Check for updates

European Journal of Dental Education

WILEY

ORIGINAL ARTICLE OPEN ACCESS

Knowledge, Attitudes, and Stigmatizing Beliefs About HIV/AIDS Among Dental Students: The Impact of Clinical Education Level

Tuğba Aydoğdu | Berkant Sezer

Department of Pediatric Dentistry, School of Dentistry, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye

Correspondence: Berkant Sezer (dt.berkantsezer@gmail.com; berkant.sezer@comu.edu.tr)

Received: 12 February 2026 | **Revised:** 10 June 2026 | **Accepted:** 17 June 2026

Keywords: AIDS | attitude | dental education | dentistry students | HIV | knowledge | stigma

ABSTRACT

Background: Human Immunodeficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) remain major global public health concerns. Oral lesions are often among the earliest manifestations of HIV, placing dentists at the forefront of early detection and management. Therefore, dental students' knowledge and attitudes toward HIV/AIDS are critical.

Aim: To assess the knowledge and attitudes of preclinical and clinical dental students toward HIV/AIDS, including knowledge of oral manifestations, transmission routes, diagnostic concepts, and stigmatizing beliefs.

Materials and Methods: This cross-sectional study involved dental students at different stages of clinical education. Participants were categorized as preclinical or clinical according to their year of study. A validated questionnaire assessed general and clinical knowledge of HIV/AIDS, awareness of oral manifestations, and attitudes toward people living with HIV/AIDS (PLWHA). Responses were scored and categorized to determine levels of knowledge and attitudinal tendencies.

Results: A total of 390 students participated. Clinical students scored significantly higher than preclinical students in both overall HIV/AIDS knowledge and awareness of oral manifestations ($p < 0.001$). While most students demonstrated some understanding of transmission and prevention, major misconceptions persisted—particularly concerning sterilization protocols, casual contact, and the concept of "Undetectable = Untransmittable," which was correctly identified by only 6.9% of participants. Although clinical students had higher attitude scores, overall perceptions toward PLWHA remained suboptimal.

Conclusion: Although clinical experience was associated with improved knowledge and attitudes, significant knowledge gaps and stigmatizing beliefs persisted. Strengthening dental curricula through case-based learning and stigma-reduction strategies may better prepare students to provide informed, ethical, and inclusive care to PLWHA.

1 | Introduction

Human Immunodeficiency Virus (HIV) and its advanced stage, Acquired Immunodeficiency Syndrome (AIDS), remain complex public health challenges that affect not only individual well-being but also global social, economic, and epidemiological stability [1–3]. According to the most recent Joint United Nations Programme on HIV/AIDS (UNAIDS) global estimates, 40.8 million people worldwide were living with HIV in 2024. In the same year, 1.3 million people became newly infected with HIV, and approximately 630 000 people died from AIDS-related illnesses. Since the beginning of the epidemic, 91.4 million individuals have acquired HIV infection, and 44.1 million have died from AIDS-related illnesses [4]. These figures underscore that HIV is not merely an infectious disease but a persistent global threat demanding ongoing attention and intervention.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2026 The Author(s). *European Journal of Dental Education* published by John Wiley & Sons Ltd.

The systemic effects of HIV often manifest through early oral signs and symptoms, placing dentists in a pivotal position for early detection and referral [5, 6]. Oral lesions are observed in nearly half of all individuals living with HIV and in over 80% of those diagnosed with AIDS. These lesions are considered biological indicators of immunosuppression [6]. Common oral manifestations include Kaposi's sarcoma, oral candidiasis, necrotizing gingivitis, necrotizing periodontitis, and oral hairy leukoplakia. Early recognition of these lesions and prompt management are critical for evaluating disease severity and preventing systemic complications [7].

Moreover, the effects of antiretroviral therapy (ART) on oral health are significant. Studies have shown that ART can decrease salivary flow rate, disrupt the oral microbiota, and promote the colonization of atypical microorganisms [3, 5, 8]. These clinical conditions not only compromise oral health but also adversely affect overall quality of life. Therefore, early diagnosis and effective management of HIV-related oral manifestations are essential to prevent systemic complications and slow disease progression [7, 9].

In recent years, scientific understanding of HIV transmission dynamics has improved substantially, leading to impactful public health messages. One such message is "Undetectable = Untransmittable" (U = U), which conveys that individuals living with HIV who maintain an undetectable viral load through ART do not pose a risk of sexually transmitting the virus [10]. This message, introduced in 2016 by the Prevention Access Campaign, has since been endorsed by major health organizations, including the World Health Organization (WHO), the United States Centers for Disease Control and Prevention (CDC), and the National Institutes of Health (NIH) [11]. Raising awareness of the U = U concept among both the general public and healthcare professionals is vital for reducing stigma and promoting equitable access to care for people living with HIV/AIDS (PLWHA) [12].

The primary modes of HIV transmission include unprotected sexual contact, exposure to contaminated blood products, intravenous drug use, and mother-to-child transmission during pregnancy, childbirth, or breastfeeding [13, 14]. The virus is most concentrated in blood, semen, vaginal secretions, and breast milk. In contrast, it is present only in trace amounts in saliva, sweat, and tears, which do not pose a risk of transmission. Accordingly, everyday interactions—such as hugging, sharing utensils, or using the same toilet—are not considered routes of HIV transmission [13, 14].

Healthcare workers, however, represent a distinct occupational risk group. In clinical settings, transmission may occur through percutaneous injuries (e.g., needlestick accidents) or mucocutaneous contact with infected fluids [15]. Dental professionals, in particular, are among the occupational groups with increased exposure to bloodborne pathogens such as HIV [16]. Despite the potential for contact with infected blood, the actual risk of transmission remains extremely low when appropriate infection control protocols are strictly followed [17, 18].

In accessing oral healthcare services, PLWHA face not only clinical challenges but also significant social and psychological barriers. These individuals may experience stigma and discrimination both within society and from certain healthcare providers [19–22]. A lack of knowledge about HIV transmission, combined with misconceptions and prejudices, may lead some healthcare professionals to avoid treating HIV-positive individuals [23, 24]. The WHO's 1988 Declaration on HIV/AIDS and Human Rights explicitly states that denying healthcare services on the basis of HIV status is unethical and violates fundamental human rights. It affirms that all individuals living with HIV have the right to equal and non-discriminatory access to healthcare services [25].

As a result of increased survival due to ART, the need for oral health services among individuals living with HIV is expected to grow even further in the coming years. In this context, the knowledge, attitudes, and clinical preparedness of dental students regarding HIV/AIDS are critically important—not only in terms of personal awareness, but also in shaping the quality, safety, and inclusivity of the healthcare services they will deliver in their future professional practice. Since dentists are often among the first to detect the oral manifestations of HIV, dental education should equip students with both scientifically accurate knowledge and ethical sensitivity. This comprehensive approach can help reduce stigma, promote patient-centered care, and ensure equitable access to oral health services for PLWHA.

This study aims to evaluate whether dental students' knowledge and attitudes regarding HIV/AIDS vary according to their level of clinical education. Additionally, gender-based comparisons were performed to explore potential differences. The null hypothesis stated that there would be no statistically significant difference in HIV/AIDS-related knowledge and attitudes between preclinical and clinical students.

2 | Materials and Methods

2.1 | Study Design and Ethical Approval

A cross-sectional, questionnaire-based study was conducted among undergraduate students at the School of Dentistry, Çanakkale Onsekiz Mart University, during the 2024–2025 academic year. Ethical approval was granted by the Ethics Committee of the Graduate Education Institute at Çanakkale Onsekiz Mart University (Approval No. 01/14, dated January 18, 2024). In accordance with the Declaration of Helsinki and considering the potential vulnerability of students in educational settings, all procedures were conducted in full compliance with established ethical standards. Prior to data collection, the lead researcher (B.S.) explained the purpose, procedures, and ethical considerations of the study, with particular emphasis on safeguarding the rights of vulnerable participants. Students were clearly informed that participation was voluntary and that no form of reward or sanction would be applied. This clarification was considered particularly important given the researcher's concurrent role as a faculty member. To ensure anonymity and minimize potential bias, questionnaires were completed without names, and data collection was supervised by an assistant researcher (T.A.), who had no instructional role in the participants' coursework. The lead researcher was not present during data collection. The informed consent form outlined all ethical commitments, and only students who voluntarily provided informed consent were included in the study.

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

2.2 | Study Population

The study population consisted of third-, fourth-, and fifth-year dental students enrolled at the School of Dentistry, Çanakkale Onsekiz Mart University. In Türkiye, dental education spans ten academic semesters. During the first 3 years, students undergo preclinical training, which focuses primarily on foundational knowledge and laboratory-based instruction. In the fourth and fifth years, students enter clinical training, where they gain hands-on experience by performing various treatment procedures on patients.

