

Original Research Article

Evaluation of change in knowledge, attitude and adoption of American Heart Association Guidelines (2007) regarding Antibiotic prophylaxis for Infective endocarditis before and after health education among dental interns in a private dental teaching institution in India.

Abstract:

Background: There was paucity of data regarding updating of 2007 AHA (American Heart Association) guidelines among dentists in India. **Objective:** To evaluate change in knowledge, attitude and adoption of AHA (2007) regarding Antibiotic prophylaxis for Infective endocarditis before and after health education among dental interns in a private dental teaching institution.

Materials and method: This was an interventional study conducted among dental interns in a teaching dental institution. Data was obtained using a validated questionnaire that finally had 32 items. Data was obtained by sharing an online link to complete survey. A reminder was also given one week later and participant responses obtained. Each correct response for a question was assigned a score of 1 while incorrect response was scored as zero. Total score was computed for each participant. Health education on AHA 2007 guidelines for antibiotic prophylaxis against infective endocarditis was offered to participants using power point presentation for about 30 -45 minutes on a scheduled day following baseline data collection. Immediately after health education, participants were again requested to fill the same questionnaire used at baseline. Mean knowledge score before and after health education was compared using paired sample t-test.

Results: 74 participants were considered with response rate of 91.4%. Mean knowledge score significantly increased from 11.5 ± 4.3 (Mean \pm Standard deviation) at baseline to 22.9 ± 4.2

post intervention ($p < 0.001$). **Conclusion:** Health education intervention was successful in improving knowledge, attitude and adoption of AHA 2007 guidelines for antibiotic prophylaxis against IE among dental interns.

Key words: American Heart Association (AHA), antibiotic prophylaxis, infective endocarditis (IE), Dental Health Education.

Introduction: Infective endocarditis (IE) is an infection of the endocardium (particularly the valve leaflets) with annual incidence of 3–10 per 100,000. It is characterized by the development of infected heart valve vegetations.¹ It is an uncommon but life threatening infection with noteworthy morbidity and mortality. It occurs despite advances in diagnosis, antimicrobial therapy, surgical techniques, and management of complications. Development of IE is the net result of the complex interaction between bloodstream pathogen with matrix molecules and platelets at sites of endocardial cell damage. Besides, many of the clinical manifestations of IE emanate from the host's immune response to the infecting microorganism.²

The first proposal that IE might be caused by microorganisms was made in 1870's. Literature later confirmed that IE was an infectious disease, and in the late 1800s, it was established that bacteria entering the circulation could colonize damaged heart valves. Osler acknowledged the importance of fibrin and platelet deposition on damaged endocardium and the primary role of microorganisms in pathogenesis. However, the concept that bacteria released into the circulation during invasive dental procedures might cause IE was first put forth by Lewis and Grant in 1923. This was later confirmed in 1935 by Okell and Elliott. They demonstrated that 61% of patients had a positive blood culture for oral viridians group Streptococci following dental extraction. They also established that oral viridans group Streptococci could be isolated

from the vegetations of 40–45% of IE cases¹. Prognosis of IE is poor with an in-hospital mortality of 15-20%, which increases to approximately 30% at 1 year. Prolonged high-dose intravenous antibiotics are the main stay of treatment. However, surgery (valve repair or replacement) is required in 40–50% of cases. Morbidity is high in those who survive, with a significant risk of re-infection or relapse, as well as progressive deterioration in valve function leading to heart failure necessitating further medical and surgical intervention. Under these circumstances of high mortality and morbidity, strategies for prevention have always been a priority¹.

