Research Article **ISSN 2639-9490**

Oral Health & Dental Science

Comparative Evaluation of knowledge of White Spot lesions and their management During Orthodontic Treatment in Costa Rica

MariLAura Romero-Quesada[1], Roberto Justus[2], Ricardo Ondarza-Rovira[2,3] and Salvador García-López[2,4,5*]

[1]*Former Resident of the Postgraduate Program at the Intercontinental University, Mexico City, Costa Rica.*

[2]*Department of Orthodontics, Intercontinental University, Mexico City.*

[3]*Instituto Nacional de Investigaciones Nucleares, Estado de México, Mexico.*

[4]*Department of Orthodontics, General Hospital, Dr. Manuel Gea Gonzalez UNAM, Mexico City.*

[5]*Health Science Department, Universidad Autónoma Metropolitana, Mexico City.*

***Correspondence:**

Dr. Salvador García-López, Health Science Department, Universidad Autónoma Metropolitana, Mexico City. Email: salvador-garcia@universidad-uic.edu.mx.

Received: 29 Nov 2025; **Accepted:** 30 Dec 2025; **Published:** 15 Jan 2026

Citation: Quesada MR, Justus R, Ondarza-Rovira R, et al. Comparative Evaluation of knowledge of White Spot lesions and their management During Orthodontic Treatment in Costa Rica. Oral Health Dental Sci. 2026; 10(1); 1-9.

ABSTRACT

Introduction: *White spot lesions caused by orthodontic treatment with fixed appliances not only affect the final aesthetic outcome but can also negatively affect the patient's oral health because of enamel demineralization.*

Objective: *To evaluate the level of knowledge regarding white spot lesions on dental enamel among general dentists and orthodontists affiliated with the Costa Rican College of Dental Surgeons, and orthodontists who are members of the Costa Rican Academy of Orthodontists.*

Materials and Methods: *A survey based on a previously developed study by Tatsi and Toumba -adapted for dental professionals in Costa Rica- was administered to the three groups. The survey, distributed via Google Forms, consisted of 30 questions related to white spot lesions on enamel during orthodontic treatment with fixed appliances.*

Results: *There were statistically significant differences among the three groups in terms of their general knowledge of the causes, diagnosis, preventive methods and management of white spot lesions. However, no statistically significant differences were found in their knowledge of corrective methods. Compared with orthodontists affiliated with the Costa Rican College of Dental Surgeons and, to a lesser extent, general dentists, members of the Costa Rican Academy of Orthodontics demonstrated a higher level of knowledge regarding prevention and clinical management of white spot lesions.*

Conclusion: *The findings suggest a need for improved education and continuing professional development to ensure high-quality outcomes for patients.*

Keywords
Costa Rica, Fixed appliances, Orthodontics, White spot lesion.

Introduction
White spot lesions are among the most common complications of orthodontic treatment. These lesions are enamel demineralization lesions that appear as opaque, white areas, affecting the patient's aesthetics and potentially their oral health. While their appearance can be prevented through good oral hygiene habits and complementary techniques applied in the dental chair, their incidence remains high in patients with fixed orthodontic appliances [1]. The literature indicates that multiple factors can predispose patients to the formation of white spot lesions. These include poor oral hygiene, prolonged treatment duration, and the type of fixed appliance used [2]. Recent research has revealed significant differences in the perception, diagnosis, and clinical management of these lesions among orthodontists, suggesting a possible lack of standardization of preventive measures employed and in how this risk and its management are communicated to patients [3]. In Costa Rica, there are no published studies evaluating the knowledge and clinical management of white spot lesions by general dentists (GDs), orthodontists registered with the Costa Rican College of Dental Surgeons (CRCDS), or orthodontists associated with the Costa Rican Academy of Orthodontics (CRAO). Therefore, this study aimed to evaluate and compare knowledge among these three groups of professionals, using a questionnaire based on the instrument developed by Tatsi and Toumba [4], which was adapted to the national context and the professional profile of the Costa Rican sample. This analysis sought to identify potential gaps between the studied groups and provide helpful evidence to strengthen clinical and preventive strategies for addressing white spot lesions on dental enamel, a consequence of poor oral hygiene during orthodontic treatment.

