Spot on orthodontics! Pun intended: The impact of white spot lesions on 21st century orthodontics

Enamel decalcification or white spot lesion (WSL) development of the enamel surface is the most important iatrogenic effect of fixed orthodontic appliance therapy.[1] Individuals with malocclusions often have many plaque retention sites due to tooth malpositions. A cause-effect relationship and incidence statistics of WSLs in such individuals sometimes question the very logic of multibanded/bonded fixed appliance therapy. Orthodontic treatment with multibanded appliance imposes a significant risk for development of WSL. Bands and brackets increase the retention of plaque and food on smooth tooth surfaces that encourage the formation of WSLs. Despite intensive efforts to educate patients about effective oral hygiene procedures, enamel demineralization associated with fixed orthodontic appliances remains a significant clinical problem.[2,3] Formation of these spots after the completion of orthodontic treatment can lead to patient dissatisfaction and legal complications.[4] From a holistic care perspective, formation of WSLs is discouraging to a specialty whose goal is to improve aesthetics. The need of the hour is to be proactive and take active responsibility toward prevention of WSLs by educating patients about the importance of maintaining an excellent dietary compliance and oral hygiene regime.

DEFINITION

The term WSL was defined as "the first sign of a caries lesion on enamel that can be detected with the naked eye."[5]

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The WSL has also been defined as a "subsurface enamel porosity from carious demineralization' that presents itself as "a milky white opacity when located on smooth surfaces."[6]

PREVALENCE

Literature reports in this regard irrespective of differences in methodology of data collection are alarming! Orthodontic patients have significantly more WSLs than nonorthodontic patients, and these WSLs may present esthetic problems years after treatment.[3,7] A recent review of literature[8] showed variations ranging from 2% to 97%, for WSL prevalence associated with orthodontic treatment.[3,7,9-13] This high prevalence is attributed to the difficulties in performing oral hygiene procedures on bonded dental arches along with a long-time accumulation and easier retention of bacterial plaque on tooth surfaces around fixed orthodontic appliances.

Depending on the examination technique used, the prevalence of WSLs varies. Gorelick *et al.*,[10] in their study using the visual examination technique, reported that 50% of patients had one or more WSLs at the end of treatment. Boersma *et al.*,[8] using quantitative light fluoroscopy, investigated the prevalence of WSLs at the end of orthodontic treatment and reported that 97% of subjects had one or more lesions.

In the literature, conflicting reports have described the distribution of WSLs. Gorelick *et al.*[10] reported that the tooth most commonly affected was the maxillary lateral incisor. On the other hand, Mizrahi[14] concluded that the maxillary and mandibular first molars were the teeth most commonly affected. In a later study, Ogaard[7] agreed with Mizrahi's conclusions. In contrast, Geiger *et al.*[11] reported that lesions occurred most frequently on maxillary lateral incisors and canines. Tufekci *et al.*,[15] however, found no significant differences among teeth in the distribution of WSLs at 6-month, at 12-month, or on the day of bonding (control).

A more recent study by Boersma[8] found that 40% of the buccal surfaces in males had demineralization compared with 22% in females. One possible explanation for these

results is that females are generally more compliant orthodontic patients.

CLINICAL DETECTION IN ACTIVE TREATMENT

Fixed appliances serve as plaque retention sites and in the absence of good oral hygiene, plaque accumulates and acidogenic bacteria cause marked demineralization. Detecting WSLs during active treatment can be challenging for the clinician. The clinical crown must be free from plaque and debris, and the presence of excess gingival tissue can make visualization of WSLs difficult. A thorough examination of each patient should be done at each appointment, and each patient should receive a customized oral hygiene treatment regimen to halt the progression of any demineralization.

The high prevalence of WSLs at 6-month into active orthodontic treatment suggests that demineralization can quickly become a concern in the presence of fixed appliances when oral hygiene is poor. According to Ogaard *et al*.,[2] these lesions can become noticeable around the brackets within 1-month of bonding. So even patients who otherwise practice good oral hygiene, cannot afford to slacken up between any consecutive appointments. It's critical that orthodontists reiterate this fact to their patients regularly. It's also important for the clinician to recognize inadequate oral hygiene early, so that preventive measures can be implemented before the development of WSLs. Length of treatment is also directly proportional to the causation of the Lesions. The prevalence of WSLs was 38% in a 6-month group, whereas it was 46% in a12-month group as reported by Tüfekçi *et al*.[15]

PREVENTION

White spot lesions are generally considered to be the precursors of frank enamel carious lesions. It is, therefore, necessary to universally promote the need to maintain a high standard of oral hygiene and to reduce daily exposure to refined carbohydrates throughout the treatment period. In addition, the continuous presence of fluoride in both saliva and plaque, even in low concentrations, is necessary for maximum caries inhibition. This would, at first, involve daily exposure to fluoridated water[16,17] (where available) and the use of a fluoride-containing toothpaste.[18] The need to prescribe an additional topical fluoride will be dependent upon the needs of the individual patient and clinical judgment. The performance of currently available fluoride releasing bonding cements[19-22] and elastomeric modules and chains[23,24] makes their use both difficult and impractical. Studies of the effects of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) have so far shown promising dose-related increases in enamel remineralization within already demineralized enamel lesions.[25-27] The ability of CPP-ACP to prevent WSL formation has not, as yet, been proven. A Recent introduction of a novel technology based on Arginine and an insoluble calcium compound with fluoride in toothpaste does show promise for prevention and early intervention of WSLs.[28,29]

AFTER DEBONDING

If WSLs occur during treatment, it is advisable first to allow the teeth to remineralize naturally. Nearly half of the original lesions would have remineralized after 6-month with no specific additional treatment. Fluoride must not be used in high concentrations because it can arrest remineralization and lead to staining. Low concentrations of fluoride might assist remineralization

If the lesions persist, professional bleaching of the teeth to diminish the contrast between the WSL and the rest of the enamel surface should be considered. Bleaching therapy can camouflage WSLs after removal of orthodontic brackets.[30] If bleaching therapy is used to mask decalcified areas, it must be considered that the microhardness of sound enamel surfaces and demineralized enamel surfaces after bleaching might be reduced.

For severe cases, acid micro abrasion is recommended when the esthetic results after external bleaching therapy are not satisfactory.[31] Finally, aggressive restorative treatment such as a direct or an indirect veneer can be considered if the patient still sees the need for further esthetic improvement when WSLs cannot be totally removed.

WE OUGHT TO CARE!

Debonds are the most exciting time for Orthodontic Patients, Parents, Orthodontists, and Staff. White Spots do detract from the quality of results and bring about disappointments for all of the above and the referring dental professional. Patients are increasingly getting aware of this menace associated with orthodontic therapy and Definitive protocols for their prevention and management are the need of the hour.[32] Appliances that do not affect the labial surfaces, accelerated orthodontics, targeted mechanics are all possible preventive modalities; but none can replace motivational techniques and due diligence during therapy. From a professional excellence standpoint, to motivate orthodontists to pay attention toward the prevention of WSLs, the degree and occurrence of WSLs need to be quantified and evaluated in pre and postorthodontic records, with their absence, also being

a criterion for scoring during evaluation of cases for Examinations and Peer Review Boards.

A concerted effort to focus on the Evaluation, Quantification, Prevention, Identification of Risk Groups and Protocols for treating WSLs is imperative for preventing this "spot on" Orthodontic Care, and also for Orthodontics to be "Spot on"!

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