RESEARCH ARTICLE

Management of orthodontically induced white spot lesions: A survey of the orthodontic practitioners of Pakistan

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Abstract

Objective: To assess the level of awareness among orthodontic practitioners about the diagnosis and management of orthodontically induced white spot lesions.

Method: The cross-sectional study was conducted from August 28, 2022, to March 3, 2023, at Bakhtawar Amin Medical and Dental College, Multan, and comprised orthodontic specialists and postgraduate residents. Data was collected using a 14-item questionnaire regarding diagnosis and management of orthodontically induced white spot lesions. The questionnaire was disseminated online, and the responses were compared between the groups. Data was analysed using SPSS 24.

Results: Of the 278 subjects, 205(73.7%) were residents; 156(75%) females and 49(24%) males with mean professional experience of 4.24±4.08 years. There were 73(26.3%) specialists; 44(60.3%) females and 29(39.7%) males with mean professional experience 9.07±4.85 years. There were 48(66%) specialists and 131(64%) residents who thought the most commonly affected teeth with WSL were maxillary central incisors, while 30(41%) specialists and 38(33%) residents said the least commonly affected tooth was maxillary canine. Among the specialists, 29(38%) considered halting treatment and regular follow-up as the best approach for managing white spot lesions detected during orthodontic treatment, while 76(37%) residents preferred to use fluorides and casein phosphopeptide-amorphous calcium phosphate. There were significant differences between the specialists and residents for the items related to the incidence of white spot lesions, timing for additional precautions and measures for detection, management during active treatment and modalities of prevention ($p<0.05$).

Conclusion: Despite being fairly common in orthodontic patients, the awareness regarding white spot lesions and related management protocols was found to be dubious in orthodontic practitioners, depicting lack of a standardised protocol.

Keywords: Dental caries, Dental white spots, Fixed orthodontic therapy. (JPMA 74: 922; 2024)

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Introduction

White spot lesions (WSLs) are considered the first clinically observable signs of carious activity.[1] Acid-producing bacteria, salivary dysfunction and a high intake of fermentable carbohydrates contribute to the enamel demineralisation. This carious activity is balanced by factors, such as the use of antibacterial agents, adequate salivary flow and remineralising ions.[1-4] A WSL comprises a surface layer and the body of the lesion. The surface layer, being in the proximity to the saliva, is subjected to remineralisation.[5] However, the body of the lesion undergoes a greater degree of demineralisation which may lead to an obvious enamel cavitation.[1-6]

Several studies emphasise the correlation of WSL and orthodontic therapy, with rapid progression of WSL during orthodontic treatment.[7,8] The fixed straight-wire appliance is the most common treatment modality used in orthodontics to achieve smile aesthetics and occlusal function. However, it is well-established that this appliance complicates the maintenance of oral hygiene and promotes plaque accumulation, leading to the increased risk of developing WSL. In addition to patient's compliance with oral hygiene measures, the type of orthodontic appliance[9] and orthodontic treatment duration are other major factors contributing to the incidence of WSL.[10] In severe cases of WSL, it may become necessary to terminate orthodontic treatment prematurely which itself may result in compromised aesthetics and poor occlusion.[11,12] Therefore, mitigating the risk of WSL is one of the primary responsibilities of orthodontic practitioners.

Primary preventive care in the form of oral hygiene instructions employing the use of high-fluoride toothpastes and antibacterial mouthwashes is the norm for the majority of practitioners.[13,14] Interceptive measures, such as the use of fluoride rinses,[15] various formulations of casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) and in-office application of fluoride varnish[16,17]

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are also suggested once the presence of WSL has been established by the practitioner. Though there are a variety of preventive and therapeutic options available, the evidence to support the superiority of one method over the other is limited.[18-20]

It is argued that it is the orthodontic practitioners' responsibility to adopt preventive and therapeutic methods to mitigate the risk and severity of WSL. Their inability to do so can be considered professional negligence having legal implications.[21]

In the absence of clinical guidelines, it has become pertinent to explore the clinician's expertise for clinical decision-making for the management of WSL. The current study was planned to assess the clinical approach used by orthodontic practitioners in Pakistan for the prevention, diagnosis, and management of WSL in their patients.