Methods
Sample Collection
A random sample of 15 professionals was obtained from each group. A series of questions based on the White Spot Lesions questionnaire by Tatsi and Toumba [4] was administered to a group of general dental practitioners (GDs), orthodontists from the CRCDS, and orthodontists who are members of the CRAO to obtain information and data about their knowledge of the topic. The survey consisted of 30 single-answer questions administered via Google Forms distributed via a link sent to participants.

Materials
A questionnaire was used to determine the effects of white spot lesions on fixed appliance treatments on the basis of the questionnaire used by members of the British Society of Orthodontics. The survey was administered to the three professional groups, using the Google Forms platform to create the online form.

Inclusion Criteria
All the surveys included in this research met the main criterion of being a GP, an orthodontist registered with the CRCDS, or an orthodontist member of CRAO.

Exclusion Criteria
Responses were obtained from individuals who did not meet the aforementioned inclusion criterion.

Methodology
A survey was developed to determine the effects of white spot lesions on fixed orthodontic treatment on the basis of the study conducted by Tatsi and Toumba [4]. The survey was adapted with some modifications to suit the Costa Rican population. The form was created in Google Forms and distributed electronically to the participating members of the different groups.

Statistical Analysis
The survey responses were classified into segments based on their subcategories. The defined subcategories were diagnosis, prevention, and treatment of white spot lesions. Each item was assigned to one of three main groups on the basis of its content. Thus, questions 1 through 9 were categorized under the diagnosis of white spot lesions, questions 10 through 22 under the prevention of white spot lesions, and finally, questions 23 through 30 were part of the white spot lesion prevention subcategory. The mean and standard deviation of the quantified results were first calculated using basic statistics, with weights assigned to the clinical classifications of the items. To determine the differences between the groups studied, the chi-square test (analysis of variance, ANOVA) was used. The GraphPad Prism 11 program (USA) with automated formulas was used to perform the analyses. The significance level was set at $p<0.05$. The existence or absence of statistically significant differences was inferred from the inequalities: (1) when FExp < FCrit, there was no statistically significant difference, and (2) when FExp > FCrit, there was a statistically significant difference.

Results
There was a statistically significant difference between the CRAO orthodontists, who had greater knowledge of white spot lesions than the CRCDS orthodontists did, and the GDs, who had greater knowledge than the CRCDS orthodontists did (Figure 1 and Table 1). There was also a statistically significant difference between the CRAO orthodontists, who used clinical photography to evaluate white enamel lesions, and the CRCDS orthodontists, and the GDs who used clinical photography very little (Figure 2 and Table 2). On the other hand, there was a statistically significant difference among the three groups studied. The CRAO orthodontists reported that white spot lesions do not necessarily require delayed treatment; they also argued that, to a lesser extent, it can delay the completion of therapy (Figure 3 and Table 3). There was a statistically significant difference among the three groups: The CRAO orthodontists frequently recommended fluoride rinses, whereas a smaller proportion of the three groups never recommended them during white spot treatment sessions (Figure 4 and Table 4).

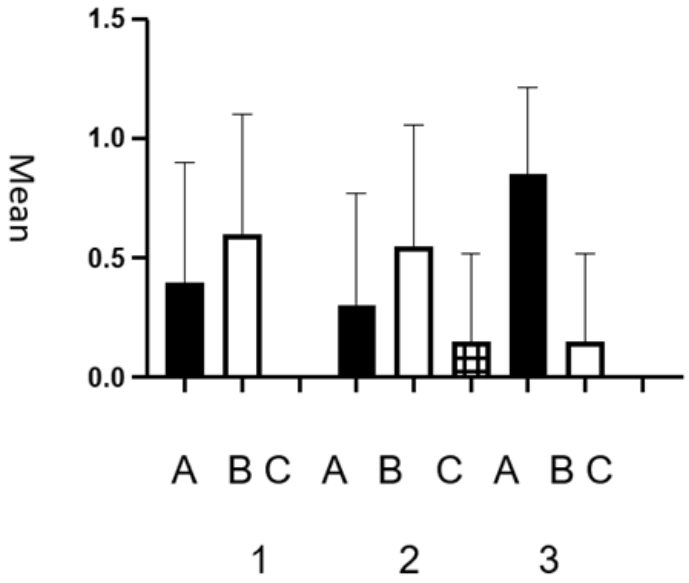

Figure 1: Knowledge of white spot lesions. (A) A lot; (B) A little; (C) Nothing. (1) General Dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) Orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 1: Comparisons among the three study groups. There was a statistically significant difference. The Fexp. value (18.26) was greater than the critical Fcrit. value (9.48).

