Ask Us*

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Topical fluoride treatment

Q Is topical fluoride treatment (TFT) effective in preventing demineralization/white spot lesions in orthodontic treatment?

A Current evidence suggests that TFT offers some benefit in preventing the development of white spot lesions (WSL) during orthodontic treatment.

Demineralization or WSL of enamel adjacent to orthodontic appliances are a common sequela of orthodontic treatment. Initially, these areas of demineralization are seen as white spots. They can progress to cavitation if the insult from acidic plaque continues for an extended time. These lesions compromise the esthetic result of orthodontic treatment, and their management might require subsequent restorative intervention. Therefore, preventive measures must be taken during orthodontic treatment.

The incidence of incipient enamel caries or WSL adjacent to orthodontic appliances has been reported by various sources to range from 15% to 85%.[1] Orthodontic appliances introduce a number of plaque retention sites and, as a result, complicate oral hygiene. Thus, 2 general approaches can prevent decalcification and caries: increased attention to plaque removal and increased resistance to demineralization. This paper focusses on the second prevention strategy. We focus on the second prevention strategy. Fluoride is the most widely used agent to inhibit or possibly reverse the progression of WSL and dental caries. Several placebo controlled trials have been used for meta-analysis and systematic reviews in nonorthodontic patients to establish the efficacy of fluoride gels,[2] mouth rinses,[3] fluoride varnishes,[4] and other topical fluorides[5] in caries prevention. Combinations of topical fluorides have been shown to further reduce the incidence of caries and WSL in nonorthodontic patients when compared with a single topical fluoride regimen.[6]

There are no standard guidelines for the most effective formulation and mode of delivery of topical fluoride agents in high-risk orthodontic patients. The efficacy of topical fluorides in orthodontic patients is also not well established. Therefore, the Council on Scientific Affairs (COSA) of the American Association of Orthodontists undertook an evidence-based approach to evaluate the current literature on the use of fluoride in preventing WSL in patients with orthodontic appliances. The question "is TFT effective in preventing demineralization/white spot lesions in orthodontic treatment?" was formulated by using the PICO guidelines[7] (P, population [orthodontic patient]; I, intervention [TFT]; C, comparison [placebo or no treatment]; O, outcome [demineralization/WSL]), and relevant articles were searched accordingly. To focus on the mode of fluoride delivery, TFT was defined as the application of fluoride to the teeth in the form of gels, varnishes, toothpastes or dentifrices, and mouth rinses. Other local fluoride delivery methods such as fluoride-releasing bonding materials, elastics, cements, and sealants were excluded for this review. The literature was searched for meta-analyses, systematic reviews, and randomized controlled trials (RCTs; published after the last systematic review or meta-analysis) in PubMed, Cochrane Database, and Google Scholar; hand searching was also done of references lists, with the key words *orthodontics, fluoride, braces, white spots, caries, demineralization,* and *preventive therapy.* Six articles were identified that fulfilled the criteria at the literature search in April 2008.[8-13] Four of these were systematic reviews,[8-11] and 2 were RCTs[12,13] published after the most recent systematic review on the subject. No meta-analysis was performed on this topic because of heterogeneity of the studies.

All 9 COSA members independently evaluated the 6 articles. The following are the critical appraisal and the synthesis of the evidence.

The first 2 systematic reviews on the subject were written by the same authors.[8,9] In both, they recommended that patients with fixed orthodontic appliances should rinse daily with a 0.05% sodium fluoride mouth rinse. These conclusions were essentially extrapolated from studies of nonorthodontic patients.[6,14] Many studies related to orthodontic patients were reported in these systematic reviews but were found to be inadequate in research design with regard to randomization, allocation concealment, error method, assessor blinding, baseline comparison, and clearly defined inclusion and exclusion criteria. It was also reported that compliance with daily use of a mouth rinse is less than 15% in the orthodontic population.[15] Thus, the conclusions based on these 2 reviews are limited.

The systematic review by Derks et al[11] found no convincing evidence about the efficacy of TFT in orthodontic patients. The authors reported that, although a trend for reduction of WSL was observed with a topical toothpaste and a gel with high fluoride (1500-5000 ppm), no specific guidelines for TFT recommendation could be drawn from this study.

