Dentistry 3000

Vol 14, No 1 (2026)
ISSN 2167-8677 (online)
DOI 10.5195/d3000/2026.1382

How Orthodontists Deal with White Spot Lesions in Patients with Fixed Appliances?

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Abstract

White spot lesions (WSLs) are one of the most unpleasant complications of fixed orthodontic treatment. The aim of the present study was to assess the knowledge and practice levels of Iraqi orthodontists' professionals regarding the prevention and management of WSLs. This cross-sectional study was conducted by publishing online questionnaire among orthodontic groups. The questionnaire included four sections about the prevalence, knowledge, and the practice about the prevention and treatment of WSL. Data were analyzed by descriptive tests, and one way ANOVA, followed by pairwise comparison. Ninety-seven orthodontists participated in the study. Most participants (62.89%) had intermediate knowledge, and 65.98% recorded intermediate practice scores. 37.11% of participants showed high knowledge level, and 32.99% showed high practice level. The present study showed good knowledge and experience about white spot lesions and how to prevent and manage their occurrence during fixed orthodontic treatment.

Open Access

Citation: Alnasrawi HA et al. (2026) How Orthodontists Deal with White Spot Lesions in Patients with Fixed Appliances? Dentistry 3000. 1:a001 doi:10.5195/d3000.2026.1382
Received: May 18, 2026
Accepted: May 20, 2026
Published: June 15, 2026
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Introduction

Orthodontic treatment could result in many undesirable adverse effect [1]. Among these adverse effects that compromising orthodontic treatment outcome, white spot lesions (WSLs) pose a major issue [2]. The WSLs are subsurface enamel lesions characterized by their opaque, chalky white appearance as light is reflected differently from demineralized enamel surfaces compared to the adjacent sound enamel [3]. It develop as a result of imbalance in the equilibrium between tooth minerals and oral biofilms, which is characterized by microbial activity due to change in the bacterial flora of the plaque with higher concentrations of acidogenic bacteria, mainly *Streptococcus mutans* and *Lactobacilli*, resulting in fluctuations in the plaque pH due to bacterial acid product [4]. Mostly, WSL appear as small lines around the brackets; in some patients, they are visible as large decalcified areas with or without cavitation; therefore, their detection after the removal of orthodontic appliances is absolutely discouraging [5].

Although treatment duration can influence the prevalence and severity of WSLs, they can developed within the first 4 weeks of fixed appliance treatment [6]. Patients with poor oral hygiene, patients whose oral hygiene declined during treatment, and patients with preexisting WSLs had been reported as at increased risk of developing WSLs during treatment [7].

High rate of its occurrence is alarming, requiring attention to be given from orthodontists to effectively implement preventive, prophylactic, and treatment approaches before, during and after the orthodontic treatment [8]. Several studies provide strategies to prevent and manage WSLs during fixed appliance time [4,9-23]

The present study was designed to provide information about the knowledge of Iraqi orthodontists regarding WSLs, the current methods used to prevent and treat them during multibracket therapy. It also aims to compare these methods with the available evidence from the scientific literature. The study's objective is to guide efficient prevention and treatment strategies of enamel

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Vol 14, No 1 (2026) DOI 10.5195/d3000/2026.1382

demineralization during orthodontic treatment with fixed appliances.

Materials and Methods

According to Likert scale research design, a specially formulated questionnaire was prepared for this cross-sectional study. The questionnaire is online posted with a covering letter illustrating the purpose of the present survey. Participation was voluntary, no names or personal information were collected so participants identities would remain anonymous. The questionnaire has five sections. The first section is to identify the demographic data including age, gender, degree of qualification, and years of experience (Table 1). The second section involve eight questions about the prevalence of WSL. The third section involve six questions regarding the knowledge of WSL. While the fourth, and fifth sections were to assess the orthodontists' attitude and practice to prevent, and manage WSL, respectively. The validity of the present questionnaire was confirmed by a team of three specialist orthodontist followed by administering the questionnaire to five volunteers from the target population and their suggestions were considered so the finale version was completed. The responses were classified according to participant qualifications degree, and years of experience. The responses to the questions related to knowledge, and practice for management of WSLs were scored as follows: Totally agree:4 points, Agree: 3 points, Disagree: 2 points, Totally disagree: 1 point [24]. Then, the total score for knowledge considered 24 points and 20 points for practice. In the case of knowledge scores, ≤12 point considered as low knowledge score, 13-18 point, considered as intermediate knowledge score, and 19-24 points considered as high knowledge score. In the case of practice score, the final levels of ≤ 10 considered as low practice score, 11-15 as intermediate practice score, and 16-20 as high practice score.

The targeted population were the Iraqi orthodontist who officially registered in the Iraqi Orthodontics Association. Using G-power version 3.1.7 (Franz Faul, Uni Kiel, Germany), power of 90%, alpha error of probability 0.05 two-sided, effect size of F is 0.4 (Large effect size), the sample size was calculated. Since the registered orthodontist were 128, The calculated sample was equal to 97 [25].

The degree of orthodontists' knowledge was compared with the qualification, and years of experience of the participants using one way ANOVA, followed by pairwise comparison. The significant difference was set at $p< 0.05$. Descriptive statistics were used to define all categorical data in the form of frequency of distribution, percentages, mean, and standard deviation. Statistical analysis was performed using the SPSS software package (version 25, SPSS Inc., Chicago, USA).

Results

After reaching the required sample size of 97 replay, the questioner form was turned off, and no more responses were received to start the analysis of the results. The mean age of participants was 43.3 ± 6.4 years old. Most of the participants had MSc. degrees in orthodontics (52.6%) with 1-5 years of experience in the field (29.9%), followed by more than 20 years (23.7%), and 10-20 years (22.7%) respectively. More details summarized in Table 1.

Most respondents with all degree of qualifications, and years of experience involved in the present study confirmed that more than 5 out of 10 patients develop WSLs. Except participants with MSc. Degree, the ruminant answers among other qualifications and experience years answered that both male and female develop WSLs similarly. Most participants agreed that adolescents' patients and patients with previous WSLs develop more WSLs though fixed orthodontic treatment course. More details illustrated in Table2, and 3 showing the classification of results regarding the prevalence of WSLs according to qualification degree, and years of experience, respectively.

The distribution of answers to the questions regarding the knowledge of orthodontists about WSLs among different qualifications, and experience years illustrated in Table 4, and 5, respectively. Most respondents among different qualifications and experience agreed that WSLs pose a major issue during treatment with fixed appliance which is preventable and could be managed.

Regarding the practice to prevent WSLs during treatment, most participated orthodontists revealed that they always perform the preventive measures. The details about the responses in relation to qualification degree, and experience years illustrated in Table 6, and 7, respectively.