Within the dental curriculum, HIV/AIDS-related education is delivered through several courses coordinated by different academic departments. During the second year, students receive instruction on the microbiological and virological aspects of HIV infection, including basic mechanisms of transmission and infection control principles. Beginning in the third year, additional coursework addresses the epidemiology, diagnosis, prevention, and management of HIV/AIDS. The curriculum also includes instruction on HIV-associated oral manifestations, such as oral candidiasis, oral hairy leukoplakia, Kaposi's sarcoma, HIV-associated periodontal diseases, salivary gland disorders, and other oral conditions commonly encountered in individuals living with HIV/AIDS. These topics are delivered through both didactic lectures and clinically oriented courses. Therefore, only students in the third year and above were invited to participate in the study. Participants were divided into two groups: preclinical students (third year) and clinical students (fourth and fifth years).

2.3 | Sample Size Calculation

The sample size was calculated using G*Power statistical software (version 3.1.9.7, Universität Kiel, Kiel, Germany). Based on data reported by Li et al. [26], who evaluated HIV/AIDS-related knowledge and attitudes among Chinese dental students, a statistically significant difference ($p = 0.008$) was observed in risk-group knowledge scores between male (17.87 ± 1.74) and female students (18.65 ± 1.07). Using these values, a minimum total sample size of 218 participants was determined to achieve 99% statistical power, with the significance level (α) set at 0.05 (effect size = 0.540).

2.4 | Primary and Secondary Outcomes

The primary outcome of this study was to evaluate whether HIV/AIDS-related knowledge and attitudes differed between preclinical (third-year) and clinical (fourth- and fifth-year) dental students. As a secondary outcome, gender-based comparisons were performed to explore potential differences in students' knowledge and attitudes.

2.5 | Data Collection and Instruments

Following a face-to-face briefing about the study by the principal investigator (B.S.) in the classroom, informed consent forms—containing detailed information about the research—were distributed to the dental students by the assistant researcher (T.A.). Participants were given adequate time to read and comprehend the information, after which they were asked to sign the consent form and complete the questionnaire.

The questionnaire was developed by reviewing previously published instruments used in studies assessing HIV/AIDS-related knowledge, attitudes, and behaviours among healthcare students [26–29]. Based on this literature, a pool of items was generated through collaboration between two expert researchers. The draft version of the questionnaire was then evaluated by three independent experts in public health and dental education. The expert review focused on content relevance and item adequacy across the domains of knowledge, attitude, and behaviour. Revisions were made based on expert feedback, and the final version of the questionnaire was developed accordingly. Additionally, the scoring systems and classification ranges used to interpret total scores (e.g., weak, moderate, good, excellent for knowledge; negative, passive, or positive for attitudes) were adapted from previously published studies involving similar target populations [26–29].

At the beginning of the questionnaire, students were asked to report their age, gender, and academic year. The first section assessed participants' knowledge regarding the virus (HIV), the disease (AIDS), high-risk populations, and possible routes of transmission in dental settings (Table 1). This section included 20 statements, each with three response options: "True," "False," or "I don't know." A correct response was awarded 2 points, while incorrect or "I don't know" responses received 0 points. The total possible score for this section ranged from 0 to 40.

The second section contained 16 statements focused on HIV transmission and post-exposure prophylaxis (Table 2). The first 13 items addressed transmission routes, while the final 3 items evaluated knowledge of mother-to-child transmission and the effectiveness of timely post-exposure treatment. Scoring followed the same scheme as in the first section, with a maximum possible score of 32.

The third section assessed knowledge of HIV-related oral lesions. Participants were presented with 14 oral conditions and asked to identify which were associated with HIV infection. Responses were again limited to "True," "False," or "I don't know." This section had a maximum possible score of 28.

Together, these three sections evaluated overall HIV-related knowledge, including basic concepts, transmission, prevention, and oral manifestations. The total possible score across these sections ranged from 0 to 100. Based on cumulative scores, knowledge levels were classified as follows: < 70 = weak, 70–79 = moderate, 80–89 = good, and ≥ 90 = excellent.

The final section measured students' attitudes toward PLWHA. This part included 17 statements reflecting both positive and negative perceptions (Tables 3 and 4). Responses were recorded using a 5-point Likert scale: "Strongly disagree," "Disagree," "Neutral," "Agree," and "Strongly agree." Positively worded items were scored from 1 (Strongly disagree) to 5 (Strongly agree), while negatively worded items were reverse-scored. The total attitude score ranged from 17 to 85. Scores above 75

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 1 | Item-by-item comparison of knowledge statements on HIV, AIDS, risk groups, and transmission in dental settings.

Statements	Correct answer	Number (percentage) of correct responses			Number (percentage) of correct responses			Total number (percentage) of correct responses
		Male ($N=172$)	Female ($N=218$)	p*	Preclinical ($N=156$)	Clinical ($N=234$)	p*	
Dental practice is considered a risk factor for the transmission of HIV/AIDS.	True	166 (96.5)	210 (96.3)	0.924	146 (93.6)	230 (98.3)	**0.014**	376 (96.4)
Patients with HIV/AIDS can be diagnosed through oral manifestations.	True	156 (90.7)	198 (90.8)	0.966	138 (88.5)	216 (92.3)	0.200	354 (90.8)
Needle-stick injuries occurring during dental procedures can lead to HIV transmission.	True	162 (94.2)	210 (96.3)	0.318	150 (96.2)	222 (94.9)	0.556	372 (95.4)
Hepatitis B is more infectious than HIV/AIDS.	True	108 (62.8)	94 (43.1)	**<0.001**	78 (50)	124 (53)	0.564	202 (51.8)
Healthcare workers are more susceptible to cross-infection compared to non-healthcare individuals.	True	156 (90.7)	190 (87.2)	0.274	138 (88.5)	208 (88.9)	0.896	346 (88.7)
A negative HIV test result provides definitive evidence that the individual is not infected with the virus.	False	142 (82.6)	134 (61.5)	**<0.001**	114 (73.1)	162 (69.2)	0.415	276 (70.8)
The Western blot test provides definitive evidence for the diagnosis of HIV/AIDS.	True	22 (12.8)	18 (8.3)	0.144	28 (17.9)	12 (5.1)	**<0.001**	40 (10.3)
ELISA is a screening test for HIV infection.	True	60 (34.9)	78 (35.8)	0.855	64 (41)	74 (31.6)	0.057	138 (35.4)
HIV tests have a specificity close to 100%.	True	26 (15.1)	32 (14.7)	0.904	22 (14.1)	36 (15.4)	0.728	58 (14.9)
HIV can be transmitted through saliva.	False	54 (31.4)	80 (36.7)	0.275	40 (25.6)	94 (40.2)	**0.003**	134 (34.4)
Infection control procedures used for hepatitis B are also sufficient to protect against HIV transmission.	True	60 (34.9)	68 (31.2)	0.442	38 (24.4)	90 (38.5)	**0.004**	128 (32.8)
The saliva of HIV/AIDS patients contains a high concentration of the HIV virus.	False	40 (23.3)	57 (26.2)	0.563	30 (19.2)	67 (28.6)	**0.042**	97 (24.7)
All sterilization methods are effective in killing the HIV virus.	False	16 (9.3)	12 (5.5)	0.150	6 (3.8)	22 (9.4)	**0.037**	28 (7.2)

(Continues)

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 1 | (Continued)

Statements	Correct answer	Number (percentage) of correct responses			Number (percentage) of correct responses			Total number (percentage) of correct responses
		Male ($N=172$)	Female ($N=218$)	p*	Preclinical ($N=156$)	Clinical ($N=234$)	p*	
HIV can be transmitted through aerosols generated by dental rotary instruments.	False	50 (29.1)	58 (26.6)	0.590	36 (23.1)	72 (30.8)	0.097	108 (27.7)
HIV infection can be controlled with antiretroviral therapy (ART).	True	66 (38.4)	76 (34.9)	0.476	36 (23.1)	106 (45.3)	**<0.001**	142 (36.4)
Every individual who is HIV-positive is considered to have AIDS.	False	128 (74.4)	176 (80.7)	0.136	112 (71.8)	192 (82.1)	**0.017**	304 (77.9)
Today, with appropriate treatment, the life expectancy of HIV-positive individuals can be comparable to that of HIV-negative individuals.	True	118 (68.6)	132 (60.6)	0.100	104 (66.7)	146 (62.4)	0.390	250 (64.1)
HIV-positive individuals with undetectable viral loads in their blood, as confirmed by relevant tests, do not transmit the virus during unprotected sexual intercourse.	True	13 (7.6)	14 (6.4)	0.816	14 (9)	13 (5.5)	0.140	27 (6.9)
Birth control pills protect women from acquiring HIV.	False	108 (62.8)	168 (77.1)	**0.002**	108 (69.2)	168 (71.8)	0.587	276 (70.8)
It is currently estimated that approximately 39 million people worldwide are HIV-positive.	True	72 (41.9)	70 (32.1)	**0.047**	72 (46.2)	70 (29.9)	**0.001**	142 (36.4)

Abbreviations: AIDS, Acquired Immune Deficiency Syndrome; HIV, Human Immunodeficiency Virus; *N*, Number.
*Chi-square test. Bold values mean statistically significant. Correct answers reflect the questionnaire answer key used during data collection.

