

EFFECT OF CHLORHEXIDINE AND FLUORIDE VARNISH ON THE INCIDENCE OF WHITE SPOT LESION IN ORTHODONTIC PATIENTS

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ABSTRACT

Clinically, an early caries lesion in enamel is initially seen as a white, opaque spot and is characterized by being softer than the adjacent sound enamel and becoming increasingly white when dried with air. The objective of this study is to compare the efficiency of Cervitec® Plus and Fluor Protector® varnish on the incidence of white spot lesions in orthodontic patients. The study was designed as a prospective control trial that included 30 patients. This is a split-mouth study in which Cervitec® Plus varnish was applied to the 1st quadrant and Fluor Protector® varnish to the 2nd quadrant. The enamel fluorescence values were noted using the Diagnodent pen in three-time intervals, where T0 is before bonding, T1 is one month after strap-up, and T2 is two months after strap-up. A paired t-test revealed a significant amount of reduction in the value of enamel fluorescence between the T0 and T2 groups and between the T1 and T2 time intervals in both the Cervitec® Plus and the Fluor Protector® groups. A Mann-Whitney test comparing the Cervitec® Plus group with the Fluor Protector® group showed no significant difference between the two groups. There is no significant difference between the Cervitec® Plus varnish and Fluor Protector® varnish in reducing the incidence of white spot lesions in patients undergoing orthodontic treatment. Thus, the use of these varnishes (Cervitec® Plus and Fluor Protector®) to prevent and, in some cases, manage white spot lesions in patients undergoing orthodontic treatment can be encouraged.

Key words: Dental varnish, Chlorhexidine varnish, Fluoride varnish, White spot lesion (WSL), Orthodontic treatment.

Introduction

Malocclusion is a common dental condition that we come across in our day-to-day practice. The increasing awareness among the general public regarding malocclusion and its problems has led to an increase in the number of people taking up orthodontic treatment. Patients undergoing orthodontic treatment are more prone to alteration in their oral microflora and oral hygiene status. This is mainly due to the increased accumulation of plaque and difficulty in maintaining oral hygiene in and around the various orthodontic attachments such as brackets, wires, modules, etc., Enamel demineralization adjacent to brackets is a significant problem during orthodontic treatment. The aetiology of white spot lesions (WSLs) is a result of increased plaque accumulation on the tooth surface with a lack of proper oral hygiene measures. The prevalence of WSLs in orthodontic patients ranges between 2 to 96 percent [1]. The presence of fluoride (F-) around the orthodontic brackets protected against the development of these lesions [2]. Orthodontic patients have increased salivary counts of *Streptococcus mutans*. This increases the chances of caries formation. Conventional oral hygiene measures in patients undergoing orthodontic treatment for plaque removal are more difficult [3, 4]. On clinical examination these sites of demineralization are detected as opaque spots which might affect the orthodontic treatment results [5].

White spots can be identified within a month after placement of orthodontic brackets but it takes about 6 months before caries become observable. The changes in scattered light on the decalcified enamel are the reason for the whitish appearance and these lesions rarely progress into cavities and are not registered as caries requiring restoration in the DMFT/S (decayed, missing, or filled teeth) index [6]. These lesions are mostly seen near the brackets and are usually seen in the gingival buccal and gingival aspects [7].

Materials releasing fluoride may be considered a useful supplement for such procedures. Application of Calcium fluoride on the tooth surface has been suggested in earlier studies [8]. Chlorhexidine inhibits the production of acid in plaque and reduces the pH level [9]. In an earlier study with banded premolars, it was shown that everyday rinsing with fluoride with chlorhexidine was more efficient in reducing demineralization than rinsing with F- mouthwashes [10].

Chlorhexidine mouthwashes have side effects, such as altered taste sensation and discoloration of the teeth and oral soft tissues [11]. One earlier study showed that compliance with fluoride mouthwashes was as low as 15% [12]. Various researchers have researched and shown the effect of a varnish containing chlorhexidine with thymol [13-16]. This clinical trial aims to find the effective comparison of Cervitec® Plus plus varnish and Fluor Protector® varnish on

the incidence of WSLs in orthodontic patients.

Materials and Methods

This is a prospective non-randomized single-blinded control trial- a split-mouth study that was conducted in the Department of Orthodontics of the University. The study was conducted on patients reporting to the Department of Orthodontics and Dentofacial Orthopaedics, with their consent. This study was approved by the Institutional Review Board and Human Ethical Committee of the University. The sample size was based on the statistical evaluation obtained from the previous study with 95% power. Based on the sample size calculation done using G-Power software, A sample size of 30 patients (n=120/group). An additional sample of 5 patients (n=20/group) was added to compensate for any patients who lost follow-up.

A qualified orthodontist was given the details about the inclusion and exclusion criteria for the study, screened, and selected the patients reported to the Department of Orthodontics in the university for orthodontic treatment. All the pre-treatment records were taken for the selected patients. Selection bias was addressed by this method of allocation of subjects. The patient's willingness to participate in the clinical trial was obtained before allocation into various groups. The shortlisted patients were briefly informed about their involvement in the study.