Hirsch et al. demonstrated reduced streptococcal bacteraemia in a group of individuals who received penicillin prophylaxis in comparison with controls, paving the way for the American Heart Association (AHA) to produce the first official guidelines on the use of Antibiotic prophylaxis (AP) in 1955.^{1,2} Subsequently, other international societies such as French recommendations (2002), British Society for Antimicrobial Chemotherapy (2006), National Institute for Health and Clinical Excellence (2008) have published recommendations and guidelines for the prevention of IE.²

One objective of the AHA guidelines was to reduce ambiguities and inconsistencies and to provide more clarity for patients and health care providers.³ After the inception of guidelines, recapitulations have occurred in the years 1957, 1960, 1965, 1972, 1977, 1984, 1990, 1997, 2007. Revised recommendations put forward in 1972 were endorsed for the first time by the American Dental Association (ADA) while emphasizing the importance of maintaining good oral hygiene.² ADA approved revised guidelines for prevention of IE published by the AHA in 2007, were later endorsed by the Canadian Dental Association.³

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Efficacy of antibiotic prophylaxis for infective endocarditis has never been established in a randomized trial. Despite the absence of clear cut evidence (and in conflict with NICE), neither the AHA nor the British Society for Antimicrobial Chemotherapy recommended withdrawal of antibiotic prophylaxis for patients with highest risk. AHA acknowledged that “in patients with certain underlying cardiac conditions associated with the highest risk of adverse outcome from infective endocarditis, prophylaxis for dental procedures may be reasonable, even though its effectiveness is unknown”.⁴

Practices for prophylaxis of infective endocarditis seem set to change. New guidelines aim to provide simple, unambiguous protocols for everyone involved in the care of those few patients at risk of disease.⁴ There seems to be a heterogeneity existing among dentists regarding their interpretation of dental and cardiac conditions for which IE prophylaxis should be used.⁵⁻¹¹ Consensus on their implementation is need of hour to avoid confusion in the minds of health professionals and, most importantly, patients.⁴ A systematic review by Loffler C on effect of interventions which aim to optimize prescription of antibiotics in dental care found that the existing studies were confounded by low quality of scientific reporting and inadequate information on methodology adopted.¹² They concluded that there is urgent need to undertake high-quality research with objective and standardized outcome reporting, longer periods of follow-up, rigorous methodology and adequate standard of study reporting.

In view of paucity of data regarding the updating of 2007 AHA guidelines among dentists in India, the present study was undertaken to evaluate change in knowledge, attitude and adoption of American Heart Association Guidelines (2007) regarding antibiotic prophylaxis for infective endocarditis before and after health education among dental interns in a private dental teaching institution.

Materials and method: This was an interventional study conducted over a period of one month from December 2017-January 2018 among dental interns in a teaching dental institution at Mysuru. Ethical Clearance was obtained from Institutional Ethical Committee (IEC) of the institution. Data was obtained from all available dental interns pursuing their internship in a dental institution during the study period.

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Sample size: It was estimated using nMaster software. Sample size was computed for hypothesis testing for single mean with standard deviation of 1.5, sample mean of 12.5 and population mean at 12, Alpha error 5%, 80% power. It was estimated to be 71. However, sample size was rounded off to 80 anticipating 10% non-response.

Informed consent and eligibility criteria: All participants were given an online link to participate in the survey. The first page of the survey provided information about the rationale, objectives and basic methods that will be used in the research and about the methods adopted by investigator to ensure individual confidentiality. Only those participants who expressed consent were allowed to answer items in subsequent section of the survey. All interns pursuing internship in the dental institution at the time of study who are willing to participate and gave informed consent were invited to participate. Incomplete questionnaires were not considered for data analysis.

Validation of questionnaire: Data was obtained using the modified version of a validated questionnaire developed by Jain M et al (2015)³. Modified questionnaire in English language containing 36 items was subjected to face validation by two subject experts in public health dentistry following which two items were removed from the questionnaire for lack of relevance. Questionnaire was then subjected to content validation by another two subject experts where the

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subject experts were asked to grade each item in the questionnaire for its relevance, appropriateness and clarity on a scale of 1-5 (1 being most unfavorable response and 5 being most favorable response). One item was removed for lack of appropriateness and one item for not being clear. The final questionnaire had 32 items. Cognitive interviewing was done on a convenient sample of 10 people and necessary modifications were done based on their suggestions to facilitate correct interpretation of items. Then, the questionnaire was checked for its reliability, before being used for data collection in the study, on a convenient sample of 10 prospective participants using test retest reliability assessment. The Cronbach's alpha was 0.93 demonstrating a substantial reliability of items. Questionnaire is attached as Annexure 1.

