

Perspectives of Orthodontists of the Diagnosis, Prevention, and Management of White Spot Lesions: A Qualitative Study

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ABSTRACT **Aims:** Several factors influence the development of white spot lesions (WSLs), and one of these is fixed orthodontic appliances. This study aims to evaluate the awareness, preventive strategies, and management of WSLs among a group of Orthodontists. **Materials and Methods:** A qualitative methodology was applied; four focus groups made up a purposive sample from Orthodontists with various training backgrounds while working within the same healthcare services. **Results:** Three main themes emerged: awareness and ability to diagnose WSLs, perceived influences on the development of WSLs, and prevention and management strategies and barriers to care delivery. All focus groups agreed that there is a need for continuous prevention and preventive strategies of WSLs, particularly among orthodontic patients. There was also a consensus that orthodontic treatment should be delayed until WSLs are managed appropriately. **Conclusions:** Within the limitation of this study, WSLs were collectively agreed to be a significant issue during fixed orthodontic therapy, and continuous professional development for Orthodontists should include risk factors evaluation, diagnosis, prevention, and management of WSLs.

KEYWORDS: Orthodontic appliance, preventive, qualitative analysis, white spot lesions

INTRODUCTION

Fixed orthodontic appliances are potential barriers to oral hygiene measures, increasing plaque accumulation, and if this persists, enamel decalcification follows, which appears as a white lesion in its early stages, a precursor to dental caries.^[1] The appearance of white spot lesions (WSLs) results from when light hits the subsurface of demineralization/decalcification areas; it then scatters differently from sound enamel, making them appear opaque milky white, hence the name WSLs. Unfortunately, and most of the time, this change is irreversible, and besides, it could stain and change in color.^[2-4]

A WSL is an optical phenomenon from the loss of minerals on the enamel surface, first seen as a white opaque and chalky enamel lesion, and clinically it is porous and feels rough. It has been estimated that

within the first four weeks of fixed appliance treatment, WSLs develop.^[1] It is accepted that the presence of WSLs before the use of orthodontic appliances presents a higher risk for further WSLs development with the potential progress to cavitation. Mirhazi reported that 24% developed at least one WSL.^[5] There are variations in reported prevalence, which could be due to differences in the definition of the lesion, the detection methods used, the risk factors, and the level of clinicians' awareness of the phenomenon, which is part of the investigation in this study.

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Several methods of detection have been proposed; the most common is the naked eye visual evaluation. This method should be used before the initiation of a fixed orthodontic appliance. Routine checks for WSLs during orthodontic treatment are also critical so that management can be implemented once diagnosed. A careful examination around orthodontic brackets, under ligatures, and elastomeric chains is essential, particularly on follow-up visits to detect lesions as soon as they appear. Other methods include auto-fluorescence, such as quantitative light-induced fluorescence (QLF), transillumination, electrical resistance, DIAGNOdent, and DIFOTI devices.^[2,3]

During orthodontic fixed therapy, several factors influence the development of WSLs. These include gender, age, time of orthodontic treatment, duration of treatment, percentage of using elastomeric chains, number of missed appointments, oral hygiene and food intake, oral musculature activity changes; all limit the self-cleansing action of the muscles and consequently increase stagnation areas around brackets. Changes in saliva bacterial content and volume are also risk factors that increase the prevalence of WSLs.^[4,6-8] Furthermore, in the first six months of orthodontic fixed appliance treatment, a fast rise in the incidence of WSLs has been reported.^[4,6-9] There is also another disappointing drawback of WSLs during fixed orthodontic therapy, leading to a potential aesthetic compromise and early treatment termination. Therefore, orthodontists should always adopt a risk assessment practice to classify their patients into high or low risk before starting orthodontic treatment.^[2]

Several known preventive measures are available, such as regular oral hygiene instructions, daily use of fluoride, and varnish application before and during orthodontic treatment; the use of fluoride-releasing glass-ionomer cement for bonding and banding and lingual orthodontic appliances have also been proposed.^[2,10-13] Fluoride varnishes, in particular, are known to reduce the development of WSLs during fixed orthodontic therapy.^[14] Therefore, the orthodontist's level of awareness of WSLs, including their clinical presentation, diagnosis, prevention, and management is fundamental, which is also the intended evaluation of this study.