The results of the last section which related to the practice to manage WSLs after removal of brackets illustrated in table 8, and 9 according to qualification degree, and experience years. Major agreement was that the first step for treatment of WSL is to allow natural remineralization for six months, resin infiltration is a minimally invasive restorative treatment for post-orthodontic WSL, and in case of cavitation lesion restoration is the treatment of choice.

Most participants showed intermediate score regarding knowledge about WSLs (62.89%), and how to practice managing them after brackets removal (65.98%). 37.11% of participants showed high knowledge level, and 32.99% showed high practice level (Table 10).

One way ANOVA test of variance was performed to show the difference of knowledge, and managements among different qualifications degree, and practice time. In case of knowledge about WSLs, significant difference was observed between different qualification (Table 11) which is followed by pair wise comparisons that revealed significant difference between post-graduation student, and PhD degree (Table 12).

In case of practice to manage WSLs, significant difference was observed between different qualification (Table 13), which is followed by pair wise comparisons that revealed significant difference between MSc., and PhD degree (Table 14).

Discussion

Since more than half of patients undergo fixed orthodontic treatment develop one or more WSLs , this condition is considered as a serious problem that need to be addressed at early stage through the course of treatment [26]. Orthodontists have to carry the responsibility to implement a preventive measures, and in case of WSLs development the orthodontist need to be at a high level of knowledge as how to practice to manage these early enamel decalcifications [24,27]. Due to the extensive literature regarding WSL prevention, and the progress in the development biomaterials to prevent enamel demineralization and remineralize early enamel lesions [28-30], it is essential to enhance the level of practice. So, the present survey was conducted firstly to evaluate the level of Iraqi orthodontists' knowledge regarding the prevalence, prevention, and management of WSLs, and secondly to spot the light to the up-to-date preventive and remineralizing protocols and materials.

Depending on the method of assessment, previous investigations found that by using visual examination, about 50% of patient underwent fixed orthodontic treatment had one or more WSLs after brackets removal. However, by using quantified light fluoroscopy; which had been proved to be a suitable *in vivo* monitoring tool for mineral loss and incipient enamel lesions; the percentage raised to 97% [31-33]. In the present study, most orthodontists (43.3%) confirmed that more than 5 from 10 of their patients develop WSLs, which come in line with the results of the previous studies.

Several previous studies found no gender predilection with respect to WSLs occurrence [34,35]. This coincides with the result of the present study in which 42.3% of participants respond that both male and female develop WSLs similarly.

In regard to the relation between WSLs prevalence and patient age at the start of treatment, previous study revealed no relation between age and enamel demineralization [36]. However, other literatures found that adolescents are more likely to develop WSLs with reduction of WSLs as the age increase [37,38]. This may be attributed to the increase concern about oral hygiene maintenance with age. More than half of the respondents in the present study (56.7%) selected the adolescents to be the most affected age group.

Among the previous literatures, controversy of results was found with respect to the most affected teeth by the development of WSLs. Several studies concluded that maxillary lateral incisor followed by mandibular canine are the most affected teeth, while the maxillary posterior segments are the sites least commonly affected by WSLs development, other studies reported that maxillary and mandibular first permanent molars are the most affected teeth. Other proposed that maxillary lateral incisors and canines were the most severely affected by WSLs, followed by the premolars and central incisors [37,39-42]. Similar controversy also noted in the present study in which 50.5% of participant agreed that maxillary lateral incisor followed by mandibular canine are the most affected teeth, and 55.7% agreed that maxillary posterior segments are the sites least commonly affected. The rest of the respondents mentioned other teeth to me the most usual sites of WSLs occurrence.

patients with extensive previous carries experience is an indicator of more enamel decalcification during fixed orthodontic treatment course [43,44] which is almost completely confirmed by the result of the present survey.

Different studies revealed high rate of WSLs occurrence which indicate that their development is a serious undesirable sequel of orthodontic treatment [36,38,45]. Almost all responses of this study agreed that WSLs is a serious issue occurred due to treatment with fixed orthodontic appliance.

WSLs development may occur within 4 weeks after bonding orthodontic brackets [46]. About 36.1% of the respondents disagree that WSLs occur within the first month. These responses may be attributed to the location of WSLs at the bracket boundaries or in the vestibular surfaces which are difficult to be distinguished. The remaining responses come in constant with the previous investigations.

Previous study found that extended orthodontic treatment duration above 12 month result in increased prevalence of WSLs by 1.7 fold compared with 12 month treatment [47]. Other study found that when orthodontic treatment exceed 17 month, the prevalence of WSLs increase [48]. Verma *et al*. concluded that the prevalence of WSLs increases significantly with increased treatment duration [32]. Most responses in this study come in consensus with previous studies where 43.3% strongly agreed, and 42.3% agreed that WSLs increase with increased treatment duration.

Before the development of enamel cavitation, WSLs are considered as a reversible condition with a potential to be remineralized [49,50]. About half of the responses (47.4%) in the present study disagreed that WSLs are reversible. This may be attributed to the deficiency in the practice to reverse this condition.

Literature had been proved that WSLs are preventable. Hussein et al. conducted a clinical trial which revealed less WSLs in orthodontic patient who received weekly reminders through Viber or WhatsApp in form of text, photos, or video messages to assure the maintenance of oral hygiene measures, appliance care, and importance of adherence to scheduled appointments [51]. So, it is the responsibility of orthodontist to establish caries management protocol started by a comprehensive assessment of the patient's oral, and general condition [27]. This should include informing the patient (and patients parents) about the current oral hygiene, effective and continues assurance about diet and encouragement about the importance of at-home mechanical and chemical plaque control , and in high risk patient electronic tooth brush with fluoridated toothpaste, fluoridated mouth rinse or at home topical fluoride products may be considered [27,52]. Besides that, professional preventive measure needs to be implemented in high-risk patient which include professional mechanical cleaning, professional fluoride varnish application, and utilization of fluoride releasing, hydroxyapatite nanoparticles, and other biomaterial for prevention of WSLs [29,53-58]. Laser application also found to reduce the incidence of WSLs. Mahmoudzadeh et al. concluded a reduction in WSLs among teeth treated by co2 laser in conjugation with fluoride. They proposed that the laser introduce a synergistic effect to improve enamel resistance to acid attacks [59].

