



“Endodontic Practice Profile amongst General Dental Practitioners in Chhatrapati Sambhajnagar: A Questionnaire Based Survey”

Dr. Devika Kale¹, Dr. Himanshu Gupta², Dr. Pooja Muley³, Dr. Dhanshri Pawar⁴, Dr. Roshani Nale⁵

¹(Fellowship Student, Endodontics, Oralcare.co.in, Chhatrapati Sambhajnagar, Maharashtra, India).

²(Head of the Institute, Oralcare.co.in, Chhatrapati Sambhajnagar, Maharashtra, India).

³(Mentor, MDS, Oralcare.co.in, Chhatrapati Sambhajnagar, Maharashtra, India).

⁴(Fellowship Student, Oral Implantology, Oralcare.co.in, Chhatrapati Sambhajnagar, Maharashtra, India)

⁵(Fellowship Student, Aesthetic and Cosmetic Dentistry, Oralcare.co.in, Chhatrapati Sambhajnagar, Maharashtra, India)

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ABSTRACT:

Introduction: Variations in endodontic practice among general dental practitioners (GDPs) may influence treatment quality and long-term outcomes. Assessing contemporary clinical trends helps identify gaps between recommended guidelines and routine practice.

Aim: To assess the endodontic practice profile of GDPs in Chhatrapati Sambhajnagar through a structured questionnaire survey.

Methods: A cross-sectional study was conducted among 145 GDPs using a pre-validated, self-administered digital questionnaire. The survey evaluated demographic characteristics, case selection, instrumentation methods, irrigants, obturation techniques, adjunctive technologies, and infection control practices. A total of 109 complete responses (75.1%) were analysed using descriptive statistics and chi-square testing.

Results: Younger practitioners constituted the majority of respondents. Apex locators and digital radiography were widely adopted for working length determination and imaging. Sodium hypochlorite and calcium hydroxide were the predominant irrigant and intracanal medicament, respectively. Rotary instrumentation and lateral compaction were commonly practiced. However, consistent rubber dam usage and magnification adoption were limited. Antibiotic prescription patterns indicated symptom-based prescribing trends.

Conclusion: GDPs demonstrate encouraging integration of modern endodontic technologies; however, deficiencies in rubber dam application, magnification use, and antibiotic stewardship underscore the need for focused continuing dental education initiatives.

KEYWORDS:Endodontics; Root canal therapy; General dental practitioners; Clinical practice patterns; Rubber dam isolation; Rotary NiTi instruments; Digital radiography; Antibiotic stewardship.

I. INTRODUCTION

The primary objective of root canal therapy (RCT) is to preserve the natural tooth by eliminating infection, relieving pulpal inflammation caused by microbial and chemical irritants, and preventing or treating diseases of the periapical tissues. The biological basis of RCT involves significant reduction or complete elimination of microorganisms from the root canal system through effective chemo-mechanical preparation, followed by three-dimensional obturation to prevent reinfection. Proper cleaning, shaping, and sealing of the canal space are fundamental to achieving long-term periapical healing and restoration of normal tooth function. [1]

The success of endodontic treatment is influenced by multiple factors, including operator skill, adherence to standardized protocols, case selection, and the use of advanced technologies. Literature reports success rates as high as 90% when treatment is performed by endodontic specialists, whereas procedures carried out by general dental practitioners (GDPs) typically demonstrate success rates ranging from 65–75%. These variations highlight the importance of continual education, updated clinical knowledge, and the incorporation of evidence-based techniques in general dental practice. [2]

Contemporary endodontics has evolved significantly with the introduction of adjunctive technologies that enhance precision and safety.