	General Dentists (OG)			Orthodontists CRCDS			Orthodontists CRAO		
	A lot	A little	Nothing	A lot	A Little	Nothing	A lot	A Little	Nothing
Mean (SD)	0.4±0.50	0.6±0.50	0±0	0.55±0.51	0.45±0.51	0±0	0.85±0.36	0.15±0.36	0±0

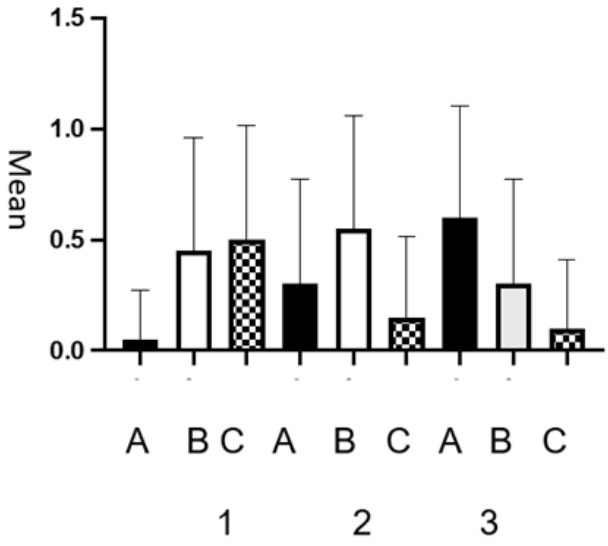

Figure 2: Clinical photograph of white enamel lesions. (A) Frequently; (B) Sometimes; (C) Never. (1) General Dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) Orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 2: Comparisons among the three study groups. There was a statistically significant difference. The Fexp value (18.64) was greater than the Fcrit value (9.48).

	General Dentists (GDs)			Orthodontists CRCDS			Orthodontists. CRAO		
Mean (SD)	Frequently	Sometimes	Never	Frequently	Sometimes	Never	Frequently	Sometimes	Never
	0.05±0.22	0.45±0.51	0.05±0.51	0.3±0.47	0.55±0.51	0.15±0.36	0.6±0.50	0.3±0.47	0.1±0.30

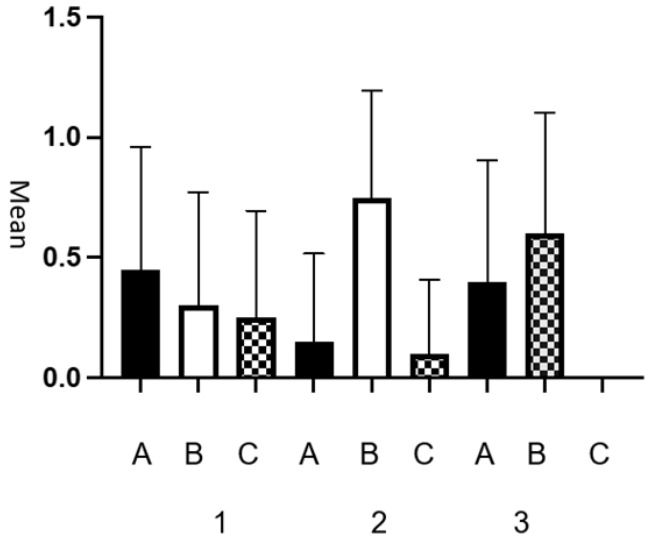

Figure 3: White spot lesions in patients with fixed orthodontics and the delay in the completion of orthodontic treatment. (A) Yes; (B) No; (C) I am not sure. (1) General Dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) Orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 3: Comparisons among the three study groups. There is a statistically significant difference. The experimental F value (12.35) was greater than the critical F value (9.48).

