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Opinions, knowledge and strategy towards occlusal dental caries diagnosis and its management among the undergraduate dental students in Tamil Nadu

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ABSTRACT

Objective: The aim of the study was to assess the occlusal caries diagnosis and treatment strategies adopted by undergraduate dental students in dental colleges in Tamil Nadu, India.
Methods: Randomly selected 7 dental institutions in Tamil Nadu state India were sent a pre-tested 12 items questionnaire designed to assess the opinion and strategy adopted for occlusal dental caries diagnosis and its management. Total of 420 undergraduate dental students whom have finished clinical postings in department of conservative dentistry and endodontics participated in the study. Chi square tests employed to test for the relationship between various years of students to their answers.
Results: The results of this study show that there is disparity among the strategies adopted between third, fourth year and internship students for diagnosis and treatment for dental caries. More number of fourth year and intern students answered correctly for the questions, which is to be expected as they have greater amount of clinical exposure than third year students.
Conclusions: The results of this study show gap in caries education in our system, this is mainly because of relying on older and outdated method of caries detection and classification. Management strategy of caries lesion is also greatly towards only restoration of tooth, with very little emphasize on either caries risk assessment or remineralization strategy.

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1. Introduction

Dental caries assessment has undergone a lot of change and caries education needs also to be updated with these advancements.[1,2] Black's cavity preparation principles have long guided dentists' diagnosis and restorative strategies, but in recent years better understanding of the carious process has changed operative treatment philosophies: now, preventive strategies involving fluoride and remineralization are preferred, and operative treatments are undesirable unless the carious lesion has reached an advanced stage of cavitation.[3] Dental Caries education in India has only been studied and reported in very few studies.[4,5] Shortcomings in dental

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undergraduate students training like lack of training in managing a comprehensive treatment plan for a patient, lack of follow up of patient treatment care and lack of interdisciplinary approach to treatment planning to address entire needs of patients has been reported in these earlier studies.[4] Also with regard to restorative dentistry training traditional amalgam restoration is still standard of care in posterior teeth, while in other countries more recently introduced composite resin restorations have taken over.[5] Also 2013 the Minamata Convention on mercury committed to a worldwide reduction and elimination of products containing mercury, this has impacted restorative dentistry with global calling for phasing out of amalgam restorations. With this background and with changes in dental caries assessment and management strategies which has evolved and changed in great deal from G.V. Black days, the present study was necessitated. No studies to date have been undertaken with regard to dental caries assessment and management strategy adopted among dental students of Indian institutions. Importance with regard to undergraduate students being exposed to recent advancements in dental caries assessment and management strategy cannot be overemphasized.

The purpose of this study was to assess the occlusal caries diagnosis and treatment strategies adopted by undergraduate dental students in dental colleges in Tamil Nadu, India. The null hypotheses for this study was there could be no significant difference of strategy in caries assessment among different levels of students.

2. Materials and methods

Randomly selected 7 dental institutions picked up by lot from different regional zones in Tamil Nadu state, India were sent a pre-tested 12 items questionnaire designed to assess the opinion and strategy adopted for occlusal dental caries diagnosis and its management. Institutional review board approval and informed consent from participants were obtained. The questionnaire was designed in accordance to prescribed caries assessment and management strategy by ICDAS II and other authors.[6–8] Questionnaire was pre tested for validity and clarity on a sample 60 students prior to study procedure. Total of 420 undergraduate dental students whom have finished clinical postings in department of conservative dentistry and endodontics participated in the study, 20 students from each third, fourth year and interns participated from each individual college. In-complete answered questions will be taken as lack of knowledge pertaining to the item concerned. The questionnaire was administered to the students after a description of the survey, and the same was collected after a prescribed time of 1 h for answering the questions. To preserve the anonymity of the participants no personal details were collected except for gender.

Since the questionnaires were administered through the dental college faculty to the students, hundred percent respondent rates was achieved. The questionnaire had questions relating to two areas of dental caries, one about diagnosis strategy and classification of dental caries and second part about caries management strategy.

Questions 1–6 were designed to test about knowledge about basic dental caries assessment and diagnosis. Questions 7–9 were designed to know about the advanced level of caries assessment such as about differentiating between active and inactive carious lesion, caries classification or scoring system they are familiar with. Question item 10 was having colour illustrations of occlusal dental caries of varying stages from incipient to advanced stage and asked about the earliest lesion at which to be diagnosed and intervened by restoration. Question item 11 asked about the adequacy of visual and tactile method for dental caries evaluation. Question item 12 asked about the importance or risk of whether to restore all the teeth even though they are sound and leaving some teeth unfilled even if they have dental caries. Questions 13 and 14 were asking about the caries risk assessment and what system of caries risk assessment being employed.