1. Your current role in the field of Orthodontics?
□ Specialist Orthodontist □ Postgraduate Resident
2. Please choose your programme (completed/enrolled)
□ MCPS □ FCPS □ M. Orth □ MDS
3. Gender:
□ Male □ Female
4. Your current city of practice: _____
5. Your current workplace of orthodontic practice?
□ Private Clinic □ Hospital/University □ Both
6. Your experience of treating orthodontic patients in years?
7. How frequently do you experience WSL in your practice?
o In less than 10% of patients
o In 10-20% of patients
o In 20-30% of patients
o In 30- 40% of patients or more
8. How early have you observed WSLs in an individual after commencement of fixed orthodontic treatment?
o 1 month
o 2 to 6 months
o 7 to 12 months
o >12 months
9. Which teeth are most commonly affected with WSL in your patients?
Central Incisor Lateral incisor Canine 1st Premolar 2nd Premolar 1st molar 2nd molar
Maxillary
Mandibular
10. Which teeth are least commonly affected with WSL in your patients?
Central Incisor Lateral incisor Canine 1st Premolar 2nd Premolar 1st molar 2nd molar
Maxillary
Mandibular
11. What do you think is the most important reason for developing WSL?
o Lack of motivation of patient to maintain oral hygiene
o Appliance burden hampering maintenance of oral hygiene
o Lack of awareness and education of patient provided by dentist
o Lack of teaching and training of orthodontic practitioners about management of WSL
o Poor dietary pattern including increased intake of sugary diet
o Other _____
12. In what situation would you like to take additional precautions for a patient (with greater perceived risk of developing white spot lesions)?
o Previous history of WSL
o High caries index
o Medical condition(s)
o Gingival inflammation with bleeding on probing
o Gingival recession with alveolar bone loss
o Other _____
13. Do you believe that you are proficient in diagnosing WSL?
o Strongly agree
o Agree
o Neutral
o Disagree
o Strongly disagree
14. In an orthodontic patient when would you take additional measures to detect WSL? (In the absence of any clinical sign of WSL)
o < 3 Months
o 3 - 6 Months
o 7 - 9 Months
o 10 - 12 Months
o 13 - 15 Months
o No need
15. What method(s) do you use in clinical practice to assess the risk of WSL prior to commencement of treatment?
□ Dental history
□ Clinical examination
□ Radiographs
□ Caries Index
□ Caries disclosing agent
□ DIAGNOdent
□ Qualitative light induced fluorescence (QLF)
□ CBCT
□ Other _____
16. What method(s) do you use in clinical practice to screen for WSL during active treatment?
□ Clinical examination
□ Radiographs
□ Caries disclosing agent
□ DIAGNOdent
□ Qualitative light induced fluorescence (QLF)
□ CBCT
□ Other _____
17. What do you most commonly advocate if you observe WSL during active treatment?
o Remove arch wire and keep on regular follow up
o Professionally apply high concentration fluorides
o Advise home application of Casein Phosphopeptide Amorphous Calcium
o Refer for resin infiltration treatment
o Refer for microabrasion treatment
o Refer for definitive esthetic restoration
18. What do you most commonly advocate if you observe WSL after treatment?
o Professionally apply high concentration fluorides
o Advise home application of Casein Phosphopeptide Amorphous Calcium
o Refer for resin infiltration treatment
o Refer for microabrasion treatment
o Refer for definitive esthetic restoration
o Reinforce oral hygiene instructions and keep on follow-up
19. Which method of treating WSLs do you believe has the best aesthetics and patient satisfaction if WSL do not improve spontaneously?
o Fluorides
o CPP-ACP paste
o Resin infiltration
o Microabrasion
o Definitive restoration
o Bleaching
o Other _____
20. Which of the following methods is the most useful in preventing WSL in an individual undergoing active orthodontic treatment?
o Regular use of mechanical aids (toothbrush, floss) for oral hygiene
o At-home fluoride application/mouthwash rinses
o Chair-side fluoride application
o Regular use of fluoride and CPP-ACP toothpaste
o Use of sugar-free chewing gum

Figure-1: The study questionnaire.