	General Dentists (GDs)			Orthodontists CRCDS			Orthodontists CRAO		
	Yes	No	I am not sure	Yes	No	I am not sure	Yes	No	I am not sure
Mean (DS)	0.45±0.51	0.3±0.47	0.25±0.44	0.15±0.36	0.75±0.44	0.1±0.30	0.4±0.50	0.6±0.50	0±0

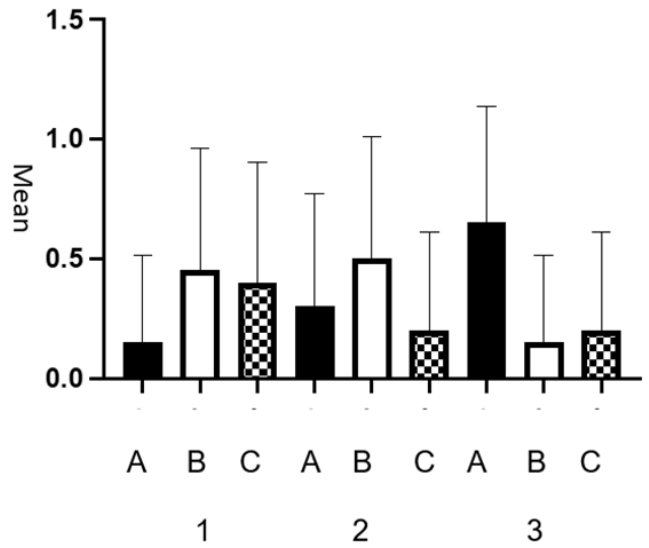

Figure 4: The slides were fluoridated and rinsed daily to prevent white spot lesions. A) Frequently; (B) Sometimes; (C) Never. (1) General Dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) Orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 4: Comparisons among the three study groups. There is a statistically significant difference. The experimental F value (13.09) was greater than the critical F value (9.48).

	General Dentists (GDs)			Orthodontists CRCDS			Orthodontists CRAO		
	Frequently	Sometimes	Never	Frequently	Sometimes	Never	Frequently	Sometimes	Never
Mean (SD)	0.15±0.36	0.45 ± 0.51	0.4±0.50	0.3±0.47	0.5±0.51	0.2±0.41	0.65±0.48	0.15±0.36	0.2±0.41

With respect to glass ionomer bonding and orthodontic appliances, there was also a statistically significant difference between the three groups; the CRAO orthodontists reported frequent use, whereas it predominated among the general practitioners who never used it (Figure 5 and Table 5). The three study groups agreed that socioeconomic status is a factor in the development of white enamel lesions. This response predominated among the CRAO members (Figure 6 and Table 6). With respect to poor oral hygiene as a risk factor for developing white spot lesions, although there was a statistically significant difference among the three groups, all groups agreed that poor oral hygiene is related (Figure 7 and Table 7). Topical fluoride applications during orthodontic treatment with fixed appliances and white spot lesions revealed two aspects: All three groups studied generally never applied topical fluoride, and only a minority applied it frequently (Figure 8 and Table 8). Although there was a statistically significant difference among the three study groups, they often recommended a less cariogenic diet to their patients during orthodontic treatment with fixed appliances; however, a smaller proportion reported never giving such advice (Figure 9 and Table 9). The microabrasion treatment for white spot lesions, which is usually applied after treatment, was reflected in the three groups of professionals: most of the professionals in the three groups generally never perform it, and a minority of the CRAO orthodontists frequently use it (Figure 10 and Table 10).