Data collection: Then, the final questionnaire containing 32 items was shared with an online link which was communicated to e-mail IDs of all the participants. A reminder was also given one week after the initial date of contact. Baseline data on knowledge, attitude and adoption of American Heart Association 2007 guidelines on antibiotic prophylaxis for infective endocarditis was collected by pooling participant responses obtained one week after the reminder. Each correct response for a question was assigned a score of 1 while incorrect response was scored as zero. Correct and incorrect responses were finalized in accordance with AHA 2007 guidelines. For those items in the questionnaire with "yes" as correct response, other options like "no, sometimes, and don't know" were considered as incorrect. For items with "no" as correct response, other options like "yes, sometimes, and don't know" were considered as incorrect. The total score for each participant in each section of the questionnaire was computed and used for analysis. Health education on American Heart Association 2007 guidelines for antibiotic prophylaxis against infective endocarditis using power point presentation was given to the participants for about 30 -45 minutes on a scheduled day following baseline data collection.

Immediately after health education, participants were again requested to fill the same questionnaire used at baseline. After completion of the survey, the resource material on American Heart Association 2007 guidelines on antibiotic prophylaxis for infective endocarditis was shared in pdf format.

Statistical analysis: Data analysis was done using SPSS software version 22. Paired t-test was used for comparing the mean change in knowledge response scores before and after health education. Mc Nemar Chi square test was used for comparing the change in frequency of knowledge responses between baseline and post intervention. The statistical significance was fixed at 0.05.

Results: The online questionnaire was shared among 81 dental interns who were pursuing their internship following completion of four years of undergraduate training in dentistry. 78 interns responded during baseline data collection. After health education, same online questionnaire which was used at baseline was shared among 78 participants who completed baseline questionnaire. Among these 78 participants, 74 responded during post intervention data collection. Response rate was 91.4%. Among 74 participants, 08 (10.8%) were males and 66 (89.2%) were females, 61 (82.4%) were females and 13 (17.6%) were males. All these participants had completed their graduation after 2007 (table 1).

Change in mean knowledge score: Mean knowledge score significantly increased from 11.5 ± 4.3 (Mean \pm Standard deviation) at baseline to 22.9 ± 4.2 post intervention ($p < 0.001$). These results were true even when a separate comparison was done among male and female participants (table 2).

Comment [AV4]: Rewrite the sentence as per gender and age wise.

Comment [AV5]: They have completed their graduation after 2007, but they were doing internship in the year 2017-18 as stated under materials and methods section?

Summary of knowledge responses regarding consideration of dental procedures: There was a significant increase in the number of interns willing to recommend (given yes response) antibiotic prophylaxis for IE while undertaking dental procedures such as Restoration of gingival (class II) carious lesion, Endodontic treatment, Periodontal surgery and Tooth extraction (which require prophylaxis according to AHA 2007 guidelines) from baseline (27%, 71.6%, 85.1%, 86.5%) to post intervention (75.7%, 86.5%, 97.3%, 87.8) respectively. Interns not willing to recommend (given no response) antibiotic prophylaxis for IE while undertaking dental procedures such as Coverage for an exfoliating primary tooth, Tooth preparation with associated impression, Placement of a stainless steel crown on a primary tooth (which does not warrant prophylaxis according to AHA 2007 guidelines) at baseline significantly increased from 55.4%, 71.6%, 62.2% to 86.5%, 89.2%, 87.8% respectively (table 3).

