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Assessment of Awareness, Knowledge and Attitude Among Undergraduate Dental Students on White Spot Lesion – A Quasi Experimental Study

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KEYWORDS

White Spot Lesion; Awareness; Knowledge Attitude

ABSTRACT:

Background: White spot lesions (WSLs) are the earliest clinical signs of enamel demineralization, commonly observed in pediatric and orthodontic patients, as well as individuals with poor oral hygiene. They signal early caries, affect esthetics, and impair oral health–related quality of life. Therefore, early detection and timely management are crucial.

Aim: This study aimed to evaluate the awareness, knowledge and attitude of WSLs among undergraduate dental students and to assess the impact of a structured health education intervention.

Methods: A quasi-experimental study was conducted among 283 undergraduate dental students (third year, final year, and interns), selected through convenience sampling. A structured, self-administered questionnaire of 30 close-ended questions was designed which included demographics, clinical presentation, risk factors, preventive and management strategies, of WSLs. A pre-test questionnaire was used to assess baseline Awareness knowledge and attitude, followed by a 30-minute educational intervention with an interactive Q&A session. The same questionnaire was administered to assess the post-intervention changes. Data were collected through Google Forms and analyzed using SPSS software.

Results: A statistically significant improvement was observed in awareness, knowledge, and attitude following the educational intervention. The mean awareness score increased from 0.86 ± 0.67 to 1.49 ± 0.54 ($t = -11.80$, $p < 0.001$), while the mean knowledge score increased from 9.81 ± 2.69 to 13.52 ± 2.16 ($t = -18.44$, $p < 0.001$). Similarly, the mean attitude score increased from 3.92 ± 1.25 to 5.64 ± 1.44 ($t = -14.87$, $p < 0.001$).

Conclusions: The structured educational intervention significantly improved undergraduate dental students' awareness, knowledge, and attitude toward white spot lesions. Integrating focused, evidence-based education on white spot lesions into the undergraduate curriculum may enhance early recognition and appropriate preventive and minimally invasive management.

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1. Introduction

White spot lesions (WSLs) are the earliest clinical manifestation of dental caries, characterized by subsurface enamel demineralization beneath an intact enamel surface[1]. Their prevalence ranges from 10% to 49%, with reported occurrence rates of 23%–95% in different populations[2,3]. Because of the dynamic process of demineralization and remineralization, the integrity of the teeth and oral cavity is generally maintained. Any disruption in this balance can lead to the formation of initial carious lesions, which may progress to dental caries if left untreated and are influenced by factors such as poor oral hygiene, reduced salivary flow, and orthodontic treatment[4,5,6,7,8]. Management includes preventive, non-invasive, and minimally invasive approaches such as fluoride therapy, CPP-ACP, resin infiltration, micro-abrasion, and restorative procedures[1,9]. Modern dentistry has shifted from G.V. Black's concept of "extension for prevention" to a preventive, minimally invasive approach. Given the high prevalence and clinical significance of WSLs, it is essential for undergraduate dental students to understand their etiology, diagnosis, prevention, and management. Therefore, this study aims to evaluate the awareness, knowledge, and attitude regarding WSLs among undergraduate dental students and assess the impact of a structured health education intervention.

2. Methods

An ethical clearance was obtained from the institutional human ethical committee before initiating the study. The study utilised a pre-test/post-test quasi-experimental study design consisted of undergraduate dental students from the third year, final year, and compulsory rotatory internship. First and second-year students were excluded owing to limited clinical exposure. A sample size of 270 was estimated using G* power software. A total of 283 students who provided informed consent were recruited through convenience sampling.

A structured, self-administered questionnaire was developed following previously published literature on white spot lesions (WSLs). The questionnaire comprised two sections. Section I recorded basic demographic information of the participants. Section II assessed the participants' awareness, knowledge, and attitudes regarding WSLs, including their clinical features, risk factors, preventive strategies, diagnostic methods, management approaches, and overall clinical relevance. The questionnaire were fabricated in English language by Google form.