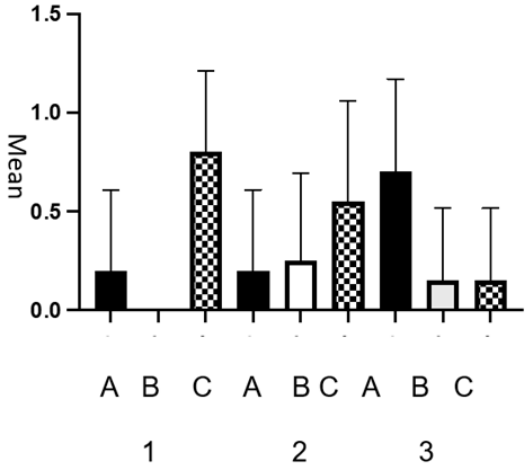

Figure 5: Glass ionomer for bracket adhesion as a preventive method. (A) Frequently; (B) Sometimes; (C) Never. (1) General Dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) Orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 5: Comparisons among the three study groups. There was a statistically significant difference. The experimental F value (22.44) was greater than the critical F value (9.48).

	General Dentists (GDs)			Orthodontists CRCDS			Orthodontists CRAO		
	frequently	Sometimes	Never	Frequently	Sometimes	Never	Frequently	Sometimes	Never
Mean (SD)	0.2±0.41	0 ± 0	0.8±0.41	0.2±0.41	0.25±0.44	0.55±0.51	0.7±0.47	0.15±0.36	0.15±0.36

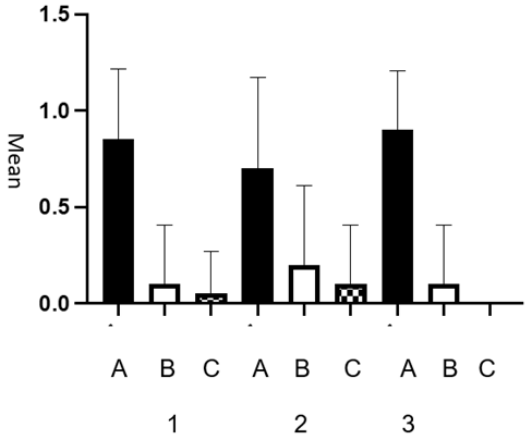

Figure 6: Low socioeconomic status is an important risk factor for the development of new white spot lesions. (A) Yes; (B) No; (C) I am not sure. (1) General dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 6: Comparisons among the three study groups. There is a statistically significant difference. The experimental F value (11.02) was greater than the critical F value (9.48).

	General Dentists (GDs)			Orthodontists CRCDS			Orthodontists CRAO		
	Yes	No	I am not sure	Yes	No	I am not sure	Yes	No	I am not sure
Mean (SD)	0.7±0.47	0.15 ± 0.36	0.15±0.36	0.25±0.44	0.6±0.50	0.15±0.36	0.35±0.48	0.55±0.51	0.1±0.30

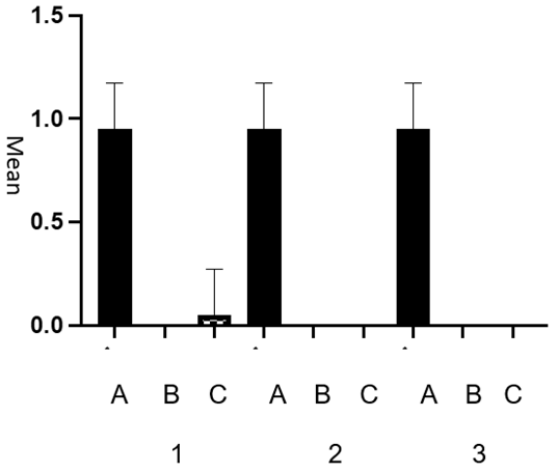

Figure 7: Poor oral hygiene is a risk factor for the development of white spot lesions. (A) Yes; (B) No; (C) I am not sure. (1) General dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 7: Comparisons among the three study groups. There is a statistically significant difference. The experimental F value (19.61) was greater than the critical F value (9.48).

