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## Management of Hot Tooth in Dental Practice: Awareness and Strategies Assessed through a Cross-Sectional Survey

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### ABSTRACT

**Objective:** To assess awareness, knowledge, and management strategies for handling hot tooth cases among dental practitioners.

**Study Design:** A cross-sectional descriptive study

**Place and Duration of Study:** Department of Endodontics, at Sardar Begum Dental College & Hospital, Gandhara University, Peshawar, from June 2023 to December 2023.

**Materials and Methods:** A survey was administered to 180 dental practitioners, including general dentists, endodontists, and oral surgeons. The questionnaire collected data on demographics, knowledge of the hot tooth phenomenon, anesthetic techniques, management approaches, and practitioners' confidence in handling such cases. Regression analysis identified factors influencing confidence levels.

**Results:** Of the respondents, 83.3% were familiar with the hot tooth phenomenon, but only 66.7% understood its pathophysiology. The inferior alveolar nerve block (44.4%) was the most commonly used technique, yet 72.2% reported difficulty achieving effective anesthesia. Alternative procedures, such as intraosseous injections, were utilized by 55.6% to enhance anesthetic success. Regression analysis revealed that years of practice ( $\beta = 0.12$ ,  $p = 0.005$ ), endodontic specialty ( $\beta = 0.25$ ,  $p = 0.001$ ), and prior awareness of hot tooth ( $\beta = 0.30$ ,  $p < 0.001$ ) were significant predictors of confidence ( $R^2 = 0.65$ ,  $p < 0.001$ ).

**Conclusion:** Most dental practitioners recognize the hot tooth phenomenon, but many lack comprehensive knowledge of its management. Endodontists and experienced practitioners demonstrate higher confidence, emphasizing the need for enhanced training in anesthetic techniques and alternative management methods.



### Key Words

Hot Tooth, Dental Anesthesia, Endodontic Pain, Anesthetic Failure, Dental Practitioners, Pain Management

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## INTRODUCTION

Pain management and efficient local anesthetic are essential in dental practice, directly affecting patient comfort, treatment effectiveness, and overall clinical results<sup>[1]</sup>. Insufficient pain management can result in heightened patient anxiety, evasion of dental care, and extended treatment durations, thereby undermining the quality of dental procedures. Effective local anesthesia not only enables painless dental procedures but also enhances patient compliance and pleasure<sup>[2, 3]</sup>. The term “hot tooth” denotes a dental ailment characterized by continuous pain and increased sensitivity to thermal stimuli, frequently complicating the administration of effective local anesthetic<sup>[4, 5]</sup>.

This condition is frequently observed in endodontic practice and can substantially influence the management and treatment outcomes for patients. Mandibular molars, recent trauma, and areas with defective or recent restorations are recognized as prevalent sites of “hot teeth,” where anesthetic failure rates may reach 44–81%<sup>[6–8]</sup>. The clinical signs of “hot pulp” encompass pain during mastication, acute severe pain elicited by cold stimuli, and subsequent pain triggered by heat. Despite its clinical importance, there is insufficient evidence regarding the awareness and management strategies concerning hot teeth among dental practitioners. Given the possible

problems and the necessity for specialized knowledge to manage such patients successfully, it is imperative to evaluate the existing level of awareness and strategies implemented by dental professionals [9–11]. This study aims to assess the awareness and management strategies for both hot tooth cases among dental practitioners in Pakistan. The results may provide valuable insights into their practitioners understanding, diagnostic techniques, and treatment options, thereby informing educational programs and improving the therapeutic practices to enhance patient outcomes in instances of hot tooth [12–14].

## MATERIALS AND METHODS

This study was a cross-sectional descriptive study carried out over a period of six months. Ethical approval for this survey was obtained from the Institutional Review Board (IRB) of Sardar Begum Dental College & Hospital, Gandhara University, Peshawar (Ref: **IRB/SBDC/2023/112**, dated **June 05, 2023**) Written informed consent was obtained from all participants prior to completing the questionnaire. If applicable, the IRB waived written consent for online participation (Ref: [INSERT REF IF WAIVER GIVEN]). Informed consent was obtained from all participants prior to their inclusion of the study. Non-probability convenience sampling was employed to select the sample. A sample size of 180 participants was determined using OpenEpi, based on a 7% margin of error and a 95% confidence level. The estimated prevalence of 78.79% for the hot tooth phenomena derived from a prior study.

