



# INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume 5, Issue 2)

Available online at: [www.ijariit.com](http://www.ijariit.com)

## Evaluation of three commercially available toothpaste/creams for resolution of white spot lesions – An in vitro study

Dr. Ravi Shanthraj

[raviortho11@gmail.com](mailto:raviortho11@gmail.com)

JSS Academy of Higher Education  
and Research, Mysore, Karnataka

Bijo Jose

[dr.bijojose@gmail.com](mailto:dr.bijojose@gmail.com)

JSS Academy of Higher Education  
and Research, Mysore, Karnataka

Kiran Joshy

[kiranjoshykj@gmail.com](mailto:kiranjoshykj@gmail.com)

JSS Academy of Higher Education  
and Research, Mysore, Karnataka

### ABSTRACT

White spot lesions are often seen on the teeth after orthodontic treatment, resulting in unpleasant esthetics. Despite many attempts at prevention of white spot lesions, its prevalence remains very high on debonding. The aim of the study was to evaluate the efficiency of 3 commercially available toothpaste/creams in the remineralization of white spot lesions. **Materials and Methods:** Hundred extracted premolars were selected as sample teeth. They were mounted into an acrylic resin block and randomly divided into four groups, consisting of 25 teeth each. Premolar brackets were bonded to facial surfaces. The specimens were color-coded with Yellow (Group-1), Red (Group-2), Green (Group-3) and Blue (Group-4). Sample teeth were exposed to demineralization solution for 14 days to produce white spot lesion. Visual verification of white spot lesions was done after 14 days on all sample teeth and brackets were debonded. The comparison between 4 groups: Artificial saliva (Group 1), Colgate PreviDent 5000 toothpaste (Group 2), GC Tooth mousse tooth crème (Group 3), Clinpro tooth crème (Group 4), were done at pre-treatment, 14-days after demineralization, 7-days after treatment, 14-days after treatment and 28-days after treatment using Gloss meter and Surface Profilometer instrument. **Results:** The mean 28 days after treatment Gloss meter values for Group 1 (Artificial saliva) were  $20.69 \pm 2.41$  GU, for Group 2 (PreviDent 5000 toothpaste) were  $21.70 \pm 2.06$  GU, for Group 3 (Tooth mousse tooth crème) were  $23.59 \pm 2.40$  GU and for Group 4 (Clinpro tooth crème) were  $22.56 \pm 2.98$  GU respectively. And mean 28 days after treatment Profilometer values for Group 1 (Artificial saliva) were  $1.84 \pm 0.50 \mu\text{m}$ , for Group 2 (PreviDent 5000 toothpaste) were  $1.542 \pm 0.33 \mu\text{m}$ , for Group 3 (Tooth mousse tooth crème) were  $1.254 \pm 0.08 \mu\text{m}$  and for Group 4 (Clinpro tooth crème) were  $1.475 \pm 0.20 \mu\text{m}$  respectively. **Conclusion:** The result of the study indicated that Gc Tooth mousse tooth crème, PreviDent 5000 toothpaste, and Clinpro tooth crème have higher remineralization potential compared to Artificial saliva. Gc tooth mouse crème had the highest remineralization potential followed by Clinpro tooth crème and PreviDent 5000 in both Gloss meter test and Profilometer test. The increased efficiency of Tooth Mousse in remineralizing white spot lesion might be because of the combined effect of CPP –APP and fluoride which was not there in all other groups.

**Keywords**— White spot lesion, Remineralization, Fluorides, Casein Phosphopeptides with amorphous calcium phosphate

### 1. INTRODUCTION

White Spot Lesions (WSLs) are defined as a “subsurface enamel porosity from carious demineralization” that presents as “a milky white opacity when located on smooth surfaces.”<sup>1</sup> White spot lesions are the first visible evidence of caries in the enamel, characterized by demineralized lesion underneath an intact surface.<sup>1</sup>