The research question “what is the level of awareness of WSLs and the ability to diagnose them, as well as the preventive and management strategies used?” A further question, “Is there an agreement and consensus regarding diagnosis, risk factors evaluation, prevention, and management of WSLs among the current cohort of Orthodontists, who are from different educational

and training backgrounds but work within the same health and educational services?”

In the present qualitative study, we aim to evaluate the level of awareness of WSLs and the ability to diagnose and evaluate risk factors; the knowledge of the incidence and development, their preventive and management strategies, among a group of Orthodontists.

MATERIALS AND METHODS

A purposive sample of Orthodontists from Saudi Arabia was invited to participate in this study. Focus groups were used in this study. Twenty Orthodontists participated in this study and divided into four focus groups. An initial survey was completed by the participants who consented to participate in this study. There were 12 females (60%) and eight males (40%); 56% of their age ranged 35–45 years, 37.5% ranged 25–34 years, and 6.25% ranged 46–55 years. The country of qualification was as follows: 25% obtained their Orthodontists qualifications from the UK and European countries, 25% from North America, and 50% were locally trained in Saudi Arabia. 62.5% worked with the governmental health service, 12.5% within private practice, and 25% worked in both governmental and private practice [Table 1].

The qualitative methodology helps us understand individuals' experiences through analyzing non-numerical data to explore concepts, opinions, or experiences, to gain in-depth insight into issues within the context of the study and in this case, the awareness and perceptions of the diagnosis, risk factors, prevention, and management of WSLs among a group of orthodontists within Saudi Arabia. Focus groups, in particular, allow interaction between participants, which helps develop new understanding through group dynamics, expressing views more than what can be achieved in a one-to-one interview.^[15-17] Their strength is that they produce a focused and shared voice in a nonthreatening atmosphere that encourages free speech and allows the building on each other's ideas.^[15,16] The participants also have an active role in the study and can voice their individual views on any issues that relate to the study. In this qualitative approach, data analysis co-occurred with data gathering as a continuing process.^[15-17]

The study's protocol was submitted to the ethics committee board for approval, subsequently granted the exempt status (2016/12/06/01QR). Letters were sent to Orthodontists practicing in Riyadh and Jeddah, explaining the study's purpose and inviting them to participate. They were ensured confidentiality,

Table 1: Participants demographics

Gender	12 (60%) females 8 (40%) males
Age	56% ranged 35–45 years 37.5 % ranged 25–35 years 6.25% ranged 46–55
Orthodontics qualification	50% Saudi Orthodontics Board and PhD degree at the same time 25% master degree 18.75 % clinical certificate 6.25% PhD
Country of qualification	25% European country 25% North American country 50% Saudi Arabia
Years of experience	37.5% 5–10 years 12.5 % 11–15 years 18.75% less than 5 years 25% 6 months to 1 year 6.25 % 21–25 years
Type of practice	62.5% governmental 12.5 % private 25% combined governmental and private

anonymity, and that their participation is voluntary. After informed verbal and written consent, the four focus groups were conducted by ST and NHA. Similar prompt questions were used for all the four focus groups, which were initially piloted and agreed upon by all authors. Additional questions triggered by responses were permitted as a focus group policy. The focus groups were conducted in a conversational style, in a pleasant environment in a room at the College of Dentistry at Princess Nourah Dental School in Riyadh and King Abdulaziz University, Faculty of Dentistry, in Jeddah. The focus groups duration was approximately 1 h, and these were audiotaped, and participants were encouraged to converse freely in their style and speed while maintaining the underpinning principles of the constant comparative method of grounded theory.^[18] This systematic collection and analysis of qualitative data construct models or theories of participants' perception, awareness, and reactions.

Considering the professional language, the focus groups were conducted in the English language. However, in this relaxed and conversational atmosphere, some participants involuntarily reverted in expressing their thoughts and reflection in a mixture of English and Arabic languages. This was well understood by the investigators (ST, NHA, and HZ.), trained in qualitative methodology and fluent in both languages. The intervening Arabic comments were checked and translated forward and backward to ensure linguistic validity.

