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# Knowledge, Attitude, and practice-based survey on Cracked tooth syndrome and its management among various dental professionals in Tamil Nadu, India- A cross-sectional web-based questionnaire

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# Abstract

# BACKGROUND:

Tooth pain refers to the pain in or around the tooth because of abnormal conditions of the tooth. Proper evaluation is necessary to diagnose the actual cause of toothache. Cracked tooth syndrome serves as the most challenging diagnostic factor in clinical practice. Since there is a lack of awareness about this condition, proper diagnosis and appropriate planning of treatment are complicated

## Aim:

This study aims to assess the knowledge and attitude among dental professionals in Chennai about Cracked tooth syndrome.

## **Materials and Methods:**

It is a questionnaire-based study and this survey was conducted among 257 dental professionals in Tamilnadu. The questionnaire was circulated via google forms. Data were collected and statistical analysis was done.

## **Results:**

Almost 86.4% stated that it is an incomplete fracture and 83.7% mentioned that the ease of diagnosis varies according to the position and extent of the fracture. And 79.8% of participants chose the extent of the crack as a factor for the immediate treatment plan.

## **Conclusion:**

Though cracked tooth syndrome is a diagnostic challenge, having adequate knowledge and creating awareness should enable the practitioners to identify and prevent crack propagation and its associated complications.

# **Clinical Significance**:

The article gives an insight into the diagnostic approach towards the patients with cracked tooth syndrome and therefore helping dentists /specialists to formulate better treatment plans and outcomes according to the patient's needs, thereby preventing any further complications.

**Keywords**: Tooth pain, proper evaluation, diagnostic challenge, cracked teeth, awareness, cross-sectional study **INTRODUCTION** 

Tooth pain refers to the pain in or around the tooth because of abnormal conditions of the tooth.<sup>[1]</sup> Toothache can be caused by dental caries, the presence of a fractured tooth or restoration, exposed pulp, or gingival disease.<sup>[2</sup>] Pain can also be caused by radiating pain from the adjacent structures. Proper evaluation is necessary to diagnose the actual cause of toothache. Cracked tooth syndrome serves as the most challenging diagnostic factor in clinical practice. Since there is a lack of awareness about this condition, proper diagnosis and appropriate planning of treatment are complicated. According to Cameron in 1964, the term cracked tooth syndrome refers to an incomplete fracture of a posterior vital tooth that involves the dentine and occasionally extends into the pulp. <sup>[3]</sup>

The incomplete fracture of posterior teeth and its clinical symptoms were first described by Gibbs in 1954.<sup>[4]</sup> In 1957, Ritchey et al reported cases of such fracture along with subsequent pulpitis.<sup>[5]</sup> Maxwell and Braly described this term in 1970.<sup>[6]</sup> The most commonly affected age group is from 30 to 50 years of age.<sup>[7]</sup> It affects both the gender with a female Mandibular predilection. second molars are commonly affected teeth. Followed by second molars, mandibular first molars, and premolars from the maxillary arch are commonly affected in Cracked tooth syndrome.<sup>[8]</sup>

The etiology of cracked tooth syndrome is multifactorial. According to Lynch and McConnell<sup>[9]</sup>, the etiology can be divided into four major categories such occlusal factors, restorative procedures, as developmental and miscellaneous factors. The diagnosis can vary based on the extent and position of the cracks.<sup>[10]</sup> Most often the tooth presents with extensive restorations, pain on a particular tooth while biting, and presence of sensitivity to sweets and thermal changes, especially cold. Chewing ice cubes or hard candy and forceful clenching or grinding are the habits that could lead to a cracked tooth.<sup>[11]</sup>

There are various methods and tests to detect the crack and also to differentiate the cracked tooth from the split tooth. Tests should predictably look to find the presenting symptoms and should localize the pain. <sup>[12]</sup> The treatment plan is based on the extent of the crack. If the crack is not extensive and no pulp involvement is detected, Immediate stabilization with Occlusal adjustments followed by cuspal protection can be done.<sup>[13]</sup> Examine the tooth for 2 to 4 weeks and if symptoms did not resolve, pulp extirpation and further root canal treatment should be performed.<sup>[14]</sup> If the crack extends into the floor of the pulp chamber or below the level of alveolar bone, the prognosis will be poor and the chances of survival of tooth are less and thus extraction can be carried out <sup>[2]</sup>

This study aims to assess the knowledge, attitude, and practice of Cracked tooth syndrome among various dental professions across Tamil Nadu, India.

