This article can be cited as: Mahdavifar M, Salimi H, Roustaeizadeh Shouroki Z, et al. Knowledge of senior dental students regarding dental management of cardiovascular patients: a cross-sectional study in Yazd, Iran. Cardiovasc Biomed J. 2025; 5(2): 59-67.

Original Article

Knowledge of senior dental students regarding dental management of cardiovascular patients: a cross-sectional study in Yazd, Iran

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Article Information:
Received: 04 Nov 2025; Revised: 29 Nov 2025; Accepted: 22 Dec 2025 DOI: 10.18502/cbj.v5i2.21137

Abstract

Objectives: Cardiovascular diseases (CVDs) are a leading cause of mortality worldwide. Patients with these conditions require special considerations during dental treatment to prevent adverse events. Therefore, the knowledge of dental practitioners is essential for the safe and effective management of such patients.

Methods: A descriptive cross-sectional study was conducted in 2023 at Shahid Sadoughi University of Medical Sciences in Yazd, Iran. A total of 65 final-year dental students were surveyed using a validated questionnaire consisting of demographic questions and 18 items assessing their level of awareness. Data were analyzed using SPSS version 23, employing both descriptive statistics and inferential tests, including the *t*-test and Pearson correlation.

Results: A total of 65 students participated (response rate: 100%). The mean awareness score was 13.04 ± 3.42 out of 20, with 78.5% of students demonstrating acceptable knowledge levels. Female students scored higher than males, but the difference was not statistically significant ($p = 0.057$). Term 12 students scored significantly higher than Term 11 students ($p < 0.001$). A significant inverse correlation was found between age and awareness ($r = –0.327$, $p = 0.008$).

Conclusions: Although the overall level of awareness was acceptable, certain demographic variables, such as age and academic term, were found to influence knowledge levels. These findings highlight the need for targeted training in cardiology-related dental care within the dental curriculum.

Keywords: Cardiovascular Diseases, Dental Students, Knowledge, Dental Care, Patient Management

Introduction

Cardiovascular diseases (CVDs) are the leading cause of morbidity and mortality worldwide, accounting for approximately 17.9 million deaths annually (1). In Iran, CVDs are responsible for over 41% of all deaths, a figure likely to rise in the coming years (2). As medical

advancements extend life expectancy, dental practitioners are increasingly encountering patients with complex cardiovascular histories (3, 4). This demographic shift highlights the urgent need for dentists to possess comprehensive knowledge of dental management considerations specific to this patient population (5, 6). The relationship between oral health and cardiovascular health is both bidirectional and complex (7, 8). Chronic oral infections, particularly periodontitis, have been associated with systemic inflammation and the progression of atherosclerosis (9, 10). During invasive dental procedures, pathogenic oral bacteria may enter the bloodstream, posing a risk of infective endocarditis (IE) in susceptible individuals (11, 12). Additionally, the stress and anxiety experienced during dental visits can trigger acute cardiovascular events, such as angina attacks or myocardial infarction (MI), in at-risk patients (13). Notably, anginal pain can radiate to the mandible, potentially leading to misdiagnosis as odontogenic pain (14, 15). Effective management of patients with cardiovascular conditions requires adherence to specific clinical protocols, including a thorough review of the medical history, regular blood pressure monitoring, and adjustments to dental treatment plans (16, 17). Key considerations include managing patients on anticoagulant therapy, selecting suitable local anesthetics, particularly those containing vasoconstrictors, and understanding the indications for antibiotic prophylaxis to prevent infective endocarditis (IE)(13, 18, 19). Insufficient knowledge in these areas may result in delayed treatment, inappropriate interventions, or potentially life-threatening complications. Several studies have evaluated the knowledge of dental professionals and students regarding the management of cardiovascular diseases. The findings reveal considerable variability. For example, a study conducted in Saudi Arabia by Al-Mohaissen et al. revealed that 72% of dentists achieved a satisfactory overall knowledge score. Meanwhile, there were still specific gaps in their understanding, and 90% expressed a need for further education (20). Similarly, research conducted in Iran has revealed persistent knowledge gaps among both general dentists and dental students (21-23). These findings suggest that, although foundational knowledge exists, ongoing reinforcement and continuing education are essential for ensuring the proper application of clinical guidelines in practice. Given the significant responsibilities entrusted to future dental practitioners, it is necessary to assess the knowledge of final year dental practitioners. This stage marks the culmination of both didactic and clinical education, serving as a critical transition point before entry into independent practice. Accordingly, the present study aimed to evaluate the level of knowledge among final-year dental students at Shahid Sadoughi University of Medical Sciences in Yazd regarding dental considerations for patients with cardiovascular conditions. Additionally, the study sought to determine whether demographic and academic factors, such as gender, age, academic semester, and grade point average (GPA), were associated with the students' knowledge levels

Materials and Methods

Study Design and Ethical Approval

This descriptive cross-sectional study was conducted in the summer of 2023 at the Faculty of Dentistry, Shahid Sadoughi University of Medical Sciences, Yazd, Iran. The study protocol was reviewed and approved by the Institutional Review Board and the Ethics Committee of Shahid Sadoughi University of Medical Sciences (Ethics Code: IR.SSU.DENTISTRY.REC.1402.043).

