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Knowledge and Attitude of Dentists towards Caries Detection and Excavation

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ABSTRACT

Aim

To evaluate caries detection and excavation methods used by dental students and practitioners in Hyderabad, and also to investigate differences in the attitude towards leaving residual caries and assess sufficient removal of caries.

Materials and Methods: A structured questionnaire-based survey consisting of multiple-choice questions was compiled and responded by distributed among 420 dentists. These included 212 students (131 undergraduates and 81 postgraduates), and 208 dental practitioners (BDS and MDS). The survey compared the various techniques used for caries detection and caries removal. Data was collected and compared using the chi-square test with a level of significance at $p< 0.05$.

Results

Demographic data presented 47% male and 53% female. The majority of the dentists preferred conventional methods for caries detection and excavation. For assessment of sufficient caries removal, hardness ($p= 0.001$) and slight discoloration ($p= 0.05$) were most common criteria. While assessing residual caries under restoration, results were significant for postgraduates ($p= 0.001$).

Conclusion

The majority of the respondents prefer conventional methods of caries diagnosis and excavation among dental students and practitioners in Hyderabad. Dentists have a minimally invasive approach towards caries removal and reported various criteria for the assessment of caries such as hardness, color, and moisture.

Keywords

caries detection, caries removal, dental practitioners, dental students, visual-tactile examination

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1. Dr. Mamta Kaushik - 35%
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INTRODUCTION

Dental caries remains an infectious microbial disease of the teeth, and in the absence of treatment, may progress to the loss of tooth structure.[1] An imbalance in the demineralisation-remineralisation cycle of the tooth surface and biofilm (plaque), over time, leads to net mineral loss, cavitation, and carious lesion.[2]

Dental caries diagnosis is about identifying caries based on signs and symptoms. It is not merely detection of caries but also a conceptual triad of identification of the carious lesion, its progression, and assessment of whether more lesions will occur or not.[3]

In Modern dentistry, the dental practice has shifted from restorative era to preventive era, with emphasis on minimal intervention approach. It is recognised that demineralised but non-cavitated enamel and dentine can heal, the treatment being noninvasive measures to arrest the disease.[4] Due to recent advancements and better diagnostic aids and treatment strategies, more evidence-based guidelines for appropriate dental practice are available.

Caries detection was limited to clinical visual examination and radiographic means. However, advancements in technology have provided us with methods such as electrical conductance, which includes electronic caries monitor (ECM), Enhanced visual techniques like Fiber-optic transillumination (FOTI and DIFOTI), Fluorescent techniques Visible light fluorescence – QLF, Laser fluorescence – DIAGNODent, and other techniques like optical coherence tomography (OCT) and ultrasound.[5, 6]

Similarly, popular methods for caries excavation are visual-tactile, and dye staining along with usage of smart burs or polymer burs, especially for deep dentinal caries. Advanced methods for caries excavation include fluorescence-aided caries excavation (FACE).[7]

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Based on advances in understanding the caries process and surge in diagnostic aids, there has been a concept change in the diagnosis and management of dental caries. Thus, the management of dental caries requires accurate diagnosis, which culminates in the management of carious tooth structure with minimal invasion of healthy tissue.

A lot of these changes are getting incorporated into the dental curriculum, but the traditional concept of Black's Cavities is still dominating. Hence, this study aims to analyse the methods for caries detection and caries excavation used by dental students and practitioners in Hyderabad, Telangana, India. The auxiliary aim was to investigate the difference in the attitude towards leaving residual caries and assessment of sufficient caries removal.

MATERIALS AND METHODS

A survey to evaluate the Knowledge and Attitude of Dentists towards the latest methods of caries detection and excavation was planned. A structured questionnaire was designed and validated by 10 members of the Department of Conservative Dentistry and Endodontics, Army College of Dental Sciences, Secunderabad, Telangana. The survey was presented to the Institutional Review Board (Ethics Committee) and certificate with number ACDS/IRB/03/JUN/2021 was obtained.