Face validity of the questionnaire was evaluated by three subject matter experts, a composite score of 3.1 out of 4, reflecting good face validity. Minor modifications were made based on their suggestions to improve clarity and simplify the language. The reliability of the questionnaire was evaluated Cronbach's alpha was calculated at 0.81, indicating good internal consistency among the items.

The questionnaire contained 30 close-ended items and evaluated participants perceptions of enamel demineralization, knowledge of remineralizing agents, familiarity with early detection methods and diagnostic tools, understanding of the clinical significance of WSLs, preference for preventive versus restorative approaches, and confidence in managing early enamel lesions.

Data collection was carried out electronically using Google Forms, and the survey link was distributed via institutional email and official social media platforms.

The pre-test–post-test design assessed changes in awareness, knowledge, and attitudes after a structured health education intervention on WSLs. Pre-test: Participants first completed the baseline questionnaire assessing their initial level of awareness, knowledge and attitudes. A structured 30-minute educational session was conducted,

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covering the etiology, risk factors, early detection, prevention, and management of WSLs. The lecture was followed by an interactive question-and-answer session to address doubts. Post-test: Immediately after the intervention, participants completed the same questionnaire to evaluate changes in awareness, knowledge and attitudes.

All responses were compiled in Microsoft Excel and subjected to statistical analysis using the Statistical Package for the Social Sciences (SPSS) for Windows (Version 28.0)

Statistical analysis

Statistical Package for Social Sciences (SPSS) Version 28.0 was used for statistical analysis. Descriptive analysis was performed using frequency and proportions for categorical variables, and mean and standard deviation for continuous variables. One-way ANOVA test, followed by Tukey's posthoc test, was employed to compare the sum scores of responses during the pre and post-intervention period based on the year of study. The paired t-test was utilised to compare the mean sum scores of responses between the pre-test and post-test periods for the knowledge, practice, and awareness. The level of significance was set at ($p<0.05$)

3. Results

The questionnaires were completed by all the students who accepted the invitation to participate in the study. A total of 283 participants were surveyed, with more third year students than final years and CRIs(Table 1).

Table 1: Distribution of participants

CATEGORY	n	%
III Year	152	53.50%
IV Year	67	24%
CRI	64	22.50%

Prior to study 83.39% were aware about white spot lesion. However, after receiving educational intervention 100% of participants were aware of white spot lesion, every single participant had acquired knowledge about the white spot lesion.

Before the education, only 164 (57.95%) of participants were aware of ICDAS classification of dental caries. However, after the education, 283 (100%) of participants became aware of it. Following the educational intervention, there was a significant change in awareness of about 38.55%.

There was a significant change in knowledge regarding diagnosing the white spot lesion, with 25.76% difference between pre and post educational intervention. Regarding treatment options most of the students 69.61% preferred micro-invasive technique such as resin in filtration 20.84% of students preferred non-invasive approaches. For superficial but visible white spot lesion professionally applied high concentration fluorides are preferred by 64.66% of students, for deep white spot lesion resin infiltration (76.32%) is the most preferred treatment option

Table 2: Comparison of Awareness, knowledge and attitude Mean scores pre and post educational intervention

	Mean±Std Deviation	t	P value
Pre-test Total score	14.39±3.34	-22.99	< 0.001
Post-test Total score	20.28±2.86		
Pre-test awareness score	0.86±.67	-11.8	< 0.001
Post-test awareness score	1.49±.54		
Pre-test knowledge score	9.81±2.69	-18.44	< 0.001
Post-test knowledge score	13.52±2.16		

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Pre-test attitude score	3.92±1.25	-14.87	< 0.001
Post-test attitude score	5.64±1.44		

The mean total scores of the responses during the post-intervention period were significantly higher (20.28±2.86) compared to the pre intervention period (14.39±3.34) with $p<0.001$. The mean score in all three domains awareness, knowledge and attitude after educational intervention are 1.49±.54, 13.52±2.16 and 5.64±1.44 respectively with a statistically significant difference $p<0.001$.

4. Discussion

White spot lesions (WSLs) represent the earliest clinically detectable stage of dental caries and provide a opportunity for prevention and minimally invasive intervention. Their increasing prevalence, particularly among children and orthodontic patients, underscores the need for early recognition and appropriate management by dental professionals. The present quasi-experimental study assessed the awareness, knowledge, and attitudes of undergraduate dental students toward WSLs and evaluated the impact of a structured health education intervention. The findings revealed a statistically significant improvement across all domains following the intervention, highlighting the effectiveness of targeted educational intervention in enhancing undergraduate competence in early caries management.