Regarding the management of WSLs, several novel materials and protocols had been developed to enhance enamel remineralization such as laser application, bioactive materials, probiotic, and peptide-based biomimetic materials [28,60-65]. In spite of the new approaches to remineralize post orthodontic WSLs, the first approach in the management is to allow natural remineralization of the for the first six months after treatment [66]. After that, teeth bleaching, micro-abrasion, and resin infiltration are considered as a less invasive methods for WSLs management with many advantages [67-70]. Resin infiltration treatment may be a good option in patients whose level of oral hygiene is poor, where the natural remineralization is unlikely to occur [71]. A recent study concluded that resin infiltration treatment is recommended only once per a tooth's lifetime which improve color stability for more than one year [72,73]. As a final treatment approach for cavitated white spot lesion, dental veneer may be required to restore the natural dental appearance [74].

Conclusion

The present study showed that Iraqi orthodontists have intermediate to high degree of knowledge about WSLs and how to practice managing them after orthodontic treatment. It also revealed that almost all orthodontic practitioners perform appropriate preventive measures during fixed orthodontic. It is recommended to perform more studies target the up-to-date materials to prevent and manage orthodontically induced WSLs..

References

1. Mohammed-Salih, H.S., et al., *Detection of orthodontically induced inflammatory root resorption-associated biomarkers from the gingival crevicular fluid by proteomics analysis: a randomized-controlled clinical trial.* 3 Biotech, 2023. **13**(5): p. 157.
2. Zabokova-Bilbilova, E., et al., *White spot lesions: prevention and management during the orthodontic treatment.* Pril (Makedon Akad Nauk Umet Odd Med Nauki), 2014. **35**(2): p. 161-8.
3. Qin, D., et al., *Protocol for the development of a Core Outcome Set for trials on the prevention and treatment of Orthodontically induced enamel White Spot Lesions (COS-OWSL).* Trials, 2021. **22**(1): p. 1-8.
4. Sonesson, M., et al., *Fluoride varnish for white spot lesion prevention during orthodontic treatment: results of a randomized controlled trial 1 year after debonding.* European Journal of Orthodontics, 2021. **43**(4): p. 473-477.
5. Riad, M.F., R. Raafat, and A.M. Nabil Amin, *Comparative Study Using Biomimetic Remineralization Versus Fluoride Varnish in Management of White Spot Lesion in Post Orthodontic Treated Patient: Split Mouth Randomized Clinical Trial.* Indian Journal of Public Health Research & Development, 2020. **11**(4).
6. Lee, J., et al., *Investigation of the esthetic outcomes of white spot lesion*

treatments. Nigerian Journal of Clinical Practice, 2020. **23**(9): p. 1312-1312.
7. Lucchese, A. and E. Gherlone, *Prevalence of white-spot lesions before and during orthodontic treatment with fixed appliances.* European journal of orthodontics, 2012. **35**(5): p. 664-668.
8. Hu, H., et al., *Effectiveness of remineralizing agents in the prevention and reversal of orthodontically induced white spot lesions: a systematic review and network meta-analysis.* Clinical Oral Investigations, 2020: p. 1-15.
9. Roveri, N., et al., *Surface enamel remineralization: biomimetic apatite nanocrystals and fluoride ions different effects.* Journal of Nanomaterials, 2009. **2009**.
10. Nascimento, P.L.d.M.M., et al., *Fluoride-releasing materials to prevent white spot lesions around orthodontic brackets: a systematic review.* Brazilian dental journal, 2016. **27**: p. 101-107.
11. Lapenaite, E., K. Lopatiene, and A. Ragauskaite, *Prevention and treatment of white spot lesions during and after fixed orthodontic treatment: A systematic.* Stomatologija, 2016. **18**(1): p. 3-8.
12. Radovic-Moreno, A.F., *Bacteria-targeting nanoparticles for managing infections*. 2013, Massachusetts Institute of Technology.
13. Sadikoglu, I.S., *White Spot Lesions: Recent Detection and Treatment Methods.* Cyprus Journal of Medical Sciences, 2020. **5**(3): p. 260-267.
14. van der Kaaij, N., *Prevention of white spot lesion formation during treatment with fixed orthodontic appliances.* Nederlands Tijdschrift Voor Tandheelkunde, 2020. **127**(12): p. 699-704.
15. Govindaraj, A. and S. Dinesh, *Effect of Chlorhexidine Varnish and Fluoride Varnish on White Spot Lesions in Orthodontic Patients-a Systematic Review.* The Open Dentistry Journal, 2021. **15**(1).
16. Aileni, K.R., et al., *Nanoparticles! Armour against White Spot Lesions.* International Medical Journal, 2021. **28**(1).
17. Behnaz, M., et al., *Effects of Orthodontic Bonding Containing TiO2 and ZnO Nanoparticles on Prevention of White Spot Lesions: an In Vitro Study.* 2021.
18. Espinosa-Cristóbal, L.F., et al., *Antiadherence and antimicrobial properties of silver nanoparticles against Streptococcus mutans on brackets and wires used for orthodontic treatments.* Journal of Nanomaterials, 2018. **2018**.
19. Memarpour, M., et al., *Effect of hydroxyapatite nanoparticles on enamel remineralization and estimation of fissure sealant bond strength to remineralized tooth surfaces: an in vitro study.* BMC Oral Health, 2019. **19**(1): p. 92.
20. Scribante, A., et al., *Biomimetic Effect of Nano-Hydroxyapatite in Demineralized Enamel before Orthodontic Bonding of Brackets and Attachments: Visual, Adhesion Strength, and Hardness in In Vitro Tests.* BioMed Research International, 2020. **2020**: p. 6747498.
21. Wierichs, R.J., T.S. Carvalho, and T.G. Wolf, *Efficacy of a self-assembling peptide to remineralize initial caries lesions - A systematic review and meta-analysis.* Journal of Dentistry, 2021. **109**: p. 103652.
22. Dogan, S., et al., *Biomimetic Tooth Repair: Amelogenin-Derived Peptide Enables in Vitro Remineralization of Human Enamel.* ACS Biomaterials Science & Engineering, 2018. **4**(5): p. 1788-1796.
23. Welk, A., et al., *Effect of self-assembling peptide P11-4 on orthodontic treatment-induced carious lesions.* Scientific Reports, 2020. **10**(1): p. 6819.
24. Kareem, F., et al., *Knowledge and Practice of Orthodontists Regarding Prevention and Treatment of White Spot Lesions during Fixed Orthodontic Treatment Course in Kurdistan Region-Iraq: A Cross Sectional Study.* Sulaimani Dental Journal, 2020. **7**(2): p. 11-11.
25. Faul, F., et al., *Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses.* Behavior research methods, 2009. **41**(4): p. 1149-1160.
26. Eslamipour, F., M. Shahmoradi, and V. Farhadi, *Assessment of Iranian orthodontists' practice with regard to the prevention and treatment of white spot lesions.* Journal of education and health promotion, 2017. **6**(1): p. 42-42.
27. Sardana, D., et al., *White spot lesions in orthodontics: consensus statements for prevention and management.* The Angle Orthodontist, 2023. **93**(6): p. 621-628.
28. Lazar, L., et al., *White Spot Lesions (WSLs)—Post-Orthodontic Occurrence, Management and Treatment Alternatives: A Narrative Review.* Journal of Clinical Medicine, 2023. **12**(5): p. 1908.
29. Adel, S.M., N. El-Harouni, and N.R. Vaid. *White Spot Lesions: Biomaterials, Workflows and Protocols*. in *Seminars in Orthodontics*. 2023. Elsevier.
30. Bencze, M.-A., et al., *Clinical Use of Nanoparticles in Orthodontics as Possible Aid to Reduce the Incidence of White Spot Lesions.* Materiale Plastice, 2022. **59**(1).
31. Boersma, J.G., et al., *Caries prevalence measured with QLF after treatment with fixed orthodontic appliances: influencing factors.* Caries research, 2004. **39**(1): p. 41-47.
32. Verma, P. and R.K. Jain, *Visual Assessment of Extent of White Spot Lesions in Subjects treated with Fixed Orthodontic Appliances: A Retrospective Study.* World Journal of Dentistry, 2022. **13**(3): p. 245-249.
33. Kumar, H., et al., *Assessment of White Spots with Quantitative Light-Induced Fluorescence in Patients Undergoing Fixed Orthodontics.* J Pharm Bioallied Sci, 2021. **13**(Suppl 1): p. S312-s314.
34. Kumar, M., et al., *Assessment of enamel decalcification in orthodontic patients.* University journal of dental sciences, 2020. **6**(1): p. 28-30.
35. Sharab, L., et al., *Prevalence of white spot lesions and gingival index during orthodontic treatment in an academic setting.* American Journal of Orthodontics and Dentofacial Orthopedics, 2023. **163**(6): p. 835-842.
36. Sagarika, N., et al., *Prevalence of white spot lesion in a section of Indian population undergoing fixed orthodontic treatment: An in vivo assessment using the visual International Caries Detection and Assessment System II criteria.* Journal of conservative dentistry: JCD, 2012. **15**(2): p. 104.
37. Khalaf, K., *Factors affecting the formation, severity and location of white spot lesions during orthodontic treatment with fixed appliances.* Journal of oral & maxillofacial research, 2014. **5**(1).
38. Richter, A.E., et al., *Incidence of caries lesions among patients treated with comprehensive orthodontics.* American Journal of Orthodontics and Dentofacial Orthopedics, 2011. **139**(5): p. 657-664.
39. Kozak, U., A. Sękowska, and R. Chałas, *The effect of regime oral-hygiene intervention on the incidence of new white spot lesions in teenagers treated with fixed orthodontic appliances.* International Journal of Environmental Research and Public Health, 2020. **17**(24): p. 9460.
40. Toti, Ç., et al. *White Spots Prevalence and Tooth Brush Habits during Orthodontic Treatment*. Healthcare, 2022. **10**, DOI: 10.3390/healthcare10020320.
41. Bock, N.C., et al., *White spot lesions after fixed appliance treatment—Can we expect spontaneous long-term (≥ 15 years) improvement?* European Journal of Orthodontics, 2023: p. cjad070.
42. Chapman, J.A., et al., *Risk factors for incidence and severity of white spot lesions during treatment with fixed orthodontic appliances.* American Journal of Orthodontics and Dentofacial Orthopedics, 2010. **138**(2): p. 188-194.
43. Pitts, N.B., et al., *Understanding dental caries as a non-communicable disease.*

