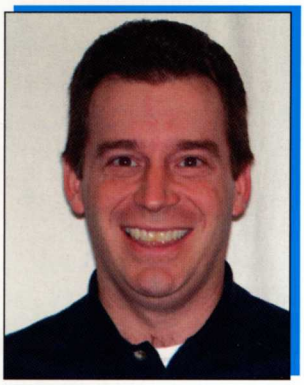
Management of Orthodontic Patients with Oral Hygiene Problems: A Case Report



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Enamel decalcification remains a significant problem when treating patients with fixed orthodontic appliances. Poor oral hygiene is the most common cause in the formation of white spot lesions. The adherence of plaque to the enamel surface is what initiates the decalcification process. Different types of bacteria, such as Lactobacillus and Streptococcus mutans, increase the risk of decalcification. The organic acids produced by these types of bacteria cause the dissolution of calcium and phosphate ions from the enamel surface. In a matter of four weeks, this process can lead to white spots or early carious lesions.

Decalcification, or demineralization, is caused by ineffective oral hygiene and retention of bacterial plaque for an extended period of time on the enamel surface.[1] As the mineral content of the enamel surface is decreased a chalky white spot develops clinically. This is termed a white spot lesion, which is the early stage of a carious lesion. Calcium and phosphate are the mineral elements that are broken down within the tooth structure. This usually occurs in an oral environment that is acidic, or has a decreased pH.[2] Decalcification is a back and forth process with alternating phases of demineralization and remineralization. This means that the mineral content fluctuates as the oral environment changes and dental plaque develops and matures.[3] There are several factors that lead to this fluctuation of mineral content within the enamel. They include oral pH, the presence or absence of fluoride, the content of the saliva, the virulence of the oral bacteria, the frequency of sugar ingestion and the duration of the pH conditions. This activity of remineralization and demineralization can occur at the same time at various levels depending on the high bacterial metabolic activity and low pH conditions.[4]

Different methods to control the destruction of the enamel surface have been employed. A few of these are fluoride application, enamel sealants, modified appliance designs and rigorous oral hygiene regimens. In addition, orthodontic adhesives that contain fluoride, such as the glass ionomer cement, may help to eliminate the problem of decalcification.

Oral hygiene can reduce or control the amount of plaque in contact with enamel, which will result in the prevention of decalcification. Continuous reinforcement of oral hygiene habits and evaluation of the oral health status of the patient should be maintained throughout treatment.[5] Holmen[6] reported that professional oral plaque removal on a weekly basis would be beneficial in preventing a white spot lesion from developing. But these measures would be very costly. Toothbrushing is still the best way to remove plaque on a daily basis. Electric rotary toothbrushes have been found to remove more plaque than a manual toothbrush.[7,8] Sonic brushes have been shown to be 20-47% more effective in removing plaque than by manual brushing.[9,10]

Other oral hygiene supplements that prove useful in decreasing the amount of decalcification are oral irrigation devices, floss, proxabrushes, and other interdental aids. But these methods cannot be substituted for good brushing with a manual or electric toothbrush.[2]

Mouthrinses can remove plaque chemically which can be advantageous.[11] Hogg attributes the effectiveness of chlorihexidine to its absorption onto the acquired pellicle resulting in substantivity.[11]

Fluoride administration has been offered as a method of reducing the amount of decalcification that may result in patients with poor oral hygiene.[2] There are many ways to apply fluoride. They include home rinses, professionally applied gels, water, and dentrifices. O'Reilly and Featherstone found that the combined daily use of fluoride dentrifice and mouthrinse (0.05% sodium fluoride) provided optimal protection form enamel decalcification during orthodontic therapy.[12] Most studies show that without good patient compliance, none of these above mentioned techniques will prevent white spot formation.