WSLs develop as a result of prolonged plaque accumulation on the affected surface, commonly due to inadequate oral hygiene.<sup>2</sup> With the maintenance of these conditions, acids diffuse into the enamel and begin to demineralize the subsurface enamel. If the demineralization process is not stopped, the intact enamel surface eventually collapses and cavitates. These lesions are characterized by a white, chalky, opaque appearance and are commonly located in pits, fissures, and smooth surfaces of teeth.<sup>3</sup>

However, after the placement of fixed orthodontic appliances, there is an increased number of plaque retention sites due to the presence of brackets, bands, wires, and other applications, which make oral hygiene more difficult and limit the naturally occurring self-cleansing mechanisms. As a consequence, there is an increased risk of demineralization and conclusively, WSLs forming on smooth surfaces, if there is no effective plaque removal.<sup>4</sup>

The clinical characteristics of these lesions include loss of normal translucency of the enamel because of altered light properties with a chalky white appearance, particularly when dehydrated. It presents as a fragile surface layer susceptible to damage from probing in pits and fissures with increased porosity.<sup>5</sup>

There are many agents like fluoride toothpaste, fluoride varnishes, and fluoride mouth rinses, and Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP) is frequently used for the remineralization of white spot lesions. However, there is no consensus in the literature with respect to the success rates of these agents.<sup>6</sup>

This study was indented to compare outcomes of white spot lesions treated with agents like Casein Phosphopeptide-Amorphous Calcium Phosphate, fluoride and tri-calcium phosphate that has been reported to have a positive effect on remineralization of enamel.

**2. MATERIALS AND METHODS**

This study was conducted in JSS Dental College and Hospital, Mysore. The study used GC Tooth mousse tooth crème, Colgate PreviDent 5000 toothpaste and Clinpro tooth crème. Instruments used were Gloss meter and Surface Profilometer.

**2.1 Methodology**

100 extracted premolars were selected as sample teeth. They were mounted into an acrylic resin block with buccal surfaces exposed. Premolar brackets were bonded to facial surfaces. Clear nail polish was used to seal exposed buccal enamel, except for area gingival to bracket, allowing for the production of a clinically appearing white spot lesion. All samples were exposed to demineralization solution (3mmol/L of mono-potassium phosphate, 3mmol/L of calcium chloride dihydrate, and 0.1 M of lactic acid 85% solution with pH adjusted to 4.5 with about 5 g of potassium hydroxide) for 14 days to produce white spot lesion.

Visual verification of white spot lesions was done after 14 days on all sample teeth and brackets were debonded. The sample teeth were randomly allocated into 4 groups. Each group had twenty-five samples. The four groups were: Group 1- Artificial saliva, Group 2- Colgate PreviDent 5000, Group 3- Gc tooth mousse, Group 4- Clinpro tooth crème. All groups were evaluated at pre-treatment, 14-days after demineralization, 7-days after treatment, 14-days after treatment, 21-days after treatment and 28-days after treatment using Gloss meter (NOVO-HAZE, Techno instruments co. Bangalore) and Surface Profilometer ((SJ-401 surface profilometer, Mitutoyo Corporation, Japan).

**3. RESULTS**

The present study showed that mean pre-treatment Gloss meter values for Group 1 (Artificial saliva) were 27.88 ±3.20 GU, for Group 2 (PreviDent 5000 toothpaste) were 27.60±3.23 GU, for Group 3 (Tooth mousse tooth crème) were 28.47±2.29 GU and for Group 4 (Clinpro tooth crème) were 28.03±3.02 GU respectively and the mean, 28 days after treatment Gloss meter values for Group 1 (Artificial saliva) were 20.69±2.41 GU, for Group 2 (PreviDent 5000 toothpaste) were 21.70±2.06 GU, for Group 3 (Tooth mousse tooth crème) were 23.59±2.40 GU and for Group 4 (Clinpro tooth crème) were 22.56±2.98 GU respectively.

