



EFFECTIVENESS OF CASEIN PHOSHOPEPTIDE STABILISED AMORPHOUS CALCIUM PHOSPHATE FOR TREATMENT OF WHITE SPOT LESIONS DEVELOPED AFTER ORTHODONTIC TREATMENT

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ABSTRACT

Objective: This study was conducted to evaluate effectiveness of 10% casein phosphopeptide amorphous calcium phosphate on white spot lesions detected after initiation of orthodontic treatment using fixed appliance

Methodology: The prospective study was conducted in Orthodontic Department, Nishtar Hospital, Multan from June 2022 to June 2023. The study included 50 patients who had at least one clinically visible white spot lesions on labial surface after debonding of orthodontic appliances. Subjects were divided into study group (n= 21) and control group (n=29). The participants in the study group were instructed to apply CPP-ACP cream (1g) on teeth once daily and to use fluoride tooth paste (1100 ppm F) once every morning for 4 weeks. The participants in study group were advised to use fluoride tooth paste twice daily.

Results: The results showed that after the treatment, there was 58% decrease in lesion area in study group and 26% decrease in control group, and this difference was statistically different from the baseline (P<0.05). However, the difference in lesion area in both groups was not statistically significant (P=0.06). At base line, 84.6% lesions study group and 86% in control group had score > 1. After 4 weeks, corresponding figures were 52.3% and 48.4% respectively. The difference between groups was not statistically significant.

Conclusion: Casein phosphopeptide-stabilised amorphous calcium phosphate agent resulted in significant reduction and improvement in white spot lesions developed because of orthodontic brackets.

Keywords: White spot lesions, CPP-ACP cream, Lesions, Orthodontic treatment, Orthodontics, Teeth

Introduction

Orthodontic treatment is associated with enamel decalcification, especially if oral hygiene is not maintained. Demineralized enamel surface reflects light differently compared to sound enamel layer, which results in chalky white appearance. In some patients, white spot lesions (WSLs) are present around dental brackets, while in others these appear as large decalcified lesions. Clinically, white spot lesions appear after a month of initiating orthodontic treatment if proper oral hygiene is not maintained. Fixed orthodontic brackets are more commonly associated with these decalcifications compared to removable appliances.⁽¹⁾ Various epidemiological studies reveal that frequency of WSLs range from 2% - 97%, depending upon techniques for characterizing and detecting them such as photographs, visual inspection, fluorescent methods, digital image fibre optic transillumination, quantitative light induced fluorescence and DIAGNOdent.⁽²⁾ Quantitative laser techniques have higher sensitivity compared to visual techniques.⁽³⁾

A study reported that 68.5% patients undergoing orthodontic treatment had WSLs and the incidence of new lesions which appear during the treatment was 45.7%.⁽⁴⁾ It was concluded that WSLs were highly prevalent in patients undergoing orthodontic treatment, thus it is necessary for both caregivers and patients to follow effective preventive measures. Presence of lesions before orthodontic treatment, poor oral hygiene, excessive consumption fermentable carbohydrates, carious molars, duration of treatment, long etching time and excess bonding are risk factors for development of WSLs during treatment.^(5, 6) Thus, before initiating treatment lesions must be diagnosed using standardized photographic plates while considering factors like lightening, exposure time and magnification etc.^(7, 8) A study reported that after 22 months of initiating orthodontic treatment, patient developed 3 new lesions had mucosal injuries in five areas.⁽⁹⁾ It is important to manage these WSLs, thus the aim of this study is to evaluate effectiveness of 10% casein phosphopeptide amorphous calcium phosphate on WSLs detected after initiation of orthodontic treatment using fixed appliances.

Methodology

The prospective study was conducted in Orthodontic Department, Nishtar Hospital, Multan from June 2022 to June 2023. The study included patients who had at least one clinically visible WSLs on labial surface after debonding of orthodontic appliances. Those patients who had high caries risk or any chronic disease were excluded. Total 50 healthy patients (28 boys and 22 girls) were selected for the study consecutively by EpiInfo Software. The sample size was calculated by keeping 95% confidence interval and 5% margin of error by formula mentioned in Bolarinwa et al.⁽¹⁰⁾ Informed consent of participants and their parents was recorded. Ethical board of the hospital approved the study. All participants lived in community with optimum water fluoride level (<0.2 ppm F). Subjects were divided into study group (n= 21) and control group (n=29). The participants in the study group were instructed to apply CPP-ACP cream (1g) on teeth once daily and to use fluoride tooth paste (1100 ppm F) once every morning for 4 weeks. The participants in study group were advised to use fluoride tooth paste twice daily.