British Dental Journal, 2021. **231**(12): p. 749-753.
44. Lam, P.P.Y., et al., *Does Early Childhood Caries Increase Caries Development among School Children and Adolescents? A Systematic Review and Meta-Analysis.* International Journal of Environmental Research and Public Health, 2022. **19**(20): p. 13459.
45. Khalaf, K., *Factors Affecting the Formation, Severity and Location of White Spot Lesions during Orthodontic Treatment with Fixed Appliances.* Journal of oral & maxillofacial research, 2014. **5**(1): p. e4-NA.
46. Toz Ertop, M., et al., *Evaluation of the Demineralization Development around Different Types of Orthodontic Brackets.* Materials, 2023. **16**(3): p. 984.
47. Brown, M.D., et al., *A practice-based evaluation of the prevalence and predisposing etiology of white spot lesions.* The Angle Orthodontist, 2016. **86**(2): p. 181-186.
48. Jiang, H., B.J. Tai, and M.Q. Du, *Patterns and risk factors for white spot lesions in orthodontic patients with fixed appliances.* Chin J Dent Res, 2015. **18**(3): p. 177-183.
49. Natchiyar, N., et al., *Comparison of Remineralizing Agents in the Management of White Spot Lesions In Three-to Five-year-old Children: a Clinical Trial.* Pediatric Dentistry, 2023. **45**(2): p. 99-106.
50. Salah, R., H. Kehela, and R.R. Afifi, *Treatment of post-orthodontic white spot lesions using Bioactive glass: A Randomized Controlled Trial with 12-months follow-up.* Alexandria Dental Journal, 2023. **48**(1): p. 227-235.
51. Hussein, S. and H. Ismail, *Influence of Reminder on Enhancing Compliance in Patients with Fixed Orthodontic Appliance Treatment (a Randomized Controlled Clinical Trial).* Patient preference and adherence, 2023: p. 1759-1769.
52. Awari, K., et al., *Efficacy of Resin-Modified Glass Ionomer Cement Varnish and Sodium Fluoride Varnish in The Prevention of White Spot Lesions During Fixed Orthodontic Treatment-A Split Mouth Study.* Clin Med Res, 2023. **4**(2): p. 1-8.
53. Sonesson, M., et al., *Fluoride varnish for the prevention of white spot lesions during orthodontic treatment with fixed appliances: a randomized controlled trial.* European Journal of Orthodontics, 2020. **42**(3): p. 326-330.
54. Lale, S., et al., *In vitro comparison of fluoride, magnesium, and calcium phosphate materials on prevention of white spot lesions around orthodontic brackets.* BioMed research international, 2020. **2020**.
55. Lelli, M., et al., *Different corrosive effects on hydroxyapatite nanocrystals and amine fluoride-based mouthwashes on dental titanium brackets: a comparative in vitro study.* International Journal of Nanomedicine, 2013: p. 307-314.
56. Kadhem, D.J. and A.H.M. Al Haidar, *Antibacterial and cytotoxic effect of a novel bio-logical Nano-silver fluoride synthesized from moringa oleifera leaf extract.* Journal of Baghdad College of Dentistry, 2023. **35**(2): p. 32-44.
57. Kadhim, H.A., S. Deb, and A.I. Ibrahim, *In vitro assessment of bracket adhesion post enamel conditioning with a novel etchant paste.* Journal of Baghdad College of Dentistry, 2023. **35**(1): p. 1-9.
58. Al Tuma, R.R. and Y.A. Yassir, *Effect of calcium fluoride nanoparticles in prevention of demineralization during orthodontic fixed appliance treatment: a randomized clinical trial.* European Journal of Orthodontics, 2023. **45**(2): p. 122-132.
59. Mahmoudzadeh, M., et al., *Effect of CO2 laser on the prevention of white spot lesions during fixed orthodontic treatment: a randomized clinical trial.* Turkish Journal of Orthodontics, 2019. **32**(3): p. 165.
60. Ren, J., et al., *Synergistic remineralization of enamel white spot lesions using mesoporous bioactive glasses loaded with amorphous calcium phosphate.* Frontiers in Bioengineering and Biotechnology, 2023. **11**: p. 1109195.
61. Shetty, S.S. and S. Nekkanti, *Remineralization Potential of a Novel Biomimetic Material (Self-assembling Peptide P.* The Journal of Contemporary Dental Practice, 2023. **24**(3): p. 182.
62. Atteya, S.M., et al., *Self-assembling peptide and nano-silver fluoride in remineralizing early enamel carious lesions: Randomized Controlled Clinical Trial.* 2023.
63. Mukherjee, K., et al., *Amelogenin Peptide-Chitosan Hydrogel for Biomimetic Enamel Regrowth.* Frontiers in Dental Medicine, 2021. **2**(37).
64. Tiwari, A. and R.K. Jain, *Comparative Evaluation of White Spot Lesion incidence between NovaMin, Probiotic, And Fluoride containing Dentifrices during Orthodontic treatment Using Laser Fluorescence-A Prospective Randomized Controlled Clinical Trial.* Clinical and Investigative Orthodontics, 2023: p. 1-8.
65. Rahee, S.S. and R.H. Jehad, *Comparing the effectiveness of using three different re-mineralizing pastes on remineralisation of artificially induced white spot lesion.* Journal of Baghdad College of Dentistry, 2023. **35**(4): p. 35-45.
66. de Camargo, M.G.A., J.A. Rodríguez, and H. Rodríguez, *Remineralization of white spot lesions in orthodontic. Is that possible? Literature review.* Revista da Faculdade de Odontologia de Porto Alegre, 2023. **64**: p. e130690-e130690.
67. Asthana, G., K. Patel, and R. Parmar, *Efficacy of microabrasion and resin infiltration techniques for masking of fluorotic white spot lesions: A randomized clinical study.* Journal of Conservative Dentistry and Endodontics, 2023. **26**(6): p. 677-681.
68. Alkhazaleh, A. and A. Tsujimoto, *Management of Multifactorial Stained Enamel Defects on Anterior Dentition Using a Combination Treatment of Whitening, Microabrasion, Resin Infiltration and Resin-based Composite Restoration.* Operative Dentistry, 2023. **48**(3): p. 251-257.
69. da Cunha, L.F., et al., *Treatment protocol of dental bleaching and resin infiltration for white spot lesions.* International Journal of Esthetic Dentistry, 2023. **18**(2).
70. LI, Y., et al., *Experimental study on the therapeutic effect of different bleaching methods on white-spot lesions of the enamel using optical coherence tomography.* Stomatology, 2023: p. 217-221.
71. Lopes, P.C., et al., *White spot lesions: diagnosis and treatment–a systematic review.* BMC Oral Health, 2024. **24**(1): p. 1-18.
72. Park, H., *Optimizing Resin Infiltration Treatment of Post-Orthodontic White Spot Lesions by Increasing Infiltrant Penetration Duration—In Vitro Study*. 2023, University of Nevada, Las Vegas.
73. Uyar, D.S., U. Tansel, and B.M. ÖZGÜL, *Application of Resin Infiltration Technique in the Treatment of Tooth Surface Losses Due to Erosion: In-Vitro Study.* ADO Klinik Bilimler Dergisi, 2023. **12**(3): p. 334-339.
74. AlBuraiki, M.J., et al., *Long term remineralizing effect of casein phosphopeptide amorphous calcium phosphate in white spot lesions: A systematic review and meta-analysis.* Technology and Health Care, 2023(Preprint): p. 1-15.