Summary of knowledge responses regarding consideration of cardiac conditions: Interns willing to recommend (given yes response) antibiotic prophylaxis for IE before undertaking invasive dental procedures in patients with cardiac conditions such as Prosthetic cardiac valve, Previous history of Infective Endocarditis, Unrepaired cyanotic (“blue baby”) congenital heart disease after a shunt operation, Completely repaired congenital heart defects with prosthetic material or device during the first 6 months after the cardiac procedure, Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch and Cardiac transplantation recipients who develop cardiac valvulopathy (which require prophylaxis according to AHA 2007 guidelines) at baseline significantly increased from 58.1%, 83.8%, 52.7%, 54.1%, 2.6%, 71.6% to 94.6%, 94.6%, 87.8%, 90.5%, 93.2%, 87.8% respectively. Interns not willing to recommend (given no response) antibiotic prophylaxis for IE before undertaking invasive dental procedures in a patient with cardiac conditions such as Innocent (“functional” or “physiologic”) heart

murmur, Patent ductus arteriosus, Mitral valve prolapse with mitral regurgitation, Rheumatic fever with mitral regurgitation, Moderate aortic stenosis, Hypertrophic cardiomyopathy, Cardiac pacemakers, and Small unrepaired ventricular septal defect (which does not require prophylaxis according to AHA 2007 guidelines) at baseline significantly increased from 39.2%, 28.4%, 14.9%, 16.2%, 24.3%, 21.6%, 12.2%, 14.9% to 87.8%, 85.1%, 86.5%, 82.4%, 87.8%, 82.4%, 60.8%, 47.3% respectively (table 4).

Summary of knowledge responses regarding antibiotic regimen: Interns who responded correctly at baseline that they would prescribe Amoxicillin 2g as their choice of orally administered antibiotic increased from 13.5% to 86.5%. Those who opted for Ampicillin 2g as a choice of parenterally administered antibiotic in a patient who is unable to take medication orally increased from 23% at baseline to 81.1% post intervention. Cefazolin or Ceftriaxone 1g IM or IV as the choice of parenterally administered antibiotic in a patient who is allergic to penicillins or ampicillin and unable to take medication orally was answered correctly by 24.3% of interns at baseline and it increased to 79.7% post intervention. Those who prescribe Clindamycin 600 mg as the choice of parenterally administered antibiotic other than Cephalosporins in a patient who is allergic to penicillins or ampicillin and unable to take medication orally at baseline has increased from 27% at baseline to 90.5% post intervention. 28.4% of interns at baseline had opted for Cephalexin 2g as the choice of orally administered Cephalosporin antibiotic in a patient who is allergic to penicillins or ampicillin which increased to 77% post intervention and those who prescribe Clindamycin 600 mg or Azithromycin 500 mg /Clarithromycin 500mg as the choice of orally administered antibiotics other than Cephalosporins in a patient who is allergic to penicillins or ampicillin increased from 29.7% at baseline to 87.8% post intervention (Table 5).

Discussion:

Infective Endocarditis caused either due to dental, respiratory, gastrointestinal tract and urinary tract procedures is associated with substantial morbidity and mortality. Prevention strategies should always be a priority to avoid such life threatening complication. Antibiotic prophylaxis prevents viridians group streptococcal IE, as these microorganisms are usually susceptible to recommended antibiotics which prevent their entry into blood stream (reduced bacteremia). Patients with cardiac pathologies are on the rise these days and such patients visit dental clinics to avail services for various oral diseases. Dentists should be responsible enough to prevent such medical complications which keep the patient's health at stake. Very few studies were available in the literature which assessed updating of guidelines given by American Heart Association in the year 2007 regarding antibiotic prophylaxis against Infective Endocarditis among dentists. Limited body of evidence suggests that there was heterogeneity in knowledge and prescribing practices among dental practitioners. Besides, no interventional studies which were aimed at enhancing existing knowledge and interpretation among dentists were available and studies regarding the updating of AHA guidelines (2007) on antibiotic prophylaxis for IE among dentists in India were almost non-existent. In this background, the present study was undertaken to evaluate change in knowledge, attitude and adoption of American Heart Association Guidelines (2007) on Antibiotic prophylaxis for Infective endocarditis before and after health education among dental interns in a teaching dental institution in India.

Dental interns were selected as study participants as they were supposed to start dealing with patients on their own after completing four years of professional undergraduate training in dentistry. In India Bachelor in Dental Surgery (BDS) degree will be awarded after completion of four years undergraduate dental training and one year compulsory rotary internship. After this, they will be called as professional dentists, who then are allowed to practice and offer oral health

services on their own by registering in their respective state dental councils. Internship program provides opportunity for real patient exposure to students who come across and manage patients with different oral health problems, thereby making them confident of tackling all kinds of situations in the near future. Considering these aspects, dental interns were regarded as the ideal target group for this kind of dental educational intervention program which aimed at improving and updating their existing knowledge.