Therefore patient compliance is a huge factor in determining which method would be most beneficial in eliminating white spot formation. Fluoride varnishes have been shown to decrease enamel demineralization in vitro and in clinical trials. These varnishes have been around since the 1960's and used mainly in Europe until the 1980's.[13] Fluoride varnishes contain 5% sodium fluoride. Fluoride varnishes have the benefit of adhering to the enamel surface longer than other topical fluoride products. The application of fluoride varnish is extremely easy. It has been shown that a thorough prophylaxis is not necessary but it is best to dry the area before applying the varnish. Studies have shown that this material mustbe reapplied every 3-6 months for maximum effect.[14,15] Duraflor, a fluoride varnish, treatment of teeth has resulted in significant reductions of smooth surface caries ranging from 50 to 70%.[16,17] Maiwald and Geiger18 determined that the varnish had no effect on caries incidence when applied once a year, but obtained a reduction of 45% when used every 4 months. In summary, Todd et al[19] reported that a fluoride containing varnish should be considered for use as a preventive adjunct to inhibit enamel demineralization adjacent to orthodontic brackets, particularly in patients who exhibit poor compliance with oral hygiene and home fluoride use.

A review of the development of adhesives must be done to have a better understanding why a fluoride releasing type would be of great value. In 1964, Newman[20] introduced the possibility of direct bonding a plastic orthodontic bracket to the enamel surface of a tooth using an adhesive resin. Newman used an epoxy, which was a combination of bisphenol A and epichlorhydrin. In 1977, Hocevar[21] initiated the use of Concise restorative resin for bonding orthodontic brackets. This system consisted of two liquids and two pastes. In 1979, 3M developed an orthodontic bonding system which decreased the necessity of adding liquid to pastes.[22] Travas and Watts[23] introduced light activated adhesives with the ability to bond orthodontic attachments in 1979. The introduction of visible light curing (VLC) made bonding safer and more effective. Fluoride containing adhesives such as the glass ionomer cement and the new pre-paste adhesive bracket system such as APC-Plus (3M Unitek, Monrovia, CA) shows promise in preventing decalcification during orthodontic therapy because patient compliance is not an issue.

Case Report

A healthy 9 year old female presented to the West Virginia University School of Dentistry, Department of Orthodontics to have orthodontic treatment. Patient had a history of numerous carious lesions in the permanent and primary dentition. All restorative treatment was completed and orthodontic therapy was initiated. Patient was treated for 15 months before the evidence of decalcification was noted. At which time oral hygiene instruction was reinforced with patient and parent. During the next 6 months, numerous brackets had to be re-bonded due to the decalcification. The patient was de-banded and de-bonded 25 months after treatment was initiated. Major decalcification was noted around the gingival areas of 85% of the teeth (Figures 1A, 1B, and 1C). After maxillary and mandibular impressions were taken for a set of Essix retainers, Duraphat was placed on all the teeth and a prescription for Prevident 5000 toothpaste was given to the patient.

The patient was seen for regular recall visits during the first year post de-bonding and the decalcification was noted (Figures 2A, 2B, and 2C). The patient, now 14 years old, was not seen for two and half years and had a few of the teeth restored that had become carious. The patient presented at this time with downward and backward mandibular growth and developed an overjet and openbite. It was decided to wait until the end of mandibular growth before addressing the re-treatment.

Conclusions

This patient's poor oral hygiene led to numerous carious lesions and generalized decalcification. Intensive oral hygiene instruction should have been a top priority during orthodontic treatment. Sometimes the "straightening of teeth" gets in the way of seeing the entire picture. Parental involvement is vital in reducing these poor oral hygiene issues. Prevident 5000 toothpaste could have been prescribed earlier in the treatment as well as 4 month applications of Duraphat. When applying the fluoride varnish, Duraphat, it is critical that the teeth be cleansed of plaque and other foreign debris. If the oral hygiene does not improve it may be necessary to remove the arch wires for a period of time. This will allow for proper brushing and flossing and return the gingival tissues to a more normal state. In summary it may be necessary to use a fluoride varnish, such as Duraphat of Duraflor, and a fluoridated toothpaste, such as Prevident 5000, to prevent enamel demineralization in patients with poor oral hygiene in conjunction with orthodontic therapy. Also a fluoride releasing adhesive on the brackets, such as 3M Unitek's APC-Plus, may prove beneficial.