Three digital photographs of the facial surface were taken at baseline and after 4 weeks of the treatment. The labial surface of premolars, cuspids and upper incisors were scored 1 for no WSL, 2 for thin rim of whit spot, 3 for thicker bands of white spots and 4 for cavitated lesion.

Quantitative light induced fluorescence (QLF) have been explained in detail.⁽¹¹⁾ Selected sites were cleaned using rubber cup and polishing cup and were rinsed subsequently. QLF device was then applied and imaged were stored. The QLF measurement was again taken after 4 weeks, and final image and mineral content was evaluated. A total of 322 WSLs, with mean 6 lesions in each subject. The primary end point was assessment QLF measurement before and after treatment and secondary endpoint was assessment of clinical score.

SPSS version 23.0 was used for data analysis. ANOVA was used for comparison of baseline and post treatment mineral content in both the groups. Chi square test or Student's t test was used for inter group comparison. In each patient, mean QLF value of included sites was calculated and each participant was used as a unit. P value < 0.05 was considered statistically significant.

Results

The mean age of the participants was 15.1 ± 3.1 years. The results of QLF analysis are shown in Table I. The change in fluorescence values (ΔF) in both groups after 4 weeks was statically significant ($P < 0.05$). After 4 weeks of treatment, WSLs in both groups were reduced by 30 to 35%. At baseline, lesion area (A) in the control was larger than the study; but after the treatment difference was statistically insignificant. After the treatment, there was 58% decrease in lesion area in study group and 26% decrease in control group, and this difference was statistically different from the baseline ($P < 0.05$). However, the difference in lesion area in both groups was not statistically significant ($P = 0.06$).

Clinical scores before and after treatment are shown in Table II. At base line, 85.7% lesions study group and 87% in control group had score > 1 . After 4 weeks, corresponding figures were 52.3% and 48.4% respectively. The difference between groups was not statistically significant.

Table I Comparison of change in fluorescence and lesion area between both groups

	Study group (n=21)		Control group (n=29)	
	ΔF (%)	A (mm ²)	ΔF (%)	A (mm ²)
At Baseline	$6.67 \pm .57$	$.13 \pm .17$	7.05 ± 1.67	$.18 \pm .42$
At 4 weeks	4.35 ± 1.81	$.04 \pm .08$	4.42 ± 2.57	$.13 \pm .32$

Table II Distribution of clinical scores of WLSs

	Study group (n =130)				Control group (n=192)			
	1	2	3	4	1	2	3	4
At Baseline	14.3%	55.0%	30.0%	0.7%	13.0%	58.4%	26.6%	2.0%
At 4 weeks	47.6%	36.1%	16.3%	-	51.5%	34.8%	12.9%	0.8%

DISCUSSION

The current study is conducted to compare the effectiveness of casein phosphopeptide amorphous calcium phosphate and fluoride tooth paste for remineralisation of WSLs. Both treatments led to significant improvement in visual scores and change of fluorescence, but difference in effectiveness of both methods was not significant. CPP-ACP group had greater improvement in lesion area, but the difference was non significant. This can be explained by the fact that baseline QLF measurements and clinical scores in control group were slightly higher.

The previous literature has shown that casein phosphopeptide- amorphous calcium phosphate can effectively remineralise enamel lesions^(12, 13), and recent data shows its beneficial effect on enamel lesions developed after orthodontic treatment.⁽¹⁴⁾ However, it was not a placebo controlled study and relative effect of use fluoride in study group remains unclear. Use of fluoride tooth paste in study group was not totally omitted as it is not the “best clinical practice”, particularly in patients with fixed orthodontic appliances as they are at increased risk of demineralization.⁽¹⁵⁾

Recently, adjunctive therapy comprising fluoride and CPP-ACP has been used for non invasive management of carious lesions.⁽¹⁶⁾ It should be noted that due short intervention period, we can not rule out the possibility of any further changes in the clinical scores. Attrition rate in study group was slightly higher than the control group, its reason remains unclear. QLF analysis has previously been used for analyzing enamel changes after orthodontic treatment , and studies have reported its correlation coefficient to be 0.8.^(17, 18, 19) However, there is a debate on its in vivo use in orthodontics.^(20, 21, 22) The limitation of this study is small sample size and short follow up period, larger studies are suggested for further evaluation.

CONCLUSION

Casein phosphopeptide-stabilised amorphous calcium phosphate agent resulted in significant reduction and improvement in white spot lesions developed because of orthodontic brackets.

However, its results were not superior to those regression of lesions with use of conventional fluoride tooth paste.

Conflict of interest: None

Funding: None

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