Participants and Sampling Procedure

The study population consisted of all final-year undergraduate dental students enrolled at Shahid Sadoughi University of Medical Sciences. A census sampling method was utilized to ensure comprehensive participation. To enhance the sample size and ensure it accurately represented the group, all eligible students were invited to take part in the study. The primary inclusion criterion was the completion of the mandatory "Systemic Diseases I" course, which covers the pathophysiology and management of cardiovascular diseases. A total of 65 students met this criterion, and all agreed to participate, resulting in a 100% response rate.

Data Collection Instrument

Data were collected using a structured, self-administered questionnaire. The instrument was adapted from a previously validated tool developed by Khozimeh et al. in a similar study conducted at Isfahan University of Medical Sciences, ensuring both its relevance and validity within the context of the Iranian dental curriculum. The questionnaire was divided into two sections:

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Demographic and Academic Information
This section collected data on participants' age (in years), gender, academic semester (11th or 12th), and cumulative grade point average (GPA).

Knowledge Assessment
This section consisted of 18 multiple-choice questions designed to evaluate students' knowledge of dental considerations for patients with various cardiovascular conditions. The questions covered topics such as: Normal and hypertensive blood pressure ranges, Dental management of hypertension, ischemic heart disease, and stable angina, Protocols for patients with a history of myocardial infarction or those on anticoagulant therapy (e.g., aspirin, warfarin), Considerations for patients with pacemakers, Indications for antibiotic prophylaxis to prevent infective endocarditis, based on specific cardiac conditions, Management of anxiety and the use of local anesthetics with vasoconstrictors.

Scoring
A standardized scoring system was applied to the knowledge assessment section. Each correct answer was awarded 1 point, while incorrect responses received 0 points. To account for uncertainty, an "I don't know" response was assigned a partial score of 0.2 points. The total raw score for each participant was then calculated and normalized to a 20-point scale to facilitate interpretation and comparison, in alignment with the reporting in the study's abstract. A score of 12 out of 20 (60%) or higher was predefined as indicating an "acceptable" level of knowledge.

Inclusion and Exclusion Criteria
Inclusion Criteria: 11th and 12th semester students, passing the Systemic Diseases course
Exclusion Criteria: Failure to complete the questionnaire, absence from the data collection session

Study Procedure
The researcher distributed the questionnaires to students in person. Before distribution, the researcher provided a detailed explanation of the study's objectives and procedures. Verbal informed consent was obtained, and were assured of the anonymity and confidentiality of their responses. Participants completed the questionnaires immediately and returned them directly to the researcher to ensure a high response rate and minimize the possibility of external consultation.

Statistical Analysis
Data were analyzed using SPSS version 23.0. Descriptive statistics, including frequencies, percentages, means, and standard deviations, are used to summarize the data. Inferential analyses included the Kolmogorov–Smirnov test to assess normality, independent samples t-tests to compare mean knowledge scores between groups, and Pearson correlation coefficients to examine relationships between knowledge scores and continuous variables. A p-value of less than 0.05 was considered statistically significant.

Results
Demographic Characteristics
A total of 65 senior dental students participated in the study, comprising 29 males (44.6%) and 36 females (55.4%). The mean age of participants was 23.83 ± 2.04 years. Most students were female (55.4%) and enrolled in term 12 (52.3%). Overall, 78.5% of participants demonstrated an acceptable level of awareness regarding dental considerations for patients with cardiovascular conditions.