The inclusion and exclusion criteria of the patients who participated in the study are given below,

Inclusion criteria

1. Patients with permanent dentition
2. Patients who require fixed orthodontic treatment.
3. Patients with maximum anchorage requirement.
4. Cooperative patients who were willing to participate in the study

Exclusion criteria

1. Patients with mixed dentition
2. Patients with active periodontal or caries lesions.
3. Patients with a previous history of active periodontal and carious lesions.
4. Patients with any systemic problems.

In this study, standard orthodontic records were taken which included case history, extra-oral and intra-oral photographs, lateral cephalogram, and panoramic radiographs. A diagnosis was made and a detailed treatment plan was formulated. The following armamentarium was used for the present study

1. Fluor Protector® varnish (**Figure 1**)
2. Cervitec®Plus Varnish (**Figure 2**)
3. Applicator tip
4. DIAGNOdent (KaVo Dental Corporation, Lake Zurich, Ill) pen (**Figure 3**)



Figure 1. Fluor Protector® varnish



Figure 2. Cervitec®Plus Varnish



Figure 3. DIAGNOdent (KaVo Dental Corporation, Lake Zurich, Ill)

A Split mouth study was planned to avoid various confounding factors (i.e diet habits, oral hygiene measures, systemic factors, etc.,) which can alter the results obtained from the study. Only the upper arch was planned as there are increased chances of salivary contamination and crossover effect in the lower arch after varnish application. A single-blinded clinical trial was planned where the patient and the observer were not informed about the intervention.

The incidence of white spot lesions was studied by measuring the enamel fluorescence on four sides around the bracket using a DIAGNOdent (KaVo Dental Corporation, Lake Zurich, Ill) pen which shows the value of fluorescence by using Laser fluorescence. The DIAGNOdent pen was initially calibrated before every patient and the values were noted in sheets. The values of enamel fluorescence were studied in three time periods. T0 is the time before bonding, T1 is the time 1 month after bonding, and T2 is the time 3

months after bonding. The initial T0 values were measured before bonding as there are high chances the values may vary after bonding due to the etching of the tooth surface at the time of bonding. Four values were taken in each tooth (cervical, incisal, mesial, and distal) and the average of these values was taken as the value of the particular tooth (**Figure 4**).



Figure 4. Laser Fluorescence Value Noted Using Diagnodent (Kavo Dental Corporation, Lake Zurich, Ill) Pen

Cervitec®Plus varnish was applied on the 1st quadrant and the Fluor Protector® varnish was applied on the 2nd quadrant. The varnishes were dispensed into individual dispensers during every patient visit and applied around the bracket on the labial surface of the tooth using applicator tips. The patients were given instructions not to eat or drink anything for half an hour after the application of the varnish. During every visit, the archwire was removed, the surfaces were cleanly wiped using wet cotton and the enamel fluorescence value is measured using a Diagnodent pen.

Informed consent was obtained from every participating patient after the clinical trial details were thoroughly explained to them and their doubts were cleared. Patients were not given any other additional oral hygiene instructions apart from the regular oral hygiene instructions given to every orthodontic patient. These instructions include the use of toothbrushes and paste for brushing and maintaining proper oral hygiene.

Results and Discussion

The results obtained in the study are given in the table below. Four values using Diagnodent were taken in every tooth and the average of the same was used as the value for the particular period. T-Test was used to study the significance between T0, T1, and T2 values. There was statistical significance during the comparison between T0 and T2 groups and the T1 and T2 group. Wilcoxon’s Signed Rank test was used to compare the Diagnodent values obtained during the T0, T1, and T2 period in the Cervitec®Plus and Fluor Protector® group.

Comparison of the Diagnodent values from the Cervitec®Plus and Fluor Protector® groups was done

individually through three time periods. From the values obtained it was noted that the current result was like the results obtained from taking all the Samples together. There was a significant difference between the T0 and T2 groups and the T1 and T2 groups. Similar to the previous results, there was no significant reduction in the values between the T0 and T1 groups.

Mann-Whitney test was used for comparing the Cervitec®Plus and Fluor Protector® groups and there was no significant difference between the two groups in reducing the incidence of white spot lesions by reducing the enamel fluorescence. The statistical tests from the current study are given in the following tables (**Tables 1-3**).