	General Dentists (GD)			Orthodontists CRCDS			Orthodontists CRAO		
	Yes	No	I am not sure	Yes	No	I am not sure	Yes	No	I am not sure
Mean (SD)	0.95±0.22	0 ± 0	0.05±0.22	1±0	0.±0	0±0	1±0	0.±0	0±0

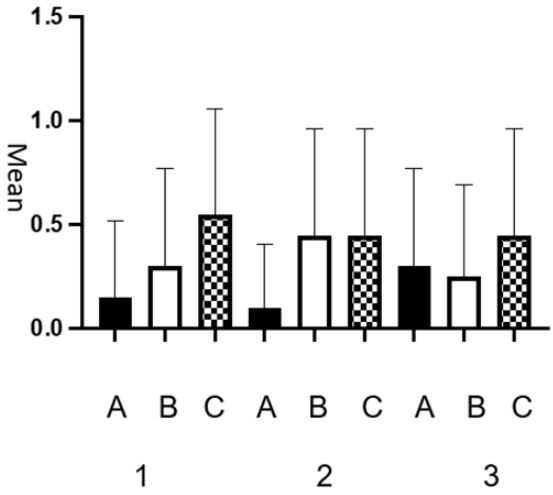

Figure 8: Topical application of fluoride to white spot lesions in fixed orthodontic patients. (A) Frequently; (B) Sometimes; (C) Never. (1) General dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) Orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 8: Comparisons among the three study groups. There was no statistically significant difference. The experimental F value (3.94) was less than the critical F value (9.48).

	General dentists (GDs)			Orthodontists CRCDS			Orthodontists CRAO		
	Frequently	Sometimes	Never	Frequently	Sometimes	Never	Frequently	Sometimes	Never
Mean (SD)	0.15±0.36	0.3 ± 0.47	0.55±0.51	0.1±0.30	0.45±0.51	0.45±0.51	0.3±0.47	0.25±0.44	0.45±0.51

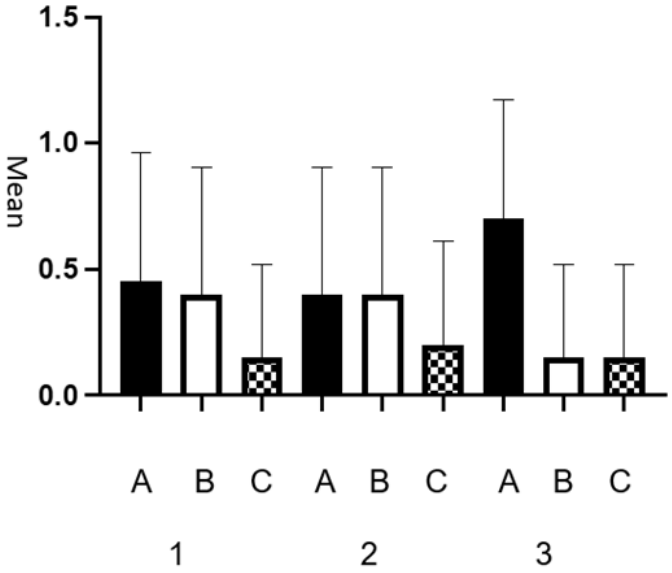

Figure 9: A less cariogenic diet is needed to avoid white spot lesions in fixed orthodontic patients. (A) Frequently; (B) Sometimes; (C) Never. (1) General dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) Orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 9: Comparisons among the three study groups. There was no statistically significant difference. The experimental F value (4.83) was less than the critical F value (9.48).

	General dentists (GDs)			Orthodontists CRCDS			Orthodontists CRAO		
	Frequently	Sometimes	Never	Frequently	Sometimes	Never	Frequently	Sometimes	Never
Mean (SD)	0.45±0.51	0.4 ± 0.50	0.15±0.36	0.4±0.50	0.4±0.50	0.2±0.41	0.07±0.47	0.15±0.36	0.15±0.36