Study population

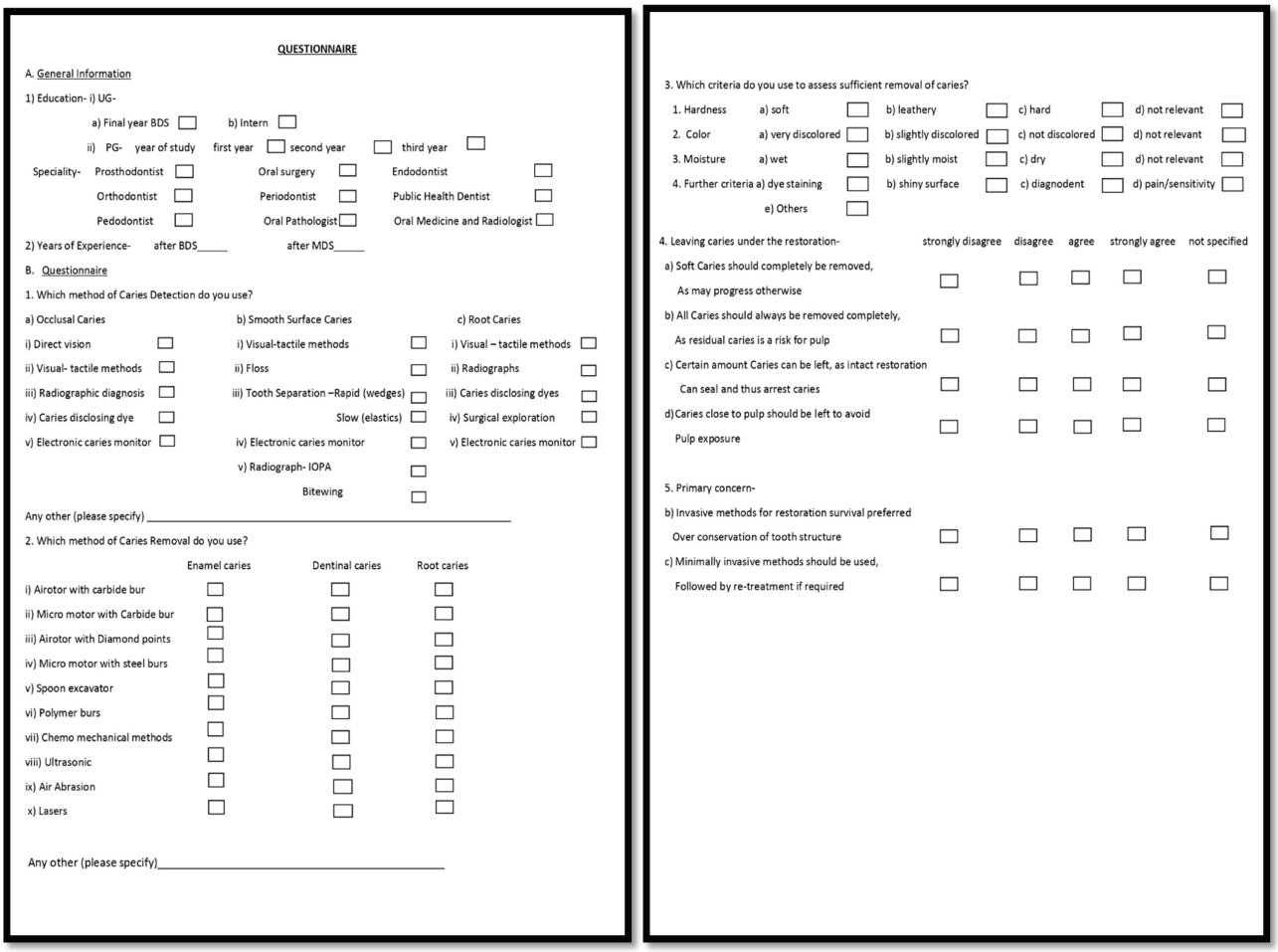
A cross-sectional, descriptive questionnaire-based study was conducted from June 2018 to July 2018. A convenient sample of 500 dental professionals (250 dental students and 250 dental practitioners) from Hyderabad city was selected for the present study. The questionnaire was distributed randomly to 250 dental students and 250 practitioners in dental colleges and clinics in Hyderabad. Students filled the Questionnaires on their own, without discussing with their contemporaries and others. About 30-minutes time was allotted to the participants to fill the questionnaire.

Data collection

The survey prepared consisted of multiple-choice questions regarding methods of caries detection and caries removal. It also recorded attitude towards caries removal and assessment of caries. Questions consisted of multiple selections, with a closed response and partially closed response, and it comprised two sections (Figures 1 and 2).

A pilot survey conducted amongst the staff in the Department of Conservative Dentistry and Endodontics validated the survey. These pre-respondents were excluded from the final tabulation.

The first section assessed the demographic and personal details of the participants, along with questions related to caries detection, excavation, and caries assessment criteria for sufficient removal. The second section that assessed their attitude towards leaving residual caries was recorded on a 5-point Likert scale.