The inclusion criteria included both males and females, qualified dentists (minimum BDS qualification), trainees in operative dentistry, endodontists, dental professionals practicing in Pakistan, and individuals aged 21 to 60 years. The exclusion criteria eliminated trainees from other dental specialties who are not presently practicing, dental technicians, frauds, and undergraduate students.

A pilot study of the questionnaire was conducted on a sample of 10 participants to identify any potential issues with the instrument and ensure clarity of the items. Cronbach Alpha was used to check the reliability of the questionnaire and it demonstrated that the instrument had a good level of internal consistency indicating that it was appropriate in the study. Sampling and recruitment

WhatsApp numbers and email addresses were compiled from the authors' professional contacts, institutional directories, and publicly available contact details in recent publications. Participation was

voluntary and no incentives were offered. We used non-probability convenience sampling; participants who did not complete all mandatory items were excluded. The inclusion and exclusion criteria described above were applied during screening. The administration of the questionnaire was done through WhatsApp groups to the dental practitioners. The survey was designed using the Google Forms platform to send the survey to the participants. The survey consisted of 12 questions that focused on the meaning of the term key hot tooth, some of its feared etiological factors, factors promoting anesthetic failure, its clinical features, common locations and management issues. Participants had to answer all the questions and the demographic information, as well as other independent variables were recorded. The responses were recorded using Google Forms and these were automatically recorded on an Excel sheet to be analyzed further. SPSS version 26 software was used in the analysis of the data. Both qualitative variables and continuous variables were used in the computation of descriptive statistics. Qualitative data were tabulated into frequencies and percentages, whereas the measurements of the continuous data were presented as the mean and the standard deviation (SD). Statistical analysis

- Data were exported from Google Forms to Excel and analyzed in SPSS v26. Statistical analysis
- Descriptive statistics (frequencies, percentages, mean  $\pm$  standard deviation [SD]) were calculated for all study variables.
- The primary outcome was practitioners' self-rated confidence in managing hot-tooth cases, measured on a 5-point Likert scale (1 = not confident to 5 = very confident). This was treated as a continuous score for regression analysis, an accepted approach when using Likert-type measures. A sensitivity analysis using ordinal logistic regression was considered to confirm the robustness of findings.

Multiple linear regression was applied to identify predictors of confidence. Independent variables were coded as follows:

- Age (years, continuous).
- Years of practice (continuous).
- Specialty (Endodontist = 1; General dentist/Oral surgeon = 0).
- Prior knowledge of hot tooth (Yes = 1; No = 0).
- Experience with hot-tooth cases is categorized as follows: 0 = none, 1 = 1–5 cases, 2 = 6–10 cases, 3 = >10 cases; entered as ordinal.

Regression results are presented as unstandardized coefficients ( $\beta$ ) with 95% confidence intervals (CI) and p-values. Model fit was evaluated using the coefficient of determination ( $R^2$ ) and the overall F-test.

Assumptions of linear regression were assessed:

- Normality of residuals (Shapiro–Wilk test, Q–Q plots).
- Homoscedasticity (residual vs. fitted plots, Breusch–Pagan test).
- Multicollinearity (variance inflation factor [VIF]; threshold <5).
- Independence of errors (Durbin–Watson statistic).

If assumptions were violated, robust standard errors or alternative ordinal models were considered. A two-tailed  $p < 0.05$  was considered statistically significant.

## RESULTS

Table 1 shows the demographic characteristics of the study, comprised an equal representation of male (50%) and female (50%) dental practitioners. The largest proportion (33.3%) were aged 25-30 years, followed by those aged 31-35 years (27.8%), 36-40 years (22.2%), and 41 years and above (16.7%). Regarding experience, 38.9% had less than 5 years, 33.3% had 5-10 years, 16.7% had 11-15 years, and 11.1% exceeded 15 years of experience. General dentists constituted the predominant category (55.6%), succeeded by endodontists (27.8%) and oral surgeons (16.7%). In terms of employment distribution, the majority of practitioners were employed in private clinics (44.4%), followed by hospitals (38.9%) and academic institutions (16.7%). This varied sample offers a comprehensive representation of dental practitioners from various disciplines and practice environments.