# **MATERIALS AND METHODS:**

This study is questionnaire-based and it was conducted among dental professionals across Tamil Nadu, India. This survey includes 25 questions. A pilot study was conducted for calculating the sample size with 25 participants. The overall responses of the immediate treatment plan for cracked tooth syndrome were estimated to be 60% and hence the estimated sample size was 256. It was circulated among dental professionals through Google forms of which 60.3% were BDS (General practitioners), 17.1% were Postgraduate (Conservative dentistry & Endodontics), 18.3% were Postgraduate (Others) and the rest were MDS practitioners. The data were collected from 257 participants and the results were analyzed.

## STATISTICAL ANALYSIS:

Frequency tabulation was computed using SPSS [Version 21.0] software.

## **RESULTS:**

The results are tabulated.

# **DISCUSSION:**

Out of 257 participants, 94.9% were aware of cracked tooth syndrome and 86.4% assumed that it is an incomplete fracture.

Though visual inspection can be helpful, the cracks may not be visible often without the proper aid of magnifying loupes. The difficulty in visualizing the extent of the fracture only through clinical examination is the factor that might result in complexity for determining the diagnosis and 76.7% agreed that visual examination alone is ineffective in detecting the cracks. The use of a clinical microscope (×16) provides an ideal magnification level for the evaluation of enamel cracks, with a range from ×14 to ×18<sup>.[15]</sup> Ultrasound is also capable of imaging cracks

in the simulated tooth structure and can be used as a future diagnostic aid.<sup>[16]</sup> According to many authors, the crack can be visualized better by removing existing stains and restoration if the tooth presents with symptoms that have been localized. The probability of enhanced vision of these cracks can be achieved by isolation of tooth with a rubber dam which can also help to highlight the crack by proving contrasting background and keep the area saliva free and also reduces the peripheral distractions which were accepted by 82.9% of participants.

A tactile examination can be done by scratching the tooth surface using a sharp explorer as its tip may serve as an aid to catch in a tooth crack and they are not tender to percussion. Periodontal probing plays a role in differentiating a cracked tooth from a split tooth. Dve test consists of Methylene blue or Gentian violet <sup>[17]</sup> can be helpful to highlight the crack but the major drawback of this method is that it takes two to five days for its action and also provisional restoration is needed over it because of which the structural integrity of the tooth is undermined and thus propagates the crack. Transillumination serves as an important aid to locate the crack and to figure out whether the crack is complete or incomplete.<sup>[18]</sup> with the help of fiber optic light along with the use of magnification. Pain on biting which ceases immediately after the withdrawal of pressure serves as a classical sign, that can be performed using a test called 'bite test' <sup>[19]</sup> Cotton wool, orangewood sticks, rubber abrasive wheels, and the tools that are available commercially such as tooth slooth II and Fractfinder can be used to perform the Bite test. Asking the patient to bite separately on individual cusps helps in isolating the fractured cusp when orangewood sticks are used for determining the cracks while biting on cotton rolls and suddenly releasing the pressure results in the perception of pain on sudden release of pressure which confirms the diagnosis. Further, to bite on a tooth slooth or Fractfinder on an individual cusp allows providing selective pressure on one cusp. If pain is detected on biting or while releasing the biting pressure, mostly it is indicative of a cracked cusp.

The vitality test shows positive <sup>[20]</sup> as the affected tooth may exhibit hypersensitivity to thermal change, particularly cold because of inflamed pulp which is a feature that could help for confirming the diagnosis of cracked tooth syndrome and 66.1% preferred to check the vitality test. Radiographs have limited significance in finding the cracks unless they are extensive.<sup>[9]</sup> When direct diagnostic methods were unsuccessful to detect the crack, indirect methods of diagnosis such as banding play a role in the detection of a cracked tooth. Thus, the acrylic provisional crowns, orthodontic bands made up of stainless steel, and copper rings can be used on the tooth to prevent crack separation during the function.

When a crack is detected, using wedging for testing the movement of the segment helps to differentiate a split tooth from a cracked tooth. No movement along with wedging force indicates a cracked tooth that was known by 66.5% of participants. A split tooth will have mobility along with wedging forces that extends below the level of cementoenamel junction. The differential diagnosis for cracked tooth syndrome is dentinal hypersensitivity, acute periodontal diseases, galvanic pain, orofacial pain, pain caused by bruxism, or atypical facial pain.

