



EFFECTIVENESS OF COMMERCIALY AVAILABLE MATERIALS FOR TREATMENT OF WHITE SPOT LESIONS – AN IN VITRO STUDY

M. Ramamurthy	Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics, C.K.S. Theja Institute of Dental Sciences and Research, Renigunta Road, Tirupati, 517506.
G. Veera Reddy	Professor, Department of Orthodontics and Dentofacial Orthopedics C.K.S. Theja Institute of Dental Sciences and Research, Renigunta Road, Tirupati, 517506
S.V. Kala Vani*	C.K.S. Professor and HOD, Department of Orthodontics and Dentofacial Orthopedics Theja Institute of Dental Sciences and Research, Renigunta Road, Tirupati, 517506.*Corresponding Author
N. Madhuri	Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics, C.K.S. Theja Institute of Dental Sciences and Research, Renigunta Road, Tirupati, 517506.
S. Hemadri	Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics C.K.S. Theja Institute of Dental Sciences and Research, Renigunta Road, Tirupati, 517506.
K. Prasanna Kumar	Senior Lecturer, Department of Orthodontics and Dentofacial Orthopedics, PMNM Dental College and Hospital, Bagalkot

ABSTRACT White spot lesions are defined as subsurface enamel porosities appearing as a milky white opacite when located on smooth enamel surfaces. They can be reversed by using the technique of remineralization. There are many commercially available products available to serve the purpose of remineralization. Among them MI Paste Plus and PreviDent 5000 Plus were evaluated in the current study. The aim of the study is to evaluate and compare the effect of remineralization agents by assessing the depth of lesion. Eighty extracted human maxillary premolars based on the remineralizing agents used were divided into two groups as group A and B which used MI Paste Plus and PreviDent 5000 Plus respectively. All the specimens were subjected to demineralization solution and the lesion depth (LD) was evaluated. Later, remineralization pastes were applied daily for a period of 3 months, and LD was noted. Results showed a significant improvement in the LD after remineralization and there was no significant difference between the 2 remineralizing pastes evaluated. So, it can be concluded that either of the two remineralizing pastes would be beneficial to prevent or reverse the white spot lesions which are most common with fixed appliance therapy.

KEYWORDS :

INTRODUCTION:

Dental caries is a microbial disease of the calcified tissues of the teeth, characterized by demineralization of the inorganic portion and destruction of the organic substance of the tooth. The progression or reversal of caries depends upon the balance between demineralization and remineralization. Dental caries progression or reversal can be visualized for clinical purposes as the “caries balance.”¹⁻³

The earliest visible clinical sign of dental caries on enamel is commonly known as “white spot lesion” (WSL). White spot lesions are defined as subsurface enamel porosities appearing as a milky white opacite when located on smooth enamel surfaces. They occur primarily on the smooth enamel surfaces of teeth, notably in the gingival third of the crown.⁴

Fixed orthodontic appliances create stagnation areas for plaque and make tooth cleaning difficult. The irregular surfaces of brackets, bands and wires limit the naturally occurring self-cleansing mechanisms of the oral musculature and saliva. This encourages plaque accumulation and the colonization of aciduric bacteria. Over time this results in active white spot lesions and if not treated a cavitated carious lesion can develop.⁵

The prevalence of white spot lesions after orthodontic treatment has been reported to be 5%-97%.⁶ Once formed, these lesions compromise esthetics and can be extremely difficult or even impossible to reverse. Saliva can remineralize white spot lesions to some degree, but this process is slow and rarely results in complete resolution of these lesions.⁷

The goal of modern dentistry is to manage non-cavitated carious lesions non-invasively by remineralization techniques in an attempt to prevent disease progression.⁸ Over the last few decades, fluoride in various forms has been proven to enhance remineralization by transforming hydroxyapatite to fluorapatite that resists the demineralization process of the tooth in both the primary and permanent dentitions in a variety of ways.⁹

The process of remineralization begins right from the earliest stage of dental caries initiation. The enamel mineral ions such as calcium and phosphate are lost due to acidic pH and result in porosities between the crystallites.¹⁰ When the super saturation of calcium and phosphate ions is elevated than that of oral fluids, redeposited enamel mineral is formed either due to regrowth of existing crystallites or de novo formation of crystallites. This forms the basis of mechanism of remineralization.^{10,11}

Many commercial products are available to remineralize the white spot lesions like Mirawhite, Nanosensitive, PreviDent 5000 Plus, MI Paste Plus, Recaldent GC tooth mousse Plus etc.¹²

OBJECTIVES:

The aim of the current study is to

- Evaluate and compare the lesion depth (LD) associated with demineralized and remineralized tooth enamel.
- Evaluate and compare the efficacy of two commercially available remineralizing agents i.e., MI Paste Plus and PreviDent 5000 Plus.