Subjects and Methods

The cross-sectional study was conducted from August 28, 2022, to March 3, 2023, at Bakhtawar Amin Medical and Dental College, Multan, and comprised orthodontic specialists and postgraduate residents. After approval from the institutional ethics review committee (No. 628/22) the sample size was calculated, utilizing the formula n=(Z^2 P(1-P))/d^2, where n gives the sample size, Z=statistic corresponding to level of confidence, P=expected prevalence and d=precision;[22] in the light of Weyland et al.[12] who reported patient education and oral hygiene instructions as the most used method to manage WSL (77%). Power of the study was 80%, level of confidence 95% and absolute precision 5%. The calculated sample was proportionally divided using stratified sampling technique into various regions according to population that was deemed sufficient to provide an accuracy of at least ±5% for any item of the study questionnaire with 95% confidence.

The sample was raised using non-probability consecutive sampling technique. Those registered with the Pakistan Association of Orthodontics and training centres approved for postgraduate training in orthodontics were approached through email and WhatsApp. Those included were specialist orthodontic practitioners who had qualified an exam-based postgraduate qualification after a minimum of 2 years of residency period, and residents regardless of the year of their postgraduate residency. Practitioners who reported treating <10 new orthodontic cases per year were excluded. All participants who provided informed consent were requested to fill the questionnaire. Those who did not fill the form were given a reminder on days 7 and 14 and 30 after the commencement of the data-collection process.

The 20-item study questionnaire, generated using Google forms (Figure 1), was originally based on literature[23,24] and was modified. The questionnaire had 6 items related to demographic and professional data, and 10 single-best along with 4 multiple-option items related to the study objectives. The questionnaire was pre-validated for its construct, face and content by a group of 3 orthodontic consultants and 2 restorative dentists. To evaluate the test-retest reliability, 10 specialists and 10 residents were asked to complete the survey twice 2 weeks apart. Kappa statistics were used to test the intra-examiner reliability. The coefficient of reliability value for any questionnaire item was not <0.913.

Data was analysed using SPSS 24 for MacOS. Data was expressed as means ± standard deviation or as frequencies and percentages, as appropriate. The responses were compared between the specialists and residents using chi-square test. P<0.05 was considered statistically significant.

Results

Of the 278 subjects, 205(73.7%) were residents; 156(75%) females and 49(24%) males with mean professional experience 4.24±4.08 years. There were 73(26.3%) specialists; 44(60.3%) females and 29(39.7%) males with mean professional experience 9.07±4.85 years (Table 1). There were 146(52.5%) subjects from Punjab, 63(22.7%) from Sindh, 48(17.3%) from Khyber Pakhtunkhwa (KP), 12(4.3%) from Balochistan and 9(3.2%) from other regions.

There were 48(66%) specialists and 131(64%) residents who thought the most commonly affected teeth with WSL were maxillary central incisors, while 30(41%) specialists and 38(33%) residents said the least commonly affected tooth was maxillary canine (Figure 2).

Among the specialists, 29(38%) considered halting treatment and regular follow-up as the best approach to managing WSLs detected during orthodontic treatment, while 76(37%) residents preferred to use fluorides and CPP-ACP. There were significant differences between the specialists and residents for the items related to WSL incidence, timing for additional precautions and measures for detection, management during active treatment and modalities of prevention (p<0.05). Responses to all the 14 relevant items were noted and compared for significance (Table 2).

Discussion

The current study found that the specialist orthodontists most commonly advocated the removal of arch wire and regular follow-up visits if WSLs were observed during active treatment. Home application of CPP-ACP and professional application of high-concentration fluoride were also commonly used by the specialists for interception during active treatment. On the other hand, the postgraduate residents emphasised more on the application of CPP-ACP and fluorides instead of halting treatment and regular follow-up. A similar pattern of practices was observed by Weyland et al.[12] but with a higher percentage of practitioners (77%) compared to 38% in the study who preferred archwire removal and oral hygiene instructions for the management of WSLs.

WSLs are frequently found in orthodontic patients. Their prevalence can vary significantly depending on the type of orthodontic appliances. A higher prevalence has been reported in patients treated with fixed orthodontic appliances compared to removable appliances.[9] A meta-analysis of 14 studies reported 45.8% incidence and 68.4% prevalence based on clinical examination in patients undergoing fixed orthodontic treatment.[25]

Table-2: Questionnaire responses and intergroup comparisons.

