

Fluorides in Orthodontic Treatment- A Review

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Abstract:

A white spot lesion (WSL) is a sign of decalcification or demineralization of enamel that appears as a white spot on surfaces of the tooth.. It was considered as a most important undesirable consequences of orthodontic therapy, despite advances in techniques and materials in preventive dentistry and orthodontics. Most commonly used self applied topical fluorides are toothpaste and mouth rinse whereas professionally applied topical fluorides for orthodontic patients include fluoride varnish, fluoridated composite bonding material, fluoridated glass - ionomer cement and pit & fissure sealant. A high dose of fluoride toothpaste is recommended to inhibit the formation of white spot lesion , and a low dose of fluoride helps in remineralization and control the progression of white spot lesion. Some evidence shows that daily use of sodium fluoride mouthwash and fluoridated glass ionomer cement reduces the severity of decay around braces where fluoride varnish resulted in a 44.3% reduction in enamel demineralization. Since Orthodontic treatment was considered as one of the risk factor for developing white spot lesions, effective and judicious use of fluoride supplements helps in preventing such lesions in them

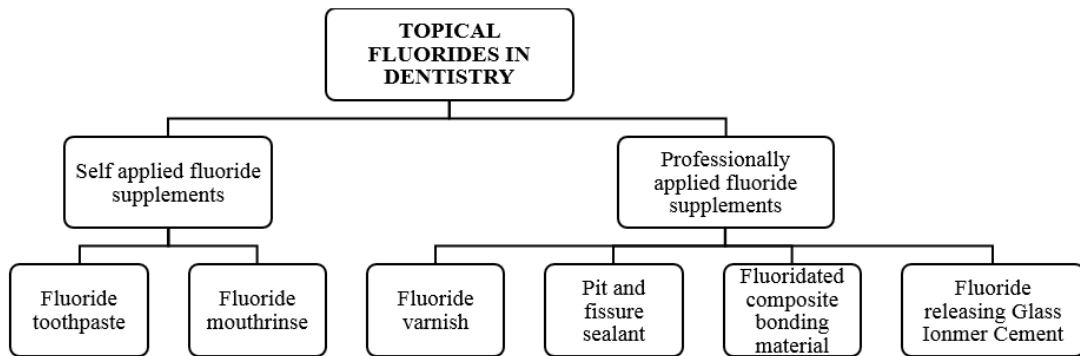
I. INTRODUCTION

A white spot lesion (WSL) is a type of enamel decalcification that shows as a white spot on tooth surfaces. They indicate the early phases of dental caries and are induced by bacterial plaque activity [1].Despite improvements in methods and materials in preventive dentistry and orthodontics, enamel surface demineralization (WSL) remains one of the most serious side effects of fixed orthodontic treatment. They appear during orthodontic therapy and can sometimes last later. [2].One of the most difficult obstacles in orthodontic practise is a dearth of patient collaboration, which results in poor oral health. Treatment discontinuation is sometimes needed to attain adequate oral health condition. To reduce the chance of having carious lesions, preventive and therapeutic steps may be required before and during orthodontic therapy.[3]. According to reports, the frequency of white spots with orthodontic therapy reached 38% at 6 months and marginally rose to 46% at 12 months. However, the longer the treatment is given, the more probable it is that WSLs will form. (4).Toothpaste is the most frequently used fluoride substance in household dental care. Fluorides in the form of mouth rinses, tablets, and gels are frequently suggested for orthodontic patients, and each product has a unique ability to boost fluoride concentration and dispersion in the oral cavity. Using fluoride-containing rinses and mouthwash during orthodontic therapy increases the fluoride concentration in saliva, reducing white spot lesions in these patients [5]. As a result, this paper discusses different fluoride supplements used during orthodontic therapy and their efficacy in avoiding white spot lesions..

TOPICAL FLUORIDES IN DENTISTRY

Fluoride supplement are classified into self applied and professionally applied. Most commonly used self applied topical fluorides are toothpaste and mouth rinse. Professionally applied topical fluorides for orthodontic patients are fluoride varnish, fluoridated composite bonding material, fluoride containing glass - ionomer cement and pit & fissure sealant (Figure 1).