Table 1. T-Test comparing the Cervitec®Plus and Fluor Protector® Group

	SIDE	Mean	Std. Deviation	Asymp. Sig. (2-tailed)
T0	Cervitec®Plus	3.3741	2.70707	.115
	Fluor Protector®	3.0659	2.57398	
T1	Cervitec®Plus	2.5162	1.57718	.280
	Fluor Protector®	2.8381	1.98930	
T2	Cervitec®Plus	2.1205	1.21671	.385
	Fluor Protector®	2.2818	1.43359	

Table 2. T-Test Cervitec®Plus

		Mean	N	Std. Deviation	Asymp. Sig. (2-tailed)
Pair 1	T0	3.3741	139	2.70707	.058
	T1	2.5162	139	1.57718	
Pair 2	T0	3.3741	139	2.70707	.000
	T2	2.1205	139	1.21671	
Pair 3	T1	2.5162	139	1.57718	.045
	T2	2.1205	139	1.21671	

Table 3. T-Test Fluor Protector®

		Mean	N	Std. Deviation	Asymp. Sig. (2-tailed)
Pair 1	T0	3.0659	139	2.57398	.766
	T1	2.8381	139	1.98930	
Pair 2	T0	3.0659	139	2.57398	.038
	T2	2.2818	139	1.43359	
Pair 3	T1	2.8381	139	1.98930	.000
	T2	2.2818	139	1.43359	

Though the average of the four Diagnodent readings was taken as the value of the particular tooth, it was noted that the Diagnodent readings obtained from the cervical region

of the tooth were higher compared to the other values despite the type of varnish applied. The values were more in the premolar regions than in the incisors, thus showing that the teeth that are difficult to maintain have higher chances of demineralization.

The results of the current study showed that there was no significant difference between the Fluor Protector® group and the Cervitec®Plus group. But the application of varnish reduced the laser fluorescence value obtained in the DIAGNodent and the values were significant. The laser fluorescence (LF) method for early diagnosis of dental caries is possible using the DIAGNodent (KaVo Dental Corporation, Lake Zurich, Ill) device. Infrared light of 655 nm wavelength will be emitted and will be absorbed by organic and inorganic tooth materials. The values on the device range from 0 to 99.20. The values obtained using the DIAGNodent pen showed that whether the patient's oral hygiene was supplemented using varnish or not, if the patient's oral hygiene maintenance was poor, it resulted in higher fluorescence values.

The results of a study evaluating a tri-monthly fluoride application demonstrated that the application of varnish on teeth surfaces was an effective auxiliary method to reduce the WSLs during fixed orthodontic treatment and showed a reduction of 44.3% in the demineralization index for that treated with fluoride varnish than the control group [17]. Earlier studies showed that the combination of Chlorhexidine and fluoride effectively reduced the incidence of WSLs on the maxillary incisors. It was stated that it could be partly due to the inhibiting effect of chlorhexidine on *S. mutans* [18].

To overcome the side effects of the use of Chlorhexidine mouthwash for a long period in orthodontic patients the use of natural substances like fruit substances like watermelon has also been studied to reduce the bacterial load in patients undergoing orthodontic treatment. These studies showed that Watermelon has a significant antibacterial effect against *Lactobacillus* and *Streptococcus mutans* bacteria which are responsible for the formation and development of white spot lesions [19].

During the time of bonding, the mean level of *S. mutans* in plaque was lower in the Cervitec®Plus® group than in the control group and the mean level was also significantly lower after twelve weeks in the Cervitec®Plus® group than the control group. There was no effect on the other parameters during the 24 weeks [20]. A study showed that the use of AF varnish around brackets every 6th week during treatment could prevent the formation of WSLs. The results of these studies reinforced the use of fluoride application to avoid caries-related problems in orthodontic patients [21, 22]. A recent systematic review also suggested that the use of both Chlorhexidine varnish and fluoride varnish can be suggested to reduce the prevalence of white spot lesions in patients undergoing orthodontic treatment [23].

Currently, there is no bonding agent in the market apart from bioactive glass-modified adhesive which has the potential to inhibit the formation of WSLs by releasing calcium and phosphate ions to prevent demineralization near the brackets while meeting ideal bond strength at the same time. A study that assessed the effectiveness of a chlorhexidine/thymol-containing varnish and two fluoride-releasing sealants (Maximum Cure® and Pro Seal®) showed greater caries-preventing ability, carious lesion formation was observed even with the use of chlorhexidine/ thymol containing varnish (Cervitec®Plus) [24]. Various studies have been published earlier regarding CHX-containing varnishes. Based on the findings of an earlier study it was shown that monthly use of varnish containing 1% chlorhexidine and 1% thymol stated that it can be an effective method to prevent the formation of plaque-induced oral diseases [25].

One demonstrated the need for further high-quality clinical trials to examine the effectiveness of chlorhexidine varnish on caries prevention during orthodontic treatment [26]. Many approaches have been used when we look back to 1988 until now, but none have been able to provide adequate mechanical and physical properties to be accepted as an orthodontic bonding agent while potentially exhibiting an anti-cariogenic behaviour [27].

Conclusion

From this research, it can be concluded that

- Orthodontic patients are more prone to White spot lesions.
- Patients undergoing orthodontic treatment should follow strict oral hygiene measures/ Brushing techniques.
- The use of additional oral hygiene aids is suggested to prevent the incidence of white spot lesions.
- DIAGNodent (KaVo Dental Corporation, Lake Zurich, Ill) can be used for the objective detection of early carious lesions in orthodontic patients.
- The use of Cervitec®Plus® and Fluor Protector® varnish can be suggested to reduce the incidence of WSLs in patients undergoing orthodontic treatment.

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