At baseline, a relatively high proportion of participants (83.39%) reported awareness of WSLs. This finding is supported by Nayak et al., who reported a high level of awareness 93.5% and ability among dental students to identify non-cavitated white spot lesions, indicating that undergraduate dental students generally possess basic familiarity with early enamel carious lesions[10]. However, awareness alone does not necessarily reflect comprehensive understanding or appropriate clinical application. Following the educational intervention, awareness increased to 100%, indicating that even brief, structured educational sessions can ensure uniform conceptual clarity among students.The marked increase in awareness of ICDAS (from 57.95% to 96.5%) is especially noteworthy. The limited baseline awareness suggests insufficient emphasis or clinical integration of ICDAS in routine undergraduate training.

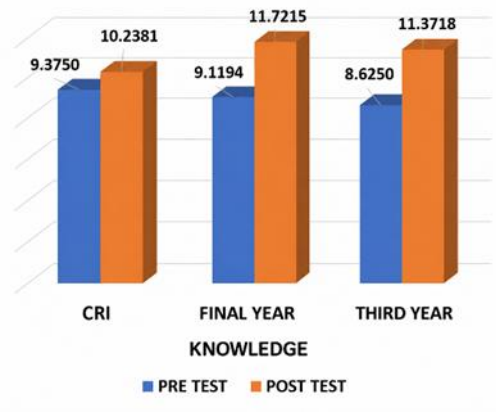
The striking findings of the present study relate to the significant improvement in knowledge scores following the intervention. The mean total knowledge score increased from 9.81±2.69 to 13.52±2.16 ($p<0.001$), reflecting enhanced understanding of WSL etiology, diagnosis, prevention, and management.

At baseline, misconceptions were evident in several critical areas. Only 59.01% of students recognized that early carious lesions are reversible via remineralization. This finding is concerning, as reversibility is the fundamental principle underlying modern non-invasive caries management. Gowdar IM et al., in a study conducted among dental students in Saudi Arabia, reported that although many participants recognized white spot lesions as carious, prevention-oriented knowledge, including concepts related to early lesion detection and management, required significant improvement[11]. Post-intervention, 100% of participants acknowledged the reversibility of early carious lesions, demonstrating that conceptual clarity can be rapidly achieved through focused educational input.

Understanding of remineralizing agents and preventive measures also improved significantly. Awareness of CPP-ACP and its role in WSL management was already relatively high at baseline, reflecting its growing popularity in preventive dentistry. However, understanding of its combined efficacy with fluoride improved substantially post-intervention (from 68.19% to 98.23%). This finding

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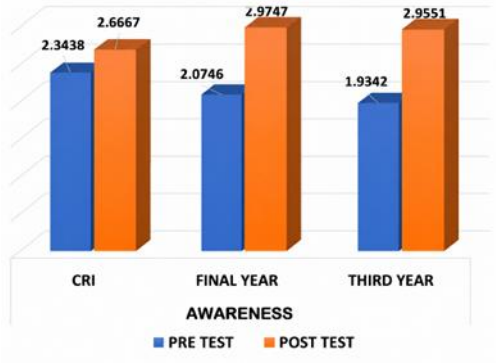
is important because combined fluoride–CPP-ACP therapy has been shown to enhance remineralization through sustained calcium and phosphate ion availability, particularly in high-risk groups such as orthodontic patients.One of the most clinically significant outcomes of this study was the marked shift in students' attitudes toward the management of white spot lesions (WSLs). At baseline, awareness of resin infiltration was low (25.44%), which likely contributed to the preference for invasive or non-specific conservative approaches. Similar deficiencies have been reported in the literature. Alhammad et al. reported limited awareness of resin infiltration among Saudi dental professionals, with only a small proportion demonstrating high levels of knowledge regarding its indications and clinical application[13]. while Tulsani et al. reported that 57.7% of respondents were unaware of the procedure and only 30.8% recognized the use of low-viscosity resin. Following the educational intervention, preference for micro-invasive techniques such as resin infiltration increased substantially (69.61%), accompanied by a rise in awareness to 100%[15]. This improvement underscores the limited routine undergraduate exposure to contemporary caries management strategies and highlights the effectiveness of targeted educational interventions.