QUESTIONNAIRE

A. General Information

1) Education- i) UG-
a) Final year BDS ☐ b) Intern ☐
ii) PG- year of study first year ☐ second year ☐ third year ☐
Speciality- Prosthodontist ☐ Oral surgery ☐ Endodontist ☐
Orthodontist ☐ Periodontist ☐ Public Health Dentist ☐
Pedodontist ☐ Oral Pathologist ☐ Oral Medicine and Radiologist ☐
2) Years of Experience- after BDS____ after MDS____

B. Questionnaire

1. Which method of Caries Detection do you use?

a) Occlusal Caries	b) Smooth Surface Caries	c) Root Caries
i) Direct vision ☐	i) Visual-tactile methods ☐	i) Visual – tactile methods ☐
ii) Visual- tactile methods ☐	ii) Floss ☐	ii) Radiographs ☐
iii) Radiographic diagnosis ☐	iii) Tooth Separation –Rapid (wedges) ☐	iii) Caries disclosing dyes ☐
iv) Caries disclosing dye ☐	Slow (elastics) ☐	iv) Surgical exploration ☐
v) Electronic caries monitor ☐	iv) Electronic caries monitor ☐	v) Electronic caries monitor ☐
	v) Radiograph- IOPA ☐	
	Bitewing ☐	

Any other (please specify) _____

2. Which method of Caries Removal do you use?

	Enamel caries	Dentinal caries	Root caries
i) Airotor with carbide bur	☐	☐	☐
ii) Micro motor with Carbide bur	☐	☐	☐
iii) Airotor with Diamond points	☐	☐	☐
iv) Micro motor with steel burs	☐	☐	☐
v) Spoon excavator	☐	☐	☐
vi) Polymer burs	☐	☐	☐
vii) Chemo mechanical methods	☐	☐	☐
viii) Ultrasonic	☐	☐	☐
ix) Air Abrasion	☐	☐	☐
x) Lasers	☐	☐	☐

Any other (please specify)_____

3. Which criteria do you use to assess sufficient removal of caries?

1. Hardness	a) soft ☐	b) leathery ☐	c) hard ☐	d) not relevant ☐
2. Color	a) very discolored ☐	b) slightly discolored ☐	c) not discolored ☐	d) not relevant ☐
3. Moisture	a) wet ☐	b) slightly moist ☐	c) dry ☐	d) not relevant ☐
4. Further criteria	a) dye staining ☐	b) shiny surface ☐	c) diagnodent ☐	d) pain/sensitivity ☐
	e) Others ☐			

4. Leaving caries under the restoration-	strongly disagree	disagree	agree	strongly agree	not specified
a) Soft Caries should completely be removed, As may progress otherwise	☐	☐	☐	☐	☐
b) All Caries should always be removed completely, As residual caries is a risk for pulp	☐	☐	☐	☐	☐
c) Certain amount Caries can be left, as intact restoration Can seal and thus arrest caries	☐	☐	☐	☐	☐
d) Caries close to pulp should be left to avoid Pulp exposure	☐	☐	☐	☐	☐

5. Primary concern-

b) Invasive methods for restoration survival preferred Over conservation of tooth structure	☐	☐	☐	☐	☐
c) Minimally invasive methods should be used, Followed by re-treatment if required	☐	☐	☐	☐	☐