In the present study, mean knowledge response scores among dental interns significantly improved following health education on AHA guidelines 2007 regarding antibiotic prophylaxis for IE. Lower knowledge score prior to health education could be due to their lack of understanding of the importance of antibiotic prophylaxis for IE while performing dental procedures in patients with some cardiac conditions at risk for IE, unawareness of the latest guidelines published by AHA in 2007, less exposure to patients with cardiac pathology requiring dental procedures, and if at all exposed, avoiding such patients due to lack of confidence and responsibility thinking like treating such medically compromised cases is beyond their standards. If they were to be exposed to such cases and were asked to treat, they would have learnt about precautions to be taken while treating those patients anticipating post-operative complications. Studies by Jain P et al (2015)³, Zadik Y et al (2008)⁶, Coutinho AC et al (2009)⁷, Doshi D et al.¹³ and others¹⁴⁻¹⁶ have assessed the knowledge and interpretation of AHA 2007 guidelines among dental professionals. It was concluded in these studies that the level of knowledge on new guidelines on antibiotic prophylaxis for preventing infective endocarditis among dental practitioners to be low necessitating continuing dental education programs to update their existing knowledge.

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Study witnessed a significant improvement in the knowledge levels pertaining to dental procedures and specific cardiac conditions where antibiotic prophylaxis is definitely indicated while reducing the frequency of needless recommendation of antibiotic prophylaxis for certain dental procedures such as coverage for an exfoliating primary tooth, Tooth preparation with associated impression, Placement of a stainless steel crown on a primary tooth as well as for certain cardiac conditions such as Innocent (“functional” or “physiologic”) heart murmur, Patent ductus arteriosus, Mitral valve prolapse with mitral regurgitation, Rheumatic fever with mitral regurgitation, Moderate aortic stenosis, Hypertrophic cardiomyopathy, Cardiac pacemakers, and Small unrepaired ventricular septal defect where such prophylaxis may not be essential. There was a significant improvement in the number of correct responses regarding antibiotic regimen to be followed like choice of antibiotics, their dosage, route and time of administration in an adult and children. The improvement could be attributed to the fact that the dental interns have understood the importance of correctly prescribing antibiotic prophylaxis where it is indicated to prevent the risk of IE while avoiding unnecessary prescription for simple procedures which may inadvertently increase the risk for antimicrobial drug resistance. Interesting case scenarios would have made interns to apply their knowledge while creating interest and this might have facilitated them to improve their attitude towards correct prescription while adopting them in their routine practice. Schmalz G et. al¹⁷ in their study to evaluate an educational concept for risk-oriented prevention applied by fifth-year undergraduate dental students concluded that there was an improvement in self-perceived skills and the knowledge among undergraduate dental students through education on risk-oriented prevention. Our findings were similar to the results of this study. This was the first of its kind study among interns in a dental institution in India where an attempt was made to evaluate the effectiveness of dental health education in enhancing the

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knowledge among interns on the AHA guidelines. Hence, we could not compare our findings with other similar studies.

Novelty: Adoption of Google forms rather than self-administered questionnaire required only limited resources in terms of money, manpower, material and time. Response rate was good as the research question was clinically relevant with significant public health significance and provided flexibility to complete questionnaires using their mobile phones.

Limitations: The study involved interns from one dental institution and involvement of interns from all other dental institutions in the region could have enhanced the external validity of the research. The post intervention evaluation was immediate which would have been repeated after 6 months to one year to check their application in the routine practice of these interns.