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 2 | Accuracy of responses regarding HIV transmission routes and post-exposure prophylaxis.

Statements	Correct answer	Number (percentage) of correct responses			Number (percentage) of correct responses			Total number (percentage) of correct responses
		Male ($N=172$)	Female ($N=218$)	p*	Preclinical ($N=156$)	Clinical ($N=234$)	p*	
Unprotected sexual intercourse	True	166 (96.5)	218 (100)	**0.005**	152 (97.4)	232 (99.1)	0.180	384 (98.5)
Sexual intercourse with condom use	False	100 (58.1)	116 (53.2)	0.332	88 (56.4)	128 (54.7)	0.740	216 (55.4)
Sharing contaminated needles/ needle-stick injuries with infected instruments	True	162 (94.2)	210 (96.3)	0.318	150 (96.2)	222 (94.9)	0.556	372 (95.4)
Blood transfusion	True	162 (94.2)	206 (94.5)	0.896	150 (96.2)	218 (93.2)	0.211	368 (94.4)
Mother-to-child transmission during pregnancy and delivery	True	122 (70.9)	174 (79.8)	**0.042**	126 (80.8)	170 (72.6)	0.067	296 (75.9)
Mother-to-child transmission through breastfeeding	True	66 (38.4)	122 (56)	0.261	82 (52.6)	80 (34.2)	**<0.001**	162 (41.5)
Handshaking	False	136 (79.1)	192 (88.1)	0.106	122 (78.2)	206 (88)	**0.009**	328 (84.1)
Mosquito bites	False	58 (33.7)	56 (25.7)	0.084	42 (26.9)	72 (30.8)	0.415	114 (29.2)
Hugging	False	142 (82.6)	194 (89)	0.068	122 (78.2)	214 (91.5)	**<0.001**	336 (86.2)
Sharing towels	False	74 (43)	74 (33.9)	0.067	44 (28.2)	104 (44.4)	**0.001**	148 (37.9)
Kissing	False	44 (25.6)	40 (18.3)	0.085	22 (14.1)	62 (26.5)	**0.003**	84 (21.5)
Sharing forks and knives	False	42 (24.4)	56 (25.7)	0.775	26 (16.7)	71 (30.8)	**0.002**	98 (25.1)
Using public toilets	False	28 (16.3)	50 (22.9)	0.103	30 (19.2)	48 (20.5)	0.757	78 (20)
It is possible to prevent mother-to-child transmission of HIV during pregnancy.	True	34 (19.8)	50 (22.9)	0.451	36 (23.1)	48 (20.5)	0.547	84 (21.5)
If treatment is initiated promptly after unprotected sexual intercourse, the risk of HIV infection can be reduced.	True	96 (55.8)	100 (45.9)	0.051	76 (48.7)	120 (51.3)	0.621	196 (50.3)
If treatment is initiated promptly after a needle-stick injury with an infected needle, the risk of HIV infection can be reduced.	True	108 (62.8)	122 (56)	0.174	90 (57.7)	140 (59.8)	0.675	230 (59)

Abbreviations: AIDS, Acquired Immune Deficiency Syndrome; HIV, Human Immunodeficiency Virus; *N*, Number.
*Chi-square test. Bold values mean statistically significant. Correct answers reflect the questionnaire answer key used during data collection.

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

indicated a positive attitude; scores between 50 and 75 reflected a negative attitude; and scores below 50 were considered passive or indifferent [26].

2.6 | Statistical Analysis

The Shapiro–Wilk test was used to assess the normality of the data. The data from the first three sections of the questionnaire were normally distributed; therefore, continuous variables were summarized as means ± standard deviations. Independent samples *t*-tests were performed to compare knowledge scores between preclinical and clinical students, as well as between male and female students. Chi-square tests were used to compare the proportions of correct responses to individual knowledge statements between groups. For the final section, which assessed attitudes using Likert-type items, most variables did not meet the assumption of normality; therefore, non-parametric tests were applied. The Mann–Whitney U test was used to compare attitude scores between preclinical and clinical students, as well as between male and female students. All statistical analyses were performed using SPSS version 26 (IBM Corp., Armonk, NY, USA). A *p*-value of less than 0.05 was considered statistically significant.

3 | Results

A total of 401 students enrolled during the 2024–2025 academic year were invited to participate in the study. Seven students declined participation and/or did not sign the informed consent form. Additionally, four questionnaires were excluded because they were incomplete or improperly completed. Ultimately, data from 390 students were included in the final analysis, corresponding to a participation rate of 97.3%. The mean age of participants was 22.35 ± 1.31 years. Of the participants, 172 (44.1%) were male and 218 (55.9%) were female. A total of 156 students (40%) were preclinical students, while 234 (60%) were clinical students.

Data related to knowledge of HIV/AIDS are presented in Table 5. There were no statistically significant differences between male and female students or between preclinical and clinical students in their scores related to knowledge of the virus (HIV), the disease (AIDS), high-risk groups, and modes of HIV transmission in dental settings ($p = 0.071$ and $p = 0.090$, respectively). Within this domain (maximum score = 40), mean scores ranged from 18.9 to 20.02 across gender and clinical education levels. Similarly, knowledge scores concerning potential transmission routes and post-exposure prophylaxis did not significantly differ by gender or clinical education level ($p = 0.967$ and $p = 0.075$, respectively). In this section (maximum score = 32), mean scores ranged from 17.41 to 18.26. However, female students (13.14 ± 6.10) scored significantly higher than male students (11.09 ± 5.74) on knowledge of oral lesions associated with HIV ($p = 0.001$). Additionally, clinical students (14.77 ± 5.44) performed significantly better than preclinical students (8.44 ± 2.72) in this domain ($p < 0.001$). When overall knowledge scores were evaluated (maximum possible score = 100), no statistically significant difference was observed between male (50.26 ± 11.35) and female students (49.06 ± 11.92) ($p = 0.316$). In contrast, clinical students (53.00 ± 11.41) demonstrated significantly higher total knowledge scores than preclinical students (44.49 ± 10.10) ($p < 0.001$). Across both gender and clinical education groups, mean total knowledge scores fell within the "weak" category based on the predefined classification criteria.

When the statements assessing knowledge of the virus (HIV), the disease (AIDS), risk groups, and HIV transmission in dental settings were examined individually, male students provided significantly more correct responses than female students to the statements "Hepatitis B is more infectious than HIV/AIDS," "A negative HIV test result provides definitive evidence that the individual is not infected with the virus," and "It is currently estimated that approximately 39 million people worldwide are HIV-positive" ($p < 0.001$, $p < 0.001$, and $p = 0.047$, respectively) (Table 1). In contrast, female students gave significantly more correct answers than male students to the statement "Birth control pills protect women from acquiring HIV" ($p = 0.002$). When compared based on clinical education level, significant differences were observed in responses to many of the individual statements. Overall, the items with the lowest proportion of correct answers were "HIV-positive individuals with undetectable viral loads in their blood, as confirmed by relevant tests, do not transmit the virus during unprotected sexual intercourse" (6.9%), "All sterilization methods are effective in killing the HIV virus" (7.2%), "The Western blot test provides definitive evidence for the diagnosis of HIV/AIDS" (10.3%), and "HIV tests have a specificity close to 100%" (14.9%).

Accuracy rates for responses to statements regarding potential HIV transmission routes and post-exposure prophylaxis, along with group comparisons, are presented in Table 2. Female students provided significantly more correct responses than male students to the statements "Unprotected sexual intercourse" and "Mother-to-child transmission during pregnancy and delivery" ($p = 0.005$ and $p = 0.042$, respectively). While preclinical students gave significantly more correct answers to the statement "Mother-to-child transmission through breastfeeding" ($p < 0.001$), clinical students demonstrated significantly higher accuracy in identifying non-transmissible routes such as "Handshaking," "Hugging," "Sharing towels," "Kissing," and "Sharing forks and knives" ($p = 0.009$, $p < 0.001$, $p = 0.001$, $p = 0.003$, and $p = 0.002$, respectively). Overall, only 29.2% of participants correctly identified that HIV is not transmitted through mosquito bites, 37.9% through sharing towels, 21.5% through kissing, 25.1% through sharing forks and knives, and 20.0% through using public toilets. Additionally, only 21.5% of participants were aware that mother-to-child transmission of HIV can be prevented. In contrast, the highest accuracy rates were observed for the statements "Unprotected sexual intercourse" (98.5%), "Sharing contaminated needles/needle-stick injuries with infected instruments" (95.4%), and "Blood transfusion" (94.4%).

