



EVALUATE AND COMPARE EFFICACY OF THREE DIFFERENT AGENTS FOR MANAGEMENT OF WHITE SPOT LESIONS IN ORTHODONTIC PATIENTS–RANDOMIZED CLINICAL TRIAL

Orthodontics

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ABSTRACT

Aim: efficacy of three different agents for management of White Spot Lesion in Orthodontic patients. **Materials and methods:** 60 patients undergoing Fixed Orthodontic Treatment with WSLs were selected. The measurements were performed and peak reading displayed on the panel of the DIAGNOdent pen was measured four times. The mean of all the four readings was calculated and was considered the final fluorescence value for each specific tooth. Intervention protocol was done. The size of the WSLs were mapped at T0, T1, T2 and T3. For Control group T0 and T1 were same because no intervention was done. **Results:** There was a significant difference between the values calculated before and after remineralization in all the three groups except the control group. **Conclusion:** There was a significant reduction in white spot lesions when treated ICON followed by MI Varnish and Fluor Protector. ICON was the most effective and Fluor Protector was the least effective.

KEYWORDS

INTRODUCTION

Fixed appliance therapy play a major role in enhancing the esthetics of an individual but also has drawbacks with it.¹

White Spot Lesions are one of the most frequent iatrogenic effects in Orthodontics.² Orthodontic Treatment makes it challenging for the patient to maintain hygiene which enhances the risk of plaque accumulation that can be attributed to decreased accessibility, reduced self-cleansing, altered salivary flow, presence or absence of fluoridation areas or poor compliance. Therefore, the progression of caries is faster in patients undergoing treatment.³

WSLs are enamel surface and subsurface demineralisation without cavitation and have white chalky, opaque appearance⁴ and observed on the labial surfaces of the maxillary incisors and are reported in 96% patients.

WSLs take 6 months for caries to develop in a patient not submitted to treatment and takes 1 month to develop in an orthodontic patient and mostly seen on labial surfaces of the maxillary lateral incisors, canines, premolars and central incisors.⁵

The method used for detection is direct visual examination and some other criteria like Gorelick et al, Nyvad et al and ICDAS II criteria.⁶

Methods to quantify caries are by measuring the fluorescence of the lesion and devices for chair side caries diagnosis have been developed like DIAGNOdent pen and Vistaproof.⁶

Fluoride reduces the rate of demineralisation by calcium and phosphate diffusion into the demineralized lesions to re-mineralize them. The rebuilt crystalline structures, composed of fluoridated hydroxyapatite and fluorapatite, are much more resistant to acid attack.⁴

Another novel method to prevent and treat WSL is the use of CPP-ACP in orthodontic patients which is a nano complex derived from milk, can stabilize higher concentrations of calcium and phosphate to enhance remineralization.⁷ It prevents enamel demineralisation for at least 4 weeks and limits demineralisation up to 12 weeks (Abufarwa et al).⁸

Recently, infiltrating resinous polymers have been introduced and these are considered as an 'ultra conservative' or 'non-invasive' approach.⁴

The aim of the study was to determine the efficacy of three different agents (ICON, MI Varnish and Fluor Protector) for management of WSLs in Orthodontic patients.

MATERIALS:

Figure 1: Standard Loupes



Figure 4: MI Varnish (GC, Tokyo)



Figure 2: KaVo DIAGNOdent Pen



Figure 5: Fluor Protector (Ivoclar Vivadent)



Figure 3: ICON (DMG Germany)



Figure 6: Armamentarium



Sample:

60 patients undergoing Treatment with WSLs were selected. Patients with no history of treatment with fully erupted permanent dentition, no smoking habits and patients having ICDAS II scores 2-4 were included. Any case with systemic diseases, enamel hypoplasia, fluorosis, pigmentation, subjects without any sign of active WSLs i.e score of 0/1/5/6 were excluded.

Distribution Of Samples:

Table 1: Group and sub groups for evaluation

S.NO	GROUP	TIME			
		T0	T1	T2	T3
1.	Group 1 (Control)	1a	1b	1c	1d
2.	Group 2 (ICON)	2a	2b	2c	2d
3.	Group 3 (MI Varnish)	3a	3b	3c	3d
4.	Group 4 (FLUOR Protector)	4a	4b	4c	4d

T₀ - Before clinical Intervention

T₁ - After clinical intervention

T₂ - after 1 month

T₃ - after 4 months

METHODOLOGY:

1. Informed consent and records were taken.
2. All anterior teeth were cleaned and dried.
3. The DIAGNOdent tip was rotated over all four surfaces of the brackets.
4. The measurements taken after 5 sec of drying.
5. Teeth with a score of 0-10 when assessed using a DIAGNOdent pen on the labial surface were selected.
6. The size of the WSLs were mapped at T₀, T₁, T₂ and T₃.