Immediate treatment of the cracked tooth depends on the extent of the cracked portion of the tooth. If the cracked portion of the tooth is small and no damage to the pulp, the tooth can be restored with restorative materials. If the crack is large with no pulpal involvement, immediate stabilization along with occlusal adjustments should be done followed by cuspal protection <sup>[21]</sup> that was agreed by 54.9% of participants. Upon using full coverage provisional crowns made of acrylic, the high success rate to stabilize the teeth that are compromised has been reported.<sup>[22]</sup> If the involvement of pulp is detected, the symptoms can be relieved by immediate stabilization and extirpation of pulp which was agreed by 80.5%. If the crack extends below the level of the pulpal floor or alveolar bone, extraction of the tooth will be the treatment of choice for 78.2%.

Cracked tooth syndrome can be prevented by preparing the cavities as minimal and conservative as possible<sup>[23]</sup>, roundening of internal line angles to avoid stress concentration, by providing adequate cuspal protection, by introducing pins in sound dentine that are placed at an appropriate distance from the enamel to reduce unnecessary stress concentration<sup>[24]</sup> and also by prophylactic removal of eccentric contacts to avoid further crack formation.<sup>[25]</sup>

A descriptive question was asked regarding the treatment plan for Cracked tooth syndrome to explain in the participant's own words based on their clinical Thanikachalam Yashini at al International Journal of Medical Science and Current Research (IJMSCR)

practice. 15.2% of participants have mentioned bonded restoration, 40.2% were root canal treatment, 22.6% were extraction, 17.9% were stabilization with orthodontic wires or copper bands and 0.4% were hemisection as a treatment choice.

## **CONCLUSION:**

Thus, we conclude that cracked tooth syndrome is not a serious and severe issue. It is a well-documented entity and common in clinical practice. Patients present with a wide variety of clinical signs and symptoms that ultimately make that diagnosis difficult. Hence it is mandatory to perform appropriate treatment at the earliest to avoid further complications. Though cracked tooth syndrome is a diagnostic challenge, having adequate knowledge and creating awareness should enable the practitioners to identify and prevent crack propagation and its associated complications.

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S.NO		OPTIONS	FREQUENCY	%
	QUESTIONNAIRES			
1	Are you aware of Cracked tooth syndrome? (CTS)?	a) Yes	245	94.9
		b) No	12	5.1
2	Cracked tooth is defined	a) Complete	35	13.6
	as fracture of the dentin in a vital posterior tooth	b) Incomplete	222	86.4
3	The ease of diagnosis varies according to	a) Position of the fracture	14	7.4
		b) Extent of the fracture	27	8.7
		c) Both (a) and (b)	216	83.7
4	Most commonly affected teeth	a) Mandibular 2 <sup>nd</sup> molar >	93	36.6
		Mandibular 1 <sup>st</sup> molar>		
		Maxillary Premolars b) Mandibular 1 <sup>st</sup> molar >	96	37.7
		Mandibular 2 <sup>nd</sup> molar>		
		Maxillary premolars	40	19.1
		c)Maxillary premolars >		
		Mandibular 1 <sup>st</sup> molar>		

#### **RESULTS:**

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		Mandibular 2 <sup>nd</sup> molar	28	6.6
		d)Maxillary premolars >		
		Mandibular 2 <sup>nd</sup> molar >		
		Mandibular 1 <sup>st</sup> molar		
5	There may be a history of	a) Extensive dental treatment	5	2.1
		b) Pain on biting on	47	17.5
		particular tooth	15	6.9
		c) Sensitivity to thermal changes (Cold) and Sweets	190	73.5
		d) All of the above		
6	Habits that might	a) Clenching/Grinding	51	19.5
	are	b) Chewing hard candy /	25	9.7
		Ice	181	70.4
		c) Both (a) and (b)		
7	Do you check for vitality	a) Yes	172	66.1
	of the tooth?	b) No	32	13.2
		c) Maybe	53	20.6
8	Do you think the use of rubber dam enhances the probability of visualising these cracks?	a) Yes	213	82.9
		b) No	44	17.1
9	If Yes, How do they	a) By isolating the tooth	37	14.9
	enhance to visualize the crack	and highlighting the cracks	12	4.6