Figures

Figure 1A: *Anterior intraoral photo of patient immediately after removal of orthodontic appliance showing extensive decalcification around the gingival portion of the crowns*

Figure 1B: *Right buccal intraoral photo*

Figure 1C: *Left buccal intraoral photo*

Figure 2A: *Anterior intraoral photo of patient 2 months after application of fluoride varnish.*

Figure 2B: *Right buccal intraoral photo*

Figure 2C: Left buccal intraoral photo

References

1. Gorelick L, Geiger AM, Gwinnett AJ. Incidence of white spot formation after bonding and banding. *Am.J.Orthod* 1982; 81:93-98
2. Mitchell L. Decalcification during orthodontic treatment with fixed appliances—an overview. *Br.J.Orthod* 1992; 19:199-205
3. Sturdevant C RTHHSJ. *The Art and Science of Operative Dentistry.* (Mosby-Year Book, Inc.: St. Louis): 1995.
4. Underwood ML, Rawls HR, Zimmerman BF. Clinical evaluation of a fluoride-exchanging resin as an orthodontic adhesive. *Am.J.Orthod. Dentofacial Orthop.* 1989;96:93-99.
5. Schwaninger B, Vickers-Schwaninger N. Developing an effective oral hygiene program for the orthodontic patient: review, rationale, and recommendations. *Am.J.Orthod.* 1979; 75:447-452.
6. Holmen L, Mejare I, Malmgren B, Thylstrup A. The effect of regular professional plaque removal on dental caries in vivo. A polarized light and scanning electron microscope study. *Caries Res.* 1988; 22: 250-256.
6. Boyd RL, Murray P, Robertson PB. Effect of periodontal status of rotary electric toothbrushes vs. manual toothbrushes during periodontal maintenance. I. Clinical Results. *J Periodontal.* 1989; 60: 390-395.
7. Wilcoxin DB, Ackerman RJ, Jr., Killoy WJ, Love JW, Sakumura JS, Tira DE. The effectiveness of counter rotational-action power toothbrush on plaque control in orthodontic patients. *AmJ.Orthod.Dentofacial Orthop.* 1991;99:7-14.
8. Ho HP, Niederman R. Effectiveness of the Sonicare sonic toothbrush on reduction of plaque, gingivitis, probing pocket depth and subgingival bacteria in adolescent orthodontic patients. *J.Clin.Dent. 1997;8:15-19.*
9. White LW. Efficacy of a sonic toothbrush in reducing plaque and gingivitis in adolescent patients. *J.Clin.Orthod.* 1996;30:85-90.
10. Hogg SD. Chemical control of plaque. *Dental Update* 1990; 330-333.
11. O'Reilly MM, Featherstone JD. Demineralization and remineralization around orthodontic appliances: an in vivo study. *Am.J.Orthod.Dentofacial Orthop.* 1987; 92:33-40.
12. Seppa L. Studies of Fluoride varnishes in Finland. *Proc.Finn.Dent.Soc.* 1991; 87:541-547.
13. Seppa L, Tuutti H, Luoma H. Post-treatment effect of fluoride varnishes in children with a high prevalence of dental caries in a community with fluoridated water. *Jz.Dent.Res.* 1984;63:1221-1222.
14. Seppa L. Fluoride content of enamel during treatment and 2 years after discontinuation of treatment with fluoride varnishes. *Caries Res.* 1984;18:278-281.
15. Koch G., Petersson LG. Caries preventive effect of a fluoride-containing varnish (Duraphat) after 1 year's study. *Comm Dent Oral Epidemiol* 1975;3:262-266.
16. de Bruyn H, Arends J. Fluoride varnishes: a review. *J.Biol Buccale* 1987;15:71-82.
17. Maiwald HJ, Geiger L. Lokalaapplikation von Fluorschutzlack zur Kariesprophylaxe in Kollektiven. *Dtsch Stomat* 1973;23:70-73.
18. Todd MA, Staley RN, Kanellis MJ, Donly KJ, Wefel JS. Effect of a fluoride varnish on demineralization adjacent to orthodontic brackets. *Am.J.Orthod.Dentofacial Orthop.* 1999;116:159-167.
19. Newman GV. Bonding plastic orthodontic attachments to tooth enamel. *J NJ Dent Soc* 1964;35: 346-358.
20. Hocevar RA. Direct bonding metal brackets with the Concise-Enamel Bond system. *J Clin Orthod* 1977; 11: 473-482.
21. Hocevar RA. Direct bonding update. *J Clin Orthod* 1979; 13: 172-175.
22. Tavas MA, Watts DC. Bonding of orthodontic brackets by transillumination of a light activated composite. *Br J Orthod* 1979; 6: 207-208.