In this study all the variables to be assessed were qualitative in nature, thus the data analysis were done with Chi square tests to evaluate for the relationship between various years of students to their responses. SPSS 11.0 (IBM Corp.,) statistical software was used for descriptive and statistical analysis of the data.

3. Results

Among the 420 participants in this study, 290 (69%) were female and 130 (31%) were male students.

Tables 1–3 show the frequency of students' responses to different questions and chi square test results of their selected options respectively. More number of students answered that they would opt for clean and dry tooth for dental caries diagnosis, with significantly ($p < 0.05$) higher fourth year students and least from third year students (Table 1). Of the method which they would prefer for cleaning the tooth vast majority of students opted for air syringe method (Table 2).

Slightly higher majority of students answered that they could be able to differentiate enamel caries and dentinal caries, with significantly ($p < 0.05$) higher number of fourth year students and least number of third year students (Table 1). For enamel caries visual and tactile criteria, higher number of students answered they would look for discolouration and catch with probe respectively (Table 2). In dentinal caries visual and tactile criteria, higher number of students answered they would look for discoloured dentine and pain or sensitivity on probing respectively (Table 2). For both enamel and dentinal caries higher number of responses was for tactile criteria with probing.

Majority of students answered discolouration and cavitated lesion will be helping for dental caries visual assessment (Table 3). And for dental caries tactile criteria majority of students answered catch with the probe and sensitivity on probing as helping them identify caries lesion (Table 3).

Majority of students (82.38%) answered that they would use sharp probe for routinely detecting occlusal caries and with least number of students answering no for use of sharp probe for detecting catch (Table 1).

For the question which criteria you rely most upon for detecting caries majority of students (90%) answered they would rely on combination of visual and tactile criteria

Table 1 – Dental students responses to closed choice questions.

	Year of study			*p*-Sig.
	3rd BDS Percentage of responses	Final BDS Percentage of responses	Intern Percentage of responses	
Clean and dry tooth				
No	45.0%	14.3%	21.4%	0.000
Yes	55.0%	85.7%	78.6%	
Difference between enamel and dentine caries				
No	48.6%	33.6%	42.9%	0.000
Yes	51.4%	66.4%	57.1%	
Which Criteria to use				
Visual criteria	13.6%	0.0%	1.4%	0.000
Tactile criteria	5.7%	4.3%	5.0%	
Combination of both	80.7%	95.7%	93.6%	
Usage of probing				
No	9.3%	2.1%	0.0%	0.000
Yes	73.6%	81.4%	92.1%	
Occasionally	17.1%	16.4%	7.9%	
Difference between active and inactive caries				
No	78.6%	60.7%	57.9%	0.000
Yes	21.4%	39.3%	42.1%	
Visual and tactile criteria sufficiency				
Not sufficient	70.7%	66.4%	51.4%	0.000
Sufficient	29.3%	33.6%	48.6%	
Earliest caries diagnosis				
A	72.1%	57.9%	46.4%	0.000
B	27.9%	37.9%	50.0%	
C	0.0%	3.6%	3.6%	
D	0.0%	0.7%	0.0%	
E	0.0%	0.0%	0.0%	
Earliest operative intervention				
A	2.1%	5.0%	3.6%	0.000
B	32.1%	58.6%	33.6%	
C	61.4%	35.0%	61.4%	
D	0.7%	0.0%	1.4%	
E	3.6%	1.4%	0.0%	
Importance regarding caries management				
Fill all teeth	45.7%	37.1%	55.0%	0.000
Not to fill all teeth	25.7%	12.9%	15.7%	
Both important	28.6%	50.0%	29.3%	
Use of caries risk assessment				
No	77.9%	88.6%	91.4%	0.000
Yes	4.3%	5.0%	0.7%	
Occasionally	17.9%	6.4%	7.9%	

Table 2 – Dental students responses to multiple responses questions.

Year of study	Method of cleaning tooth		Enamel caries visual criteria		Enamel caries tactile criteria		Dentine caries visual criteria		Dentine caries tactile criteria	
	Air syringe	Cotton	Discoloration	Cavitations	Catch with probe	Texture	Discolour dentine	Cavity dentine	Sensitivity on probing	Catch with probe for dentine caries
Third BDS										
Percentage of responses within year	58.4%	26.0%	77.9%	39.7%	60.9%	45.7%	62.5%	.0%	77.0%	8.2%
Final BDS										
Percentage of responses within year	70.0%	40.8%	72.0%	29.0%	72.8%	9.8%	58.1%	59.1%	75.3%	26.9%
Intern										
Percentage of responses within year	67.3%	43.6%	93.8%	32.5%	96.2%	2.5%	68.8%	55.0%	90.0%	27.5%

Table 3 – Dental students responses to multiple responses questions.