Participants' confidentiality was assured by assigning each participant a random number during the focus groups discussions. Two researchers were present during the focus groups: one was a facilitator and the other was taking field notes. One of the facilitators was an orthodontist and the other was restorative dentist. When researchers felt that the data saturation was achieved concerning the study's research question, the discussion was stopped, and focus groups were terminated.

After finishing all the focus groups, all recordings were transcribed verbatim for the preparation of the analysis. To ensure transcription accuracy, the researchers checked the accuracy of transcripts several times. To confirm the data's trustworthiness, the investigators also individually, thoroughly, and systematically read and analyzed the data. The focus group participants were also allowed to review the transcripts for accuracy and validity and invited to edit them as they see appropriate from their recollections.

Reading and familiarization with data occurred by reading the transcripts several times, followed by the generation of preliminary codes by the three researchers and then searching for broad themes. The transcripts were then coded using the qualitative data software, NVivo version 12. For validity, codes were compared for parallels and commonalities, and modifications were made during this process. The three researchers (ST, NHA, and HZ) further discussed and reviewed codes and themes (investigator triangulation) for consistency until a consensus was reached. Additional modifications were also made to codes and categories in preparation for thematic analysis.^[19] Finally, the thematic analysis described by Braun and Clarke was used to identify themes regarding awareness, perceptions, risk factors, prevention, and management of WSLs.^[20] It involved a six-stage approach to manage and evaluate the data, categorize, and report themes.^[20] The themes were based on their importance in capturing essential aspects concerning the research question rather than quantifying measures.

RESULTS

Three themes emerged from the data that interrelate to each other and the research question, and these are:

- The awareness and ability to diagnose WSLs.
- Influences and risks in the development of WSLs.
- Prevention and management strategies and barriers to delivery of care.

THEME 1: THE AWARENESS AND ABILITY TO DIAGNOSE WHITE SPOT LESIONS

Candidates were initially asked to describe WSLs and all described it, indicating awareness of this phenomenon.

White spot lesions are chalky white patches on the enamel surface visible by the naked eye are usually found in the plaque accumulation area where the cervical area of the tooth or around brackets (FG3, Participant 1).

Given that the group was made of Orthodontists, WSLs were also described relative to where these lesions may appear in relation to orthodontic appliances.

White spot lesions look like white chalky appearance and usually spots around the brackets (FG4, Participant 2).

The literature describes a wide range and variations regarding the prevalence and incidence of WSLs, which increases with orthodontic treatment. This was also presented by participants in a range as in the literature.

I think it is maybe 25% of cases; there is a white spot lesion (FG2, Participant 1).

50% of the patients who have ortho treatment will have white spot lesions (FG2, Participant 2).

Likewise, what is reported in the literature, participants also believed that WSLs were more reported than any other orthodontic complications.

I don't have any exact statistics, but I know that it's probably the most common adverse effect; because compared to root resorption and compared to devitalization and necrosis of certain teeth; white spot lesions' appearance is certainly way higher than all the problems that might occur during Orthodontic treatment (FG1, Participant 1).

There was a consensus on the location and its relationship to left and right-handed patients' oral hygiene measures.

We have more decalcification on the right side, and I believe that the patient was probably right-handed and was doing better hygiene on the left side (FG1, Participant 1).

However, other participants did not have similar observations.

I have to say I never recorded the difference between the two sides. I've never taken that into consideration when I report any white spot lesions (FG1, Participant 3)

Some participants found that the identification of WSLs may occasionally be confusing or difficult and indicated that they would resort to their general or restorative dentist for this purpose.

I agree with my colleague here that detection of white spot lesions is sometimes difficult. Because sometimes it

has already started, but it's a small size. And you can't see it in the clinic until it becomes really big size or visible (FG2, Participant 1).

The concept of caries risk assessment was based on the presence of restorations and/or active caries cavities. Unfortunately, participants did not use a specific caries risk assessment evaluation that is standardized and evidence-based. Indeed, familiarity with CAMBRA or ICDAS was not evident.