Electronic apex locators improve the accuracy of working length determination and reduce reliance on radiographs, thereby minimizing radiation exposure. Magnification devices such as loupes and operating microscopes enhance visualization of complex canal anatomies, accessory canals, and procedural errors, leading to improved treatment outcomes. Rubber dam isolation is internationally recommended as the standard of care to maintain asepsis, prevent salivary contamination, and ensure patient safety during procedures. Despite these advantages, many GDPs continue to rely on conventional radiographic methods and tactile sensation, and routine rubber dam use remains inconsistent due to perceived barriers such as time, cost, and patient compliance. Assessing the adoption of these adjuncts provides insight into the standardization and quality of endodontic care delivered in general practice. [3][4]

Effective irrigation and intracanal medication are indispensable components of successful RCT. Mechanical instrumentation alone cannot adequately clean the intricate root canal system; therefore, irrigating solutions are essential to dissolve organic tissues, eliminate microorganisms, and remove the smear layer. Sodium hypochlorite remains the irrigant of choice due to its strong antimicrobial and tissue-dissolving properties, often used in combination with EDTA to enhance dentin cleanliness and improve sealer adaptation. Activation techniques such as ultrasonic or sonic agitation further improve irrigant penetration into canal irregularities. [5][7]

In multi-visit treatments, intracanal medicaments help maintain canal disinfection between appointments, suppress residual bacteria, and promote periapical healing. Calcium hydroxide is the most widely used medicament because of its high alkaline pH and antibacterial action, although its effectiveness against resistant organisms such as *Enterococcus faecalis* is limited. Alternative agents, including chlorhexidine and antibiotic-based preparations, have been explored to enhance antimicrobial efficacy. [6][8]

Sterilization of endodontic instruments is a critical aspect of infection control, as these instruments are exposed to saliva, blood, and infected tissues. Steam autoclaving is considered the gold standard for achieving complete sterility. However, repeated sterilization cycles may alter the surface characteristics, cutting efficiency, and fatigue resistance of nickel-titanium and stainless-steel instruments. Therefore, sterilization protocols must balance effective microbial elimination with preservation of instrument integrity to ensure safe and predictable clinical outcomes. [9][10]

II. METHODS

A cross-sectional questionnaire-based survey was conducted among general dental practitioners (GDPs) in Chhatrapati Sambhajnagar to evaluate their endodontic practice patterns. A total of 145 practitioners were selected using convenience sampling.

Data were collected using a pre-validated, self-administered questionnaire created in Google Forms and distributed digitally via WhatsApp and other social media platforms. The questionnaire assessed demographic details, clinical approaches to root canal therapy, use of instruments and materials, adoption of modern endodontic adjuncts, and infection control practices.

Of the 145 questionnaires distributed, 109 complete responses were received (response rate: 75.1%) and included for analysis. Participation was voluntary, and informed consent and confidentiality were ensured.

Inclusion criteria comprised registered GDPs practicing in Chhatrapati Sambhajnagar who routinely perform endodontic procedures. Specialists in Conservative Dentistry and Endodontics, non-practicing dentists, incomplete responses, and practitioners outside the study area were excluded.

III. RESULTS

Out of the 145 questionnaires distributed to general dental practitioners (GDPs), a total of 109 were completed and returned, resulting in a response rate of 75.2%, which was considered satisfactory for analysis and interpretation. The demographic profile of the respondents revealed that nearly half of the participants (49.1%, $n = 54$) were below 30 years of age, while 20% ($n = 22$) were between 31 and 40 years, and 30.9% ($n = 34$) were between 41 and 50 years, indicating a predominance of relatively young practitioners in the study population.

In terms of gender distribution, 58 respondents (52.7%) were male and 51 (47.3%) were female, demonstrating an almost equal representation of both genders with a slight male predominance.

With respect to clinical experience, the largest proportion of GDPs reported having 6–10 years of experience (41.8%, $n = 46$), followed by 2–5 years (31.8%, $n = 35$) and less than 1 year of experience (25.5%, $n = 28$), whereas only one practitioner (0.9%) had more than 10 years of clinical experience, suggesting that the majority of respondents were in the early to mid-stages of their professional careers.