**Table 1:** Demographic Data of Respondents

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	90	50
	Female	90	50
Age Group (Years)	25-30	60	33.3
	31-35	50	27.8
	36-40	40	22.2
	41 and above	30	16.7
Years of Practice	< 5 years	70	38.9
	5-10 years	60	33.3
	11-15 years	30	16.7
	> 15 years	20	11.1
Specialization	General Dentist	100	55.6
	Endodontist	50	27.8
	Oral Surgeon	30	16.7
Workplace	Private Clinic	80	44.4
	Hospital	70	38.9
	Academic Institution	30	16.7

Table 2 findings reveal that 83.3% of dental practitioners are acquainted with the term “Hot Tooth,” whilst 16.7% are not. Nonetheless, comprehension of its pathophysiology is rather deficient, with 66.7% exhibiting knowledge and 33.3% lacking a definitive grasp. In response to inquiries on anesthetic management, 77.8% of participants recognized that a hot tooth necessitates a distinct anesthetic technique, whereas 22.2% failed to grasp the requirement for an alternate strategy. The data indicate that, although awareness of the word is prevalent, there remains a deficiency in thorough understanding and clinical management among practitioners.

**Table 2:** Awareness and Knowledge of Hot Tooth Management

Question	Category	Frequency (n)	Percentage (%)
Awareness of "Hot Tooth"	Yes	150	83.3
	No	30	16.7
Understanding Pathophysiology	Yes	120	66.7
	No	60	33.3
Belief that Different Anesthetic Approach Required	Yes	140	77.8
	No	40	22.2
Preferred Technique	Inferior alveolar nerve block	80	44.4
	Gow-Gates technique	40	22.2
	PDL injection	30	16.7
	Intraosseous injection	20	11.1
	Others	10	5.6
Difficulty Achieving Anesthesia	Yes	130	72.2
	No	50	27.8

Table 2 reveal that the inferior alveolar nerve block (IANB) is the predominant anesthetic treatment favored for hot tooth situations, employed by 44.4% of practitioners. Nonetheless, alternate procedures include the Gow-Gates technique (22.2%), PDL injection (16.7%), and intraosseous injection (11.1%) are utilized, with a minority (5.6%) selecting additional approaches. A substantial majority (72.2%) of responders indicated challenges in attaining anesthesia for hot tooth situations, whereas just 27.8% did not face such difficulties. The findings underscore

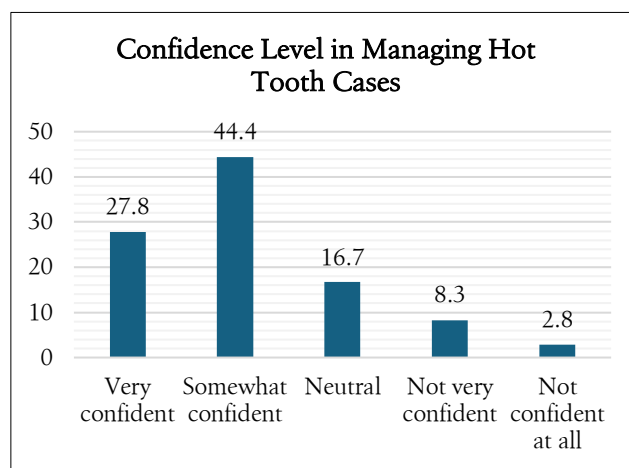
the difficulties associated with anesthetizing approaches of acute dental pain and indicate a necessity for enhanced knowledge and implementation of adjunctive anesthetic methods to elevate clinical success rates.

Table 3 results indicate that the predominant management options for hot tooth cases are the administration of supplemental anesthesia (55.6%) and the augmentation of anesthetic dosage (50%), suggesting that several practitioners seek to improve anesthesia efficacy through these approaches. Furthermore, 44.4% of participants indicated a transition to alternative anesthetic drugs when traditional methods were ineffective. Immediate pulp extirpation was conducted in 38.9% of cases, whereas 27.8% administered preoperative analgesics to facilitate pain management. Only 11.1% of practitioners choose to defer treatment owing to pain, indicating that the majority favor active action over postponement. The results indicate that although practitioners utilize diverse management tactics, a stronger focus on evidence-based techniques could improve treatment outcomes.