I'm not aware of the assessment tool that you mentioned actually (CAMBRA). I don't know (FG2, participant 5) I also do not know about this system (ICDAS) (FG3, participant 3).

No, I'm not aware of it. I understand regular caries assessment, but as an index for white spots I'm not familiar with the white spot index (FG4, Participant 5).

The risk of caries was judged mostly by the level of oral hygiene and the presence of plaque.

The most common factor for white spot lesions is plaque accumulation or anything that would help in plaque accumulation, such as brackets and wires (FG3, Participant 1).

In addition to plaque accumulation, many participants also considered the patients' diet in their evaluation for caries risk.

I think the risk factors of white spot lesion is the bad oral hygiene, and also the type of the diet and the retentive areas in the amount such as the appliances and such as the orthodontic braces (FG3, Participant 4)

Of concern is that some were quite clear in that they do not evaluate caries risk, citing time as the primary barrier; any assessment that would take time from their related orthodontic evaluation will not be considered or carried out.

If it is a 5-minute thing, I think that we can check it, but other than that (FG1, Participant 4).

While participants did not use a specific caries risk assessment but were generally quite diligent in following up on diagnosed lesions.

The development or appearance of white spot lesions is another thing that I write specifically about (FG1, Participant 1).

There were some misconceptions, which is to do with explorers in WSLs in enamel diagnosis.

Some of them you can clinically with a probe or explorer you can feel if there's some sort of catch and kind of give

you an idea of how much demineralization is happening on the enamel (FG4, Participant 4).

THEME 2: INFLUENCES AND RISKS IN THE DEVELOPMENT OF

WHITE SPOT LESIONS

The perceptions of the influence of age on the development of WSLs were discussed, particularly age and the ability to follow oral hygiene instructions.

I think the age plays a role. I feel that the adult patients maybe take more responsibilities about their teeth and brushing (FG1, Participant 4).

There was a view that compliance relates to age groups, but this was from a financial point of view; given that older individuals are paying for their treatment, they tend to be more compliant.

With grownups they're usually, they're the ones who are paying for their treatment. So, they're eager to get and they are very keen about getting, you know, maintaining all the instructions that we give them even with the rubber bands and stuff (FG2, Participant 5).

Hence, this was also discussed in the context that teenage age groups are more affected by WSLs as they are less compliant.

When it comes to white spot lesions, as my colleagues have mentioned, it's mainly a teenager issue (FG1, Participant 2).

The perception was different for this participant, and they found teenagers easy to communicate with and consequently show improvements.

I find dealing with teenagers; maybe this is my personal experience. It's very easy to relate to them and to motivate them. It's very hard to change the behavior in adults, but in teenagers, it's easy to handle, it's easier (FG1, Participant 3).

Some participants believed that parents' compliance to oral hygiene advice influences their siblings' level of oral hygiene. This participant shared their experiences of a parent interaction in relation to oral hygiene measures.

I remembered an incident that a teenage patient, when I spoke to her about this and her mom was with her. I left the room and asked her to brush. The mom followed me out, and she really complained that I embarrassed her daughter, and this is not the way I should do, although this is probably the fourth or fifth time I'm talking about the same issue. One of the problems I face is basically the response I get from the parents in the majority of the time, and they would either say, but she/he is brushing; which is very common, I think is the basically their way of saying it's not our problem. Don't blame us. But

obviously, she/he is not. So this is probably one of the most common replies I receive or I get from the parents. The second most common is basically you tell them that their not brushing, when I'm talking to parents and trying to explain the problem, (tell them in Arabic) you know (FG1 Participant 1).

The need to have good oral hygiene before and during orthodontic treatment cannot be overemphasized.

I kind of agree with everybody on the panel. Proper oral hygiene I think is key. The idea of establishing proper oral hygiene from the beginning of treatment or even before treatment, I think is very important. So, once the oral hygiene is up to standard, we can go ahead (FG4, Participant 4).

Indeed, poor oral hygiene was viewed as the number one risk in the development of WSLs.