Figure 7: Measurement taken



Figure 8: Clinical use of DIAGNOdent

1. Intervention Protocol:

Group 1 (control)- no intervention

Group 2 (icon):

ICON Etch applied over the WSLs for 2 minutes.

Followed by water rinsing and air drying.

ICON Dry applied for 30 seconds and air blown.

ICON Infiltrant was rubbed on and left for 3 minutes.

Light-cured for 60 seconds.

Group 3 (mi Varnish):

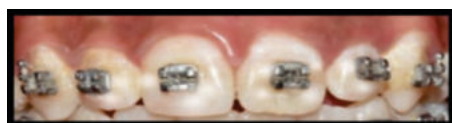
MI Varnish applied on the labial surfaces

left for 1-2 minutes.

Group 4 (fluor Protector):

Fluoride Varnish applied using Viva brush.

Left for 1 minute.

Figure 9: T₀ in Group 1Figure 11: T₀ in Group 212: T₃ in Group 2Figure 13: T₀ in Group 3Figure 14: T₃ in Group 3Figure 15: T₀ in Group 4Figure 16: T₃ in Group 4**RESULTS****Descriptive Results:****Table 2: Demographic details of study subjects**

Variable	Category	Control	ICON	MI varnish	Fluor Protector
Age	--	19.27 ± 2.25	18.60 ± 2.10	19 ± 2.59	19.20 ± 2.15
Gender	Male	6 (60%)	6 (60%)	8 (80%)	7 (70%)
	Female	9 (90%)	9 (90%)	7 (70%)	8 (80%)
Tooth number	11	4 (26.7%)	4 (26.7%)	4 (26.7%)	3 (20%)
	12	3 (20%)	4 (26.7%)	3 (20%)	3 (20%)
	21	4 (26.7%)	4 (26.7%)	4 (26.7%)	4 (26.7%)
	22	4 (26.7%)	3 (20%)	3 (20%)	4 (26.7%)
	23	0	0	1 (6.7%)	1 (6.7%)

Comparative Results:**Table 3: Time dependent changes in WSLs**

Group	T0		T1		T2		T3		p value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Control	4.52	0.99	4.52	0.99	4.47	0.94	4.43	0.97	0.125
ICON	5.62	1.08	4.45	0.96	3.73	1.01	3.25	0.95	<0.001*
MI Varnish	4.98	0.93	4.32	0.92	3.77	0.98	3.45	0.97	<0.001*
Fluor Protector	5.18	0.83	4.73	0.77	4.37	0.67	4.27	0.72	<0.001*

Repeated measures ANOVA test; * significant difference at p≤0.05, ** highly significant difference at p≤0.001

Table 4: Pairwise comparison of changes in WSLs

Group	T0 vs T1	T0 vs T2	T0 vs T3	T1 vs T2	T1 vs T3	T2 vs T3
Control	--	1.000	0.577	1.000	0.577	1.000
ICON	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	0.001**
MI Varnish	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	0.015*
Fluor Protector	<0.001*	<0.001*	<0.001*	<0.001*	<0.002*	0.986

*significant difference at p≤0.05, ** highly significant difference at p≤0.001

Table 5: Intergroup comparison of change in WSLs

	Groups	Mean	SD	p value	Ctrl vs IC	Ctrl vs MI	Ctrl vs FP	IC vs MI	IC vs FP	MI vs FP
T ₀ to T ₁	Control	0	0	<0.001**	<0.001**	<0.001**	0.001**	<0.001**	<0.001**	0.096
	ICON	1.17	0.35							
	MI Varnish	0.67	0.29							
	Fluor Protector	0.42	0.31							
T ₁ to T ₂	Control	0.05	0.17	<0.001**	<0.001**	<0.001**	0.016*	0.623	0.006*	0.446
	ICON	0.72	0.41							
	MI Varnish	0.55	0.25							
	Fluor Protector	0.37	0.21							
T ₂ to T ₃	Control	0.02	0.15	<0.001**	0.001**	0.059	1.000	0.857	0.017*	0.646
	ICON	0.48	0.38							
	MI Varnish	0.32	0.33							
	Fluor Protector	0.13	0.31							
T ₁ to T ₃	Control	0.08	0.18	<0.001**	<0.001**	<0.001**	0.157	0.311	<0.001**	0.123
	ICON	1.20	0.70							
	MI Varnish	0.87	0.41							
	Fluor Protector	0.47	0.39							
T ₀ to T ₂	Control	0.05	0.17	<0.001**	<0.001**	<0.001**	<0.001**	<0.001**	<0.001**	0.045*
	ICON	1.88	0.52							
	MI Varnish	1.22	0.36							
	Fluor Protector	0.85	0.31							
T ₀ to T ₃	Control	0.08	0.18	<0.001**	<0.001**	<0.001**	<0.001**	<0.001**	<0.001**	0.009*
	ICON	2.37	0.81							
	MI Varnish	1.53	0.40							
	Fluor Protector	0.92	0.42							