**Table 1: Result 1**

		N	Mean	Standard Deviation	Standard Error	F	Sig.
<b>Pre treatment</b>	Group 1	25	27.88	3.21	0.64	0.38	0.77
	Group 2	25	27.60	3.24	0.65		
	Group 3	25	28.47	2.29	0.46		
	Group 4	25	28.03	3.03	0.61		
<b>14-days-after demineralization</b>	Group 1	25	15.35	2.28	0.46	0.38	0.77
	Group 2	25	15.70	2.20	0.44		
	Group 3	25	15.85	1.95	0.39		
	Group 4	25	15.93	1.80	0.36		
<b>7-days after treatment</b>	Group 1	25	16.48	2.31	0.46	3.08	0.03**
	Group 2	25	17.36	2.05	0.41		
	Group 3	25	18.38	2.27	0.45		
	Group 4	25	17.80	2.47	0.49		
<b>14-days after treatment</b>	Group 1	25	18.04	2.19	0.44	3.78	0.001***
	Group 2	25	18.72	2.14	0.43		
	Group 3	25	20.31	2.66	0.53		
	Group 4	25	19.35	2.85	0.57		
<b>21-days-after treatment</b>	Group 1	25	19.31	2.45	0.49	5.54	0.001***
	Group 2	25	20.23	2.12	0.42		
	Group 3	25	22.15	2.53	0.51		
	Group 4	25	21.05	3.07	0.61		
<b>28-days-after treatment</b>	Group 1	25	20.70	2.42	0.48	6.14	0.001***
	Group 2	25	21.70	2.07	0.41		
	Group 3	25	23.59	2.41	0.48		
	Group 4	25	22.57	2.98	0.60		

\*P<0.05 and \*\*p<0.01; Significant \*\*\*p<0.001\*\*\* Highly significant; p>0.05 not significant

The mean pre-treatment Profilometer values for Group 1 (Artificial saliva) were 0.843 ± 0.10µm, for Group 2 (PreviDent 5000 toothpaste) were 0.846 ± 0.098 µm, for Group 3 (Tooth mousse tooth crème) were 0.843 ± 0.096µm and for Group 4 (Clinpro tooth crème) were 0.805±0.071µm respectively and the mean 28 days after treatment Profilometer values for Group 1 (Artificial saliva) were 1.84 ± 0.50µm, for Group 2 (PreviDent 5000 toothpaste) were 1.542 ± 0.33µm, for Group 3 (Tooth mousse tooth crème) were 1.254 ± 0.08µm and for Group 4 (Clinpro tooth crème) were 1.475 ± 0.20µm respectively.

Table 2: Result 2

		N	Mean	Standard Deviation	Standard Error	F	Sig.
Pre treatment	Group 1	25	0.84	0.11	0.02	1.06	0.37
	Group 2	25	0.85	0.10	0.02		
	Group 3	25	0.84	0.10	0.02		
	Group 4	25	0.81	0.07	0.01		
14-days-after demineralization	Group 1	25	2.36	0.57	0.11	0.14	0.93
	Group 2	25	2.38	0.54	0.11		
	Group 3	25	2.40	0.27	0.05		
	Group 4	25	2.32	0.37	0.07		
7-days-after treatment	Group 1	25	2.20	0.59	0.12	0.80	0.50
	Group 2	25	2.10	0.45	0.09		
	Group 3	25	2.00	0.32	0.06		
	Group 4	25	2.06	0.40	20.08		
14-days-after treatment	Group 1	25	2.06	0.55	0.11	4.14	0.001***
	Group 2	25	1.88	0.46	0.09		
	Group 3	25	1.68	0.18	0.04		
	Group 4	25	1.80	0.24	0.05		
21-days-after treatment	Group 1	25	1.94	0.56	0.11	7.01	0.001***
	Group 2	25	1.70	0.42	0.08		
	Group 3	25	1.45	0.21	0.04		
	Group 4	25	1.63	0.22	0.04		
28-days-after treatment	Group 1	25	1.84	0.51	0.10	13.87	0.001***
	Group 2	25	1.54	0.34	0.07		
	Group 3	25	1.25	0.09	0.02		
	Group 4	25	1.48	0.21	0.04		

\*P<0.05 and \*\*p<0.01; Significant \*\*\*p<0.001\*\*\* Highly significant; p>0.05 not significant

#### 4. DISCUSSION

White Spot Lesion (WSL) development is a frequent side-effect to treatment with fixed orthodontic appliances. The prevalence is reported to vary from 2 to 96%, depending on method and criteria for detection as well as patient compliance with advocated preventive measures. WSLs can seriously jeopardize the esthetic outcome of the treatment; data indicate that such lesions have a limited ability to improve after appliance removal and white spots can sometimes be detectable even 12 years after treatment.