	Dental caries visual criteria		Dental caries tactile criteria		Caries classification		Caries risk assessment		
	Discoloration	Cavity presence	Catch with probe	Sensitivity on probe	G.V. Black	Mount and Hume	Saliva testing	Oral hygiene	Diet
Third BDS									
Percentage of responses within year	74.3%	75.0%	60.0%	56.4%	98.6%	9.3%	25.8%	38.7%	16.1%
Final BDS									
Percentage of responses within year	93.6%	63.6%	76.4%	60.0%	98.6%	7.9%	31.3%	68.8%	68.8%
Intern									
Percentage of responses within year	100.0%	70.0%	84.3%	57.1%	98.6%	5.7%	91.7%	0.0%	41.7%

(Table 1). Statistically significant number of fourth year and intern students answered they would rely upon combination of criteria for caries evaluation than compared to third year students (Table 1). Statistically significant number of third year students answered they would rely mostly upon visual criteria than fourth year and intern students (Table 1).

Majority of students' (65%) answered that they will not be able to differentiate between active and inactive caries (Table 1). Statistically significant number of third year students answered they will not be able differentiate active and inactive caries than fourth year and intern students (Table 1).

Almost all of the students equally among all the years of study answered that they use G.V. Black classification for dental caries classification (Table 3). Next classification that was known to students was Mount and Hume classification (Table 3).

For question with picture illustrations about the earliest stage at which you will diagnose caries, it was seen that higher number of students answered for illustration A followed by B (Table 1). Statistically significant number of third year students answered for earliest stage at which diagnose caries as illustration A, and higher number of intern students answered for illustration B (Table 1). For second sub question with illustrations for earliest stage at which you will opt for restoration, it was seen that higher number of students answered for illustration C followed by B (Table 1). Statistically significant number of fourth year students answered they will opt for earliest operative intervention in illustration B, than compared to third year and intern students (Table 1).

For the question whether visual and tactile criteria will be sufficient for coronal caries assessment, higher number of students answered it will not be sufficient (Table 1). Whereas higher number of intern students answered that visual and tactile criteria will be sufficient than compared to other years' students (Table 1).

For the question which is important with regard to caries management, it was seen that higher number of students (46%) answered that they would fill all teeth even if it means restoring some sound teeth (Table 1). Among the different years of students it was seen that statistically significant number of intern students answered they would fill all teeth, whereas least number of fourth year students answered for option filling all teeth and opted for option that both strategy are important (Table 1).

Almost all of students answered that they do not assess the caries risk of patient (Table 1). Among the students who answered yes for caries risk assessment it was seen that, higher number of students opted for oral hygiene, diet and saliva testing parameters for caries risk assessment (Table 3).

4. Discussion

The results of this study show that there is disparity among the strategies adopted between third, fourth year and internship students for diagnosis and management of dental caries. More number of fourth year and intern students answered correctly for the questions, which is to be expected as they have greater amount of clinical exposure than third year students. Gentle blast of air from three-in-one syringe has been shown to be effective for making tooth dry prior to caries examination.[6] The results of this study also show that students prefer air syringe for clean/dry tooth. Depth of caries penetration assessment is important with regard to reading of the severity of lesion, and also determining operative intervention.[7] Dentinal invasion with cavitation is minimum stage at which operative intervention of caries lesion is recommended, as even full depth enamel lesion without cavitation has been shown to be able to remineraiized.[8] So assessment of depth to which caries lesion has penetrated needs to be done, but results of this study reveal more reliance on probing than visual criteria for differentiating enamel and dentinal caries lesion by students, might well lead to more number of non-cavitated early enamel lesions with subtle colour difference remaining undetected and higher number of sound teeth being restored; thus leading to erroneous assessment of depth of caries lesion. The results of this study reveal, that the caries assessment strategy adopted by students in differentiating enamel and dentine caries is old and with greater reliance on tactile criteria than compared to visual criteria. Contemporary usage of probe serves two purposes: first, to remove the bio film (using the side of the