Figure 1: Questionnaire for Dental Students

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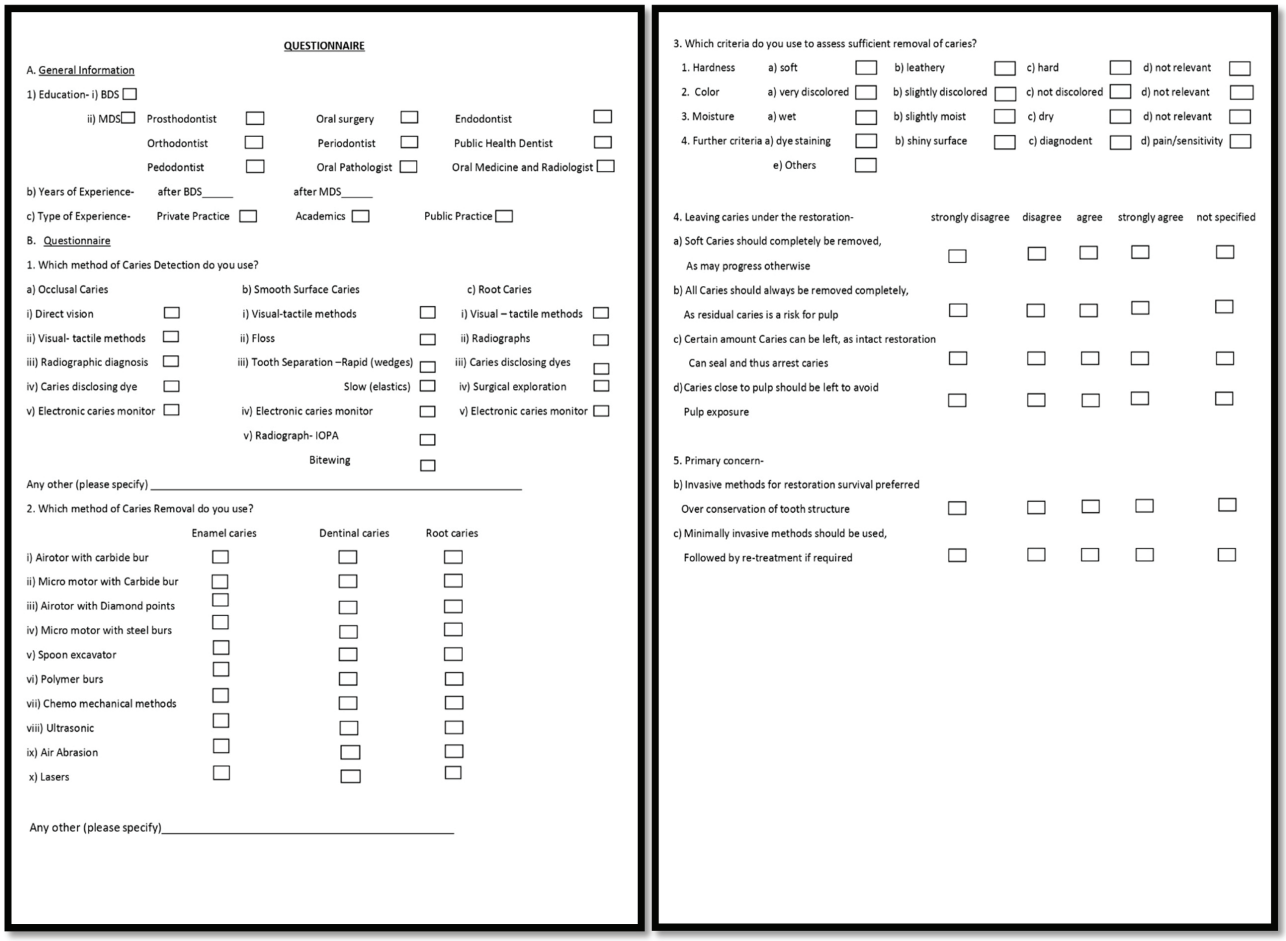

QUESTIONNAIRE

A. General Information

1) Education- i) BDS ☐

ii) MDS ☐ Prosthodontist ☐ Oral surgery ☐ Endodontist ☐

Orthodontist ☐ Periodontist ☐ Public Health Dentist ☐

Pedodontist ☐ Oral Pathologist ☐ Oral Medicine and Radiologist ☐

b) Years of Experience- after BDS_____ after MDS_____

c) Type of Experience- Private Practice ☐ Academics ☐ Public Practice ☐

B. Questionnaire

1. Which method of Caries Detection do you use?

a) Occlusal Caries	b) Smooth Surface Caries	c) Root Caries
i) Direct vision ☐	i) Visual-tactile methods ☐	i) Visual – tactile methods ☐
ii) Visual- tactile methods ☐	ii) Floss ☐	ii) Radiographs ☐
iii) Radiographic diagnosis ☐	iii) Tooth Separation –Rapid (wedges) ☐	iii) Caries disclosing dyes ☐
iv) Caries disclosing dye ☐	Slow (elastics) ☐	iv) Surgical exploration ☐
v) Electronic caries monitor ☐	iv) Electronic caries monitor ☐	v) Electronic caries monitor ☐
	v) Radiograph- IOPA ☐	
	Bitewing ☐	

Any other (please specify) _____

2. Which method of Caries Removal do you use?

	Enamel caries	Dentinal caries	Root caries
i) Airotor with carbide bur	☐	☐	☐
ii) Micro motor with Carbide bur	☐	☐	☐
iii) Airotor with Diamond points	☐	☐	☐
iv) Micro motor with steel burs	☐	☐	☐
v) Spoon excavator	☐	☐	☐
vi) Polymer burs	☐	☐	☐
vii) Chemo mechanical methods	☐	☐	☐
viii) Ultrasonic	☐	☐	☐
ix) Air Abrasion	☐	☐	☐
x) Lasers	☐	☐	☐

Any other (please specify)_____

3. Which criteria do you use to assess sufficient removal of caries?

1. Hardness	a) soft ☐	b) leathery ☐	c) hard ☐	d) not relevant ☐
2. Color	a) very discolored ☐	b) slightly discolored ☐	c) not discolored ☐	d) not relevant ☐
3. Moisture	a) wet ☐	b) slightly moist ☐	c) dry ☐	d) not relevant ☐
4. Further criteria	a) dye staining ☐	b) shiny surface ☐	c) diagnodent ☐	d) pain/sensitivity ☐
	e) Others ☐			