Figure 1: Topical fluorides in dentistry



SELF APPLIED FLUORIDE SUPPLEMENTS

Fluoride toothpaste

Proper oral hygiene maintenance with regular use of fluoride toothpaste is a common recommendation from orthodontists, but has been shown to be effective in inhibiting the development of white spots around orthodontic brackets[6]. Fluoride dentifrices have proven ability to reduce white spot lesion. These reductions are largely attributed to the effects of small but protracted increases in plaque and salivary fluoride levels. Regular twice-daily brushing with a fluoride toothpaste typically increases salivary fluoride levels by at least twofold, and plaque levels can be much higher. There is overwhelming evidence that low levels of fluoride have been found in dormant plaque and saliva more than 12 hours after brushing with a fluoride tooth paste [7].

The active component, sodium fluoride (NaF), must also contain enough detergent (typically sodium lauryl sulfate, SLS) to prevent fluoride ions from reacting with silica abrasives and forming insoluble fluorosilicates. The fluoride in toothpaste is classified into three types: the first one is free ionic fluoride, which can combine with dental structure, disturb microbial metabolism, be taken by the mouth mucosa, and have an anti-caries effect. The second type of fluoride is ionic fluoride, which can combine with dental structure, disturb microbial metabolism, and be taken by the mouth mucosa. The final one is Non-available fluoride compounds that are either spat out or ingested and have no anti-caries properties. Pro fluoride compounds that are released into the oral cavity or precipitated during teeth brushing produce ionic fluoride over time and add to the efficacy of anti-caries medications. (8).

'According to some clinical study, only the use of fluoridated toothpaste improved the mineral condition and decreased the area of the WSL after de bonding. Long-term follow-up revealed, however, that while the area decreased, it did not entirely vanish, instead stabilising in a specific area. This condition is caused primarily by a decline in enamel hardness following demineralization. Brushing and biting motions abraded the tooth surface, resulting in demineralized enamel structure loss. Fluoride toothpaste has a minimal fluoride concentration and requires little consumption per time.

Lussi discovered that at low fluoride ion concentrations (below 100 mg/l), fluorapatite is produced, which enhances the acid resistance of enamel. When fluoride ions are present in higher concentrations, they combine with calcium ions to create calcium fluoride, which encourages remineralization. The fluoride content in a pea-sized fluoride toothpaste used for cleaning teeth was about 2-3mg; however, gargling after brushing teeth lowers the fluoride content, which can bond to the enamel surface, resulting in a weak therapeutic impact. Uysal and colleagues discovered that brushing with fluoride toothpaste alone is ineffective in preventing the development of white spot lesions discovered during orthodontic therapy. When WSIs were discovered, extra remineralization treatments were needed [(9)]. According to Alexander et al., brushing twice-daily with 5000 ppm fluoride toothpaste was more successful than brushing with 1000 ppm fluoride toothpaste in correcting enamel demineralization.. Fluoride application quantity and dose are contentious. Fluoride agents that deliver a large dosage of fluoride at the start (the burst effect) are more successful at raising the enamel's resilience to decalcification. A modest fluoride concentration is more efficient at remineralizing dental enamel. The large fluoride dose literally prevents calcium ions from penetrating into the subsurface layers of dental enamel. As a result, a high fluoride dosage is suggested to prevent lesion development and a low fluoride dose to remineralize and control lesion progression [10].

Fluoride mouthrinse

Daily sodium fluoride (NaF) (0.05% or 0.2%) mouth rinses and/or weekly acidified phosphate fluoride (1.2%) rinses have been found to decrease the frequency of enamel demineralization during ongoing fixed orthodontic therapy. Following a comprehensive study, Benson advised that daily use of 0.05% NaF mouthwash