I think the risk factors of white spot lesions are bad oral hygiene, acidity of the mouth, and also the type of the diet and the retentive areas in the amount such as the appliances and such as the orthodontic braces (FG3, Participant 4).

While the clinic being public or private may influence how WSLs are managed, this participant believes that the care delivery site should not make a difference in the patient's treatment.

I never embark on an Orthodontic treatment if I'm in doubt of the patient's oral hygiene. It wouldn't be different whether I'm in the private or in the government clinic (FG1, Participant 2).

However, other participants disagreed and gave a rationalization to that.

We are trying to do our best but still, we need help, and in private practice patients are probably not willing to pay the extra fee of seeing a hygienist or seeing the general dentist during the treatment (FG1, Participant 1).

THEME 3: PREVENTION AND MANAGEMENT STRATEGIES AND BARRIERS FOR THE DELIVERY OF CARE

There was a consensus that orthodontic patients of all age groups are not well-motivated or compliant towards preventive measures, particularly caries prevention. The motivation strategies practiced by participants seem to concentrate on showing evidence of deterioration of decay to patients as a motivation tool.

There is a series of orthodontic video clips for oral hygiene instructions and White spot lesion and how it develops. A company called the Dolphin. Very effective, it is on my mobile; usually, I show them to all my patients (FG2, Participant 3).

Another strategy and in addition to showing images were discussions with patients on the worst scenarios that may occur.

I also tell them that if you don't follow strict oral hygiene instruction, then the case will take forever to finish." So usually that also motivates them in a way (FG1, Participant 3).

Motivation through relating the white spots lesions to social aspects and social acceptance was also practiced by some participants as a measure.

I start to stress on their social life and that it would affect relationships with friends, and that poor oral hygiene might make bad odour (FG1, Participant 2).

Oral hygiene instructions and reinforcements are fundamental in the preventive approach against WSLs.

I think the most effective preventive measure of white spot lesions is to enforce the oral hygiene and to teach the patient how to use the brush, interdental brush with the braces, and how to clean around the brackets from all the sides (FG3, Participant 4).

The use of fluoride as a preventive measure was also cited as of significant importance in the group discussions.

I agree reinforcing oral hygiene and application of fluoride (FG3, Participant 2).

Fluoride was also suggested as a deliberate drive to re-mineralize white spot lesions.

I usually put fluoride on during the treatment. Because, long procedures, especially extraction cases, oral hygiene usually fluctuates during treatment. So, I prefer to put fluoride. This is one of my like routines (FG2, Participant 3).

However, the use of fluoride did not seem to be a consistent measure with few participants, which is a deviation from the consensus in the management of WSL; indicating that they might, as opposed to would use fluoride.

If I noticed a white spot lesion around the braces during the treatment, I would reinforce oral hygiene and I might apply fluoride to enhance the re-mineralization process (F.G. 3, Participant 4).

The steps or actions taken by participants toward the detection of WSLs were reflected. Various strategies were used. For example, during treatment, wires are removed, and the patient is allowed time to improve on oral hygiene.

We take the wire off, archwire off and hand the patient the disposable toothbrush and have them brush in front of a mirror outside the clinic and then come back (FG1, Participant 4)

WSLs found towards the end of orthodontic treatment were managed through attempts to re-mineralizing the lesion/s.

After debonding the braces, if I found the white spot lesion I will reinforce the oral hygiene again and, I will apply fluoride and I will refer the patient to the restorative department (FG2, Participant 4).

There was also an indication by some participants that no clear management protocol was used for WSLs.

Unfortunately, I don't have a clear management protocol for white spot lesions. However, I usually reinforce oral hygiene. Tell the patient if oral hygiene did not get better the next visit that we might debond (FG3, Participant 1).

There was on the other hand a predominant clear and systematic management protocol narrated.

If it's not cavitated and we can reverse the process, I start with fluoridation, and then later on if it's more of an aesthetic concern, then most likely they will need to see a restorative dentist take care of that (FG4, Participant 5).