4. Leaving caries under the restoration-	strongly disagree	disagree	agree	strongly agree	not specified
a) Soft Caries should completely be removed, As may progress otherwise	☐	☐	☐	☐	☐
b) All Caries should always be removed completely, As residual caries is a risk for pulp	☐	☐	☐	☐	☐
c) Certain amount Caries can be left, as intact restoration Can seal and thus arrest caries	☐	☐	☐	☐	☐
d) Caries close to pulp should be left to avoid Pulp exposure	☐	☐	☐	☐	☐

5. Primary concern-

b) Invasive methods for restoration survival preferred Over conservation of tooth structure	☐	☐	☐	☐	☐
c) Minimally invasive methods should be used, Followed by re-treatment if required	☐	☐	☐	☐	☐

Figure 1: Questionnaire for Dental Students

STATISTICAL ANALYSIS

Questionnaire data were organised using a databank Excel 10 (Microsoft, USA) and subject to statistical analysis using SPSS 20(IBM, Armonk, NY:IBM Corp). Statistical analysis was performed using SPSS version 20. Descriptive statistics was done to understand the mean, std deviation and other parameters to describe the study population. Chi square test was done to check the association of different demographic details with other relevant study variables and the ones which were statistically significant were reported as mentioned in the tables. A level of significance at $p< 0.05$ was accepted.

RESULTS

Among the 500 participants dentists surveyed, 420 responded participated, resulting in a response rate of 84%. The respondents comprised 208 practitioners and 212 students (undergraduate students- 131, Postgraduate students- 81). The demographic data presented that 47% were males, and 53% were females.

The various methods employed for the detection of occlusal, smooth surface and root caries are listed in Table I. All the respondents stated that they prefer direct vision, visual examination and tactile sensation, and radiographic methods for the detection of occlusal caries. For smooth surface caries, 100% of the participants prefer visual-tactile method. The intraoral periapical radiograph (IOPA) is the most commonly employed radiographic technique followed by bitewing ($p= 0.043$) for the detection of smooth caries. 100% of dental practitioners, 96.3% of postgraduates, and 94.7% of undergraduates were using IOPA. Whereas, for root caries, all of the participants (100%) preferred radiographic methods followed by visual-tactile method ($p= 0.001$) (98.6% practitioners, 96.3% postgraduate students, 89.3% undergraduate students) and surgical exploration (46.6% practitioners, 22.3% postgraduate students and none of the undergraduate students). None of the participants use caries disclosing dye and electronic caries monitor for caries detection.

Out of 500 dentists approached, 420 responded (response rate: 84%). The sample included 208 practitioners and 212 students (131 undergraduates and 81 postgraduates), with a slight female predominance.

All participants reported the use of visual-tactile and radiographic methods for the detection of occlusal and smooth surface caries (Table I). For smooth surface caries, intraoral periapical radiographs were preferred over bitewing radiographs, with a statistically significant difference ($p = 0.043$). In the detection of root caries, radiographic methods were universally employed, while the use of visual-tactile methods showed a statistically significant difference among groups ($p = 0.001$). Surgical exploration was reported variably, with minimal use among undergraduates. No participants reported the use of caries disclosing dyes or electronic caries monitoring devices.

For caries removal (Table II), airotor handpieces with diamond burs were the most commonly used method across all lesion types, with no statistically significant intergroup differences. The use of carbide burs for enamel caries showed a statistically significant difference ($p = 0.001$), as did the use of polymer burs for dentinal caries ($p = 0.001$). Spoon excavators were used consistently across groups without statistically significant variation. None of the respondents

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reported the use of chemo-mechanical, ultrasonic, air abrasion, or laser-assisted techniques.

Regarding criteria for sufficient caries removal (Graph I), hardness of dentine was the most significant parameter (p = 0.001), followed by slight discolouration (p = 0.05). Other criteria showed variability but were not statistically significant. Dentists' perspectives on leaving caries beneath restorations (Table III) demonstrated a statistically significant difference among postgraduates (p = 0.001), particularly in the assessment of residual caries. Differences in attitudes towards complete caries removal, pulpal risk, and minimally invasive approaches were observed but did not consistently reach statistical significance.

Graph I presents the criteria for the assessment of sufficient caries removal among dentists. The majority of dentists stated that they check for hardness (78.4% practitioners, 59.3% postgraduate and 51.9% undergraduates) and slight discoloration (55.8% practitioners, 63% postgraduates and 45.8% undergraduates) 46.6% undergraduates check for dry surface, whereas 39% of practitioners and 30.9% postgraduates assess by slightly moist surface. The majority of undergraduates (70.2 %) assess through pain and sensitivity, postgraduates (40.4 %) by dye staining, and practitioners (38.6 %) shiny surface. For assessment of sufficient caries removal, hardness (p= 0.001) and slight discoloration (p= 0.05) were most common criteria.

