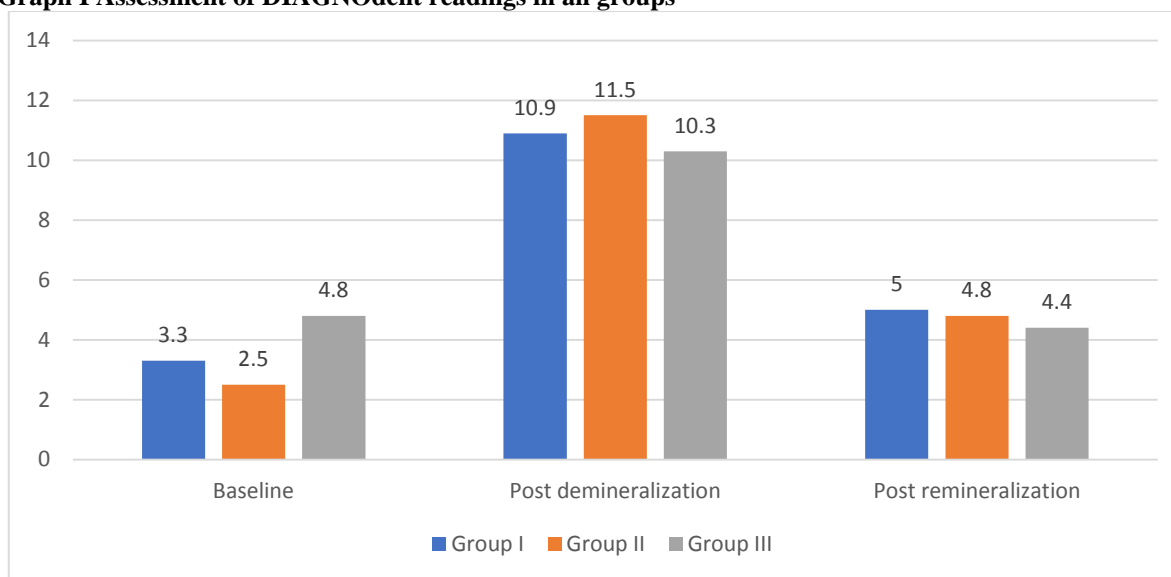
Table I shows distribution of teeth in group I, II and III based on remineralizing agents used. Each group had 15 teeth.

Table II Assessment of DIAGNOdent readings in all groups

Groups	Baseline	Post demineralization	Post remineralization	P value
Group I	3.3	10.9	5.0	0.03
Group II	2.5	11.5	4.8	0.01
Group III	4.8	10.3	4.4	0.02

Table II, graph I shows that mean DIAGNOdent readings at baseline was 3.3, 2.5 and 4.8, post demineralization reading was 10.9, 11.5 and 10.3 and post- remineralization was 5.0, 4.8 and 4.4 in group I, II and III respectively. The difference was significant (P< 0.05).

Graph I Assessment of DIAGNOdent readings in all groups



DISCUSSION

Dental caries is a most common disease that affects a large number of people. It is a worldwide public health problem, affecting numerous urban and rural communities. White-spot lesions are the earliest macroscopic evidence of enamel caries. Typically, the enamel surface layer stays intact during subsurface demineralization, but, without treatment, will eventually collapse into a full cavity.⁶ Near-neutral pH of saliva is endowed with a natural buffering capacity. Natural demineralization of tooth at an early stage is reversed by saliva, which contains calcium

ions, phosphate ions, buffering agents, fluoride, and other substances. The strategy for aided remineralization is to have ions directly delivered to where and when they are needed most. Several mechanisms are available for aided remineralization.⁷ The most well- known is the delivery of topical fluoride, which has been proven to be a highly effective measure for prevention of caries. More recently, this has led to introduction of new materials containing calcium and phosphate ions.⁸ Caries management is early detection and targeted non-invasive management of invasive reversible lesions

using novel remineralization agents.¹The high concentration of calcium and phosphate in saliva is the major mineral source in the oral environment.⁹ The present study was conducted to assess the remineralization efficacy of casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACPF), tricalcium phosphate (FTCP) and hydroxyapatite (HA) on artificially induced white spot lesions in primary teeth.