Graph 2: Comparison Mean Knowledge score among CRI's, Final year and Third year students

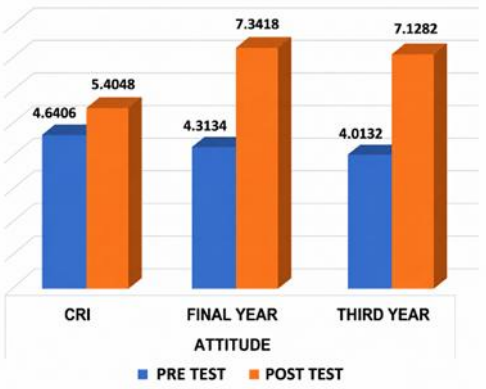
Baseline responses regarding follow-up revealed variability and uncertainty, with many students opting for shorter follow-up periods or none at all. Post-intervention, the majority (81.62%) selected a 12-month follow-up period, reflecting improved understanding of the chronic and dynamic nature of caries and the importance of long-term monitoring.

An important finding of the present study was the variation in awareness(Graph 1), knowledge(Graph 2) and attitude(Graph3) scores across different academic years.



Graph 1: Comparison Mean Awareness score among CRI's, Final year and Third year students

Compulsory rotatory interns (CRIs) demonstrated higher pre-test score compared to third- and final-year students, likely due to greater clinical exposure and experiential learning acquired during routine patient care.



Graph 3: Comparison Mean Attitude score among CRI's, Final year and Third year students

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However, one-way ANOVA followed by Tukey's post-hoc analysis revealed that final-year students achieved significantly higher post-intervention mean scores than CRIs and third-year students. This indicates that final-year students demonstrated greater knowledge acquisition and attitudinal change following the educational intervention. Although CRIs possessed higher baseline knowledge, the magnitude of improvement was comparatively smaller, possibly due to a ceiling effect and the increased clinical workload during internship limiting engagement with didactic sessions. Third-year students also showed substantial post-intervention improvement, reflecting attentiveness and readiness to learn during the early clinical phase. These findings suggest that third- and final-year students were more receptive to structured educational input and keen to assimilate new information, reinforcing the importance of strategically timed educational interventions within the undergraduate curriculum.

Following the structured educational intervention, the mean awareness score increased from 0.86 ± 0.67 to 1.49 ± 0.54 ($t = -11.80$, $p < 0.001$), while the mean knowledge score increased from 9.81 ± 2.69 to 13.52 ± 2.16 ($t = -18.44$, $p < 0.001$). The mean attitude score increased from 3.92 ± 1.25 to 5.64 ± 1.44 ($t = -14.87$, $p < 0.001$). The overall mean total score increased from 14.39 ± 3.34 to 20.28 ± 2.86 ($t = -22.99$, $p < 0.001$). All post-test scores were significantly higher than the corresponding pre-test scores, demonstrating the effectiveness of the educational intervention in enhancing students' awareness, knowledge, and attitude toward white spot lesions.

Limitations

Despite its strengths, the study has certain limitations. The use of convenience sampling and inclusion of participants from a single institution may limit generalizability. Additionally, the immediate post-test design does not assess long-term retention of knowledge or translation into clinical practice. Future studies should incorporate multi-center designs, objective clinical assessments, and long-term follow-up to evaluate sustained change.

5. Conclusion

This quasi-experimental study demonstrated that while undergraduate dental students showed reasonable baseline awareness of white spot lesions, significant gaps existed in their knowledge and clinical management. The structured health education intervention led to a statistically significant improvement in awareness, knowledge, and attitude scores, with a clear post-intervention shift toward evidence-based, minimally invasive management approaches. These findings highlight the importance of early and continuous integration of preventive and contemporary incipient caries management concepts into undergraduate dental education to enhance clinical decision-making and patient care.

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