Question	Variable	Specialist (n =73) n (%)	Postgraduate Resident (n =205) n (%)	*p* - value
Incidence and Aetiology				
7. Frequency of white spot lesions (WSLs)	In less than 10% of patients	16 (22)	60 (29)	0.27
	In 10-20% of patients	29 (40)	63 (31)	
	In 20-30% of patients	13 (18)	46 (24)	
	In 30- 40% of patients or more	15 (20)	33 (16)	
8. Earliest incidence of WSL after commencing treatment	1 month	0 (0)	14 (7)	0.006*
	2 to 6 months	18 (25)	75 (37)	
	7 to 12 months	25 (34)	66 (32)	
	>12 months	30 (41)	50 (24)	
11. Most important reason for developing WSL	Lack of motivation of patient to maintain oral hygiene	36 (49)	96 (47)	0.279
	Appliance burden hampering maintenance of oral hygiene	23 (31)	67 (33)	
	Lack of awareness and education of patient provided by dentist	8 (11)	21 (10)	
	Lack of teaching and training of orthodontic practitioners about management of WSL	0 (0)	11 (5)	
	Poor dietary pattern including increased intake of sugary diet	6 (8)	10 (5)	
	Other	0 (0)	0 (0)	
Diagnosis				
12. Situation for additional precautions (with greater perceived risk of WSL)	Previous history of WSL	27 (37)	59 (29)	<0.001*
	High caries index	33 (45)	135 (66)	
	Medical condition(s)	2 (3)	0 (0)	
	Gingival inflammation with bleeding on probing	6 (8)	8 (4)	
	Gingival recession with alveolar bone loss	0 (0)	3 (1)	
	Other	5 (7)	0 (0)	
13. Proficiency in diagnosing WSL	Strongly agree	8 (11)	22 (11)	0.299
	Agree	48 (66)	114 (55)	
	Neutral	17 (23)	65 (32)	
	Disagree	0 (0)	4 (2)	
	Strongly disagree	0 (0)	0 (0)	
14. Timing for additional WSL screening (in absence of any clinical sign of WSL)	< 3 Months	11 (15)	31 (15)	0.045*
	3 - 6 Months	30 (41)	83 (41)	
	7 - 9 Months	6 (8)	44 (21)	
	10 - 12 Months	5 (7)	13 (6)	
	13 - 15 Months	3 (4)	10 (5)	
	No need	18 (25)	24 (12)	
15. Method for assessing WSL risk before commencing treatment (Multiple Choice)	Dental history	16	70	0.008*
	Clinical examination	64	156	
	Radiographs	5	23	
	Caries Index	35	71	
	Caries disclosing agent	8	24	
	DIAGNOdent	1	10	
	Qualitative light induced fluorescence (QLF)	5	33	
	CBCT	0	0	
	Other	0	0	
16. Method for screening of WSL during active treatment (Multiple Choice)	Clinical examination	68	154	0.002*
	Radiographs	6	31	
	Caries disclosing agent	11	35	
	DIAGNOdent	5	7	
	Qualitative light induced fluorescence (QLF)	8	45	
	CBCT	0	0	
	Other	0	0	
Management and Prevention				
17. Management of WSL during active treatment	Remove arch wire and keep on regular follow up	29 (38)	32 (16)	<0.001*
	Professionally apply high concentration fluorides	15 (21)	76 (37)	
	Advise home application of Casein Phosphopeptide Amorphous Calcium	22 (30)	76 (37)	
	Refer for resin infiltration treatment	2 (3)	8 (4)	
	Refer for microabrasion treatment	5 (7)	6 (3)	
	Refer for definitive aesthetic restoration	0 (0)	7 (3)	

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Table-2: *Continued from previous page*.