is the best way of avoiding enamel demineralization during fixed orthodontic therapy. Hirschfield, on the other hand, recommended using an APF mouthwash to make dental enamel more impervious to orthodontic decalcification. Geiger et al. found that using a fluorine rinse reduced the frequency of WSLs by 25%. The concentration of fluoride in saliva rose considerably after 2 weeks of using NaF mouthwash with one rinse per day [6]. Fluoride amounts in sampled mouthwashes ranged from 45 to 3000 ppm. Fluoridated mouthwash, unlike toothpaste, can be used everyday, once, twice, or three times a week, every two weeks, or three or four times a year. Fluoride-containing mouthwashes are usually used only rarely. A regularity of only three or four times per year is no longer recommended[11].According to Benson's study, daily sodium fluoride mouthwash reduces the degree of dental decay around braces, and glass ionomer cement, which is used to attach orthodontic brackets to teeth, reduces the frequency and intensity of whitespots when compared to a composite resin.[12]. A fluoride mouthwash will only function if the patient uses it on a frequent basis, so its effectiveness is dependent on patient compliance. There is proof, however, that mouthwash usage is low[13].

PROFESSIONALLY APPLIED FLUORIDE SUPPLEMENTS

Fluoride varnish

Fluoride varnish, when in direct contact with the enamel surface, produces a transient reservoir of highly concentrated fluoride ions that can penetrate into the hydroxyapatite crystals. When hydroxide ions are replaced for unbound fluoride ions, the volume of the apatite crystals decreases, their stability increases, and their solubility decreases.[14]. The most frequently used fluoride coatings are Duraphat (5% NaF), Fluoroprotector (1% difluorosilane and 0.1% F), and Duraflor (5% NaF).[6].When used directly, fluoride varnishes have demonstrated to be safe and practical. They have higher fluorine amounts than the toothpastes and mouthwashes we use every day. The coating can stay on dental surfaces for several hours after application and release enough fluoride ions to keep the surface fluoridated. [15].

In individuals having orthodontic therapy, the use of a fluoride varnish reduced enamel demineralization by 44.3%. In patients with a low to moderate risk of caries, a single application of fluoride varnish immediately before the start of orthodontic treatment provided no additional preventive benefit over good dental hygiene when using fluoride toothpastes in terms of the development of WSL and gingivitis. Fluoride varnish is frequently applied to patients directly previous to orthodontic therapy with fixed appliances. The efficacy of this method, however, has yet to be determined.

The discharge of fluorine from elastomeric ligatures may aid in the reduction of demineralization. Fluoride incorporation into rubber bands, on the other hand, may influence their physical characteristics, resulting to quicker deterioration in the oral cavity[16]lesions treated with F-varnish demonstrated faster remineralization than the other therapies. Over a three-month span, the remineralization with F-varnish was steady. The benefit of this application routine could be the deposition of a CaF₂-like coating on the enamel, which would increase the remineralization of previously demineralized enamel. Higher mineral levels have been demonstrated with more regular expert fluoride use. It is essential to observe that fluoride concentration has a favourable but not linear relationship with enamel mineralization and remineralization.

Brackets, on the other hand, encourage biofilm buildup and may also promote enamel retention, increasing contact time with enamel. As a result, the brackets would extend NaF interaction with the molar surface, justifying their use in orthodontic patients with active WSLs.(17). According to Minquan Du, a recent research suggests that using a fluoride varnish can help decrease WSLs that develop near orthodontic appliances. Aside from requiring less time in the clinical operating room, it removes patient cooperation, provides for better fluoride exposure management, and can be done by a qualified hygienist. [18]

Pit and fissure sealant

Light-cured pit and fissure sealants applied to the buccal areas near bonded orthodontic braces were found to be very successful (80%) in avoiding demineralization in vitro, with no need for patient permission. These coatings, however, are difficult to remove and must be meticulously polished after removal [15].

Fluoridated composite bonding material

The literature of Silva-Fialho P et al indicates a low effectiveness of fluoride-containing composite resins, since the fluoride release is only short-term compared to the longevity of orthodontic treatments (duration of about 2 years) [13].

Fluoride releasing glass ionomer cement

A non-compliance method that not only seals the vulnerable area adjacent to the brackets but also provides a caries-inhibiting zone around it would be beneficial for orthodontic patients were able to inhibit enamel demineralization around orthodontic brackets after exposure to acetate demineralization for 7 days [19].

II. CONCLUSION

Since Orthodontic treatment was considered as one of the risk factor for developing white spot lesions, effective and judicious use of fluoride supplements helps in preventing such lesions in them. The form of fluoride to be used depends on individuals caries risk and oral hygiene maintenance of the orthodontic patient.

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