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		<ul> <li>b) By keeping the area free of saliva</li> <li>c) Reducing peripheral distractions</li> <li>d) only (a) and (b)</li> <li>e) All of the above</li> </ul>	11 68 121	4.6 28.1 47.8
10	Do you think visual examination alone is effective in detecting the cracks?	<ul><li>a) Yes</li><li>b) No</li><li>c) Maybe</li></ul>	15 196 46	5.4 76.7 17.9
11	How do you check for crack in tactile examination?	<ul> <li>a) Visualizing the tooth with mouth mirror</li> <li>b) Scratch the surface of the tooth with tip of a sharp explorer</li> <li>c) Percussing the tooth with blunt instrument</li> </ul>	36 142 79	9.7 55.3 30.7
12	Which dye can be used to highlight fracture lines?	<ul> <li>a) Gentian violet</li> <li>b) Methylene blue</li> <li>c ) Both (a) and (b)</li> <li>d) None of the above</li> </ul>	16 67 158 16	<ul><li>6.2</li><li>26.1</li><li>61.5</li><li>6.2</li></ul>
13	Bite test can be performed using	<ul> <li>a) orange wood sticks/Cotton roll</li> <li>b) Tooth sloth /Fractfinder</li> <li>c) Rubber abrasive wheels</li> </ul>	52 58 13 134	20.2 22.6 5.1 52.1

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		d)All of the above		
14	Fracture of individual cusp can be detected by	a) Percussion test	25	9.7
		b) Transillumination	109	42.4
		c) Bite test	103	40.1
		d) Dyes	20	7.8
15	The important aid to	a) Percussion test	34	13.2
	crack is complete or	b) Transillumination	128	49.8
	incomplete	c) Bite test	41	16
		d) Dyes	54	21
16	Which of the following test is used to differentiate crack tooth from split tooth ?	a) Dye test	40	15.6
		b) Bite test	49	19.1
		c) Periodontal probing	109	42.4
		d)Transillumination	59	23
17	Which of the following is CORRECT?	a) No movement with wedging force implies Split tooth	22	6.6
		b) Mobility with wedging force implies Cracked tooth	69	26.8
		c) No movement with wedging force implies Cracked tooth	166	66.5
18	The immediate treatment plan depends on	a) Site of the crack	30	11.7
		b) Extent of the crack	205	79.8
		c) Direction of the crack	22	8.6

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19	If no pulpal involvement, the immediate relief of symptoms can be achieved by	<ul> <li>a) Immediate stabilization</li> <li>with orthodontic band or</li> <li>acrylic crown</li> <li>b) Immediate stabilisation</li> <li>with Occlusal adjustments</li> <li>followed by cuspal</li> <li>protection</li> <li>c) Only occlusal</li> <li>adjustments</li> <li>d) No treatment required</li> </ul>	14 193 36 14	25.7 54.9 13.6 5.8
20	If pulpal involved is detected, the relief symptoms can be achieved by	<ul> <li>a) Immediate Stabilization along with pulpal extirpation</li> <li>b) Only Stabilization</li> <li>c) Only pulp extirpation</li> <li>d)No treatment</li> <li>requirement</li> </ul>	207 16 30 4	80.5 3 13.6 2
21	What will be the treatment plan if vertical crack extends through the pulpal floor or below the level of alveolar bone	<ul> <li>a) Leave the tooth as such</li> <li>b) Stabilization with orthodontic band</li> <li>c)Occlusal adjustments</li> <li>d) Extraction</li> </ul>	9 33 14 201	<ul><li>4.5</li><li>12.8</li><li>4.5</li><li>78.2</li></ul>
22	Crack tooth can be prevented by	<ul><li>a) Preparing the conservative cavities</li><li>b) Rounded internal line angles</li></ul>	14	5.4 4.3

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		c)Adequate cuspal protection d)All of the above	32 200	12.5 77.8
23	How frequently you encounter the crack tooth cases in your regular dental practice?	<ul><li>a) Weekly</li><li>b) Monthly</li><li>c) Half yearly</li><li>d) Yearly</li></ul>	12 56 84 105	<ul><li>9.7</li><li>21.4</li><li>32.7</li><li>36.2</li></ul>
24	Total number of patients (per month ) you come across in your practice with cracked tooth	<ul><li>a) 0-5</li><li>b) 5-10</li><li>c) More than 10</li></ul>	234 18 5	91.1 7 1.9

Table 1: Questions and options along with the frequency of responses by the participants

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