Question	Variable	Specialist (n=73) n (%)	Postgraduate Resident (n=205) n (%)	*p*-value
18. Management of WSL after treatment	Professionally apply high concentration fluorides	8 (11)	30 (15)	0.069
	Advise home application of Casein Phosphopeptide Amorphous Calcium Phosphate (CPP-ACP)	15 (20)	22 (11)	
	Refer for resin infiltration treatment	7 (10)	26 (12)	
	Refer for microabrasion treatment	3 (4)	17 (8)	
	Refer for definitive aesthetic restoration	5 (7)	4 (2)	
	Reinforce oral hygiene instructions and keep on follow-up	35 (48)	107 (52)	
19. Treatment method with best aesthetics (if WSL do not improve spontaneously)	Fluorides	3 (4)	34 (17)	<0.001*
	CPP-ACP paste	8 (11)	35 (17)	
	Resin infiltration	37 (51)	57 (28)	
	Microabrasion	8 (11)	47 (23)	
	Definitive restoration	14 (19)	22 (11)	
	Bleaching	0 (0)	10 (5)	
	Other	3 (1)	0 (0)	
20. Method for prevention of WSL during active treatment	Regular use of mechanical aids (toothbrush, floss) for oral hygiene	57 (78)	137 (67)	0.047*
	At-home fluoride application/mouthwash rinses	3 (4)	17 (8)	
	Chair-side fluoride application	0 (0)	13 (6)	
	Regular use of fluoride and CPP-ACP toothpaste	13 (18)	31 (15)	
	Use of sugar-free chewing gum	0 (0)	7 (3)	

$p < 0.05$ will be considered as statistical significant

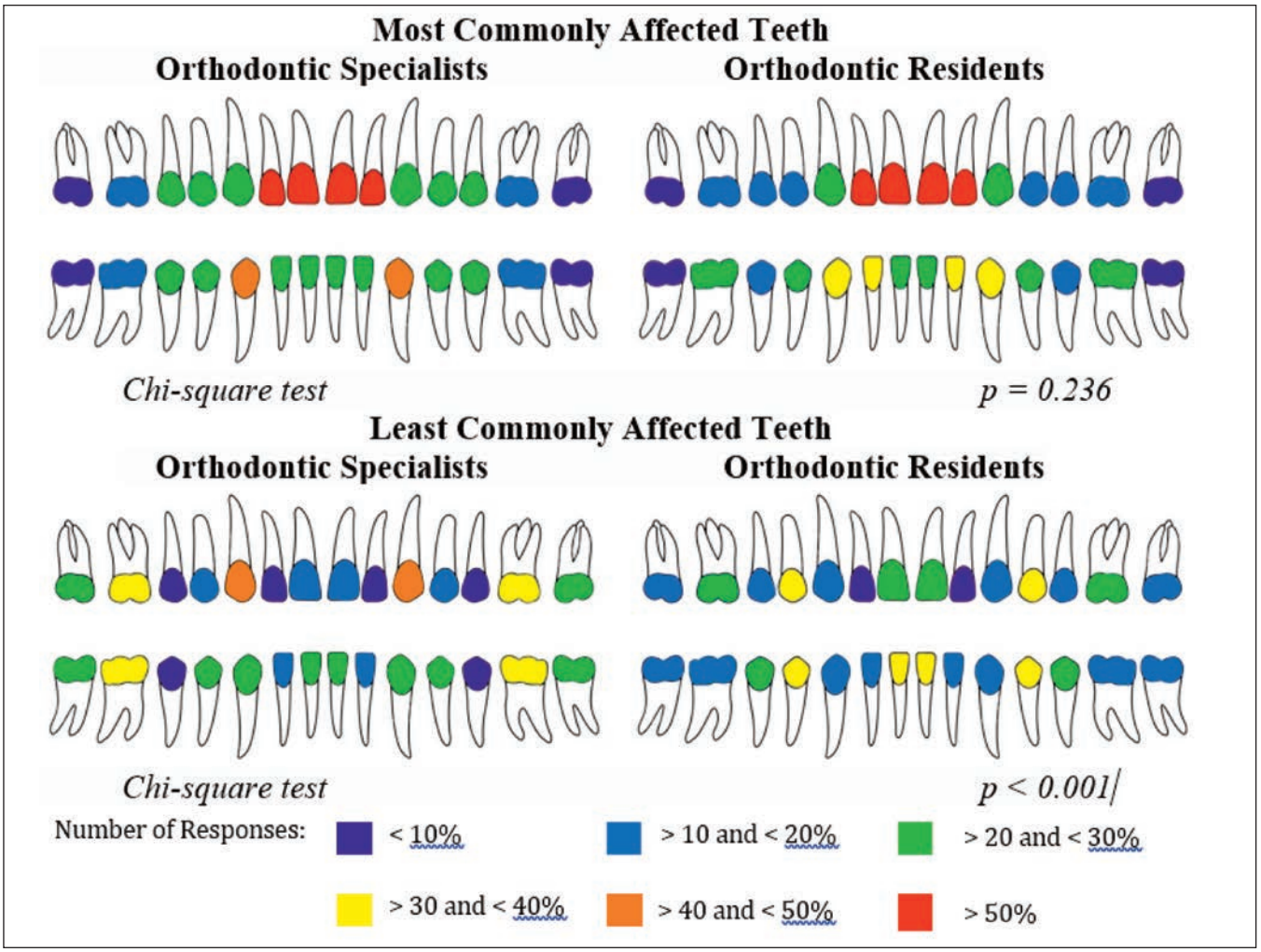

Figure-2: The most commonly affected teeth as identified by orthodontic specialists and residents.

