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ORIGINAL ARTICLE

Therapeutic Effect of Two Fluoride Varnishes on Remineralisation of White Spot Lesions Evaluated by Laser Fluorescence

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Abstract

Background / Aim: The presence of white spot lesion (WSL) is considered the first stage of dental caries. The early detection and diagnosis of WSL is of crucial importance, since caries can be prevented at this stage, reversed and/or controlled by elimination of etiological factors and by use of fluorides. The aim of this study was to compare the efficacy between the two fluoride varnishes on WSL remineralisation evaluated by laser fluorescence.
Methods: A total of 30 children and 60 WSL cases (2 per each child) were included in this study. The selected WSL were randomly divided into two groups in each child: G1 applying Fluor Protector S®, Vivadent, Lichenstein (n = 30) and G2 applying MI varnish®, GC, Tokyo, Japan (n = 30). The fluoride varnishes were submitted to three applications: at baseline, four weeks and eight weeks following the baseline, according to the manufacturer's recommendations. Mineral density of the enamel was measured using laser fluorescence (DIAGNOdent® 2095, KaVo, Biberach, Germany) for each WSL. Laser fluorescence (LF) measurements were performed at baseline and at fourth, eighth and twelfth week after starting the treatment and LF scores were calculated.
Results: By comparing LF scores at each measurement after treatment initiation, it was found that the scores were significantly lower in all groups when compared to baseline.
Conclusion: The results of this study indicate that both fluoride varnishes used were capable of remineralising WSL as evaluated by LF measurements. No difference was noted in the remineralising efficacy of the varnishes despite their different compositions. The main limitations of this study are small sample size and short follow up period. Therefore, further studies with large sample size and a longer follow up are, however, necessary.

Key words: Remineralisation; Laser fluorescence; Enamel mineral density.

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Introduction

Dental caries is non-transmissible multifactorial disease, known to be related to the presence of the microorganisms from dental biofilm and to be modulated by diet.[1] It is one of the most widespread disease and significant health problem worldwide, also present in the Republic of Srpska, Bosnia and Herzegovina.[1] Obradović et al stated that 34 % of the children from municipality of Banja Luka at the age of two are having caries present.[2] Latest studies confirmed the presence of caries in 99 % of the thirteen years old children from municipality of Banja Luka, with mean number of 6 cavities per child.[3]

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CONTENT

Pathogenesis of tooth decay involves phases of demineralisation and remineralisation. The presence of white spot lesions (WSL) is considered the first stage of caries, that is characterised by demineralised enamel, with roughness and opacity.[4] The early detection and diagnosis of WSL is of crucial importance, since at this stage the caries can be prevented, reversed and/or controlled by elimination of an etiological factors such as diet and dental biofilm control, as well as by use of fluorides.[4, 5] The use of fluoride treatment is considered the golden standard for dental remineralisation.[6] Currently, there are several fluoride treatments available on the market, out of which 1.5 % ammonium fluoride (NH_4F) is considered one of the most commonly used (Fluor Protector S®, Ivoclar Vivadent, Lichenstein).[6] Some of the latest methods of promoting remineralisation of initial caries lesions involve the use of casein phosphopeptideamorphous calcium phosphate (CPPACP), unstabilised (ACP) and a bioactive glasscontaining calcium sodium phosphosilicate, etc.[7] The combination of 5 % sodium fluoride (NaF) and CPP-ACP (Recaldent®) is extensively studied and proven to be an effective way to remineralise teeth (MI varnish®, GC, Tokyo, Japan).[7]

In the last decade interest in detecting and monitoring WSL and subclinical precavitated lesions has increased. One of the available non-invasive methods to measure early enamel demineralisation is laser fluorescence (LF).[8]

Therefore, the aim of this study was to compare the efficacy of two topically applied fluoride varnish formulations on remineralisation potential of WSL using LF.

Methods

The study was approved by the Ethics Committee of Institute of Dentistry Banja Luka (registration number 01-343-3/17), and Ministry of Education and Culture of the Republic of Srpska, Bosnia and Herzegovina (registration number 07.041/052-7273/17).

Inclusion criteria

Fifty-six children (M: 36, F: 20) ranging from 12 to 13 years of age with regular hygiene habits (brushing teeth everyday) were screened for this study. The inclusion criteria were: children with two or more WSL on the buccal surface of permanent teeth, whose parents/guardians/legal representatives signed an informed consent form. Children with dental caries in the form of small cavities or restorations and/or developmental enamel alterations (hypoplasia, fluorosis) and/or periodontal disease in the selected teeth, presence of orthodontic devices, and children under medical treatment or taking any kind of medicine were excluded from this study. Thirty children (M: 12, F: 18) that met the inclusion criteria were recruited for this study.

Fluoride application

A total of 60 WSL (2 per each child) were present. The selected WSL were randomly divided into two groups according to the fluoride varnish used: G1 = Fluor Protector S®, Vivadent, Lichenstein (n = 30) and G2 = MI varnish®, GC, Tokyo, Japan (n = 30). Following the recruitment, baseline characteristics (plaque and gingival index) were assessed. In all sessions, professional brushing/dental prophylaxis was performed prior to each application of topical fluoride, with the aim of providing clean tooth surfaces for the application of fluoride varnishes and LF evaluation of the WSL. The fluoride varnishes were submitted to three applications: at baseline, four weeks and eight weeks following the baseline, according to the manufacturer's recommendations.