Table 1. Demographic Profile of Participants

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	29	44.6
	Female	36	55.4
Academic Term	Term 11	31	47.7
	Term 12	34	52.3
Awareness Level	Acceptable (≥13)	51	78.5
	Unacceptable (<13)	14	21.5

Table 1 sup. Frequency distribution of students' responses to knowledge questions

No.	Question	Correct n (%)	I don't know n (%)	Incorrect n (%)	Mean ± SD
1	What effect does patient anxiety have on blood pressure?	4 (6.2)	1 (1.5)	60 (92.3)	0.65 ± 0.00
2	Which of the following is not a side effect of antihypertensive drugs?	43 (66.2)	6 (9.2)	16 (24.6)	0.68 ± 0.00
3	What are the maximum normal systolic and diastolic blood pressure values?	47 (72.3)	3 (4.6)	15 (23.1)	0.73 ± 0.00
4	In an ischemic heart disease patient, which option has a lower risk for jaw surgery?	31 (72.3)	3 (4.6)	31 (47.7)	0.48 ± 0.00
5	Use of epinephrine-containing gingival retraction cords in a patient with stable angina.	47 (72.3)	3 (4.6)	15 (23.1)	0.73 ± 0.00
6	In a patient taking aspirin due to MI, which test should be performed before dental treatment?	29 (44.6)	5 (7.7)	31 (47.7)	0.46 ± 0.00
7	In a patient taking coumarin due to MI, which test should be performed before dental treatment?	25 (38.5)	9 (13.8)	31 (47.7)	0.41 ± 0.00
8	Which of the following is safe for a patient with a pacemaker?	49 (75.4)	1 (1.5)	15 (23.1)	0.75 ± 0.00
9	Which of the following cardiovascular conditions require antibiotic prophylaxis due to the risk of infective endocarditis after dental procedures with bleeding?	48 (73.8)	17 (26.2)	0 (0)	0.79 ± 0.35
9a	Prosthetic heart valve	56 (86.2)	9 (13.8)	0 (0)	0.89 ± 0.27
9b	Previous history of infective endocarditis	41 (63.1)	24 (36.9)	0 (0)	0.70 ± 0.39
9c	Cyanotic congenital heart disease	0 (0)	48 (73.8)	17 (26.2)	0.14 ± 0.08
9d	Mitral valve prolapse with regurgitation	0 (0)	60 (92.3)	5 (7.7)	0.18 ± 0.05
9e	Mitral valve prolapse without regurgitation	0 (0)	58 (89.2)	7 (10.8)	0.17 ± 0.06
9f	Mitral valve prolapse in elderly men	0 (0)	58 (89.2)	7 (10.8)	0.17 ± 0.06
9g	Cardiac pacemaker	0 (0)	58 (89.2)	7 (10.8)	0.17 ± 0.06
9h	Bypass surgery	0 (0)	58 (89.2)	7 (10.8)	0.17 ± 0.06
9i	Physiologic heart murmur	0 (0)	60 (92.3)	5 (7.7)	0.18 ± 0.05
9j	Rheumatic heart disease	0 (0)	55 (84.6)	10 (15.4)	0.17 ± 0.07
9k	Vascular graft or stent (after 6 months)	0 (0)	55 (84.6)	10 (15.4)	0.17 ± 0.07
9l	SLE with/without disorder	0 (0)	52 (80.0)	13 (20.0)	0.16 ± 0.08
10	What should be done for hypertensive patients before dental treatment?	42 (64.6)	0 (0)	23 (35.4)	0.64 ± 0.48
11	If a hypertensive patient becomes anxious during treatment, what should be done?	19 (29.2)	7 (10.8)	39 (60.0)	0.31 ± 0.44
12	For a patient with stable angina, which measure is appropriate for routine dental care?	27 (41.5)	7 (10.8)	31 (47.7)	0.43 ± 0.48
13	How do you manage coagulation tests in MI patients taking anticoagulants?	34 (52.3)	6 (9.2)	25 (38.5)	0.54 ± 0.48
14	If a patient experiences mandibular pain only during	51 (78.5)	5 (7.7)	9 (13.8)	0.80 ±

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No.	Question	Correct n (%)	I don't know n (%)	Incorrect n (%)	Mean ± SD
	activity, what should be done?				0.38
15	What measures are taken before treatment in a patient with tachycardia?	24 (36.9)	9 (13.8)	32 (49.2)	0.39 ± 0.47
16	What is done to reduce anxiety in patients with tachycardia or hypertension?	34 (52.3)	12 (18.5)	19 (29.2)	0.56 ± 0.46
17	How do you use vasoconstrictors in patients with tachycardia, hypertension, or stable angina?	36 (55.4)	9 (13.8)	20 (30.8)	0.58 ± 0.47
18	Patients with congestive heart failure (CHF) are classified into four groups; how do you manage treatment accordingly?	20 (30.8)	15 (23.1)	30 (46.2)	0.50 ± 0.92

Overall Awareness Scores

The average awareness score among participants was 13.04 ± 3.42 out of 20. Based on the predefined threshold, 51 students demonstrated an acceptable level of awareness, while 14 students exhibited lower levels of knowledge. The mean score suggests a moderately good overall knowledge level. However, more than one-fifth of the participants still showed insufficient awareness regarding the safe dental management of patients with cardiovascular conditions.