probe) to check for signs of demineralization and surface break and, secondly, to 'feel' the surface texture of a lesion, as sensed through minute vibrations of the instrument by the supporting fingers when moving the tip of the probe at an angle of 20–40° across the surface.[6] But results of this study show more proportion of senior students, i.e., fourth year and intern students were more aggressive in their usage of probe for tactile evaluation of dental caries for catch and sensitivity, this might be because of peer influence as they progress towards senior years. Third year students are more reluctant with usage of tactile criteria and rely higher upon visual criteria for caries assessment. Traditional use of probe as answered by students in this study, to attack caries lesion by way of looking for ''catch'' with moderate to firm pressure has been to shown to cause intact subsurface caries lesion into frank cavity and not improve the accuracy of diagnosis.[9–11] Eyes of dental operator has been documented to have remarkable ability to assess degree of mineral loss, lesion depth and activity, and studies have shown that assessing for non-cavitated lesion does not reduce examiner reliability provided examiners are thoroughly trained and calibrated.[12] But excluding out non-cavitated lesion diagnosis from caries recording system as could happen here because of greater reliance on usage of probe, has been shown to missing out on half of total caries incidence.[13–15] Also contemporary caries evaluation requires differentiating between active and inactive lesion, but results of this study shows that students are not able to differentiate active and inactive caries lesion.[16] According to Baelum et al. (2008) good caries diagnostic approach requires selection of visual and tactile method that incorporates appreciation of active and in-active caries lesion to determine management options.[17] G.V. Black classification was almost the universal classification adopted for caries categorization in this study, this has many drawbacks as usage of this classification does not allow for caries categorization into active or inactive lesions and per se it was classification for cavity design rather than caries lesion.[18] Most of caries diagnosis strategies answered by students in this study are because of greater reliance on G.V. Black caries classification.

For question with clinical pictorial illustrations, the results showed greater variation in answers among the three years of students. For question on earliest stage at which caries to be diagnosed, results showed that more intern students diagnose caries at a later stage than compared to third final year students. And more final year students opted for operative intervention at earlier stage of caries progression than third year and intern students, even though they opted for both risks of restoring caries affected teeth and preserving sound teeth are equally important in the next question. This was in contrary to a study by Stéphanie Tubert-Jeannin et al. (2004) where more number of dentists who preferred for management of risk strategy of restoring all teeth, opted to intervene operatively for caries lesion confined to enamel than dentists who preferred for both risks to be equally important.[18] This variation might be because of education system and relying greater upon tactile evaluation for caries assessment and subject samples being students in our study. And also because of reason that fourth year students in dental education system in Tamil Nadu are highly exam oriented, and students are highly driven to finish their quota number of patients for restorations leading to intervene caries lesion at an earlier stage.[5] These answers by students combined with higher importance to strategy of restoring all tooth even if it means restoring sound teeth and not practicing caries risk assessment, shows very less emphasizes on early caries lesion detection and management of caries lesion by remineralization protocols. Baelum et al. (2008) emphasized that populations living in high-caries countries characterized by increasing caries incidence, dental clinicians should exercise diligence and meticulousness in the detection of signs of non-cavitated stages of caries lesion formation, to postpone the entry to the vicious cycle of re-restorations for as long as possible.[16] But the results of this study show that students opted for restoration rather than preservation of sound teeth, even though incidence and prevalence of dental caries in India has been reported to be on higher side.[19,20] Visual and tactile examination of dental caries is quick, effective, and easy to perform and requires no expensive equipment.[6] But contrary to this fact, higher percentage of students in this study believed that visual and tactile method of caries is not sufficient. Caries risk assessment has been shown to be very integral part of caries management for both operative, non-operative treatment, recall visits and also for formulating prevention strategy both at individual and community level.[21–29] But in this study show that almost all the students answered that they do not practice caries risk assessment.

5. Conclusions

The results of this study show gap in caries education and evaluation strategy in our system, this is mainly because of relying on older and outdated method of caries detection and classification. Management strategy of caries lesion is also greatly towards only restoration of tooth, with very little emphasize on either caries risk assessment or remineralization strategy. It's high time that system of caries education here should be in tune with global standards of caries research, with greater emphasis on early caries detection, more importance for visual criteria evaluation in caries assessment, newer caries scoring systems and caries risk assessment.

India is a country with vast population and increasing dental care demand. It is of paramount importance that dental graduates graduating should be able to meet this great demand in an efficient manner. The results of this study have revealed gaps in caries education in Indian dental education, which require revisiting of our cariology curriculum. And with increased globalization and more of our dental graduates opting for further opportunities in foreign countries, it becomes mandatory that both India and other foreign nations have a better understanding of the prevalent dental education system and areas that needs to be addressed and enhanced training be required.

The limitations of this is study includes, it was conducted only among the students of Tamil Nadu state, a wider representation from across various other regions of India might be needed in the future to device or modify the existing dental education curriculum. Also representation from dental practitioners' perspective can add further information

regarding the existing dental caries assessment and management strategy adopted and practiced.

Conflicts of interest

The authors have none to declare.

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