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Table 1. Demographic data of the study populations.

Variable	Mean and standard deviation		
Age	43.3 ± 6.4		
	-	Frequency	Percentage
Gender	Male	53	
	female	44	
Degree of qualification	Philosophiae Doctor	18	18.6
	Master of Science	51	52.6
	General practitioner/ training certificate	17	17.5
	Post graduate student	11	11.3
Years of experience	Less than one year	5	5.2
	1-5 years	29	29.9
	5-10 years	18	18.6
	10-20 years	22	22.7
	More than 20 years	23	23.7

Table 2. Prevalence of white spot lesion according to participants' qualification degree.

Prevalence of WSLs		Qualification								F.	%
		GP		MSc		PhD		Post			
		F.	%	F.	%	F.	%	F.	%		
Number of patients	Less than 3 out of 10	3	11.54	12	46.15	6	23.08	5	190.23	26	26.80
	More than 5 out of 10	12	22.64	33	62.26	4	7.55	4	70.55	53	54.64
	1 out of 10	2	11.11	6	33.33	8	44.44	2	110.11	18	18.56
Gender of patients	Male	4	12.50	22	68.75	3	9.38	3	9.38	32	32.99
	Female	3	12.50	13	54.17	4	16.67	4	16.67	24	24.74
	Both	10	24.39	16	39.02	11	26.83	4	9.76	41	42.27
Age of patients	Adolescent	9	16.07	26	46.43	13	23.21	8	14.29	56	57.73
	Young adult	3	12.50	14	58.33	4	16.67	3	12.5	24	24.74
	Adult	4	26.67	10	66.67	1	6.67	0	0	15	15.46
	All age	1	50	1	50	0	0	0	0	2	2.06
Most common location of WSLs	Agree	8	16.33	27	55.1	8	16.33	6	12.24	49	50.52
	Disagree	6	19.35	18	58.06	3	9.68	4	12.9	31	31.96
	Strongly agree	3	20	4	26.67	7	46.67	1	6.67	15	15.46
	Strongly disagree	0	0	2	100	0	0	0	0	2	2.06
Least common location of WSLs	Agree	8	14.81	30	55.56	9	16.67	7	12.96	54	55.67
	Disagree	5	21.74	15	65.22	1	4.35	2	8.7	23	23.71
	Strongly agree	4	22.22	4	22.22	8	44.44	2	11.11	18	18.56
	Strongly disagree	0	0	2	100	0	0	0	0	2	2.06
Susceptibility of new WSLs	Agree	10	19.61	25	49.02	7	13.73	9	17.65	51	52.58
	Disagree	2	40	3	60	0	0	0	0	5	5.15
	Strongly agree	5	12.2	23	56.1	11	26.83	2	4.88	41	42.27

GP: General practitioner; PhD: Philosophiae Doctor; MSc: Master of Science; Post: Post graduate student; F: Frequency; %: percentage.