Table2. Overall Awareness Score Distribution

Statistic	Value
Mean Score	13.04
Standard Deviation	3.42
Minimum Score	6
Maximum Score	20
Acceptable Awareness	78.5% (n = 51)
Unacceptable Awareness	21.5% (n = 14)

Awareness by Gender and Academic Term

Analysis of awareness scores revealed that female students scored slightly higher than male students, though this difference was not statistically significant (P = 0.057). However, a highly significant difference was observed between academic terms, with students in Term 12 demonstrating significantly better awareness compared to those in Term 11 (P < 0.001), indicating a higher level of awareness with academic progression.

Table 3. Comparison of Awareness Scores by Gender and Academic Term

Group	n	Mean ± SD	P-value
Male	29	12.52 ± 3.93	0.057
Female	36	13.48 ± 2.87	
Term 11	31	11.65 ± 3.21	< 0.001
Term 12	34	14.32 ± 2.85	

Correlation Analysis: Age and GPA

A significant negative correlation was found between age and awareness scores (p = 0.008), indicating that younger students exhibited higher levels of awareness. No significant correlation was observed between GPA and awareness.

Table 4. Correlation Between Awareness and Continuous Variables

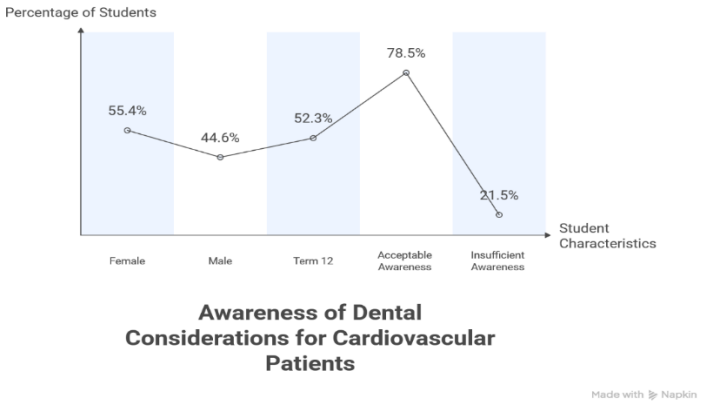
Variable	Correlation Coefficient (r)	P-value	Significance
Age	–0.327	0.008	Significant (inverse)
GPA	0.082	0.327	Not significant

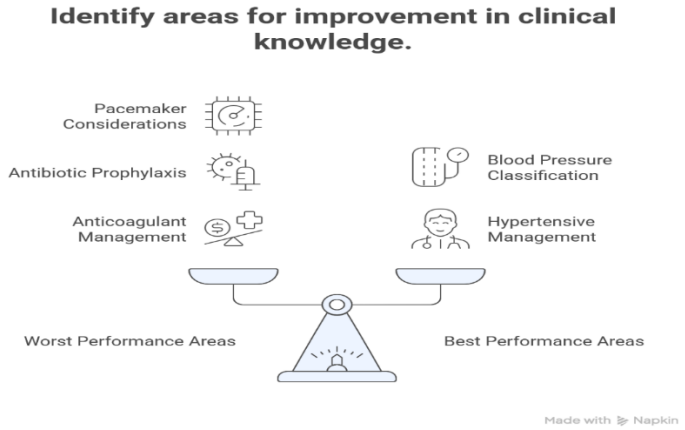
Participants' Performance

As shown in Table 5, the lowest levels of student performance were observed in topics related to pacemaker considerations, antibiotic prophylaxis guidelines, and anticoagulant management. In contrast, the highest performance was noted in blood pressure classification and the management of hypertensive patients.

Table5. Summary Item Analysis of Participants' Performance

Area of Performance	Topic
Lowest performance	Pacemaker considerations
	Antibiotic prophylaxis guidelines
	Anticoagulant management
Highest performance	Blood pressure classification
	Management of hypertensive patients