**Table 3:** Management Strategies for Hot Tooth Cases

Management Approach	Frequency (n)	Percentage (%)
Increasing anesthetic dosage	90	50
Using supplemental anesthesia (intraalveolar, intraosseous)	100	55.6
Switching to different anesthetic agents	80	44.4
Performing pulp extirpation immediately	70	38.9
Prescribing preoperative analgesics	50	27.8
Delaying treatment due to pain	20	11.1

Figure 1 reveal differing degrees of confidence among dental practitioners in handling hot tooth instances. Although 27.8% expressed high confidence, the predominant group (44.4%) characterized themselves as fairly confident, indicating that numerous practitioners feel moderately equipped yet may encounter difficulties. 16.7% adopted a neutral position, 8.3% expressed limited confidence, and 2.8% reported a complete lack of confidence. The findings indicate that although the majority of practitioners possess a degree of confidence, a significant number could gain from further training and exposure to advanced anesthetic and pain management approaches to improve their efficacy in managing hot tooth patients.



**Figure 1:** Confidence Level in Managing Hot Tooth Cases

Table 4 regression analysis shows multiple important predictors of confidence in addressing acute dental situations among practitioners. Prior knowledge of the hot tooth ( $\beta = 0.30, p < 0.001$ ) was identified as the most potent predictor, suggesting that practitioners acquainted with the notion exhibit markedly more confidence in managing such patients. Specialization in endodontics ( $\beta = 0.25, p = 0.001$ ) significantly contributed, indicating that specialized training improves proficiency. Years of practice ( $\beta = 0.12, p = 0.005$ ) and experience with challenging dental patients ( $\beta = 0.15, p = 0.008$ ) shown a positive correlation with confidence, underscoring the significance of clinical exposure. Furthermore, age ( $\beta = 0.08, p = 0.012$ ) had a moderate yet significant influence, suggesting that older practitioners may possess increased confidence. The model accounts for a significant percentage of the variance ( $R^2 = 0.65$ ), underscoring the significance of education, expertise, and practical experience in enhancing practitioners' confidence in handling hot tooth patients.

Multiple linear regression (confidence treated as continuous) identified several independent predictors of higher practitioners' confidence (Table 5). The number of years in practice was associated with greater confidence ( $\beta = 0.12; 95\% \text{ CI } 0.04\text{--}0.20; p = 0.005$ ). Specialization in endodontics predicted higher confidence compared with other specialties ( $\beta = 0.25; 95\% \text{ CI } 0.11\text{--}0.39; p = 0.001$ ). Previous knowledge of the hot-tooth phenomenon was strongly associated with increased confidence ( $\beta = 0.30; 95\% \text{ CI } 0.14\text{--}0.46; p < 0.001$ ). Experience with hot-tooth cases also contributed positively ( $\beta = 0.15; 95\% \text{ CI } 0.04\text{--}0.26; p = 0.008$ ). Age had a modest effect ( $\beta = 0.08; 95\% \text{ CI } 0.02\text{--}0.14; p = 0.012$ ). The model

explained a substantial proportion of variance in confidence ( $R^2 = 0.65$ ; overall model  $p < 0.001$ ). Assumptions of the linear regression model were assessed and found to be acceptable (normality of residuals, homoscedasticity, VIFs within acceptable ranges, and independence of residuals); residual plots and diagnostic statistics are available upon request.

**Table 4:** Regression Analysis Results

Predictor Variable	Coefficient ( $\beta$ )	Standard Error	p-value	95% CI (Lower - Upper)
Age (years)	0.08	0.03	0.012*	0.02 – 0.14
Years of Practice	0.12	0.04	0.005**	0.04 – 0.20
Specialization (Endodontist = 1)	0.25	0.07	0.001**	0.11 – 0.39
Previous Knowledge of Hot Tooth (Yes = 1)	0.3	0.08	0.000**	0.14 – 0.46
Experience with Hot Tooth Cases	0.15	0.06	0.008**	0.04 – 0.26
Constant	1.2	0.2	0.000**	0.80 – 1.60

## DISCUSSION

This study's findings demonstrate the awareness and management strategies of dental practitioners concerning hot tooth, a condition identical with permanent pulpitis. Notwithstanding progress in dental care and the accessibility of efficacious drugs, instances of hot tooth provide difficulties in attaining pain management and anesthetic. In this study, a significant percentage of dental practitioners recognized the term “hot tooth,” with 85.50% confirming its presence [15]. Nevertheless, a significant subset (14.50%) remained uninformed, suggesting possible deficiencies in knowledge transmission or education concerning this illness. Comparable results were documented in prior research [16, 17].