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Table 3. Prevalence of white spot lesion according to participants' practice time.

Prevalence of WSLs		Practice time								Total	
		1-5 y		5-10 y		10-20 y		> 20 y			
		F.	%	F.	%	F.	%	F.	%	F.	%
Number of patients	Less than 3 out of 10	13	50	3	11.54	8	30.77	2	7.69	26	26.80
	More than 5 out of 10	16	30.19	11	20.75	9	16.98	17	32.08	53	54.64
	1out of 10	5	27.78	4	22.22	5	27.78	4	22.22	18	18.56
Gender of patients	Male	13	40.63	4	12.5	7	21.88	8	25	32	32.99
	Female	8	33.33	4	16.67	6	25	6	25	24	24.74
	Both	13	31.71	10	24.39	9	21.95	9	21.95	41	42.27
Age of patients	Adolescent	22	39.29	11	19.64	10	17.86	13	23.21	56	57.73
	Young adult	9	37.5	3	12.5	7	29.17	5	20.83	24	24.74
	Adult	3	20	3	20	4	26.67	5	33.33	15	15.46
	All age	0	0	1	50	1	50	0	0	2	2.06
Most common location of WSLs	Agree	23	46.94	8	16.33	9	18.37	9	18.37	49	50.52
	Disagree	8	25.81	8	25.81	8	25.81	7	22.58	31	31.96
	Strongly agree	3	20	2	13.33	5	33.33	5	33.33	15	15.46
	Strongly disagree	0	0	0	0	0	0	2	100	2	2.06
	Agree	22	40.74	8	14.81	14	25.93	10	18.52	54	55.67
	Disagree	7	30.43	6	26.09	5	21.74	5	21.74	23	23.71
	Strongly agree	5	27.78	4	22.22	3	16.67	6	33.33	18	18.56
	Strongly disagree	0	0	0	0	0	0	2	100	2	2.06
Least common location of WSLs	Agree	22	43.14	12	23.53	8	15.69	9	17.65	51	52.58
	Disagree	1	20	2	40	2	40	0	.00	5	5.15
	Strongly agree	11	26.83	4	9.76	12	29.27	14	34.15	41	42.27

F: Frequency; %: percentage.

Table 4. Knowledge about white spot lesions according to participants' qualification degree.

Knowledge	Answers	Qualification								Total	
		GP		MSc		PhD		Post			
		F.	%	F.	%	F.	%	F.	%	F.	%
WSL poses a major issue during treatment	Agree	9	19.57	23	50	6	13.04	8	17.39	46	47.42
	Disagree	0	0	3	50	1	16.67	2	33.33	6	6.19
	Strongly agree	8	17.78	25	55.56	11	24.44	1	2.22	45	46.39
WSLs develop as early as 4 weeks after treatment	Agree	4	10.53	17	44.74	11	28.95	6	15.79	38	39.18
	Disagree	11	31.43	22	62.86	1	2.86	1	2.86	35	36.08
	Strongly agree	2	8.7	11	47.83	6	26.09	4	17.39	23	23.71
	Strongly disagree	0	0	1	100	0	0	0	0	1	1.03
Increased duration of orthodontic treatment is associated with significant increase in the occurrence of WSL	Agree	8	19.51	19	46.34	9	21.95	5	12.2	41	42.27
	Disagree	2	14.29	11	78.57	0	.00	1	7.14	14	14.43
	Strongly agree	7	16.67	21	50.00	9	21.43	5	11.9	42	43.3
WSL is a reversible condition	Agree	5	13.89	18	50	9	25	4	11.11	36	37.11
	Disagree	10	21.74	29	63.04	2	4.35	5	10.87	46	47.42
	Strongly agree	2	18.18	4	36.36	5	45.45	0	0	11	11.34
	Strongly Disagree	0	0	0	0	2	50	2	50	4	4.12
WSL is preventable	Agree	4	10.81	19	51.35	8	21.62	6	16.22	37	38.14
	Disagree	10	28.57	21	60	0	0	4	11.43	35	36.08
	Strongly agree	3	13.04	9	39.13	10	43.48	1	4.35	23	23.71
	Strongly disagree	0	0	2	100	0	0	0	0	2	2.06
WSL can be treated	Agree	5	10.20	26	53.06	10	20.41	8	16.33	49	50.52
	Disagree	7	31.82	11	50	2	9.09	2	9.09	22	22.68
	Strongly agree	5	20	13	52	6	24	1	4	25	25.77
	Strongly disagree	0	0	1	100	0	0	0	0	1	1.03

GP: General practitioner; PhD: Philosophiae Doctor; MSc: Master of Science; Post: Post graduate student; F: Frequency; %: percentage.

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Table 5. Knowledge about white spot lesions according to participants' years of experience.

Knowledge		Practice time								Total	
		1-5 y		5-10 y		10-20 y		> 20 y			
		F.	%	F.	%	F.	%	F.	%	F.	%
WSL poses a major issue during treatment	Agree	21	45.65	11	23.91	7	15.22	7	15.22	46	47.42
	Disagree	4	66.67	1	16.67	1	16.67	0	0	6	6.19
	Strongly agree	9	20.00	6	13.33	14	31.11	16	35.56	45	46.39
WSLs develop as early as 4 weeks after treatment	Agree	14	36.84	7	18.42	9	23.68	8	21.05	38	39.18
	Disagree	13	37.14	10	28.57	5	14.29	7	20	35	36.08
	Strongly agree	7	30.43	1	4.35	7	30.43	8	34.78	23	23.71
	Strongly disagree	0	0	0	0	1	100	0	0	1	1.03
Increased duration of orthodontic treatment is associated with significant increase in the occurrence of WSL	Agree	14	34.15	9	21.95	11	26.83	7	17.07	41	42.27
	Disagree	4	28.57	4	28.57	3	21.43	3	21.43	14	14.43
	Strongly agree	16	38.10	5	11.90	8	19.05	13	30.95	42	43.30
WSL is a reversible condition	Agree	14	38.89	6	16.67	8	22.22	8	22.22	36	37.11
	Disagree	15	32.61	9	19.57	13	28.26	9	19.57	46	47.42
	Strongly agree	3	27.27	1	9.09	1	9.09	6	54.55	11	11.34
	Strongly Disagree	2	50	2	50	0	0	0	0	4	4.12
WSL is preventable	Agree	13	35.14	7	18.92	10	27.03	7	18.92	37	38.14
	Disagree	14	40	7	20	7	20	7	20	35	36.08
	Strongly agree	7	30.43	4	17.39	4	17.39	8	34.78	23	23.71
	Strongly disagree	0	0	0	0	1	50	1	50	2	2.06
WSL can be treated	Agree	18	36.73	9	18.37	11	22.45	11	22.45	49	50.52
	Disagree	8	36.36	6	27.27	6	27.27	2	9.09	22	22.68
	Strongly agree	8	32	3	12	5	20	9	36	25	25.77
	Strongly disagree	0	0	0	0	0	0	1	100	1	1.03

F: Frequency; %: percentage.