There was also some who prefer to have the management of WSL taken of are by another discipline

Personally I don't do any measures; I just refer the patients to the restorative department (FG3, participant 3)

Indeed, some believed that WSLs should be managed by disciplines other than theirs.

When it comes to the management, I think that the majority are better with my colleague, general dentist than myself (FG1, Participant 2).

There were, some delays in referrals with some patients, which were not made till cavitation, occurred.

For referring, from my studies and short experience white spot lesions I don't refer unless it is cavitated, and if it's cavitated, this means that the patient slipped you know at some point disappeared or something happened (F.G. 1 Participant 4).

There was an acknowledgment that Orthodontists are responsible for the management of WSLs; however, one barrier was the financial constraint in orthodontic practices as described by this participant.

So, this will take a lot of my time, plus we have to charge for it; this is a delicate situation. They are committed to paying the Orthodontic fees, but they're probably not

going to pay for the extra preventive measures that we prescribe (FG1, Participant 1).

Another barrier was particularly time constraints within a busy orthodontic practice or hospital clinic.

So, for example, for myself working in a very busy hospital and clinic, we don't have time really to do diet counseling (FG 2, Participant 3).

When asked, what would be the steps to take if WSLs are present before treatment; the delay of treatment till these are managed was the consensus.

I will not initiate treatment until that is all under control and then usually they'll follow up with a general dentist or whoever is taking care of them like every two or three months and kind of establish protocol to keep on top of it (FG4, participant 4).

Some participants affirmed that they learned from previous experiences that it is better to delay the treatment till oral hygiene and WSLs are managed.

The more I see those who would reach the cavitation stage and need Restorative treatment, the more cautious I am with new patients; not to start with them until we see reasonable practice of oral hygiene (FG1, Participant 2).

After the treatment started, to pause and hold off the treatment for a while was a measure to motivate patients, to improve oral hygiene was another approach.

It really depends on the severity of the white lesions also. If it's a cavitation, I would stop the treatment. If its initial stages, I would warn the patients and give them time to improve these oral hygiene measures. Otherwise, I will stop the treatment and start managing the white spot lesions (FG4, Participant 5).

DISCUSSION

This study explored the awareness and perceptions of a group of orthodontists of WSLs risk, diagnosis, prevention, and management using qualitative focus groups methodology. The focus groups were used to allow a purposive sample of participants from different educational and training backgrounds working within the same health care and educational services and sharing their perspectives and collective narratives. Purposive sampling in qualitative studies maximizes the range of participants and researchers' characteristics, reduces bias, and may provide potential generalizability to findings.^[21] There was a general agreement among groups of the significance of preventing WSLs before, during, and after orthodontic therapy, agreeing with the study by Maxfield *et al.*^[22]

Failure to maintain adequate preventive measures and plaque control levels are a feature with many orthodontic

patients, who are likely to suffer from gingival inflammation and enamel decalcification. Orthodontists in this study were clear in their commitment to continuous and repeated instructions regarding oral hygiene. Huber *et al.*, reported a significant decrease in plaque accumulation, gingival inflammation, and related gingival enlargement associated with fixed appliances when regular oral hygiene measures and professional prophylaxis are maintained.^[23]

The incidence and prevalence during orthodontic treatment were perhaps slightly underestimated by orthodontists in this study, since the reported incidence during the fixed orthodontic treatment has been shown in a meta-analysis to have an incidence and prevalence of 45.8% and 68.4%, respectively.^[24] While past caries is reasonable in the projection of future caries, however, orthodontists also need to be aware that both CAMBRA and ICDAS have been shown to estimate caries well in adults.^[25,26] Perhaps they should also consider using the Decayed Initial Missing Filled Surfaces (DiMFS) that measures patients' caries experience, which recently showed its ability to predict initial caries during orthodontic treatment.^[27] The authors also suggest that continuous professional development for Orthodontists should include caries risk assessment and the development of guidelines related to this issue within the region.