The current study found maxillary incisors to be the most commonly affected teeth (reported by 66% and 64% specialists and residents, respectively) and maxillary canines (41% specialists) and maxillary first premolar (33% residents) to be the least commonly affected teeth. These statistics indicate the need for taking special precautionary measures to prevent, diagnosis and manage WSLs during different stages of treatment in patients undergoing fixed orthodontic treatment.

In this study, the prevalence of WSL in their orthodontic patients was reported to be <20% by majority of orthodontic practitioners, but the reported prevalence of WSL varied from <10% to >40%. This may be due to the fact that different diagnostic approaches or screening techniques were used by different practitioners. Evidence showed a sharp increase in the number of WSLs during the first 6 months of treatment that continued to rise at a slower rate to 12 months.[7] In this study, majority of the specialists observed the WSL after 12 months of fixed orthodontic treatment, while the residents noted WSL as early as 2-6 months post-treatment. This finding was significant, showing a difference in observation of WSL between residents and specialists.

The clinician may find it difficult to identify WSLs during ongoing treatment as it requires a clear clinical crown free from any debris or plaque build-up. Additionally, the excessive presence of gingival tissue can impede the visibility of WSLs. To detect early signs of WSLs, the tooth must be dried using air.[26] Diagnosis of orthodontic treatment-induced WSLs can be made using visual clinical examination, radiographs or specialised diagnostic tools, such as quantitative light-induced fluorescence (QLF) or laser fluorescence.[27] QLF is a non-invasive imaging technique that can detect early signs of enamel demineralisation and guide appropriate treatment planning. Radiographs can also be used to detect WSLs, but they may not be sensitive enough to detect early-stage lesions. Radiography cannot distinguish between an active and an arrested lesion; a demineralised "scar" may often be left in the hard tissues after lesion progression has been arrested, since fluoride, as a marker of remineralisation, only rarely diffuses into the body of the lesion even if it maintains an intact outer surface.[28]

In the present study, majority of the specialists and residents considered themselves proficient enough in diagnosing WSL as per their responses on a Likert scale. A statistically significant difference was found between the opinions of specialists and residents regarding that method used for assessment of the risk of WSL prior to starting orthodontic treatment. A large number of residents opted for dental radiographs to assess the risk of WSL, while the specialists relied on dental radiographs and caries disclosing agents for the assessment of WSL prior to treatment. Only a few residents and specialists opted for fluorescence techniques or DIAGNOdent device for the assessment of WSL prior to treatment. During active orthodontic treatment, both the specialists and residents considered clinical examination to be useful in screening for WSL. Only a few specialists used QLF and DIAGNOdent during active treatment to detect any signs of impending WSLs. A systematic review of 51 studies, regarding the incidence of WSL, reported clinical examination (49%), visual inspection by photographs (29%), DIAGNOdent (27%) and QLF (19%) as the preferred evaluation methods.[29] Another systematic review demonstrated similar findings, but emphasised the importance of evaluation by quantitative methodology, such as DIAGNOdent and QLF.[30]

Majority of the residents and specialists considered taking additional measures to detect WSL after 3-6 months of commencement of treatment in the absence of any clinical sign of WSL, as a precautionary measure. Interestingly, 25% of the specialists considered that there was no need to take additional measures for the detection of WSL in the absence of clinical signs of WSL during treatment. Tooth discolouration was reported to be the most common sign associated with WSLs, followed by enamel surface discontinuity. A few orthodontists also considered tooth sensitivity a relevant symptom associated with WSL.