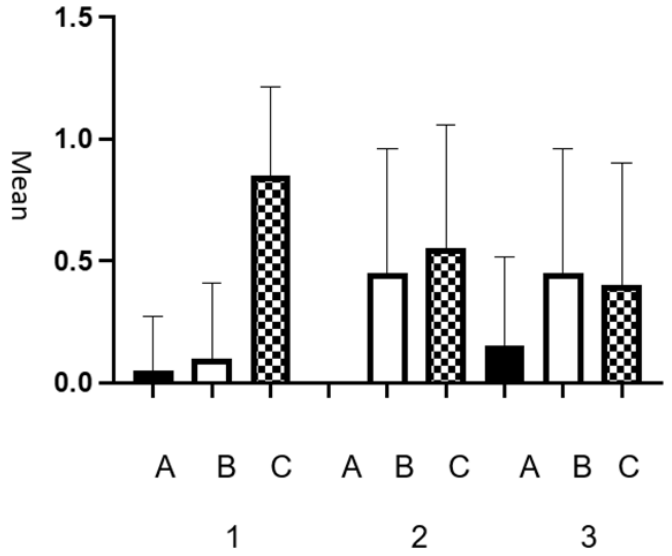

Figure 10: Micro abrasion as a treatment for white spot lesions in patients with fixed orthodontics. (A) Frequently; (B) Sometimes; (C) Never. (1) General Dentists (GDs); (2) orthodontists of the Costa Rican College of Dental Surgeons (CRCDS); (3) Orthodontists of the Costa Rican Academy of Orthodontists (CRAO).

Table 10: Comparisons among the three study groups. There is a statistically significant difference. The experimental F value (11.90) was greater than the critical F value (9.48).

	General Dentists (GDs)			Orthodontists CRCDS			Orthodontists CRAO		
	Frequently	Sometimes	Never	Frequently	Sometimes	Never	Frequently	Sometimes	Never
Mean (SD)	0.05±0.22	0.1 ± 0.30	0.85±0.36	0±0	0.45±0.51	0.55±0.51	0.15±0.36	0.45±0.51	0.4±0.50

Discussion

The purpose of this study was to conduct a comparative investigation among three groups of dentists, focusing on their knowledge of white spot lesions. The survey was administered to I: General dentists without orthodontic specialization; II: Orthodontists from the CRCDS who practice as such but are not affiliated with any academy; and III: Orthodontists certified by the CRAO. The study was based on a survey by Tatsi and Toumba [4], which was modified to meet the needs of this study and its participants. The results obtained offer an interesting comparison between the three study groups, as they analyze a topic familiar to any dentist but particularly important in orthodontics because of the increased risk of white spot lesions on dental enamel. These lesions can be easily prevented with good oral hygiene, but fixed orthodontic appliances make it challenging to maintain proper hygiene because they retain biofilms that develop rapidly [2]. The survey assessed three main characteristics, although these were not clearly separated in the instrument. First, the causes and diagnosis of white spot lesions were analyzed. Statistically significant differences were found for the first question about participants' general knowledge of white spot lesions. Compared with other groups, orthodontists associated with the CRAO demonstrated greater understanding, which aligns with other studies in the literature that report that orthodontists describe themselves as familiar with these lesions because of their common occurrence in orthodontic treatments [3]. Other elements, such as the use of diagnostic photographs to assess the presence and severity of white spot lesions, were significantly different among the three groups. These findings suggest that CRAO members may have more up-to-date academic training and a focus on using technology for clinical evaluation and periodic follow-up of monthly orthodontic treatment check-ups [5]. The use of digital cameras for photographic control can be advantageous for reducing the variation in image production and the time needed. Enamel demineralization can be quantified by determining the size of the white spot lesion or the amount of mineral lost [6].

Furthermore, there is greater awareness among CRAO-affiliated professionals of the clinical implications of white spot lesions, such as premature appliance removal, delayed treatment completion, or the need for future restorative treatment [7]. This may provide a more in-depth understanding of these issues during orthodontic treatment, which could result from increased training among the CRAO members. Several elements related to the diagnosis and causes of white spot lesions did not significantly differ, suggesting that they are part of the general knowledge of the three groups studied, as all groups have similar and consistent basic dental training. However, all three groups reported that they did not routinely use specialized equipment for diagnosing white spot lesions in the office, nor did they use the International Caries Detection and Assessment System (ICDAS) categorization system, which may also suggest a need for continuing education in this area. Systematic studies analyzing the diagnosis of white spot lesions also indicate that it is not necessary to use highly complex diagnostic tools since they would not change the type of restorative treatment chosen [8].