The proportions of correct responses to statements regarding HIV-associated oral lesions by gender and clinical education level are presented in Figure 1 and Figure 2, respectively. Female students provided significantly more correct responses than male students for items related to oral hairy leukoplakia, herpes simplex infections, severe periodontitis, and severe gingivitis ($p < 0.001$, $p < 0.001$, $p = 0.041$, and $p = 0.037$, respectively). With the exception of herpes simplex

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 3 | Distribution of attitude scores toward people living with HIV/AIDS by gender.

Statements on attitudes toward people living with HIV/AIDS	Male ($N=172$)					Female ($N=218$)					p*
	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	
Treating patients with HIV/AIDS is a waste of national resources.	52.3	40.7	5.8	1.2	0	67	28.4	4.6	0	0	**0.004**
All patients undergoing invasive procedures should be considered potential carriers of HIV.	3.5	12.8	11.6	33.7	38.4	45.9	33	11.9	6.4	2.8	**0.047**
If I found out that a friend was HIV positive, I would end the friendship.	32.6	39.5	16.3	8.1	3.5	41.3	42.2	8.3	7.3	0.9	**0.010**
HIV-positive women should not have children.	8.1	24.4	34.9	18.6	14	7.3	17.4	49.5	20.2	5.5	0.526
Supporting people living with HIV/AIDS improves public health.	0	33.7	40.7	20.9	4.7	0	32.1	45	16.5	6.4	0.933
HIV-positive healthcare providers should not treat patients.	22.1	25.6	29.1	11.6	11.6	12.8	44	23.9	11.9	7.3	0.491
Patients with HIV/AIDS should be treated in a separate section of the clinic.	4.7	4.7	7	47.7	36	1.8	5.5	18.3	40.4	33.9	0.503
Blood testing for HIV should be mandatory for all patients undergoing invasive procedures.	2.3	29.1	16.3	31.4	20.9	2.8	15.6	27.5	30.3	23.9	0.134
People living with HIV/AIDS can live in the same place as others.	3.5	18.6	23.3	45.3	9.3	3.7	11	25.7	46.8	12.8	0.119
I am not obligated to treat patients with HIV/AIDS.	31.4	32.6	15.1	12.8	8.1	32.1	44	11.9	9.2	2.8	**0.019**
HIV-positive individuals can live a normal lifespan.	1.2	12.8	22.1	38.4	25.6	2.8	7.3	19.3	48.6	22	0.591
I have sufficient knowledge to safely treat patients with HIV/AIDS.	14	24.4	36	19.8	5.8	5.5	22	49.5	19.3	3.7	0.148
I intend to provide treatment to HIV/AIDS patients in the future.	2.3	5.8	25.6	51.2	15.1	1.8	2.8	21.1	58.7	15.6	0.137

(Continues)

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Betkent Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 3 | (Continued)

Statements on attitudes toward people living with HIV/AIDS	Male ($N=172$)					Female ($N=218$)					p*
	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	
My knowledge of infection control is sufficient to treat patients with HIV/AIDS.	7	27.9	32.6	29.1	3.5	4.6	23.9	45	24.8	1.8	0.896
I am concerned about contracting HIV from my patients.	3.5	12.8	14	52.3	17.4	1.8	9.2	13.8	53.2	22	0.088
I would not hesitate to perform cardiopulmonary resuscitation (CPR) on a patient with HIV/AIDS if necessary.	2.3	10.5	29.1	36	22.1	6.4	5.5	25.7	45.9	16.5	0.091
I believe I have the right to know if my patient is HIV positive.	1.2	5.8	3.5	7	82.6	0	0.9	0	18.3	80.7	**0.034**
Total score (Mean ± SD) (Min. – Max.)	56.9 ± 7.33 (39–76)					58.31 ± 6.86 (38–76)					**0.048**

Abbreviations: AIDS, Acquired Immune Deficiency Syndrome; HIV, Human Immunodeficiency Virus; Max, Maximum; Min, Minimum; *N*, Number; SD, Standard deviation.
*Mann–Whitney U test. Bold values mean statistically significant.

infections, salivary gland infections, and xerostomia, clinical students demonstrated significantly higher correct response rates than preclinical students across all remaining oral lesion items. Preclinical students achieved significantly higher correct response rates for salivary gland infections and xerostomia. Among preclinical students, the highest proportion of correct responses was observed for oral candidiasis (66.7%), whereas the lowest was observed for severe periodontitis. Overall, more than half of the participants failed to correctly identify necrotizing gingivitis, cytomegalovirus infections, salivary gland infections, and xerostomia as HIV-related oral manifestations. In contrast, a considerable number of students mistakenly identified Fordyce granules, peripheral ossifying fibroma, lichen planus, severe periodontitis, and severe gingivitis as oral conditions commonly associated with HIV infection.

Table 3 presents the distribution of responses to the statements assessing attitudes toward PLWHA by gender, while Table 4 shows the same distribution by clinical education level. Female students (mean score: 58.31 ± 6.86; range: 38–76) demonstrated significantly more positive attitudes than male students (mean score: 56.90 ± 7.33; range: 39–76) ($p = 0.048$). However, the mean scores of both groups fell within the predefined range corresponding to a negative attitude classification. Similarly, clinical students (mean score: 60.19 ± 6.12; range: 38–76) scored significantly higher than preclinical students (mean score: 53.94 ± 6.81; range: 39–70) ($p < 0.001$). Nevertheless, both scores remained within the predefined range corresponding to a negative attitude classification, suggesting that despite subgroup differences, attitudes toward PLWHA remained suboptimal across the sample.

4 | Discussion

This study aimed to assess dental students' knowledge of HIV/AIDS, their recognition of HIV-related oral manifestations, and their attitudes toward PLWHA. The findings revealed that overall knowledge and attitudes remained suboptimal, raising concerns about the potential impact on both the accessibility of dental care for HIV-positive individuals and the ethical preparedness of future practitioners. The null hypothesis—which stated that there would be no statistically significant difference in HIV/AIDS-related knowledge and attitudes between preclinical and clinical students—was rejected. Clinical students demonstrated significantly higher knowledge scores and more positive attitudes than their preclinical counterparts, suggesting that progression through clinical training may be associated with improved understanding and reduced stigma.

Participants' overall knowledge of HIV/AIDS was categorized as poor, with particularly limited understanding of diagnostic methods and contemporary concepts such as new transmission paradigms. This aligns with previous studies reporting similarly insufficient knowledge among dental students [27, 30, 31]. Particularly notable gaps were observed in knowledge of transmission routes, diagnostic tools, and HIV-associated oral manifestations. Compared to studies reporting higher knowledge levels, the mean scores in the present study were considerably lower [18, 26, 28, 29].

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 4 | Distribution of attitude scores toward people living with HIV/AIDS by clinical education level.

Statements on attitudes toward people living with HIV/AIDS	Preclinical dental students ($N=156$)					Clinical dental students ($N=234$)					p*
	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	
Treating patients with HIV/AIDS is a waste of national resources.	51.3	42.3	6.4	0	0	66.7	28.2	4.3	0.9	0	**0.013**
All patients undergoing invasive procedures should be considered potential carriers of HIV.	2.6	15.4	23.1	32.1	26.9	53	34.2	4.3	5.1	3.4	**<0.001**
If I found out that a friend was HIV positive, I would end the friendship.	29.5	37.2	15.4	16.7	1.3	42.7	43.6	9.4	1.7	2.6	**<0.001**
HIV-positive women should not have children.	5.1	21.8	33.3	25.6	14.1	9.4	19.7	49.6	15.4	6	**0.002**
Supporting people living with HIV/AIDS improves public health.	6.4	16.7	47.4	29.5	0	5.1	19.7	40.2	35	0	0.565
HIV-positive healthcare providers should not treat patients.	11.5	29.5	21.8	19.2	17.9	20.5	40.2	29.1	6.8	3.4	**<0.001**
Patients with HIV/AIDS should be treated in a separate section of the clinic.	3.8	3.8	6.4	47.4	38.5	2.6	6	17.9	41	32.5	0.077
Blood testing for HIV should be mandatory for all patients undergoing invasive procedures.	2.6	11.5	16.7	39.7	29.5	2.6	28.2	26.5	24.8	17.9	**<0.001**
People living with HIV/AIDS can live in the same place as others.	6.4	18.6	23.3	45.3	9.3	3.7	11	25.7	46.8	12.8	**<0.001**
I am not obligated to treat patients with HIV/AIDS.	24.4	42.3	15.4	16.7	1.3	36.8	36.8	12	6.8	7.7	0.171
HIV-positive individuals can live a normal lifespan.	1.3	17.9	24.4	41	15.4	2.6	4.3	17.9	46.2	29.1	**<0.001**
I have sufficient knowledge to safely treat patients with HIV/AIDS.	17.9	32.1	38.5	10.3	1.3	3.4	17.1	47	25.6	6.8	**<0.001**
I intend to provide treatment to HIV/AIDS patients in the future.	3.8	6.4	21.8	61.5	6.4	0.9	2.6	23.9	51.3	21.4	**0.001**