Conclusion: Health education intervention was successful in improving the knowledge, attitude and adoption of AHA 2007 guidelines for antibiotic prophylaxis against IE among dental interns. Dentists should have updated knowledge regarding guidelines such as AHA that can be adopted for antibiotic prophylaxis against IE. This type of customized training should begin early in their academic program. A customized training module on Basic Life Support which includes other vital aspects of clinical practice such as specific updated guidelines on antibiotic prophylaxis to prevent infective endocarditis could be considered as a value addition to the existing curriculum. This is especially important for public health dentists who frequently indulge in the delivery of oral health care services in remote areas using mobile and portable dental equipment.

Recommendations: Dental Councils of respective countries should consider renewal of licenses of registered dentists only on strict compliance of continuing dental education on updated concepts at least once in every five years. Dental interns should mandatorily undergo such

training before their internship is complete. This will help in making them realize the importance of avoiding unnecessary antibiotic load which can exaggerate the antimicrobial drug resistance.

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Table 1: Demographic details of study participants:

Characteristic		Frequency (percentage) N (%)	Total N (%)
Gender	Males	08 (10.8)	74 (100)
	Females	66 (89.2)	
Age	≤23 years	61 (82.4)	74 (100)
	>23 years	13 (17.6)	
Year of completion of final BDS	Before 2007	0 (0)	74 (100)
	After 2007	74 (100)	

Table 2: Mean knowledge score (correct responses) of the study participants at baseline and post intervention:

Gender	Baseline Mean ± SD	Post intervention Mean ± SD	Statistical inference
Males	14.5 ± 4.1	26.8 ± 3.5	t value:-7.88 df:07 p value:0.00
Females	11.1 ± 4.2	22.5 ± 4.1	t value:-16.48 df:65 p value:0.00
Total	11.5 ± 4.3	22.9 ± 4.2	t value:-18.03 df:73 p value:0.00

* Paired t test applied

Table 3: Summary of knowledge responses regarding consideration of dental procedures while recommending antibiotic prophylaxis for infective endocarditis in patients with cardiac conditions at risk for developing IE among dental interns at baseline and post intervention:

S.No	Dental procedures	Baseline N (%)	Post intervention N (%)	p value
1*	Restoration of gingival (class II) carious lesion	20 (27)	56 (75.7)	< 0.05
2*	Endodontic treatment	53 (71.6)	64 (86.5)	
3*	Periodontal surgery	63 (85.1)	72 (97.3)	
4*	Tooth extraction	64 (86.5)	65 (87.8)	
5#	Coverage for an exfoliating primary tooth	41 (55.4)	64 (86.5)	
6#	Tooth preparation with associated impression	53 (71.6)	66 (89.2)	
7#	Placement of a stainless steel crown on a primary tooth	46 (62.2)	65 (87.8)	

➤ Mc Nemar Chi square test is applied.

* 1-4: Frequencies and percentages of those who said yes for recommendation are given.

5-7: Frequencies and percentages of those who said no for recommendation are given.

Table 4: Summary of knowledge responses regarding consideration of cardiac conditions while recommending antibiotic prophylaxis for infective endocarditis before undertaking an invasive dental procedure among dental interns at baseline and post intervention:

S.No	Cardiac conditions	Baseline N (%)	Post intervention N (%)	p value
1*	Prosthetic cardiac valve	43 (58.1)	70 (94.6)	< 0.05
2*	Previous history of Infective Endocarditis	62 (83.8)	70 (94.6)	
3*	Unrepaired cyanotic (“blue baby”) congenital heart disease after a shunt operation	39 (52.7)	65 (87.8)	
4*	Completely repaired congenital heart defects with prosthetic material or device during the first 6 months after the cardiac procedure	40 (54.1)	67 (90.5)	
5#	Innocent (“functional” or “physiologic”) heart murmur	29 (39.2)	65 (87.8)	
6#	Patent ductus arteriosus	21 (28.4)	63 (85.1)	
7#	Mitral valve prolapse with mitral regurgitation	11 (14.9)	64 (86.5)	
8#	Rheumatic fever with mitral regurgitation	12 (16.2)	61 (82.4)	
9#	Moderate aortic stenosis	18 (24.3)	65 (87.8)	
10#	Hypertrophic cardiomyopathy	16 (21.6)	61 (82.4)	
11#	Cardiac pacemakers	09 (12.2)	45 (60.8)	
12#	Small unrepaired ventricular septal defect	11 (14.9)	35 (47.3)	
13*	Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch	01 (2.6)	69 (93.2)	
14*	Cardiac transplantation recipients who develop cardiac valvulopathy	53 (71.6)	65 (87.8)	

➤ Mc Nemar Chisquare test is applied.