Chadwick et al[10] found evidence from qualifying studies that the use of topical fluorides (0.05% sodium fluoride rinse, 0.4% stannous fluoride gel, and sodium fluoride gel 1.1%, 5000 ppm) in addition to fluoride toothpaste (1000, 1500,

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and 5000 ppm) reduced the incidence of WSL in orthodontic patients. The preventive effect of fluoride was observed in orthodontic patients with both fluoridated and nonfluoridated water supplies. All formulations of fluoride were reported to decrease WSL, but there was no conclusive evidence that any method was superior. The authors reported that increasing the potency of fluoride preparations resulted in significantly fewer decalcification sites. It was found that brushing with a high-potency sodium fluoride gel (1.1%, 5000 ppm) after normal brushing at night, and high-potency (1.1%, 5000 ppm) sodium fluoride toothpaste used twice daily resulted in fewer WSL ($P < 0.05$) than in the control group brushing twice daily with a fluoride toothpaste (1000 ppm) and rinsing once a day with a 0.05% acidulated phosphofluoride rinse.

The systematic reviews presented only a qualitative assessment and a trend toward reduction of WSL in orthodontic patients with TFT. The authors noted that no selected study fulfilled all methodologic quality-assessment criteria. All COSA members concluded that the systematic reviews provided only weak, indirect, or secondary level of evidence for the use of TFT in orthodontic patients. The evidence suggests that increasing the potency of fluoride and the frequency of application might have value in increasing resistance to demineralization and prevention of WSL.

Since the last systematic review, 2 randomized trials have been published. Ogaard et al[12] reported evidence in favor of amine fluoride/stannous fluoride toothpaste (AmF/SnF2; 140 ppm F; pH 4.5) used twice daily with a daily rinse of AmF/SnF2 solution (250 ppm F; pH 4.0) over a sodium fluoride (NaF; 1400 ppm F; pH 6.7) toothpaste and NaF rinse (250 ppm; pH 6.3) combination used similarly. A limitation of this study was its lack of a control group. In addition, although statistical significance was observed in favor of 1 TFT modality, it did not eliminate the development of WSL completely.

The most recent RCT, by Stecksen-Blicks et al,[13] presents the most robust evidence about the protective effect of regular topical fluoride varnish applications during orthodontic treatment. This was a double-blind RCT with 2 parallel arms in which consecutively treated patients were examined (n = 273; 257 subjects completed the trial). Both the experimental (n = 132) and the control (n = 125) groups had similar numbers of WSL before treatment. The active agent used in the experimental group was 0.1% fluoride as difluorosilane in a polyurethane varnish base (commercially available as Fluor Protector, Ivoclar Vivadent, Schaan, Lichtenstein). The placebo varnish had an identical composition but no fluoride. The varnish was applied every sixth week during the treatment period. Digital photographs were used by 2 examiners at debonding to assess the incidence and progression of WSL on the maxillary incisors, canines, and premolars. The posttreatment incidences of WSL were 7.4% in the fluoride varnish group and 25.3% in the placebo group ($P < 0.001$). The authors concluded that the results strongly suggest that regular topical fluoride varnish should be a routine preventive measure in orthodontic practice.[13] Once again, it was noted that, although fluoride varnish significantly reduced the incidence of WSL, it did not totally prevent WSL formation.

An absolute prevention of WSL perhaps requires both immaculate plaque control and increasing enamel resistance to demineralization. Plaque control depends on the patient, and should be emphasized and reinforced periodically. With regard to TFT, all COSA members agreed that there is some evidence that TFT is helpful in preventing WSL. However, it is still unclear which fluoride agents are most effective. Future RCTs are necessary to address the various formulations, concentrations, and frequencies of application.