TableIII depicts the perspective of dentists towards leaving caries under the restoration. 70.4% postgraduates, 57.4% practitioners, and 51.6% undergraduates, strongly agree that 'soft caries should be completely excavated as it may progress otherwise.'

65.1% undergraduates, 51.9% postgraduates, and 46.4% practitioners agreed that 'all caries should always be removed completely, as residual caries is a risk for pulp.

On the concept of leaving caries under an intact restoration 58.7% of undergraduates disagreed, whereas 70.3% of practitioners and 45.7% of postgraduates agreed.

34.9% undergraduates strongly disagreed, 59.3% postgraduates agreed, and 54.5% practitioners disagreed that caries close to the pulp should be left to avoid pulp exposure.

Assessing residual caries under restoration results were significant for postgraduates (p= 0.001). The participants were also asked about their primary concern whether 'invasive methods for restoration survival preferred over conservation or minimally invasive methods should be used, followed by retreatment if required'. 44.4% undergraduates disagreed, 67.9% postgraduates, and 48.8% practitioners strongly agreed that invasive methods for restoration survival preferred over conservation. Whereas, 56.9% practitioners, 55.6% undergraduates, agreed and 44.4% postgraduates strongly agreed that minimally invasive methods should be used, followed by retreatment if required.'

DISCUSSION

An ideal diagnostic tool should have accuracy, reliability, precision, objectivity, sensitivity, specificity, reproducibility, validity quantitative analysis, ease of application, and should be able to identify caries adjacent to restorations.[5]

Conventional or traditional methods are qualitative in nature, inferior in validity, with low sensitivity, and less specificity. The need for identification of carious lesions in the early stages is of utmost importance in deciding the treatment plan. Advanced diagnostic methods are quantitative, detect lesions at an earlier stage, and are more reliable than the conventional methods. They have better sensitivity and specificity and help in a preventive approach towards the management of caries.[8]

Studies by Khaleis et al.(2010) and Diniz et al.(2013) have compared conventional diagnostic methods with advancements in the diagnosis of caries.[6,9]

The present study found that the majority (100%) of the respondents prefer direct vision, visual-tactile and radiographic methods for caries detection (occlusal, smooth surface caries and root caries) (Table I). These findings are similar to the results obtained by Ntovas et al. (2018) among Greek dentists [10]. The preference of radiographs is IOPA and bitewings in 94.7% and 71.8% undergraduates, 96.3% and 79% postgraduate students, and 100% and 83.2% practitioners' respectively. Visual-tactile and conventional radiographic diagnostic modalities are the most common methods used to diagnose caries even though the use of the traditional probe has been discouraged because of the risk of mechanically damaging the enamel.[6] This may be because the visual-tactile method is easy to perform routinely in clinical practice has high specificity but low sensitivity.[11]

Radiographic methods act as an adjunct to the clinical examination and allow more sensitive detection of carious lesions (proximal and occlusal) in dentin, which are not detected just by visual –tactile examination. It also provides better lesion depth than the visual inspection performed alone.[11]

For root caries, postgraduate students (22.3%) and practitioners (46.6%) preferred to explore caries surgically. None of the dentists reported the use of caries disclosing dye and electronic caries monitor for caries detection. This could be due to technique sensitivity and high cost.[12]

For caries removal of enamel caries, dentinal caries, and root caries, airotor with diamond points, was found to be the most popular for the removal of enamel caries, dentinal caries, and root caries, followed by airotor with carbide burs and spoon excavators. The difference is statistically significant among the three categories. None of the dentists reported the use of ultrasonic, air abrasion, or lasers. However, the use of polymer burs (Table II) was reported which is in contrast with the study performed by Ntovas, *et al*.[10] The reason behind this is probably the necessity of additional equipment for the application of new technology and ease of application of polymer burs.

The most commonly used criteria for assessing sufficient caries removal among dentists were dentin hardness (51–78%) and slight discoloration (45–63%). Among undergraduates, 46.6% evaluated dryness of the surface, while 30.9% of postgraduates and 39% of practitioners assessed a slightly moist surface. Additionally, 70.2% of undergraduates relied on pain and sensitivity, 38.3% of practitioners considered a shiny surface, and 40.4% of postgraduates used dye staining as their assessment method (Graph I). These findings are consistent with a previous study conducted in Northern Germany (2013).[13]

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Assessment to analyse the perspective of the dentists regarding leaving caries under the restoration was done. The majority of the respondents (51-70%) strongly agreed that soft caries should completely be removed, as may progress otherwise (Table III). 46-65% of the respondents agreed that all caries should always be removed completely, as residual caries is a risk for pulp. Among undergraduate respondents, 58.7% opposed the concept of leaving residual carious tissue, indicating a preference for complete caries removal. Conversely, 45.7% of postgraduate students and 70.3% of dental practitioners supported the selective removal of caries, acknowledging that a properly sealed restoration can isolate the lesion from the oral environment and thereby arrest its progression.