(Continues)

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Betkent Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 4 | (Continued)

Statements on attitudes toward people living with HIV/AIDS	Preclinical dental students ($N=156$)					Clinical dental students ($N=234$)					p*
	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	
My knowledge of infection control is sufficient to treat patients with HIV/AIDS.	10.3	43.6	25.6	20.5	0	2.6	13.7	48.7	30.8	4.3	**< 0.001**
I am concerned about contracting HIV from my patients.	1.3	6.4	6.4	64.1	21.8	3.4	13.7	18.8	45.3	18.8	**< 0.001**
I would not hesitate to perform cardiopulmonary resuscitation (CPR) on a patient with HIV/AIDS if necessary.	3.8	7.7	26.9	46.2	15.4	5.1	7.7	27.4	38.5	21.4	0.872
I believe I have the right to know if my patient is HIV positive.	1.3	2.6	1.3	16.7	78.2	0	3.4	1.7	11.1	83.8	0.310
Total score (Mean ± SD) (Min. – Max.)	53.94 ± 6.81 (39–70)					60.19 ± 6.12 (38–76)					**< 0.001**

Abbreviations: AIDS, Acquired Immune Deficiency Syndrome; HIV, Human Immunodeficiency Virus; Max, Maximum; Min, Minimum; *N*, Number; SD, Standard deviation.
*Mann–Whitney U test. Bold values mean statistically significant.

Of particular concern, only 6.9% of students correctly identified the U = U principle, and awareness of key diagnostic tools such as the Western blot test was minimal. Alarmingly, 92.8% of students incorrectly believed that all sterilization methods are effective in eliminating HIV, and only 21.5% were aware that mother-to-child transmission can be prevented. Misconceptions about non-transmission routes were widespread; a majority of students incorrectly believed HIV could be transmitted via mosquito bites, towels, utensils, kissing, or public toilets—findings that are consistent with previous literature [26, 32, 33]. In contrast, knowledge of well-publicized transmission routes—such as unprotected sex, shared needles, and blood transfusions—was high, also consistent with earlier research [26, 32, 34–36]. These findings suggest that while a basic level of knowledge exists, substantial gaps remain in less emphasized areas, particularly among preclinical students, highlighting the need for targeted curricular reinforcement early in dental education.

The study also revealed nuanced gender-based differences in specific knowledge areas. Female students outperformed their male peers in recognizing HIV-associated oral lesions—a finding consistent with previous research [29, 37]. They were also significantly more successful in rejecting common misconceptions, such as the belief that birth control pills offer protection against HIV, and demonstrated a better understanding of transmission during unprotected sexual intercourse and pregnancy. These differences may be related to variations in exposure to or engagement with topics concerning reproductive health and HIV-related issues. In contrast, male students more accurately answered certain epidemiological items, such as the relative infectivity of hepatitis B compared to HIV. Despite these item-specific distinctions, no statistically significant gender difference was observed in overall knowledge scores, which is consistent with the findings of earlier studies [18, 30, 32].

The notably low rates of correct responses regarding HIV diagnostic tools—particularly the Western blot test and the specificity of HIV tests—suggest deficiencies in students' understanding of concepts typically covered in foundational microbiology education and clinical training. In the present study, only 10.3% of participants correctly identified the Western blot as a confirmatory test, and just 14.9% recognized the high specificity of HIV tests. These figures are substantially lower than those reported in previous studies, where correct identification of the Western blot ranged from 46% to over 90%, and recognition of high specificity ranged between 48% and 62.8% [29, 38]. This discrepancy suggests a notable conceptual gap in students' understanding of diagnostic procedures. Similar deficiencies have been reported among dental students in various countries, suggesting that these challenges may extend beyond a single educational setting. These gaps may result from insufficient curricular emphasis on diagnostic principles and inadequate integration of theoretical knowledge into clinical training environments. Limited understanding of key concepts—such as sensitivity, specificity, false-positive and false-negative results, and the role of confirmatory testing—may adversely affect students' professional competence and the quality of patient care they deliver. Therefore, it is essential to strengthen the integration of microbiological and clinical content on diagnostic testing within dental curricula. This integration should be supported through case-based learning,

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Betkent Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 5 | Comparison of HIV/AIDS-related knowledge scores by gender and clinical education level.

Knowledge of HIV/AIDS	Scores (Mean ± SD)			Scores (Mean ± SD)		
	Male ($N=172$)	Female ($N=218$)	p*	Preclinical dental students ($N=156$)	Clinical dental students ($N=234$)	p*
The virus (HIV) and the disease (AIDS), risk groups, and HIV transmission in the dental setting	20.02 ± 5.22	19.03 ± 5.52	0.071	18.9 ± 5.5	19.85 ± 5.33	0.090
Potential transmission routes and post-exposure prophylaxis	17.91 ± 4.63	17.93 ± 4.58	0.967	17.41 ± 4.26	18.26 ± 4.78	0.075
Oral lesions associated with HIV	11.09 ± 5.74	13.14 ± 6.10	**0.001**	8.44 ± 2.72	14.77 ± 5.44	**< 0.001**
Total Scores	50.26 ± 11.35	49.06 ± 11.92	0.316	44.49 ± 10.10	53 ± 11.41	**< 0.001**

Abbreviations: AIDS, Acquired Immune Deficiency Syndrome; HIV, Human Immunodeficiency Virus; *N*, Number; SD, Standard deviation.
*Independent samples *t*-test. Bold values mean statistically significant.

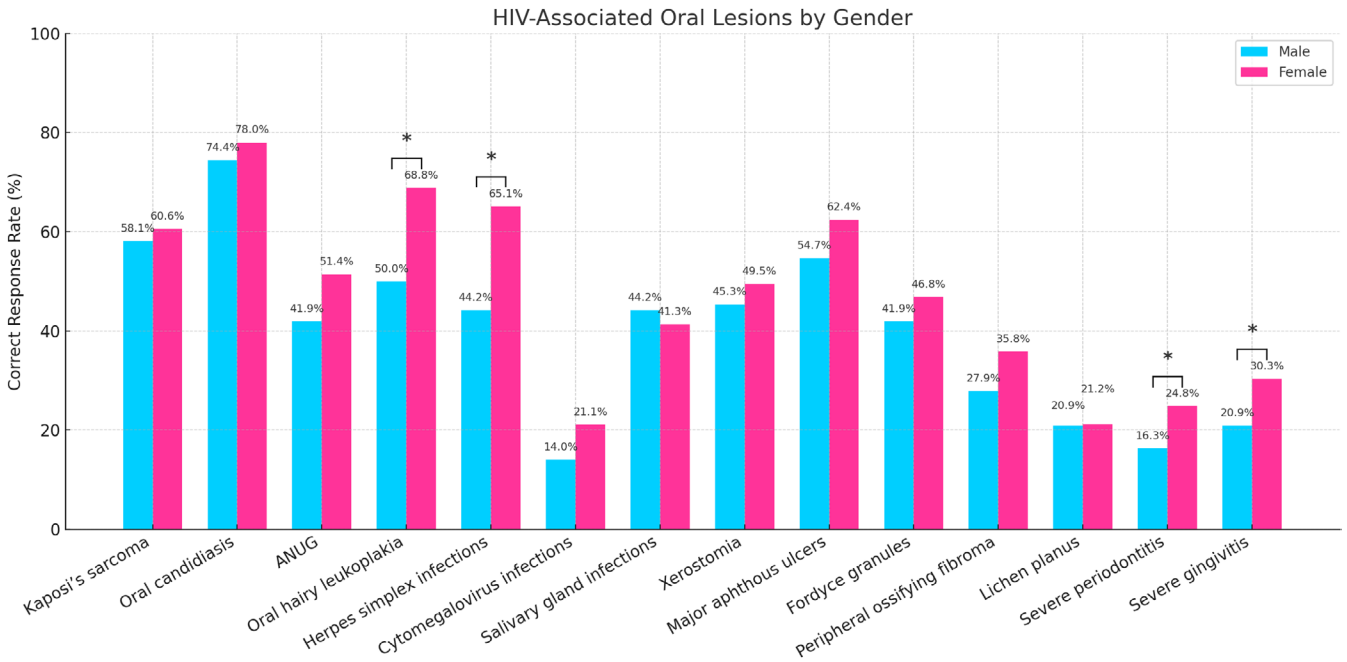


FIGURE 1 | Proportion of correct responses to HIV-associated oral lesions by gender. (An asterisk indicates a statistically significant difference. The percentage of correct responses for each item is shown above the corresponding bar. *ANUG: Acute necrotizing ulcerative gingivitis.*)

clinical simulations, and real-world applications to enhance both conceptual understanding and clinical readiness.