Table 6. Practice to prevent white spot lesion occurrence lesions according to participants' qualification degree.

Practice to prevent WSLs occurrence		Qualification								Total	
		GP		MSc		PhD		Post			
		F.	%	F.	%	F.	%	F.	%	F.	%
Do you inform your patient about the current oral hygiene situation	Always	13	15.85	43	52.44	16	19.51	10	12.20	82	84.54
	Sometimes	4	26.67	8	53.33	2	13.33	1	6.67	15	15.46
Do you instruct your patient about oral health care during treatment either	Always	12	15	42	52.5	16	20	10	12.5	80	82.47
	Sometimes	5	29.41	9	52.94	2	11.76	1	5.88	17	17.53
If you instruct your patient, which of the following approaches do you prefer	Orally	6	18.18	19	57.58	5	15.15	3	9.09	33	34.02
	Educational video	0	0	2	66.67	1	33.33	0	0	3	3.09
	Oral instruction with live demonstration	0	0	1	25	3	75	0	0	4	4.12
	Written information	4	57.14	2	28.57	0	0	1	14.29	7	7.22
	Combined	7	14	27	54	9	18	7	14	50	51.55
Do you instruct your patient to use electronic toothbrush instead of manual	Always	4	19.05	10	47.62	7	33.33	0	0	21	21.65
	Never	2	10	8	40	4	20	6	30	20	20.62
	Sometimes	11	19.64	33	58.93	7	12.50	5	8.93	56	57.73
Do you give dietary advice to your patient	Always	5	8.33	31	51.67	16	26.67	8	13.33	60	61.86
	Never	0	0	1	100	0	0	0	0	1	1.03
	Sometimes	12	33.33	19	52.78	2	5.56	3	8.33	36	37.11
Do you advice your patient to use fluoridated toothpaste	Always	7	14	23	46	15	30	5	10	50	51.55
	Never	0	0	2	66.67	1	33.33	0	0	3	3.09
	Sometimes	10	22.73	26	59.09	2	4.55	6	13.64	44	45.36
Do you perform professional tooth cleaning at each activation visit	Always	5	17.24	15	51.72	8	27.59	1	3.45	29	29.90
	Never	1	20	3	60	0	0	1	20	5	5.15
	Sometimes	11	17.46	33	52.38	10	15.87	9	14.29	63	64.95
Do you apply any form of fluoride (gel, varnish, foam) to prevent WSL development	Always	2	12.50	7	43.75	7	43.75	0	0	16	16.49
	Never	1	6.67	7	46.67	4	26.67	3	20	15	15.46
	Sometimes	14	21.21	37	56.06	7	10.61	8	12.12	66	68.04

GP: General practitioner; PhD: Philosophiae Doctor; MSc: Master of Science; Post: Post graduate student; F: Frequency; %: percentage.

Table 7. Practice to prevent white spot lesion occurrence lesions according to participants' years of experience.

Practice to prevent WSLs occurrence		Practice time								Total	
		1-5 y		5-10 y		10-20 y		> 20 y			
		N.	%	N.	%	N.	%	N.	%	N.	%
Do you inform your patient about the current oral hygiene situation	Always	29	35.37	16	19.51	19	23.17	18	21.95	82	84.54
	Sometimes	5	33.33	2	13.33	3	20	5	33.33	15	15.46
Do you instruct your patient about oral health care during	Always	27	33.75	16	2	20	25	17	21.25	80	82.47
	Sometimes	7	41.18	2	11.76	2	11.76	6	35.29	17	17.53
treatment either If you instruct your patient, which of the following approaches do you prefer	Orally	13	39.39	6	18.18	8	24.24	6	18.18	33	34.02
	Educational video	0	0	1	33.33	1	33.33	1	33.33	3	3.09
	Oral instruction with live demonstration	0	0	1	25	2	50	1	25	4	4.12
	Written information	5	71.43	2	28.57	0	0	0	0	7	7.22
	Combined	16	32	8	16	11	22	15	30	50	51.55
Do you instruct your patient to use electronic toothbrush instead of manual	Always	7	33.33	4	19.05	3	14.29	7	33.33	21	21.65
	Never	11	55	3	15	2	10	4	20	20	20.62
	Sometimes	16	28.57	11	19.64	17	30.36	12	21.43	56	57.73
Do you give dietary advice to your patient	Always	21	35	9	15	15	25	15	25	60	61.86
	Never	0	0	0	0	1	100	0	0	1	1.03
	Sometimes	13	36.11	9	25	6	16.67	8	22.22	36	37.11
Do you advice your patient to use fluoridated toothpaste	Always	18	36	9	18	11	22	12	24	50	51.55
	Never	1	33.33	2	66.67	0	0	0	0	3	3.09
	Sometimes	15	34.09	7	15.91	11	25	11	25	44	45.36
Do you perform professional tooth cleaning at each activation visit	Always	6	20.69	5	17.24	6	20.69	12	41.38	29	29.9
	Never	4	80	0	0	1	20	0	0	5	5.15
	Sometimes	24	38.1	13	20.63	15	23.81	11	17.46	63	64.95
Do you apply any form of fluoride (gel, varnish, foam) to prevent WSL development	Always	4	25	1	6.25	4	25	7	43.75	16	16.49
	Never	7	46.67	4	26.67	4	26.67	0	0	15	15.46
	Sometimes	23	34.85	13	19.7	14	21.21	16	24.24	66	68.04

F: Frequency; %: percentage.

Table 8. practice to prevent white spot lesion occurrence lesions according to participants' qualification degree.