Lokesh Suri
Associate professor, Department of Orthodontics
Tufts University School of Dental Medicine, Boston, Mass

Greg Huang
Associate professor and chair, Department of Orthodontics
University of Washington, Seattle, Wash

Jeryl D. English Jr
Professor and chair, Department of Orthdontics
University of Texas Health Science Center at Houston
Houston, Tex

Shannon Owen
Private practice, Jackson, Wyo

Hyun-Duck Nah
Clinical associate professor, Department of Orthodontics
Temple University, Philadelphia, Pa

Michael L. Riolo
Adjunct professor, Department of Orthodontics
School of Dentistry
University of Detroit Mercy, Detroit, Mich

Bhavna Shroff
Professor and postgraduate program director
Department of Orthodontics, Virginia Commonwealth
University, Richmond, Va

Thomas E. Southard
Professor and head, Department of Orthodontics
University of Iowa, Iowa City, Iowa

David L. Turpin
Affiliate professor, Department of Orthodontics
University of Washington, Seattle, Wash

REFERENCES

1. Mitchell L. Decalcification during orthodontic treatment with fixed appliances—an overview. Br J Orthod 1992;19:199-205.
2. Marinho VC, Higgins JP, Logan S, Sheiham A. Fluoride gels for preventing dental caries in children and adolescents. Cochrane Database of Systematic Reviews 2002:CD002280.
3. Marinho VC, Higgins JP, Logan S, Sheiham A. Fluoride mouthrinses for preventing dental caries in children and adolescents. Cochrane Database of Systematic Reviews 2003:CD002284.
4. Marinho VC, Higgins JP, Logan S, Sheiham A. Fluoride varnishes for preventing dental caries in children and adolescents. Cochrane Database of Systematic Reviews 2002:CD002279.
5. Marinho VC, Higgins JP, Logan S, Sheiham A. Topical fluoride (toothpastes, mouthrinses, gels or varnishes) for preventing dental caries in children and adolescents. Cochrane Database of Systematic Reviews 2003:CD002782.

6. Marinho VC, Higgins JP, Sheiham A, Logan S. Combinations of topical fluoride (toothpastes, mouthrinses, gels, varnishes) versus single topical fluoride for preventing dental caries in children and adolescents. Cochrane Database of Systematic Reviews 2004:CD002781.
7. Huang X, Lin J, Demner-Fushman D. Evaluation of PICO as a knowledge representation for clinical questions. Proceeding of the Annual Symposium of the American Medical Informatics Association; 2006 Nov 11-15, Washington, DC. 2006. p. 359-63.
8. Benson PE, Parkin N, Millett DT, Dyer FE, Vine S, Shah A. Fluorides for the prevention of white spots on teeth during fixed brace treatment. Cochrane Database of Systematic Reviews 2004:CD003809.
9. Benson PE, Shah AA, Millett DT, Dyer F, Parkin N, Vine RS. Fluorides, orthodontics and demineralization: a systematic review. J Orthod 2005;32:102-14.
10. Chadwick BL, Roy J, Knox J, Treasure ET. The effect of topical fluorides on decalcification in patients with fixed orthodontic appliances: a systematic review. Am J Orthod Dentofacial Orthop 2005;128:601-6.
11. Derks A, Katsaros C, Frencken JE, van't Hof MA, Kuijpers-Jagtman AM. Caries-inhibiting effect of preventive measures during orthodontic treatment with fixed appliances. A systematic review. Caries Res 2004;38:413-20.
12. Ogaard B, Alm AA, Larsson E, Adolfsson U. A prospective, randomized clinical study on the effects of an amine fluoride/stannous fluoride toothpaste/mouthrinse on plaque, gingivitis and initial caries lesion development in orthodontic patients. Eur J Orthod 2006;28:8-12.
13. Stecksen-Blicks C, Renfors G, Oscarson ND, Bergstrand F, Twetman S. Caries-preventive effectiveness of a fluoride varnish: a randomized controlled trial in adolescents with fixed orthodontic appliances. Caries Res 2007;41:455-9.
14. Marinho VC, Higgins JP, Sheiham A, Logan S. One topical fluoride (toothpastes, or mouthrinses, or gels, or varnishes) versus another for preventing dental caries in children and adolescents. Cochrane Database of Systematic Reviews 2004:CD002780.
15. Geiger AM, Gorelick L, Gwinnett AJ, Benson BJ. Reducing white spot lesions in orthodontic populations with fluoride rinsing. Am J Orthod Dentofacial Orthop 1992;101:403-7.

Am J Orthod Dentofacial Orthop 2009;135:561-3
0889-5406/$36.00

doi:10.1016/j.ajodo.2009.02.001