These results are concurring with the study performed by F. Schwendicke et al.(2013) [13] and Terek Rabi (2016) [14] in northern Germany and Palestine respectively. 34.9% of undergraduates strongly disagreed and 54.5% of practitioners disagreed, whereas 59.3% of postgraduates agreed (Table III) that caries close to the pulp should be left to avoid pulp exposure, which may be due to their knowledge of minimally invasive dentistry. These results are in contrast with the study performed by F. Schwendicke et al.(2013) [13] and Terek Rabi (2016).[14]

Dentists were also asked about their primary concern–whether they prioritised invasive methods to ensure restoration longevity over conserving tooth structure through minimally invasive techniques, with the option of re-treatment if necessary (Table III).

44.4% of undergraduates disagreed, 67.9% of postgraduates and 48.8 % of practitioners strongly agreed that invasive methods for restoration survival were preferred over conservation. 44-60% respondents agreed that minimally invasive methods should be used, followed by retreatment if required the results are in disagreement to previous studies conducted by F. Schwendicke et al.(2013)[13] and Terek Rabi (2016) [14] in Northern German dentist and Palestine dentists respectively, where the majority of dentists attempt complete removal of caries since they fear residual caries may progress or harm if not excavated.

The limitations of the present study include its confinement to a single city and its reliance on a questionnaire-based survey; as such, the self-reported responses may not accurately reflect actual clinical practices. Further studies are recommended to gain a more comprehensive understanding of dentists' awareness and approaches.

CONCLUSION

The findings of this study highlight a continued reliance on conventional methods such as visual-tactile examination and traditional radiography for caries diagnosis and removal among dental students and practitioners in Hyderabad. While

Table I: Caries detection methods

Caries detection	Undergraduates % (n=131)	Post graduates% (n=81)	Practitioners% (n=208)	Chi-square value	p value
Occlusal caries					
Direct vision	100	100	100	--	--
Visual-tactile	100	100	100	--	--
Radiographic diagnosis	100	100	100	--	--
Caries disclosing dye	0	0	0	--	--
Electronic caries monitor	0	0	0	--	--
Smooth surface caries					
Visual-tactile	100	100	100	--	--
Floss	61.1	46.9	53.8	4.188	0.123
Tooth separation rapid (wedges)	83.2	61.7	83.2	18.175	0.001*
Tooth separation slow(elastics)	3.8	27.2	10.6	26.941	0.001*
Electronic caries monitor	0	0	0	--	--
Radiographic IOPA	94.7	96.3	100	10.630	0.005*
Radiographic bitewing	71.8	79	83.2	6.276	0.043*
Root caries					
Visual-tactile	89.3	96.3	98.6	17.673	0.001*
Radiographic	100	100	100	--	--
Caries disclosing dye	0	0	0	--	--
Surgical exploration	0	22.3	46.6	99.689	0.001*
Electronic caries monitor	0	0	0	--	--

Chi-square test; * indicates significant at $p \leq 0.05$

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a minimally invasive approach is generally adopted, the criteria for assessing sufficient caries removal vary, with hardness and color being the most commonly used indicators. These results emphasise the need for increased awareness and integration of evidence-based, modern diagnostic tools and techniques to enhance clinical decision-making and improve patient outcomes in caries management.

Table II: Caries removal methods

Caries removal	Undergraduates %	Post graduates %	Practitioners %	Chi-square value	p value
Enamel caries					
Airotor with carbide bur	64.9	75.3	61.5	8.782	0.067
Micro motor with carbide bur	2.3	3.7	1.0	1.127	0.569
Airotor with diamond points	90.1	90.1	99	16.226	0.001*
Micro motor with steel burs	0.8	2.5	0	3.645	0.162
Spoon excavator	35.1	54.3	77.4	60.687	0.001*
Polymer burs	0	0	0	--	--
Chemo mechanical methods	0	0	0	--	--
Ultrasonic	0	0	0	--	--
Air abrasion	0	0	0	--	--
Lasers	0	0	0	--	--
Dentinal caries					
Airotor with carbide bur	61.8	53.1	79.3	21.890	0.001*
Micro motor with carbide bur	0	0	18.8	43.819	0.001*
Airotor with diamond points	89.3	91.3	92.8	1.239	0.538
Micro motor with steel burs	0	16	12	20.089	0.001*
Spoon excavator	74	80.2	79.3	1.633	0.442
Polymer burs	14.8	17.6	37.0	38.953	0.001*
Chemo mechanical methods	8.4	1.2	9.1	5.610	0.061
Ultrasonic	0	0	0	--	--
Air abrasion	0	0	0	--	--
Lasers	0	0	0	--	--
Root caries					
Airotor with carbide bur	3.8	1.2	50.5	122.775	0.001*
Micro motor with carbide bur	6.1	6.2	1.9	4.790	0.091
Airotor with diamond points	77.9	98.8	86.5	18.415	0.001*
Micro motor with steel burs	0	0	0	--	--
Spoon excavator	45.8	71.6	59.2	27.812	0.001*
Polymer burs	0	0	0	--	--
Chemo mechanical methods	0	0	0	--	--
Ultrasonic	0	0	0	--	--
Air abrasion	0	0	0	--	--
Lasers	0	0	0	--	--