Regarding anesthesia approaches, lip numbness was the favored way for providing lower pulpal anesthesia among 70.23% of practitioners, whereas 29.77% depended on the absence of pain during access. Mandibular molars were recognized as the most difficult teeth to anesthetize by 81.68% of participants, underscoring the particular challenges associated with this category of teeth. These findings correspond with prior literature demonstrating elevated failure rates in attaining anesthesia for mandibular molars relative to other tooth types. A notable disparity in awareness levels of hot tooth was noted among various qualification tiers, with specialized practitioners exhibiting greater awareness

than general dental practitioners and trainees. This may be ascribed to the particular training and exposure to intricate situations that endodontists undergo, which enhances their awareness of problems such as hot tooth. Previous studies indicated that dental practitioners with better qualifications possess more awareness of dental issues and procedures [18, 19].

Furthermore, the selection of anesthetic techniques differed significantly across different qualification levels, with endodontists demonstrating a predilection for treatments such as the maxillary block, which were less frequently employed by general dentistry practitioners and trainees. This divergence in practice patterns highlights the necessity of customized training and educational programs to prepare dental practitioners with the requisite skills and knowledge to proficiently handle hot tooth patients. The use of supplemental injections for addressing hot tooth varied significantly among qualification levels, with endodontists demonstrating a reduced inclination to employ such injections in contrast to ordinary dental practitioners and trainees. This variation in practice approaches may indicate differing degrees of confidence and competence in handling complex endodontic patients among various practitioner groups [20, 21].

The limited utilization of the intraosseous (IO) injection technique among dental professionals may be ascribed to its procedural sensitivity and complexity. These obstacles can be mitigated with suitable training and the application of guiding tips that facilitate needle insertion into the bone. Furthermore, although there is apprehension regarding a transient elevation in heart rate subsequent to the delivery of vasopressor-containing anesthetics via intraosseous injections, studies indicate that heart rates often normalize within four minutes. Consequently, notwithstanding these apprehensions, the IO approach continues to be a valuable alternative for addressing instances of unsuccessful anesthesia [22, 24].

## Limitations

This study has several limitations. First, convenience sampling via WhatsApp groups and email invitations may have introduced selection and self-selection bias; the sample may not be fully representative of all dental practitioners in Pakistan. Where total invitations were sent to open groups, an exact response rate could not be calculated, limiting assessment of non-responder bias. Second, data were self-reported and subject to recall and social desirability bias. Third, the instrument relied on a 5-point self-rated confidence scale that was

treated as continuous for regression analysis; although this is an accepted approach for multi-item scales, an ordinal logistic regression sensitivity analysis could further validate findings. Finally, the study was single-center in coordination and used authors' professional networks for recruitment, which may limit the generalizability of results. Future multi-center studies with probability sampling and objective clinical measures are recommended.

## CONCLUSION

This study emphasizes that although the majority of dental practitioners recognize the hot tooth phenomena, there are deficiencies in their comprehension and management of this complex problem. A considerable number of practitioners encounter difficulties in attaining effective anesthesia, frequently depending on traditional approaches that may prove inadequate. The results indicate that experience, specialty in endodontics, and prior knowledge are critical factors affecting confidence in handling hot tooth cases. To enhance patient outcomes, it is crucial to incorporate modern anesthetic procedures, adjunctive injections, and evidence-based pain management treatments into dental education curricula. Ongoing education and practical workshops can address the knowledge deficit, ensuring that practitioners are adequately prepared to manage complex anesthetic patients effectively.

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Future study should focus on evaluating the clinical effectiveness of various anesthetic approaches and investigating innovative strategies to manage the hot tooth phenomena more effectively in clinical practices.

## Declarations

Ethics approval and consent to participate: Ethical approval for this survey was obtained from the Institutional Review Board (IRB) of Sardar Begum Dental College & Hospital, Gandhara University, Peshawar(Ref: **IRB/SBDC/2023/112**, dated **June 05, 2023**) .Written informed consent was obtained from all participants.

**Availability of data and materials:** De-identified data that support the findings of this study are available from the corresponding author upon reasonable request.

**Disclaimer:** Nil

**Conflict of Interest:** The authors declare no conflict of interest related to this study.

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## AUTHOR'S CONTRIBUTION

**SIG:** study conceptualization and manuscript drafting;

**SMJ:** data collection and management;

**SIG:** statistical analysis and interpretation.

All authors read and approved the final manuscript.

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