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Discussion

This study aimed to assess the knowledge of final-year dental students regarding the management of patients with cardiovascular diseases, a critical competency for graduating dentists. The findings indicate that the majority of students (78.5%) at Shahid Sadoughi University of Medical Sciences possessed an acceptable level of knowledge, with a mean score of 13.04 out of 20. This result is encouraging and suggests that the dental curriculum has been largely effective in imparting foundational knowledge. However, the analysis also identified key academic factors, namely, semester level and GPA that significantly influence this knowledge, highlighting areas for potential educational refinement. The level of awareness observed in our study appears favorable when compared to some previous research in Iran. For instance, a study by Aliabadi et al. among general practitioners in Shiraz found that only 25% had high knowledge, while 55% had moderate and 20% had low knowledge. The present study's finding that nearly 80% of students have acceptable knowledge suggests that recent education may be more aligned with current guidelines. Moreover, the present study assessed participants, and not practicing dentists with varying years of experience (23). The most significant finding was the strong association between academic progression and knowledge. Dental students in their 12th and final semester demonstrated substantially higher scores than their peers in the 11th semester, which is an expected and logical outcome, as students in their final semester have had more extensive clinical exposure and have likely completed all relevant didactic coursework, including advanced topics and comprehensive patient care rotations. The findings are consistent with studies by Vinayak et al, which emphasized that students develop a deeper understanding of the oral-systemic link as they advance through their education. This fact reinforces the significance of a spiraling curriculum, where knowledge is not only introduced but also revisited and applied in increasingly complex clinical situations (24). An intriguing and seemingly paradoxical result was the significant inverse correlation between age and knowledge ($r = -0.327$), suggesting that younger students performed better. While this contradicts the general expectation that experience (often correlated with age) enhances knowledge, the specific demographics of our cohort can explain it. In this study, the 12th-semester students, who performed better, were, on average, younger than the 11th-semester students. Therefore, age in this context appears to be a confounding variable for academic level. The knowledge measured here is likely "book knowledge" that is fresher in the minds of students who have more recently covered the material. This contrasts with studies like Sanchez et al., which found no link between age and awareness, but supports the idea that recent education is a powerful factor. It also highlights the critical difference between knowledge and clinical wisdom, which develops over time (25). Our study found no statistically significant difference in knowledge between male and female students ($p=.057$), although females received higher scores. This aligns with a body of literature that shows mixed results on gender-based differences in medical knowledge. While some studies, such as one by Chaudhry et al (26), have suggested minor differences. A comprehensive investigation conducted by Gopinathan et al. concludes that factors like educational level and training are far more predictive of competence than gender. Our finding is congruent with this view (27). Additionally, the positive correlation between GPA and knowledge ($r=0.428$) is a logical outcome. Students who perform better academically across all subjects are more likely to excel in specialized topics as well. This finding is consistent with research by Dwivedi et al., which underscores that diligent and high-achieving students are more likely to master the complex information related to managing medically compromised patients (28). This reinforces the idea that a strong academic foundation is essential for developing specialized clinical knowledge.

Strengths and Limitations

The primary strength of this study is its census sampling method, which included all eligible final-year students, thereby eliminating sampling bias and providing a complete snapshot of this specific cohort. Additionally, the use of a previously validated questionnaire enhances the reliability of our findings. However, the study has several limitations. First, it was conducted at a single institution, which may limit the generalizability of the findings to other dental schools in Iran or internationally. Second, the cross-sectional design allows for the identification of associations but not causation. Third, the assessment was based on a knowledge questionnaire, which may not perfectly

reflect actual clinical decision-making or practical skills. A student's ability to perform under pressure in a real-world emergency may differ from their ability to answer a theoretical question.

Implications for Dental Education

The results of this study suggest that while the current curriculum is providing a solid foundation, dental education could benefit from strategies aimed at ensuring knowledge retention and uniform competency across all students. The significant gap between the 11th and 12th semesters suggests that integrating complex medical management cases earlier and more frequently in the clinical curriculum could be beneficial. Furthermore, given the "freshness" effect of recent learning, the implementation of continuous professional development and refresher courses immediately upon graduation is paramount to prevent knowledge decay as dentists enter practice.

Conclusion

The final-year dental students at Shahid Sadoughi University of Medical Sciences demonstrated an acceptable level of knowledge regarding the dental management of patients with cardiovascular disease. Higher academic standing, as measured by semester level and GPA, was a significant predictor of superior knowledge. The findings highlight the success of the dental curriculum in this area but also emphasize the need for continuous reinforcement of this critical information to ensure that all graduating dentists are fully prepared to provide safe and effective care for this prevalent and high-risk patient population. Given the single-center design, caution should be exercised in generalizing findings to all Iranian dental students.

Ethical Statement

This study was approved by the Ethics Committee of Shahid Sadoughi University of Medical Sciences (IR.SSU.DENTISTRY.REC.1402.043). Participation was voluntary and anonymous.

Acknowledgments

The authors thank the dental students who participated in this study.

Authors' Contributions

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Final Approval

All authors

Conflicts of Interest

The authors declare no conflicts of interest.

Funding

No external funding was received for this study.

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