With respect to prevention, some differences again reflect that specialized orthodontists and CRAO members tend to be more cautious and adopt a more up-to-date approach to preventing white spot lesions. The use of fluoride rinses, the topical application of acidulate phosphate fluoride (APF) in the office, and the use of bonding materials with glass ionomer components all support this. While we can relate these responses to greater exposure of the study group to current and relevant literature, they may also reflect clinical standards for the improvement, regression, or elimination of lesions using topical agents such as fluoride and xylitol. Internationally validated remineralizing agents are usually the most common options chosen and recommended to patients during orthodontic treatment checkups [9]. Both groups of orthodontists showed greater awareness of certain risk factors, such as low socioeconomic status and poor oral hygiene, suggesting a holistic view of the patient. They also reported greater confidence in their clinical decisions when patients were given recommendations for treating white spot lesions, which may indicate a greater body of literature on this type of lesion focused specifically on postorthodontic treatment patients rather than on patients outside this specialty [10]. With respect to the treatment focused on white spot lesions, only microabrasion, as a suggested treatment, was significantly different between the groups studied. Microabrasion is the most familiar treatment type among specialist orthodontists and academics, as it has demonstrated promising results, especially when combined with more recently studied techniques, such as resin infiltration in the area before microabrasion, to improve aesthetics [11]. However, the fact that only one of the treatment scenarios for white spot lesions showed statistically significant differences may suggest that all three groups have similar knowledge, use related techniques, or that their methods are outdated and limited [12].

Conclusions

General dentists and both groups of specialists lack further clinical training in conservative, modern, and effective restorative treatments for white spot lesions. The findings suggest a need for improved education and continuing professional development to ensure high-quality outcomes for patients.

References

1. Telatar GY, Telatar BC. Oral Health Status After Orthodontic Treatment: A Retrospective Study. Odovtos - International Journal of Dental Sciences. 2021; 23: 147-154.
2. Brown MD, Campbell PM, Schneiderman ED, et al. A Practice-Based Evaluation of the Prevalence and Predisposing Etiology of White Spot Lesions. Angle Orthod. 2016; 86: 181-186.
3. Taibah S, Abubakr NH, Ziada H. Perspectives of Orthodontists of the Diagnosis, Prevention, and Management of White Spot Lesions: A Qualitative Study. J Int Soc Prev Community Dent. 2022; 12: 117-125.
4. Tatsi C, Toumba KJ. Questionnaire on White Spot Lesions to Orthodontist: Members of the British Orthodontic Society. Journal of Contemporary Dentistry. 2020; 10: 25-29.

5. Beerens MW, Boekitwetan F, van der Veen MH, et al. White Spot Lesions After Orthodontic Treatment Assessed by Clinical Photographs and by Quantitative Light-Induced Fluorescence Imaging; A Retrospective Study. Acta Odontol Scand. 2015; 73: 441-446.
6. Livas C, Kuijpers-Jagtman AM, Bronkhorst E, et al. Quantification of White Spot Lesions Around Orthodontic Brackets with Image Analysis. Angle Orthod. 2008; 78: 585-590.
7. Tufekci E, Dixon JS, Gunsolley JC, et al. Prevalence of White Spot Lesions During Orthodontic Treatment with Fixed Appliances. Angle Orthod. 2011; 81: 206-210.
8. Lopes PC, Carvalho T, Gomes ATPC, et al. White Spot Lesions: Diagnosis and Treatment – A Systematic Review. BMC Oral Health. 2024; 24: 58.
9. Gudeleviciute I, Spaicyte N, Migoniene I, et al. White Spot Lesions Risk Management Prior and During the Orthodontic Treatment. Stomatologija. 2023; 25: 39-46.
10. Puleio F, Fiorillo L, Gorassini F, et al. Systematic Review on White Spot Lesions Treatments. Eur J Dent. 2022; 16: 41-48.
11. Alrebdi AB, Alyahya Y. Microabrasion Plus Resin Infiltration in Masking White Spot Lesions. Eur Rev Med Pharmacol Sci. 2022; 26: 456-461.
12. Pliska BT, Warner GA, Tantbirojn D, et al. Treatment of White Spot Lesions with ACP Paste and Microabrasion. Angle Orthod. 2012; 82: 765-769.