In the present study, the overall correct identification rate for necrotizing gingivitis ranged between 45% and 50%, and between 55% and 60% among clinical students. These rates are lower than those reported in previous studies, which ranged from 65% to 76% [27, 39]. According to the 2017 World Workshop on the Classification of Periodontal and Peri-Implant Diseases and Conditions, necrotizing periodontal diseases constitute a distinct category of periodontal diseases and are recognized as conditions that may be associated with severe immunosuppression, including HIV infection [40]. However, the clinical group in the current study outperformed fifth-year students in another study, where the correct diagnosis rate was below 30% [33]. This finding suggests that knowledge of HIV-related periodontal lesions may not be adequately reinforced during clinical training [27, 32, 34, 39]. Interestingly, xerostomia was identified more accurately by preclinical students (55.1%) than by clinical students (42.7%), despite the overall trend favoring clinical students. These results are consistent with previous studies reporting similar rates, such as 39.7% and 41.6% [32, 34].

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

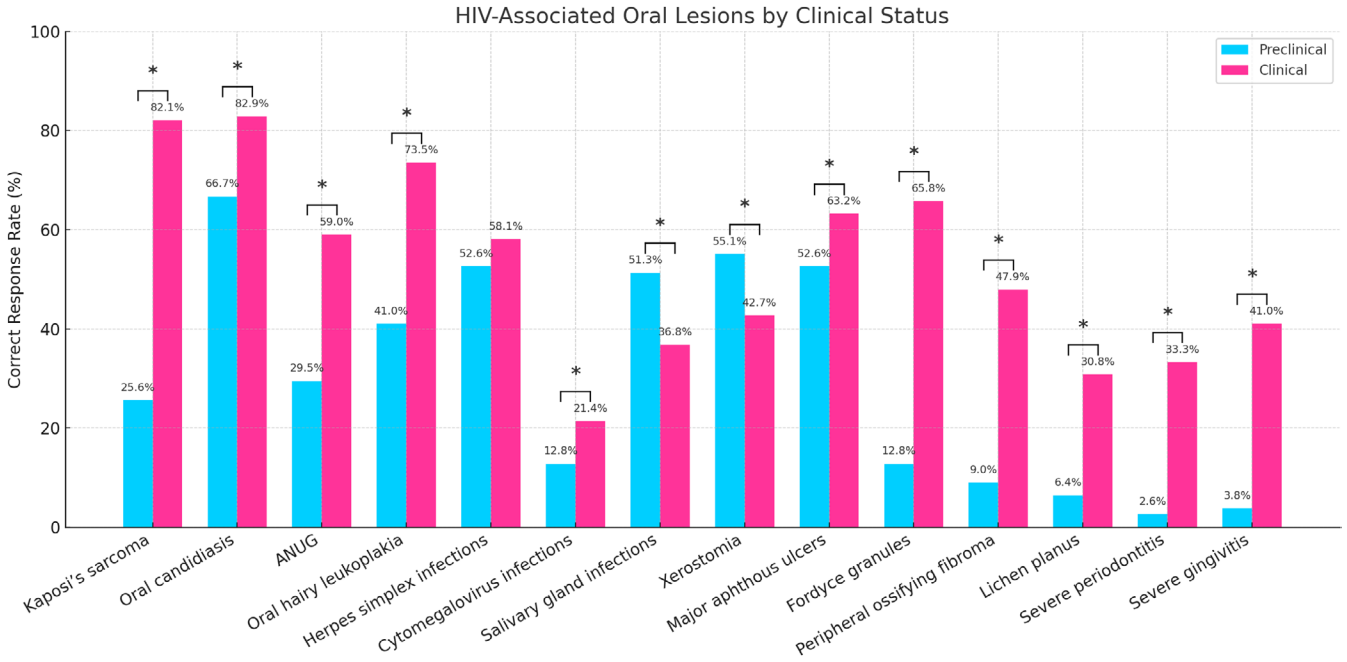


FIGURE 2 | Proportion of correct responses to HIV-associated oral lesions by clinical education level (An asterisk indicates a statistically significant difference. The percentage of correct responses for each item is shown above the corresponding bar. *ANUG: Acute necrotizing ulcerative gingivitis*.)

Furthermore, the frequent misclassification of lesions not associated with HIV—such as Fordyce granules, peripheral ossifying fibroma, and lichen planus—suggests difficulties in differentiating HIV-associated oral lesions from non-associated conditions, which is consistent with previous findings. Accurate identification of such lesions, particularly lichen planus, which occupies a diagnostically ambiguous area, is critical for clinical reasoning. In the present study, only 21% of participants correctly identified this condition, with clinical students performing slightly better at 30.8%. Despite this, the accuracy remains well below that reported in another study, which found a correct identification rate of 54.1% [39]. While recognition rates for more distinctive lesions—such as Kaposi's sarcoma, oral hairy leukoplakia, and oral candidiasis—were relatively high, none were identified correctly by all students. The overall correct identification rate for Kaposi's sarcoma was slightly below 60%; however, clinical students exceeded 80%, closely aligning with previous findings reporting rates between 60% and 85% [27, 39, 41]. Diagnostic accuracy in the current study was even higher than that reported in a previous study conducted among clinical dental students, which showed a rate of approximately 70% [34]. In contrast, fewer than 30% of preclinical students correctly identified Kaposi's sarcoma, highlighting a substantial gap in foundational knowledge regarding HIV-specific oral lesions at the preclinical level. These findings collectively emphasize the urgent need to reinforce theoretical instruction with clinical case-based learning early in dental education, in order to enhance diagnostic accuracy and improve awareness.

The findings suggest that greater HIV/AIDS-related knowledge is associated with progression through clinical training. Clinical students not only demonstrated superior recognition of HIV-related oral manifestations but also held fewer misconceptions about transmission. Notably, their higher rates of correct responses regarding non-transmission through casual contact suggest that progression through clinical training may be associated with improved awareness and understanding of HIV transmission. In contrast, preclinical students were more likely to exhibit insufficient understanding of diagnostic procedures and contemporary transmission paradigms, such as U = U. These findings suggest that didactic instruction alone may be insufficient to achieve optimal levels of knowledge and awareness and highlight the potential value of clinically oriented educational experiences. Consistent with previous studies, the present findings support the view that clinical training is associated with greater competence and preparedness among health professional students [27, 32, 34, 39, 41, 42].

The attitudinal findings of this study are particularly concerning. Despite variations in knowledge levels, the overall mean attitude scores indicated persistent stigma toward PLWHA, consistent with earlier studies [26–29, 42, 43]. Gender-based analysis revealed that female students demonstrated significantly more positive attitudes toward PLWHA than their male counterparts. They were significantly more likely to reject stigmatizing statements such as "Treating individuals with HIV/AIDS is a waste of national resources" and "I would end a friendship with an HIV-positive person," and less likely to support exclusionary or patient-blaming views. These findings underscore the importance of integrating stigma-reduction and ethics-focused content into healthcare education. Previous studies have often reported a disconnect between HIV-related knowledge and professional attitudes [28, 29], although few have examined gender-specific patterns. In contrast, our results suggest that gender may be associated with differences in attitudes toward PLWHA—female students were more likely to reject unethical statements such as "I am not obligated to treat HIV-positive patients," indicating more favorable attitudes toward professional responsibility

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

[27]. However, despite these differences, overall attitude scores remained low, suggesting that knowledge alone is insufficient to combat stigma. Although the literature presents mixed findings on gender and attitude [18, 29, 37, 39], our results highlight that both gender and clinical education level influence attitudes.

Interestingly, progression through clinical training was not consistently associated with more positive attitudes. While students at more advanced stages of training demonstrated more favourable attitudes toward professional obligations and patient rights, stigmatizing views still persisted. Studies from India and Egypt have reported that even with increased knowledge, interns or senior students sometimes exhibited reduced willingness to treat PLWHA, possibly due to emotional fatigue or fear of infection [32, 44]. These findings suggest that stigma in healthcare requires more than factual knowledge; it demands ongoing interventions that cultivate empathy, challenge prejudice, and reinforce professional values. As emphasized by Lee et al. [43], knowledge should be accompanied by ethically grounded learning to help ensure that future professionals provide compassionate and stigma-free care.