Although all teeth pose a certain risk, the current study found that the most frequently affected teeth were maxillary incisors, followed by the canines and then the premolars. This finding correlates with the results of Nayak et al.[24] This order of incidence was noted by both specialists and residents, giving a statistically non-significant difference. The findings of Lucchese et al.[8] Gorelick et al.[31] and Mizrahi et al.[21] established greater prevalence of WSL in maxillary and mandibular molars. On the other hand, Artun et al.[32] found mandibular premolars to be commonly affected. The present study found the first and second maxillary and mandibular molars to be the least common affected teeth by WSL, and the difference in opinions of specialists and residents was significant. This may be attributed to the higher level of experience of the specialists compared to the residents.

Lack of motivation of the patients to maintain oral hygiene was identified in the current study as the main risk factor of developing WSL, and this was followed by the appliance burden which hampered the maintenance of oral hygiene. Patients with high caries index and a prior history of WSL were perceived to have greater risk of developing WSL.

The management of orthodontic treatment-induced WSLs depends on the severity of the lesion. The continuous presence of fluoride in both saliva and plaque, even in low concentrations, is necessary for maximum inhibition of demineralisation. Topical fluoride application, either in the form of a gel, varnish or mouthwash, has been shown to be effective in remineralising early-stage lesions.[31] In more severe cases, resin infiltration, micro-abrasion, or restorative treatments, such as dental bonding, veneers or crowns may be necessary to restore the tooth's appearance.[33] The current study found that specialist orthodontists most commonly advocated the removal of arch wire and regular follow-up if WSL was observed during active treatment. Home application of CPP-ACP and professional application of high-concentration fluoride were also commonly used for interception during active treatment. The residents emphasised more on the application of CPP-ACP and fluorides instead of halting treatment and regular follow-up. If WSL was observed after orthodontic treatment, majority of the specialists and residents advocated the reinforcement of oral hygiene and regular follow-up for the management of the condition. The study showed that most of the specialists considered resin infiltration to be the best treatment modality for aesthetics and patient satisfaction, while the residents also considered micro-abrasion, CPP-ACP formulations and high-concentration fluorides as viable treatment options. Regarding the prevention of WSL during active orthodontic treatment, a vast majority of both the specialists and residents considered the regular use of mechanical aids for the maintenance of oral hygiene to be the best modality. A study[12] described a similar methodology of prevention and interception, but differed with regard to a greater emphasis on the use of fluoride-releasing bonding materials at the commencement of treatment, and the use of topical fluorides and resin infiltration by orthodontists for the management of WSL after debonding.

Despite the various management options available, there is still uncertainty regarding the most effective treatment approach for orthodontic treatment-induced WSLs. This uncertainty arises due to the lack of long-term follow-up studies[29] the variability in lesion severity and location, and the lack of standardised treatment protocols.[20,34] Therefore, the management approach is often based on the individual clinician's experience and preference. Advancements in the detection and management of WSL are needed to be made a part of postgraduate orthodontic curriculum, and orthodontic specialists should remain involved in continuous medical education (CME) activities to update their knowledge.

The current study had limitations as it dealt only with the perception of both specialist and resident orthodontists. A thorough investigation of different modalities of treatment, their relative efficacy and the preferences of orthodontists in this particular setting was not tackled by the current study. Moreover, the stratification of the sample was not done according to the region or province because of highly skewed distribution of the population, resulting in minimal representation from certain regions of the country.

Conclusion

There was a large variation in the reported prevalence of WSLs in orthodontic practitioners of Pakistan. Lack of patient motivation to maintain oral hygiene and the appliance burden were regarded as the primary factors leading to WSL in orthodontic patients. Use of QLF and DIAGNOdent for the diagnosis of WSL was sparse and the mainstay of diagnosis was clinical examination and radiographs. Practitioners mainly relied on the use of mechanical aids to maintain oral hygiene during treatment. In case WSLs were observed during treatment, removal of arch wire to allow effective use of mechanical aids to maintain oral hygiene and use of topic fluorides and CPP-ACP were the commonly used methods. Post-treatment management of WSL not improving over time was mainly carried out by using resin infiltration by specialists, and resin infiltration and micro-abrasion by the residents.

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Author Contribution:

MES: Literature search, concept, data collection and interpretation, write-up.
WJ: Concept, data analysis and interpretation, proof reading, literature search.
MA: Data analysis and interpretation, write-up, proof reading.
AK: Data interpretation, proof reading, concept.