MATERIALS AND METHODOLOGY

Sample for this study consisted of eighty healthy extracted human maxillary first premolar teeth ignoring the sex, race, and malocclusion. Exclusion criteria included those teeth with any carious lesions, developmental defects or with any restorations and endodontic treatment.

Each tooth was embedded in acrylic blocks in such a way that only the crowns were exposed up to the cemento-enamel junction. The specimens were stored in physiological saline at all times to prevent enamel desiccation. The teeth were then coated with an acid resistant nail varnish leaving a narrow window approximately 1 × 1 mm square, on the sound, intact surface of the buccal enamel. All the specimens were divided into two groups; Group A and Group B. Forty teeth were assigned to each group.

The buffered remineralizing and the demineralizing solutions were made up of analytical-grade chemicals and deionized water. Both the

groups were then subjected to demineralization for 4 days and the samples were tested for lesion depth. Group A was treated with MI Paste Plus and Group B was treated with PreviDent 5000 Plus. The samples of both the groups were placed in 2 separate containers of artificial saliva and placed in an incubator at 37°C.

Remineralization paste was applied twice daily for 90 days. Each sample was removed from the artificial saliva solution, treated with its designated product applied with a toothbrush, and returned to its container without rinsing. The solution of artificial saliva in each container was changed after each treatment. After 90 days of treatment, samples of both the groups were tested for lesion depth, and the obtained values were noted.

Lesion depth was evaluated by polarized light microscopy. The depth of the lesion was measured with a computerized calculation method using the software program (ProgRes®, Germany).⁷¹

RESULTS:

After demineralization, the mean values of LD for groups A and B were $147.57 \pm 31.97 \mu\text{m}$ and $150.37 \pm 31.87 \mu\text{m}$ respectively. Remineralization values for LD were $72.09 \pm 15.16 \mu\text{m}$ and $70.20 \pm 9.32 \mu\text{m}$ for Group A and Group B respectively. (Table 1)

Table 1: Intragroup comparison of lesion depth in group A and group B samples

Group	Demineralization			Remineralization			Mean Difference	p value
	Mean SD	Mean difference	p value	Mean SD	Mean difference	p value		
Group A	147.57 ±31.97	-3.2	0.713 NS	72.0 9±15 .16	1.8961	0.502 NS	75.4700	<0.001*
Group B	150.37 ±31.87			70.2 0±9. 32			80.1685	<0.001**

NS- Not significant ($p>0.05$), **-Highly significant ($p<0.001$)

The difference in LD between demineralized teeth and post remineralization was highly significant ($p<0.001$).

No statistically significant difference was found between 2 groups either after demineralization or after remineralization.

DISCUSSION:

Fixed orthodontic appliances cause inaccessible areas for plaque removal and make tooth cleaning difficult with irregular surfaces of brackets, bands, and wires. The colonization of aciduric bacteria encourages biofilm formation resulting in a rise in the levels of mutans streptococci and lactobacilli. In time, this causes active WSLs, and, if not treated, a cavitated carious lesion can develop.^{4,13,14}

An early detection of WSL would allow clinicians to apply preventive measures to control the demineralization process before lesions progress, but it is a great challenge.¹⁵ Currently, many products have been developed and claim that they have effectiveness in promoting remineralization and slowing progression of demineralization avoiding the negative effects of fluoride.¹⁶

In the current study, two such products MI Paste Plus and PreviDent 5000 Plus were evaluated which are being used widely as the remineralising pastes. The results showed no significant difference existed among them at the end of 3 months, implying that both the methods are equally effective to treat white spot lesions.

Eberle¹⁷, Clark¹⁸ and Huang et al.⁶, conducted identical studies which showed similar results.

Lesion depth was evaluated after placing the specimens in the demineralizing solution and also after the treatment of those specimens with remineralizing pastes for 3 months using MI Paste Plus and PreviDent 5000 Plus for the specimens belonging to group A and group B respectively. There was a significant difference ($p<0.001$) between mean LD values before and after remineralization treatment. No studies have been conducted so far to evaluate the effect of MI Paste Plus and PreviDent 5000 Plus on the lesion depth of tooth enamel to compare our results. But similar studies using different remineralizing agents were conducted by Jones et al.,¹⁹ Manesh et al.,²⁰ Buskes et al.,²¹ Jones and Fried,²² Lijima et al.,²³ Larsen and Fejerkov.²⁴

Results of all these studies were in accordance with the current study.

CONCLUSION:

In view of the possible occurrence of white spot lesions and secondary caries post orthodontic treatment, several remineralizing agents were used as a part of treatment. This study provided important information about the remineralizing effect of the two commercially available tooth pastes, PreviDent 5000 Plus and MI Paste Plus on the experimentally induced white spot lesions.

Both the pastes were equally effective in decreasing the lesion depth, when used for a period of 3 months. The simplicity involved in using either one of them, will enable the clinician to use them as chair side remineralizing agents.

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