Practice to prevent WSLs occurrence		Qualification								Total	
		GP		MSc		PhD		Post			
		F.	%	F.	%	F.	%	F.	%	F.	% T
The first step for treatment of WSL is to allow natural re-mineralization for six months	Agree	8	16.33	27	55.10	8	16.33	6	12.24	49	50.52
	Disagree	3	11.54	17	65.38	2	7.69	4	15.38	26	26.80
	Strongly agree	6	27.27	7	31.82	8	36.36	1	4.55	22	22.68
Microabrasion is one of the treatment methods for WSL	Agree	5	9.43	29	54.72	12	22.64	7	13.21	53	54.64
	Disagree	7	23.33	20	66.67	1	3.33	2	6.67	30	30.93
	Strongly agree	5	35.71	2	14.29	5	35.71	2	14.29	14	14.43
Bleaching is one of the treatment methods for WSL	Agree	6	17.65	20	58.82	5	14.71	3	8.82	34	35.05
	Disagree	7	15.22	26	56.52	7	15.22	6	13.04	46	47.42
	Strongly agree	3	27.27	3	27.27	4	36.36	1	9.09	11	11.34
	Strongly Disagree	1	16.67	2	33.33	2	33.33	1	16.67	6	6.19
Resin infiltration is a minimally invasive restorative treatment for post-orthodontic WSL	Agree	12	19.35	36	58.06	7	11.29	7	11.29	62	63.92
	Disagree	2	18.18	7	63.64	2	18.18	0	0	11	11.34
	Strongly agree	3	13.64	6	27.27	9	40.91	4	18.18	22	22.68
	Strongly disagree	0	0	2	100	0	0	0	0	2	2.06
In case of cavitation lesion, restoration is the treatment of choice	Agree	3	9.09	19	57.58	6	18.18	5	15.15	33	34.02
	Disagree	0	0	0	0	1	100	0	0	1	1.03
	Strongly agree	14	22.58	31	50	11	17.74	6	9.68	62	63.92
	Strongly Disagree	0	0	1	100	0	0	0	0	1	1.03

GP: General practitioner; PhD: Philosophiae Doctor; MSc: Master of Science; Post: Post graduate student; F: Frequency; %: percentage.

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Table 9. Practice to prevent white spot lesion occurrence lesions according to participants' years of experience.

Vars.		Practice time								Total	
		1-5 y		5-10 y		10-20 y		> 20 y			
		F.	%	F.	%	F.	%	F.	%	F.	% T
The first step for treatment of WSL is to allow natural remineralization for six months	Agree	19	38.78	10	20.41	13	26.53	7	14.29	49	50.52
	Disagree	6	23.08	3	11.54	6	23.08	11	42.31	26	26.80
	Strongly agree	9	40.91	5	22.73	3	13.64	5	22.73	22	22.68
Microabrasion is one of the treatment methods for WSL	Agree	17	32.08	13	24.53	11	20.75	12	22.64	53	54.64
	Disagree	10	33.33	4	13.33	8	26.67	8	26.67	30	30.93
	Strongly agree	7	50.00	1	7.14	3	21.43	3	21.43	14	14.43
Bleaching is one of the treatment methods for WSL	Agree	11	32.35	7	20.59	9	26.47	7	20.59	34	35.05
	Disagree	18	39.13	9	19.57	10	21.74	9	19.57	46	47.42
	Strongly agree	3	27.27	1	9.09	2	18.18	5	45.45	11	11.34
	Strongly Disagree	2	33.33	1	16.67	1	16.67	2	33.33	6	6.19
Resin infiltration is a minimally invasive restorative	Agree	26	41.94	13	20.97	15	24.19	8	12.90	62	63.92
	Disagree	2	18.18	1	9.09	3	27.27	5	45.45	11	11.34
	Strongly agree	6	27.27	3	13.64	4	18.18	9	40.91	22	22.68
	Strongly disagree	0	0	1	50	0	0	1	50	2	2.06
In case of cavitation lesion, restoration is the treatment of choice	Agree	12	36.36	7	21.21	5	15.15	9	27.27	33	34.02
	Disagree	0	0	0	0	1	100	0	0	1	1.03
	Strongly agree	22	35.48	10	16.13	16	25.81	14	22.58	62	63.92
	Strongly Disagree	0	0	1	100	0	0	0	0	1	1.03

F: Frequency; %: percentage.

Table 10. Knowledge and practice scores of the study population.

Variables	Degree of knowledge	F.	%
Knowledge	Intermediate"13-18"	61	62.89
	High"19-24"	36	37.11
Practice	Low"<=10	1	1.03
	Intermediate"11-15"	64	65.98
	High"16-20"	32	32.99

F: Frequency; %: percentage.

Table 11. One way ANOVA test of knowledge about WSLs.

Variables	degree	F.	Mean	±SD	P-value
Qualification	GP	17	17.235	3.113	0.015*
	Post	11	17.364	1.912	
	M.Sc.	51	17.569	2.516	
	PhD	18	20.056	2.555	
	Total	97	17.948	2.736	
Practice time (years)	1-5 y	34	17.647	2.718	0.089
	5-10 y	18	16.833	1.978	
	10-20 y	22	18.000	2.655	
	>20 y	23	19.217	2.999	
	Total	97	17.948	2.736	

*Difference is significant at 0.05. GP: General practitioner; PhD: Philosophiae Doctor; MSc: Master of Science; Post: Post graduate student.

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Table 12. Pairwise comparison of knowledge between different qualification degrees.

Variables		Mean difference	P-value
GP	Post	0.118	0.482
	Msc	0.0	1.0
	PhD	-0.271	0.251
Post	Msc	-0.118	0.06
	PhD	-0.389	0.02*
Msc	PhD	-0.271	0.171

*Difference is significant at 0.05. General practitioner; PhD: Philosophiae Doctor; MSc: Master of Science; Post: Post graduate student.

Table 13. One way ANOVA test of practice to manage WSLs.

Variables		f.	Mean	±SD	P-value
qualification	GP	17	15.588	2.551	0.019 *
	Post	11	15.0	1.612	
	M.Sc.	51	14.412	1.951	
	PhD	18	16.111	2.272	
	Total	97	15.0	2.175	
Practice time (years)	1-5 y	34	15.206	1.887	0.927
	5-10 y	18	14.889	1.967	
	10-20 y	22	14.909	2.136	
	>20 y	23	14.87	2.801	
	Total	97	15.0	2.175	

*Difference is significant at 0.05. General practitioner; PhD: Philosophiae Doctor; MSc: Master of Science; Post: Post graduate student.

Table 14. Pairwise comparison of knowledge between different qualification degrees.

Variables		Mean difference	P-value
GP	Post	0.588	0.977
	M.Sc.	1.176	0.252
	PhD	-0.523	0.975
Post	M.Sc.	0.588	0.951
	PhD	-1.111	0.664
M.Sc.	PhD	-1.699	0.023*

*Difference is significant at 0.05. General practitioner; PhD: Philosophiae Doctor; MSc: Master of Science; Post: Post graduate student.