One of the key strengths of this study lies in its comparative approach, examining preclinical and clinical dental students to assess how the stage of education influences HIV/AIDS-related knowledge and attitudes. The inclusion of students from different academic levels provided a broader perspective on the differences associated with clinical training. Additionally, the questionnaire adopted a multidimensional structure—addressing not only general knowledge but also specific topics such as transmission routes, post-exposure prophylaxis, HIV-related oral manifestations, and attitudes toward PLWHA. This comprehensive design enabled a detailed analysis of both cognitive and affective domains. Voluntary and anonymous participation helped minimize social desirability bias, while subgroup analyses by gender and clinical level added further depth to the findings.

However, several limitations should be acknowledged. As a cross-sectional study, the design captures a single time point and cannot establish causality. Although clinical education was associated with improved knowledge and attitudes, this relationship should not be interpreted as causal. The study's single-institution sample limits the generalizability of the findings to the broader population of dental students. Self-reported responses may also have been subject to social desirability bias, particularly for sensitive items. Furthermore, students' attitudes may have been influenced not only by formal education but also by informal sources, such as media, personal beliefs, and cultural norms.

5 | Conclusion

This study highlights persistent gaps in dental students' knowledge of HIV/AIDS and attitudes toward PLWHA, particularly among those in the preclinical stage. Although clinical training was associated with improved awareness and more positive attitudes, significant misconceptions and stigmatizing views persisted even at advanced levels. Notably, female students demonstrated better knowledge of HIV-related oral manifestations and more positive attitudes toward PLWHA than male students.

The widespread difficulty in accurately identifying HIV-associated oral lesions highlights the need for more robust, case-based clinical education. Given the increasing life expectancy of PLWHA, it is essential for dental professionals to be adequately prepared to deliver care free from bias. Strengthening HIV-related content within dental curricula is therefore crucial—not only to enhance diagnostic competence, but also to cultivate empathy, promote patient rights, and reduce stigma. Equipping future dentists with both clinical knowledge and ethical sensitivity will be vital to ensuring equitable and respectful care for people living with HIV/AIDS.

Author Contributions

Conceptualization: T.A. and B.S. Methodology: T.A. and B.S. Formal analysis: B.S. Writing – original draft preparation: T.A. and B.S. Writing – review and editing: B.S. Supervision and integrity of the data and analysis: B.S.

Acknowledgements

The authors would like to thank all dental students who voluntarily participated in this study for their time, cooperation, and valuable contributions.

Funding

The authors have nothing to report.

Ethics Statement

Ethical approval was granted by the Ethics Committee of the Graduate Education Institute at Çanakkale Onsekiz Mart University (Approval No. 01/14, dated January 18, 2024). In accordance with the Declaration of Helsinki, which recognizes university students as a vulnerable population, all procedures were conducted in full compliance with established ethical standards.

Consent

Informed consent was obtained from all participants involved in this study prior to data collection.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

1. C. Beyrer, J. Ratevosian, H. Gelderblom, and N. E. Rosenberg, "The HIV/AIDS Pandemic: Where Are We Now?," *AIDS* 39, no. 11 (2025): 1497–1504, https://doi.org/10.1097/QAD.0000000000004308.

2. S. Payagala and A. Pozniak, "The Global Burden of HIV," *Clinics in Dermatology* 42, no. 2 (2024): 119–127, https://doi.org/10.1016/j.clindermatol.2024.02.001.

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

3. A. R. Tappuni, "The Global Changing Pattern of the Oral Manifestations of HIV," *Oral Diseases* 26, no. Suppl 1 (2020): 22–27, https://doi.org/10.1111/odi.13469.

4. UNAIDS, "UNAIDS Data Joint United Nations Programme on HIV/AIDS. Global HIV & AIDS STATISTICS — Fact Sheet," (2025), https://www.unaids.org/en/resources/fact-sheet.

5. S. M. Lomelí-Martínez, L. A. González-Hernández, A. J. Ruiz-Anaya, et al., "Oral Manifestations Associated With HIV/AIDS Patients," *Medicina (Kaunas, Lithuania)* 58, no. 9 (2022): 1214, https://doi.org/10.3390/medicina58091214.

6. P. Vohra, K. Jamatia, B. Subhada, R. V. C. Tiwari, M. S. N. Althaf, and C. Jain, "Correlation of CD4 Counts With Oral and Systemic Manifestations in HIV Patients," *Journal of Family Medicine and Primary Care* 8, no. 10 (2019): 3247–3252, https://doi.org/10.4103/jfmpc.jfmpc_767_19.

7. R. K. Indrastiti, I. I. Wardhany, and A. I. Soegyanto, "Oral Manifestations of HIV: Can They Be an Indicator of Disease Severity? (A Systematic Review)," *Oral Diseases* 26, no. Suppl 1 (2020): 133–136, https://doi.org/10.1111/odi.13394.

8. S. M. Lomelí-Martínez, L. A. González-Hernández, J. F. Andrade-Villanueva, et al., "In Vitro Azole Antifungals Susceptibility of Candida spp. Isolates From HIV-Infected Patients With Periodontitis," *Journal de Mycologie Médicale* 32, no. 3 (2022): 101294, https://doi.org/10.1016/j.mycmed.2022.101294.

9. Z. H. Khoury and V. Meeks, "The Influence of Antiretroviral Therapy on HIV-Related Oral Manifestations," *Journal of the National Medical Association* 113, no. 4 (2021): 449–456, https://doi.org/10.1016/j.jnma.2021.02.008.

10. D. Grace, M. Stewart, E. Blaque, et al., "Challenges to Communicating the Undetectable Equals Untransmittable (U = U) HIV Prevention Message: Healthcare Provider Perspectives," *PLoS One* 17, no. 7 (2022): e0271607, https://doi.org/10.1371/journal.pone.0271607.

11. R. W. Eisinger, C. W. Dieffenbach, and A. S. Fauci, "HIV Viral Load and Transmissibility of HIV Infection: Undetectable Equals Untransmittable," *Journal of the American Medical Association* 321, no. 5 (2019): 451–452, https://doi.org/10.1001/jama.2018.21167.

12. J. Bor, C. Fischer, M. Modi, et al., "Changing Knowledge and Attitudes Towards HIV Treatment-As-Prevention and "Undetectable = Untransmittable": A Systematic Review," *AIDS and Behavior* 25 (2021): 4209–4224, https://doi.org/10.1007/s10461-021-03296-8.

13. B. Sezer, T. Aydoğdu, and B. Ata, "Knowledge and Attitudes Toward HIV/AIDS Among Turkish Clinical Medical and Dental Students," *HIV Medicine* 27, no. 3 (2026): 339–350, https://doi.org/10.1111/hiv.70146.

14. O. Amin, J. Powers, K. M. Bricker, and A. Chahroudi, "Understanding Viral and Immune Interplay During Vertical Transmission of HIV: Implications for Cure," *Frontiers in Immunology* 12 (2021): 757400, https://doi.org/10.3389/fimmu.2021.757400.

15. N. Akpuh, I. Ajayi, A. Adebowale, I. C. Obasi, and E. K. Nwala, "Occupational Exposure to HIV Among Healthcare Workers in PMTCT Sites in Port Harcourt, Nigeria," *BMC Public Health* 20 (2020): 451, https://doi.org/10.1186/s12889-020-08528-5.

16. S. H. Al-Amad, "Bloodborne Infections Relevant to Dental Practice," *International Dental Journal* 74, no. Suppl 2 (2024): S429–S436, https://doi.org/10.1016/j.identj.2024.09.010.

17. I. Sufiawati, M. A. Rafi, and F. M. Putri, "Evaluating Knowledge, Attitude, and Behavior of Dentists on HIV/AIDS in West Java, Indonesia, in the COVID-19 Era," *International Journal of Dentistry* 2021 (2021): 1901887, https://doi.org/10.1155/2021/1901887.

18. A. Aggarwal and S. R. Panat, "Knowledge, Attitude, and Behavior in Managing Patients With HIV/AIDS Among a Group of Indian Dental Students," *Journal of Dental Education* 77, no. 9 (2013): 1209–1217, https://doi.org/10.1002/j.0022-0337.2013.77.9.tb05594.x.

19. Z. G. Dessie and T. Zewotir, "HIV-Related Stigma and Associated Factors: A Systematic Review and Meta-Analysis," *Frontiers in Public Health* 12 (2024): 1356430, https://doi.org/10.3389/fpubh.2024.1356430.