One-way ANOVA test; Post hoc Bonferroni test; * significant difference at $p \leq 0.05$, ** highly significant difference at $p \leq 0.001$

DISCUSSION

WSLs are a side-effect during orthodontic treatment with fixed appliances.⁹ WSLs develops around orthodontic brackets, ligatures and bands because these appliances make it difficult to clean and lead to accumulation of bacterial biofilm on tooth surfaces.¹⁰ The lesions are commonly observed on the labial surfaces of the maxillary incisors and a of incidence from 2% to 96% has been reported⁷ (Restrepo et al.¹¹)

The area of WSLs has been found to decrease exponentially during the 1st and 2nd years following orthodontic appliance removal but fail to return to pre levels, even 12 years after debonding.¹² A range of remineralising agents like CPP-ACP, Clinpro Toothpaste (1.1% Sodium Fluoride with Tri-Calcium Phosphate), GC Tooth Mousse, MI Varnish (CPP-ACP with Fluoride), Fluor Protector (Fluoride Varnish) have been used to prevent and treat WSLs. and maintain a condition of supersaturation with tooth enamel, applied CPP-ACP buffers free calcium and phosphate ion activity, preventing demineralisation and promote remineralization of WSLs (Shahmoradi M et al)¹³.

Resin Infiltration is a minimally invasive treatment involving penetration of resin into the WSLs. The clinician uses an acid etchant to remove the outer layer of sound enamel, exposing the demineralized lesion body; filling the lesion with a low-viscosity resin.¹⁴ This unfilled resin has optical properties similar to those of natural shade of tooth.¹⁵ The 'infiltrant,' acts by occluding the pores of the lesion body by capillary forces and when the pores are filled with the infiltrant, the infiltrated WSLs appear to be similar to the surrounding enamel because of the negligible difference in the refractive indices between the sound enamel ($RI=1.62$) and the infiltrant (Paris and Lueckel,¹⁶ Gray and Shellis¹⁷ and Cazolla et al⁴).

The results of our study showed that for all the groups except control group the mean DIAGNOdent reading decreased from T₀ to T₃. Intragroup time dependent changes in WSLs using ANOVA test showed that there is a statistically significant decrease in the WSLs with the application of all agents.

In ICON, MI Varnish and Fluor protector groups, maximum change was seen from T₀ to T₁ which was after the 1st intervention (Cazzolla et al)⁴. When a second intervention was done at T₂ there was improvement in the WSLs which continued to improve upto 4 months. Our study shows a significant improvement in these WSLs between the first and second month and no further improvement at 4 months indicating that fluorides by themselves may improve the WSLs.

Intergroup comparison of change showed a significant difference except in MI Varnish vs Fluor Protector group and ICON vs MI Varnish

Group indicating that both MI Varnish and ICON were able to improve the tooth aesthetics after a second application. In contrast, although there was an improvement in aesthetics in Fluor Protector group it was not as much as ICON or CPP-ACP group.¹⁸ (Kannan et al)

Limitations included the efficacy of these agents posterior region. Similar studies can also be done in males and females. Also, application of these agents before placement of brackets and its effect on bracket bond strength. Similar study can also be done in patients with Self-ligating brackets.

CONCLUSIONS

1. All the three re-mineralising agents used were effective in limiting active WSLs during treatment.
2. The effectiveness of ICON and MI Varnish increased on repeated application till 4 months but Fluor Protector increased only for first 2 months.
3. There was a significant reduction in WSLs when treated ICON followed by MI Varnish and Fluor Protector. ICON was the most effective and Fluor Protector was the least effective.

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