We found that mean DIAGNOdent readings at baseline was 3.3, 2.5 and 4.8, post demineralization reading was 10.9, 11.5 and 10.3 and post-remineralization was 5.0, 4.8 and 4.4 in group I, II and III respectively. Vinod et al¹⁰ in their study thirty freshly extracted premolars for orthodontic treatment were collected. Specimens were randomly divided into 3 groups of 10 each: group I: SDF, group II: CSP, group III: CPP-ACP. The samples were subjected to DIAGNOdent analysis for recording the baseline values. Specimens were placed in demineralizing solution incubated at 37°C for 72 hours. DIAGNOdent values were recorded after demineralization. Following this, remineralization procedure was carried out using 3 different remineralizing agents: group I samples with SDF, group II with CSP, and group III with CPP-ACP. The remineralization procedure was performed to group I once and repeated for 14 days for group II and group III and storage solution was changed every 24 hours. The samples were subjected to DIAGNOdent analysis after 72 hours, 7 days, and 14 days and values were recorded. Intragroup comparison of DIAGNOdent readings showed a highly significant difference between baseline, post-demineralization, and post-remineralization values. Among intergroup comparison, SDF showed maximum remineralization values followed by CSP and CPP-ACP, respectively. Silver diamine fluoride, CSP, and CPP-ACP are proven to possess remineralization potential. A comparative evaluation of these three remineralizing agents will aid in identifying most potent and effective agent in treating initial caries lesions in an effective noninvasive and child-friendly manner.

Patil et al¹¹ found out the efficacy of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACPF), and tricalcium phosphate fluoride (TCP-F) in remineralizing enamel surface on which artificial caries lesion had been created. The changes were analyzed using DIAGNOdent® (KaVo) and scanning electron microscope (SEM). A total of 52 premolars and 24 molars were selected and classified into four groups of 13 premolars and 6 molars in each: I (CPP-ACP), II (CPP-ACPF), III (TCP-F), and IV (artificial saliva). All the samples were assessed using DIAGNOdent at the baseline and after demineralization and remineralization. Ten samples were randomly selected from each group baseline after demineralization and after remineralization for surface evaluation using

SEM. Statistical analysis showed that all the experimental groups had a significantly higher amount of remineralization except for group IV.

Joshi et al¹² in their study sixty permanent intact premolars were randomly divided into six groups: Four test groups – (1) bioactive glass (BAG) Novamin (SHY-NM), (2) nano-hydroxyapatite (nHAp) (Acclaim), (3) functionalized tricalcium phosphate (f-TCP) (Clinpro Tooth Crème), and (4) grape seed extract (GSE); one positive control – (5) fluoride (1000 ppm) containing dentifrice (Colgate Calci-Lock); and one negative control – (6) distilled water. The samples were initially evaluated for baseline surface microhardness (SMH); later on, these samples were placed in the demineralizing solution for 48 h in an incubator at 37°C, and post demineralization again SMH was measured. Thereafter, the samples were subjected to the pH cycling for consecutive 21 days, and SMH was recorded. The SMH was evaluated using a Vickers microhardness tester. BAG Novamin showed SMH recovery at 96.75% followed by f-TCP at 95.83%, nHAp at 90.88%, and GSE at 48.71%. Statistically significant differences were observed between the first three groups and the rest of the groups after RML stage.

CONCLUSION

Remineralization efficacy of casein phosphopeptide-amorphous calcium phosphate fluoride (CPP-ACPF), tricalcium phosphate (FTCP) and hydroxyapatite (HA) on artificially induced white spot lesions in primary teeth were comparable.

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