The degree of white spot lesion development is not completely apparent until the fixed orthodontic appliances are removed. Upon removal of appliances, white, opaque demarcations on the labial surface of the teeth where the brackets and bands once were may be evident.<sup>7</sup> these white, unesthetic demarcations of decalcification detract from the smile and final esthetic result of straight teeth and good occlusion. Because these white spot lesions most often occur on maxillary anterior teeth, they pose a significant esthetic problem.<sup>8</sup>

#### 5. METHODS TO DECREASE DEMINERALIZATION DURING ORTHODONTIC TREATMENT

Depending on the patient's risk factors, a number of suitable agents and therapies can be used to help prevent white spot lesions in orthodontic patients: fluoride toothpaste, gels, varnishes, and mouth rinses; antimicrobials; xylitol gum; diet counselling; and casein derivatives.<sup>9</sup>

##### 5.1 Casein Phosphopeptides

The Casein Phosphopeptides (CPP) have the remarkable ability to stabilizing the calcium and phosphate ions present in the solution, creating the Casein Phosphopeptides with Amorphous Calcium Phosphate (CPP-ACP complex). This complex increases the calcium and phosphate levels, promoting the remineralization process. Although this does not occur without the presence of fluorides, the CPP ACPF complex (Casein Phosphopeptides with Amorphous Calcium Phosphate and Fluoride) exists commercially for this.<sup>10</sup>

The CPP has the ability to bind and stabilize calcium and phosphate in solution, as well as to bind dental plaque and tooth enamel. Through their multiple phosphoryl residues, CPPs bind to form clusters of ACP in metastable solution, preventing their growth to the critical size required for nucleation and precipitation. The proposed mechanism of anticariogenicity for the CPP-ACP is that it localizes ACP in dental plaque, which buffers the free calcium and phosphate ion activities, thereby helping to maintain a state of super saturation with respect to tooth enamel depressing demineralization and enhancing remineralization. The CPPs have been shown to keep fluoride ions in solution, thereby enhancing the efficacy of the fluoride as a remineralizing agent.<sup>11</sup>

##### 5.2 Amorphous Calcium Phosphate

The ACP technology requires a two-phase delivery system to keep the calcium and phosphorous components from reacting with each other before use. The current sources of calcium and phosphorous are two salts, calcium sulfate and dipotassium phosphate. When the two salts are mixed, they rapidly form ACP that can precipitate onto the tooth surface. This precipitated ACP can then readily dissolve into the saliva and can be available for tooth remineralization.<sup>12</sup>

### **5.3 Mechanism of action of Tri-Calcium Phosphate (TCP)**

Tri-Calcium Phosphate (TCP) has been considered as one possible means for enhancing the levels of calcium in plaque and saliva. Tri-calcium phosphate has remineralization properties with the advantage of the calcium phosphate system that is stable in an aqueous environment and does not affect the fluoride activity when added to dentifrices.

A protective barrier is created around the calcium allowing it to coexist with the fluoride ions. It acts as a bubble that transports the Tri-Calcium Phosphate to the teeth. As the toothpaste comes in contact with saliva during brushing, the barrier breaks down and makes the calcium, phosphate and fluoride readily available to the tooth. The tooth naturally absorbs these components, helping to prevent the initiation and further progression of demineralization and allowing remineralization to occur.