Laser fluorescence

For each WSL, the mineral density of the enamel was measured using LF (DIAGNOdent® 2095, KaVo, Biberach, Germany). DIAGNOdent® 2095 operates with a diode laser having a wavelength of 655 nm and 1 mW peak power. Sound enamel does not fluoresce at this wavelength, but caries and bacteria do.[8] Three measurements were taken and averaged to give the final test value. Measurements were performed at baseline and at fourth, eighth and twelfth week after starting the treatment and LF scores calculated. All measurements were conducted by one pedodontics (RK).

Statistical analysis

The SPSS (Statistical Package for the Social Sciences, SPSS Inc., Chicago, Illinois, USA) Version 11.0 was used for the statistical calculations. The Wilcoxon Signed Ranks test was applied for comparison between LF scores and Mann-Whitney U test was applied for comparisons between varnish groups ($p < 0.05$).

Results

Application of the fluoride varnish from G1 (Fluor Protector S®, Vivadent, Lichenstein) resulted in statistically significant treatment outcomes when compared to baseline (Table 1 and 2).

Table 1: The results of application of the fluoride varnish G1 measured by laser fluorescence

DIAGNOdent	Baseline	4 weeks	8 weeks	12 weeks
Mean	17.41	15.91	14.44	12.94
Standard deviation/SD	3.83	4.30	3.38	3.74
Median	18.00	16.50	14.50	13.00

Table 2: The statistical analysis of the fluoride varnish G1

	Baseline	4 weeks	8 weeks	12 weeks
Baseline		Z = 4.242 p = 0.000	Z = 4.557 p = 0.000	Z = 4.963 p = 0.000
4 weeks			Z = 3.550 p = 0.000	Z = 4.562 p = 0.000
8 weeks				Z = 4.059 p = 0.000
12 weeks				

Table 3: The results of application of the fluoride varnish G2 measured by laser fluorescence

DIAGNOdent	Baseline	4 weeks	8 weeks	12 weeks
Mean	16.48	15.87	15.19	14.26
Standard deviation/SD	4.80	4.98	4.76	4.52
Median	17.00	16.00	15.00	14.00

Table 4: The statistical analysis of the fluoride varnish G2

	Baseline	4 weeks	8 weeks	12 weeks
Baseline		Z = 1.891 p = 0.059	Z = 2.439 p = 0.015	Z = 3.959 p = 0.000
4 weeks			Z =2.018 p = 0.044	Z = 3.638 p = 0.000
8 weeks				Z = 2.894 p = 0.004
12 weeks				

Table 5: The comparison between values of laser fluorescence from two fluoride varnish groups

		Baseline	4 weeks	8 weeks	12 weeks
Fluoride varnish G1	Mean	17.41	15.91	14.44	12.94
	Median	3.83	4.30	3.38	3.74
	Standard deviation/SD	18.00	16.50	14.50	13.00
Fluoride varnish G2	Mean	16.48	15.87	15.19	14.26
	Median	4.80	4.98	4.76	4.52
	Standard deviation/SD	17.00	16.00	15.00	14.00
	p	0.323*	0.939*	0.419*	0.275*

** - there was no statistically significant difference;*

Application of the fluoride varnish from G2 (MI varnish®, GC, Tokyo, Japan) resulted in statistically significant treatment outcomes when compared to baseline (Table 3 and 4). The values of LF between two flouride varnish groups showed no significant difference (Table 5).

Discussion

Tooth decay is affecting 60-90 % of the children. Its level vary between countries and it is strongly related to behavioural and socioeconomic factors (eg, income, education and employment). Consequently, the caries prevalence is very high in the Republic of Srpska, Bosnia and Herzegovina.

The presence of WSL is considered an initial stage of caries and it is really important to detect it in order to prevent further process of demineralisation that will further lead to cavitation. Treatment of WSL with fluoride is considered the widespread measure of primary prevention of caries.[10] The use of fluoride varnishes for caries prevention is supported and recommended by American Academy of Paediatric Dentistry and European Academy of Paediatric Dentistry.[11, 12] The American Dental Association recognises 5 % sodium fluoride (NaF) or 2.26 % fluoride content varnish treatment for the benefit of caries prevention when given at least twice per year to children up to age of 18.[11]

To date, radiographic image is considered the golden standard for the early caries detection.[13] However, non-invasive LF represents a promising method for monitoring enamel demineralisation and progression of caries lesion.[14, 15]

In this study we performed a 3-month comparative study of WSLs with two different fluoride varnishes. On assessing DIAGNOdent scores at baseline, 4, 8 and 12 weeks after treatment initiation, we found that the scores significantly decreased in all groups (Table 1 and 3). Previous studies demonstrated that fluorides remineralised WSL in 63.6 %.[16]

To date, majority of published studies demonstrated superiority of CPP-ACP fluoride varnishes when compared to conventional fluoride varnishes.[17-20] However, in our study the comparison of remineralisation efficacy between the G1 and CPP-ACP compounds fluoride varnish was not significant. it was concluded that both fluoride

treatments were effective in remineralising WSLs, despite their different compositions.

Also, in this study the detected remineralisation after 3 months of follow up failed to show the complete remineralisation evaluated by laser fluorescence. We suppose that major explanation for this drawback was short follow up period.

Conclusion

Within the limitations of this study it can be concluded that fluoride varnishes used in this study were capable of remineralising white spot lesions evaluated by laser fluorescence. No difference was noted in the remineralising efficacy of the varnishes despite their different compositions. The main limitations of this study are small sample size and short follow up period. Therefore, further studies with large sample size and a longer follow up are, however, necessary.

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None.

Conflict of interest

None.

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