20. B. Armoon, M. J. Fleury, A. H. Bayat, et al., "HIV-Related Stigma Associated With Social Support, Alcohol Use Disorders, Depression, Anxiety, and Suicidal Ideation Among People Living With HIV: A Systematic Review and Meta-Analysis," *International Journal of Mental Health Systems* 16 (2022): 17, https://doi.org/10.1186/s13033-022-00527-w.

21. C. C. Jordans, K. J. Vliegenthart-Jongbloed, A. W. van Bruggen, J. T. V. M. de Jong, and R. Reis, "Unmasking Individual and Institutional HIV Stigma in Hospitals: Perspectives of Dutch Healthcare Providers," *AIDS and Behavior* 28 (2024): 3184–3195, https://doi.org/10.1007/s10461-024-04404-0.

22. R. Iardino, L. Brogonzoli, E. Sala, M. Cascio, and A. A. Monforte, "HIV and Hospitals Between Knowledge and Stigma," *AIDS Care* 37, no. 4 (2025): 654–668, https://doi.org/10.1080/09540121.2025.2453123.

23. N. K. Fauk, P. R. Ward, K. Hawke, and L. Mwanri, "HIV Stigma and Discrimination: Perspectives and Personal Experiences of Healthcare Providers in Yogyakarta and Belu, Indonesia," *Front Med (Lausanne)* 8 (2021): 625787, https://doi.org/10.3389/fmed.2021.625787.

24. M. L. Ekstrand, J. Ramakrishna, S. Bharat, and E. Heylen, "Prevalence and Drivers of HIV Stigma Among Health Providers in Urban India: Implications for Interventions," *Journal of the International AIDS Society* 16, no. 3 Suppl 2 (2013): 18717, https://doi.org/10.7448/IAS.16.3.18717.

25. World Health Organization, "Forty-First World Health Assembly, Geneva, 2–13 May 1988 (WHA41/1988/REC/3)," https://iris.who.int/handle/10665/164199.

26. R. Li, W. Dong, W. He, and Y. Liu, "Chinese Dental Students' Knowledge and Attitudes Toward HIV/AIDS," *Journal of Dental Sciences* 11, no. 1 (2016): 72–78, https://doi.org/10.1016/j.jds.2015.09.001.

27. F. M. Alali, B. Tarakji, A. S. Alqahtani, et al., "Assessment of Knowledge and Attitude of Dental Students Towards HIV and Its Oral Manifestations in Saudi Arabia—A Cross-Sectional Study," *Healthcare (Basel)* 10, no. 8 (2022): 1379, https://doi.org/10.3390/healthcare10081379.

28. M. Sadeghi and H. Hakimi, "Iranian Dental Students' Knowledge of and Attitudes Towards HIV/AIDS Patients," *Journal of Dental Education* 73, no. 6 (2009): 740–745, https://doi.org/10.1002/j.0022-0337.2009.73.6.tb04753.x.

29. V. P. Singh, I. S. Osman, N. A. Rahmat, et al., "Knowledge and Attitude of Dental Students Towards HIV/AIDS Patients in Melaka, Malaysia," *Malaysian Journal of Medical Sciences* 24, no. 3 (2017): 73–82, https://doi.org/10.21315/mjms2017.24.3.9.

30. A. N. Hamid Albujeer, A. R. Shamshiri, and A. Taher, "HIV/AIDS Awareness Among Iraqi Medical and Dental Students," *Journal of International Society of Preventive and Community Dentistry* 5, no. 5 (2015): 372–376, https://doi.org/10.4103/2231-0762.164788.

31. S. Cangül, Ö. Adıgüzel, B. Erpaçal, et al., "Evaluation of the Knowledge of the Dentists and the Students of the Faculty of Dentistry in Relation to the HIV/AIDS and Their Approaches to the Patients," *Selcuk Dental Journal* 7, no. 2 (2020): 273–279, https://doi.org/10.15311/selcukdentj.568215.

32. R. K. Abou El Fadl, A. Abdelmoety, Z. Farahat, and M. A. Hussein, "Assessing the Levels of HIV-Related Knowledge and Attitudes Toward HIV-Infected Patients Among Undergraduate Dental Students: A Cross-Sectional Study," *HIV AIDS (Auckl)* 11 (2019): 83–92, https://doi.org/10.2147/HIV.S195984.

33. V. Brailo, I. Pelivan, J. Škaričić, M. Vuletić, N. Dulčić, and G. Cerjan-Letica, "Treating Patients With HIV and Hepatitis B and C Infections: Croatian Dental Students' Knowledge, Attitudes, and Risk Perceptions," *Journal of Dental Education* 75, no. 8 (2011): 1115–1126, https://doi.org/10.1002/j.0022-0337.2011.75.8.tb05157.x.

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

34. A. H. Lorosa, C. M. Pereira, R. P. Hussne, and C. M. Silva-Boghossian, "Evaluation of Dental Students' Knowledge and Patient Care Towards HIV/AIDS Individuals," *European Journal of Dental Education* 23, no. 2 (2019): 212–219, https://doi.org/10.1111/eje.12423.

35. E. F. Nasir, A. N. Åstrøm, J. David, R. W. Ali, and M. Ali, "HIV and AIDS Related Knowledge, Sources of Information, and Reported Need for Further Education Among Dental Students in Sudan: A Cross-Sectional Study," *BMC Public Health* 8 (2008): 286, https://doi.org/10.1186/1471-2458-8-286.

36. G. Premadasa, M. Sadek, A. Ellepola, J. Sreedharan, and J. Muttappallymyalil, "Knowledge of and Attitudes Towards HIV/AIDS: A Survey Among Dental Students in Ajman, UAE," *Journal of Investigative and Clinical Dentistry* 6, no. 2 (2015): 147–155, https://doi.org/10.1111/jicd.12080.

37. E. R. Oliveira, S. Narendran, and A. Falcão, "Brazilian Dental Students' Knowledge and Attitudes Towards HIV Infection," *AIDS Care* 14, no. 4 (2002): 569–576, https://doi.org/10.1080/09540120208629675.

38. S. Kumar, J. Tadakamadla, A. Y. B. H. Areeshi, and H. A. W. M. Tobaigy, "Knowledge and Attitudes Towards HIV/AIDS Among Dental Students of Jazan University, Kingdom of Saudi Arabia," *Saudi Dental Journal* 30, no. 1 (2018): 47–52, https://doi.org/10.1016/j.sdentj.2017.10.003.

39. S. Fotedar, K. R. Sharma, G. M. Sogi, V. Fotedar, and A. Chauhan, "Knowledge and Attitudes About HIV/AIDS of Students in H.P. Government Dental College and Hospital, Shimla, India," *Journal of Dental Education* 77, no. 9 (2013): 1218–1224, https://doi.org/10.1002/j.0022-0337.2013.77.9.tb05595.x.

40. J. G. Caton, G. Armitage, T. Berglundh, et al., "A New Classification Scheme for Periodontal and Peri-Implant Diseases and Conditions - Introduction and Key Changes From the 1999 Classification," *Journal of Clinical Periodontology* 45, no. Suppl 20 (2018): S1–S8, https://doi.org/10.1111/jcpe.12935.

41. Y. S. Wimardhani, Y. F. Ossa, I. I. Wardhany, D. A. Maharani, and C. Lee, "Indonesian Dental Students' Attitudes, Knowledge, Preparation, and Willingness to Treat HIV/AIDS Patients," *European Journal of Dentistry* 16, no. 4 (2022): 867–874, https://doi.org/10.1055/s-0041-1740350.

42. A. N. Ellepola, B. K. Joseph, D. B. Sundaram, and P. N. Sharma, "Knowledge and Attitudes Towards HIV/AIDS Amongst Kuwait University Dental Students," *European Journal of Dental Education* 15, no. 3 (2011): 165–171, https://doi.org/10.1111/j.1600-0579.2010.00652.x.

43. C. Lee, Y. Fan, J. R. Starr, and I. L. Dogon, "Dentists' and Dental Students' Attitudes, Knowledge, Preparedness, and Willingness Related to Treatment of People Living With HIV/AIDS in China," *Journal of Public Health Dentistry* 77, no. 1 (2017): 30–38, https://doi.org/10.1111/jphd.12168.

44. S. S. Oberoi, C. M. Marya, N. Sharma, V. Mohanty, M. Marwah, and A. Oberoi, "Knowledge and Attitude of Indian Clinical Dental Students Towards the Dental Treatment of Patients With Human Immunodeficiency Virus (HIV)/acquired Immune-Deficiency Syndrome (AIDS)," *International Dental Journal* 64, no. 6 (2014): 324–332, https://doi.org/10.1111/idj.12122.

16000579, 0, Downloaded from https://onlinelibrary.wiley.com/doi/10.1111/eje.70223 by Berkant Sezer - Canakkale Onsekiz Mart Uni , Wiley Online Library on [03/07/2026]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License