There was a misconception among a few participants, which is to do with explorers use in WSLs in enamel diagnosis, which can accidentally penetrate with an explorer and convert a subsurface lesion into a cavity.^[28]

Whereas it is accepted that patients may have different healthcare beliefs, motivations, and expectations; similarly, orthodontists training and experience differ, which may affect their decision making. However, the orthodontists in the current study demonstrated a similar attitude to what has been described in the meta-analysis by Rubak *et al.*^[29] Nevertheless, compliance is a barrier that frustrated the orthodontists in this study. Patients' compliance with preventive measures is challenging, and there are many reasons for noncompliance, but it could simply be due to forgetting and inconvenience.^[30] To overcome this, automated text message reminders proved effective in improving compliance to home oral hygiene measures in orthodontic patients.^[31-33] It is also advisable to pay attention to the psychological aspects related to compliance.^[34]

There is some degree of agreement and correlation between a quantitative study and what was narrated by the Orthodontists in this study, in that, for the prevention of WSLs, the most commonly advised was the usage of fluoride-containing toothpaste.^[35]

However, in one study, 75% of patients reported that their Orthodontists never told them about the recommended fluoride concentration in their toothpaste.^[36] In addition, Orthodontists should provide continuous fluoride supplements regardless of patients' cooperation to help to reduce the risk of WSLs during fixed orthodontic appliances.^[37] Such professional topical fluoride application narrated in this study has shown in one quantitative study to bring about a 25%–30% reduction in the incidence of WSLs after debonding.^[38]

Orthodontists in the focus groups were keen to involve their general or restorative dentist colleagues in diagnosing and managing WSLs. The importance of referring a high-carries risk population for a dental examination with their dentist is essential since many of these patients may view their Orthodontist as their general dentist, and, therefore, may not be aware that they require periodic check-ups with their dentist.^[36] Furthermore, in a cross-sectional survey, Hamdan *et al.* concluded that to prevent the development of WSLs successfully, both general dentists and orthodontists should work together as a team.^[39]

A particular limitation of this study is that participants in the focus groups may have withheld their views, cautious of sharing their views openly. Furthermore, the presence of a restorative dentist as a facilitator inhibited them from talking freely about WSLs awareness diagnosis and management. Focus groups discussions might also be influenced by recollection, and social-desirability response bias, and not true feelings or actual behaviors are provided, as participants may attempt in their response to conform to certain standards and accordingly may provide responses that are perceived to be acceptable by the researchers/facilitators and others.^[40] Although there was researchers' triangulation, another limitation was the absence of method triangulation as we only used a qualitative method. Therefore, future studies should consider a mixed-method analysis, a triangulated methodological approach that might produce more robust findings. Furthermore, the researchers made every effort not to input meanings or particular perspectives.^[41] However, transcripts interpretations may produce variable connotations and individual perspectives may have influenced our interpretations as researchers, which may be sometimes unavoidable. Furthermore, generalizability may not be possible to claim, as data and experience relate to only the current cohort; however, it may apply to a similar situation. However, we attempted to eliminate or reduce limitations as much as possible by training, planning,

and discussing with the facilitators beforehand, which produced an unbiased, open, nonjudgmental atmosphere during the focus groups.

CONCLUSION

Within the limitation of this study, WSLs were confirmed by participants as a significant issue during the fixed orthodontic therapy. There was a consensus that prevention is significant during the fixed orthodontic therapy and to delay the start of treatment and pausing the treatment in neglected cases until WSLs are managed.

FUTURE SCOPE/CLINICAL SIGNIFICANCE

This study provided an insight into the perceptions of orthodontists of the risk, prevention, and management of white spot lesions before, during, and after orthodontic fixed appliance therapy.

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CONFLICT OF INTEREST

There are no conflicts of interest.

AUTHORS CONTRIBUTION

Dr. Taibah and Dr. Abubakr: Conceptualization, visualization, facilitating focus groups and taking notes during the focus group and coding, reviewing codes, and writing the manuscript. Dr. Ziada: Visualization, investigation, coding, software, data interpretation, thematic analysis, and writing the original draft manuscript.

ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the ethics committee board and granted the exempt status (2016/12/06/01QR).

PATIENT DECLARATION OF CONSENT

All participants provided consent to participate in the study.

DATA AVAILABILITY STATEMENT

All data generated or analyzed in this study are included in this article.

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