Chi-square test; * indicates significant at $p \leq 0.05$

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Graph I: Assessment of sufficient caries removal

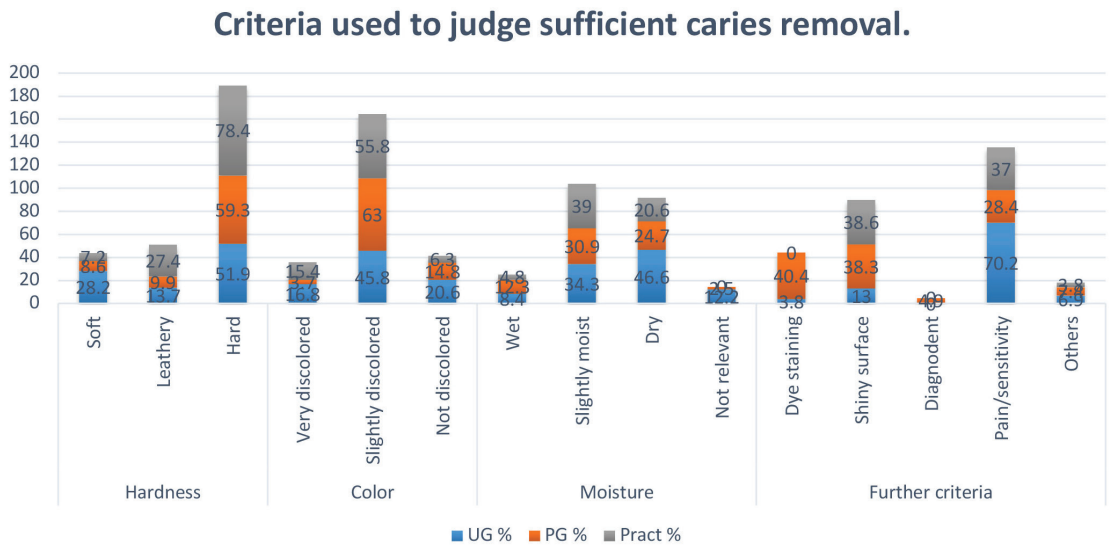

Table III: Leaving caries under the restoration

	Strongly disagree %	Disagree %	Agree %	Strongly agree %	Not relevant %	Chi-square value	p value
Soft Caries should completely be removed, As may progress otherwise							
Undergraduates	3.2	15.1	11.1	51.6	19		
Post graduates	0	0	29.6	70.4	0	64.897	0.001*
Practitioners	0	8.6	29.2	57.4	4.8		
All Caries should always be removed completely, As residual caries is a risk for pulp							
Undergraduates	1.6	10.3	65.1	16.7	6.3		
Post graduates	0.	21	51.9	22.2	4.9	31.025	0.001*
Practitioners	0	34	46.4	13.9	5.7		
Certain amount Caries can be left, as intact restoration Can seal and thus arrest caries							
Undergraduates	11.9	58.7	10.3	9.5	9.5		
Post graduates	0	35.8	45.7	13.6	4.9	151.019	0.001*
Practitioners	0	18.7	70.3	11	0		
Caries close to pulp should be left to avoid pulp exposure							
Undergraduates	34.9	18.3	12.7	10.3	23.8		
Post graduates	0	12.3	59.3	28.4	0	216.773	0.001*
Practitioners	11.5	54.5	27.3	6.7	0		
Primary concern -							
Invasive methods for restoration survival preferred over conservation							
Undergraduates	21.4	44.4	9.5	0	24.6		
Post graduates	0	0	32.1	67.9	0	323.766	0.001*
Practitioners	0	0	43.1	48.8	8.1		
Minimally invasive methods should be used, followed by re-treatment if required							
Undergraduates	17.5	7.9	55.6	11.9	7.1		
Post graduates	0	0	30.9	44.4	24.7	193.545	0.001*
Practitioners	0	32.1	56.9	11	0		

Chi-square test; * indicates significant at $p \leq 0.05$