The present study used GC Tooth *mousse* tooth crème which contain CPP-ACP, Colgate PreviDent toothpaste (a fluoride toothpaste) and Clinpro tooth cream which contain tri-calcium phosphate. The result of the present study showed that mean 28 days after treatment Gloss meter values and Profilometer values of Group 1 with Group 2, Group 3, and Group 4 were statistically significant. The mean 28 days after treatment Gloss meter values and Profilometer values of Group 3 and Group 2 were statistically significant. It suggests Tooth mousse tooth crème has higher remineralization ability and compared to PreviDent 5000. The Mean 28 days after treatment Gloss meter values and Profilometer values of Group 4 and Group 2 were not statistically significant. The mean 28 days after treatment Gloss meter values and Profilometer values of Group 3 and Group 4 were statistically significant. It suggests that Tooth mousse tooth crème toothpaste has higher remineralization potential when compared to Clinpro tooth crème.

### **6. CONCLUSION**

Within the limitations of this study, it was concluded that,

- (a) Gc Tooth mousse tooth crème, PreviDent 5000 toothpaste and Clinpro tooth crème showed higher remineralization potential compared to Artificial saliva.
- (b) Clinpro tooth crème and PreviDent 5000 toothpaste showed remineralization potential on white spot lesions. Even though it was not statically significant, higher Gloss meter values and Profilometer values indicated a tendency for Clinpro tooth crème.
- (c) Tooth mousse tooth crème has shown statistically significant remineralization potential compared to PreviDent 5000.
- (d) Tooth mousse tooth crème and Clinpro tooth crème showed remineralization potential on white spot lesion. Even though mean Gloss meter values are not statistically significant, higher Gloss meter values and statistically significant Profilometer values suggest Tooth mousse tooth crème toothpaste has higher remineralization potential compared to Clinpro tooth crème.
- (e) The increased efficiency of Gc Tooth mousse tooth crème in remineralizing white spot lesion might be because of the combined effect of CPP –ACP and fluoride which was not there in all other groups.

### **7. REFERENCES**

- [1] Summitt's *jb* Fundamentals of Operative Dentistry a Contemporary Approach. Chicago; Quintssence, 2006.
- [2] Sudjalim T, Woods M, Manton D. Prevention of white spot lesions in orthodontic practice: a contemporary review. *Aust Dent J* 2006;51(4):284-9
- [3] Aykut-Yetkiner A, Kara N, Ates, M, Ersin N, Ertugrul F. Does casein phosphopeptide amorphous calcium phosphate provide remineralization on white spot lesions and inhibition of *Streptococcus mutans*? *J Clin Pediatr Dent* 2014;38(4):302-6
- [4] Benson PE, Parkin N, Dyer F, et al. Fluorides for the prevention of early tooth decay (demineralised white lesions) during fixed brace treatment. *Cochrane Database Syst Rev*; 2013: CD003809
- [5] Mount GJ. Defining, classifying, and placing incipient caries lesions in perspective. *Dent Clin North Am* 2005; 49(4):701-23.
- [6] Effects of various remineralizing agents on the outcome of post-orthodontic white spot lesions (WSLs): a clinical trial. Singh et al. *Progress in Orthodontics* (2016) 17:25
- [7] Øgaard B, Rølla G, Arends J. Orthodontic appliances and enamel demineralization Part 1. Lesion development. *Am J Orthod Dentofac Orthop.* 94(1):68-73, 1988
- [8] Gorelick L, Geiger AM, Gwinnett AJ. Incidence of white spot formation after bonding and banding. *Am J Orthod.* 81(2):93-8, 1982.
- [9] Guzman-Armstrong S, Warren JJ. White spot lesions: Prevention and treatment. *AJODO.* 138(6):690-6, 2010.
- [10] Kugel G, Arsenault P, Papas A. Treatment modalities for caries management, including a new resin infiltration system. *Compend Contin Educ Dent* 2009; 30(3):1-10.
- [11] Llana-Puy C. MI Paste Plus and PreviDent fluoride varnish appear No more effective than normal home care for improving the appearance of white spot lesions. *J Evid Based Dent Pract* 2013; 13(3):114-6.
- [12] Tung MS, Eichmiller FC. Dental applications of amorphous calcium phosphates. *J Clin Dent* 1999;10:1-6