* 1-4, 13-14: Frequencies and percentages of those who said yes for recommendation are given.

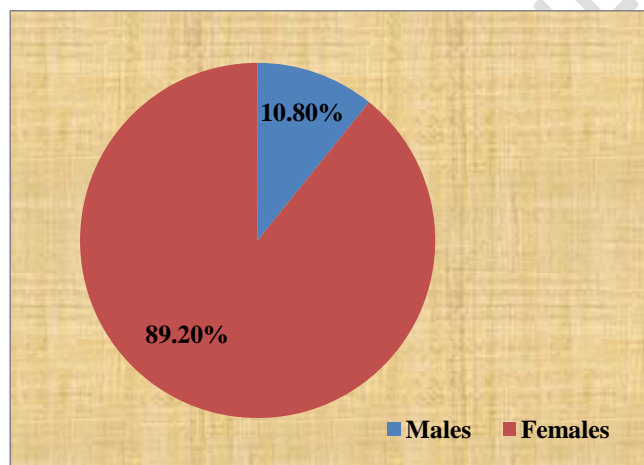
5-12: Frequencies and percentages of those who said no for recommendation are given.

Table 5: Summary of knowledge responses regarding antibiotic regimen to be followed while recommending antibiotic prophylaxis for infective endocarditis before undertaking an invasive dental procedure in a patient with cardiac conditions at risk for developing IE among dental interns at baseline and post intervention:

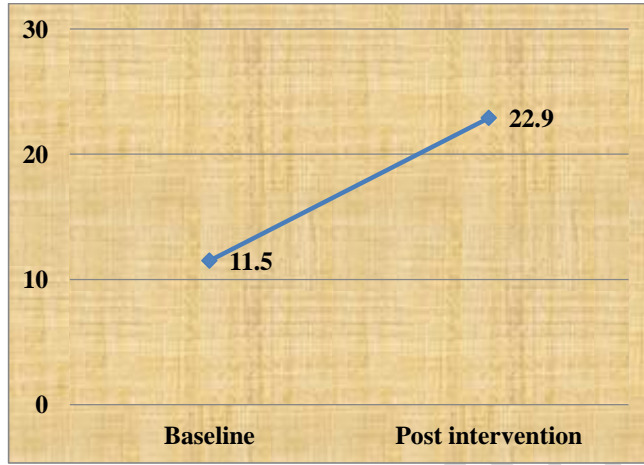
S.No	Antibiotic regimen to be followed in the given scenario	Baseline N (%)	Post intervention N (%)	p value
1	What would be your choice of orally administered antibiotic?	10 (13.5)	64 (86.5)	< 0.05
2	What would be your choice of parenterally administered antibiotic in a patient who is unable to take medication orally?	17 (23)	60 (81.1)	
3	What would be your choice of parenterally administered antibiotic in a patient who is allergic to penicillins or ampicillin and unable to take medication orally?	18 (24.3)	59 (79.7)	
4	What would be your choice of parenterally administered antibiotic other than Cephalosporins in a patient who is allergic to penicillins or ampicillin and unable to take medication orally?	20 (27)	67 (90.5)	
5	What would be your choice of orally administered Cephalosporin antibiotic in a patient who is allergic to penicillins or ampicillin?	21 (28.4)	57 (77)	
6	What would be your choice of orally administered antibiotics other than Cephalosporins in a patient who is allergic to penicillins or ampicillin?	22 (29.7)	65 (87.8)	

- Mc Nemar Chisquare test is applied and frequencies and percentages of those who gave correct response for the given situation is given.

Pie diagram 1: Gender distribution of study participants:



Line diagram 1: Comparison of mean knowledge response scores among study participants at baseline and immediately after intervention:



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