Regarding the types of cases managed in daily practice, most practitioners reported treating multirrooted teeth (75.5%, $n = 83$), whereas single-rooted teeth accounted for 19.1% ($n = 21$) and retreatment cases for 5.5% ($n = 6$), and this distribution was statistically significant ($\chi^2 = 8.76$, $p = 0.041$), indicating a clear preference or greater exposure to multirrooted cases.

The use of rubber dam isolation varied among practitioners, with 58.2% ($n = 64$) reporting occasional use, 39.1% ($n = 43$) reporting that they never used rubber dam, and only 2.7% ($n = 3$) indicating consistent use in all cases; however, this variation did not reach statistical significance ($\chi^2 = 3.87$, $p = 0.213$).

In terms of workload, 30.9% ($n = 34$) of practitioners performed 0–5 root canal treatments (RCTs) per week, 29.1% ($n = 32$) performed 6–10 RCTs weekly, and another 29.1% ($n = 32$) reported performing 21 or more RCTs per week, while the remaining proportion fell within intermediate ranges, with no statistically significant difference observed in the distribution ($\chi^2 = 5.76$, $p = 0.194$).

Concerning intracanal medicaments, calcium hydroxide was overwhelmingly preferred (82.7%, $n = 91$), followed by formocresol (9.1%, $n = 10$), and this difference was statistically significant ($\chi^2 = 15.39$, $p = 0.004$), reflecting a strong inclination toward calcium hydroxide as the medicament of choice.

For working length determination, the majority of respondents relied on apex locators (77.3%, $n = 85$), while 15.5% ($n = 17$) used radiographs with an instrument in the canal; this preference was statistically significant ($\chi^2 = 13.86$, $p = 0.013$). Digital radiography was used exclusively by 69.1% ($n = 76$) of practitioners, 23.6% ($n = 26$) used both digital and conventional film-based radiography, and only 7.3% ($n = 8$) relied solely on film-based imaging, with the observed distribution being statistically significant ($\chi^2 = 10.37$, $p = 0.018$), highlighting the widespread adoption of digital imaging systems.

The use of magnification devices was limited, as 72.7% ($n = 80$) of practitioners reported not using any form of magnification, while 20.9% ($n = 23$) used loupes and 6.4% ($n = 7$) used a dental operating microscope, and this difference was statistically significant ($\chi^2 = 11.87$, $p = 0.014$).

In terms of instrumentation, rotary nickel–titanium (NiTi) files were most commonly utilized (63.6%, $n = 70$), followed by NiTi hand files (30%, $n = 33$); however, this difference was not statistically significant ($\chi^2 = 4.973$, $p = 0.086$). Regarding canal preparation techniques, the step-back technique was preferred by 75.5% ($n = 83$) of

practitioners, whereas 20.9% ($n = 23$) used the crown-down technique, and this difference was statistically significant ($\chi^2 = 13.48$, $p = 0.007$).

Sodium hypochlorite was the primary irrigant for 88.2% ($n = 97$) of respondents, followed by normal saline (9.1%, $n = 10$), with a statistically significant difference observed ($\chi^2 = 17.91$, $p = 0.001$), indicating strong consensus regarding irrigant selection.

For obturation, lateral compaction techniques (cold or warm) were preferred by 80.9% ($n = 89$) of practitioners, while 14.5% ($n = 16$) opted for the single-cone technique, and this difference was statistically significant ($\chi^2 = 11.86$, $p = 0.005$). Epoxy resin–based sealers were most frequently used (58.2%, $n = 64$), followed by zinc oxide eugenol–based sealers (30%, $n = 33$), though this variation was not statistically significant ($\chi^2 = 4.064$, $p = 0.214$).

With regard to post-endodontic restoration, composite resin was the material of choice for 68.2% ($n = 75$) of practitioners, followed by glass ionomer cement (26.4%, $n = 29$), without a statistically significant difference ($\chi^2 = 3.87$, $p = 0.421$).

Antibiotic prescription practices indicated that 72.7% ($n = 80$) of practitioners prescribed antibiotics primarily in the presence of symptoms or pain, and this distribution was statistically significant ($\chi^2 = 10.75$, $p = 0.031$).

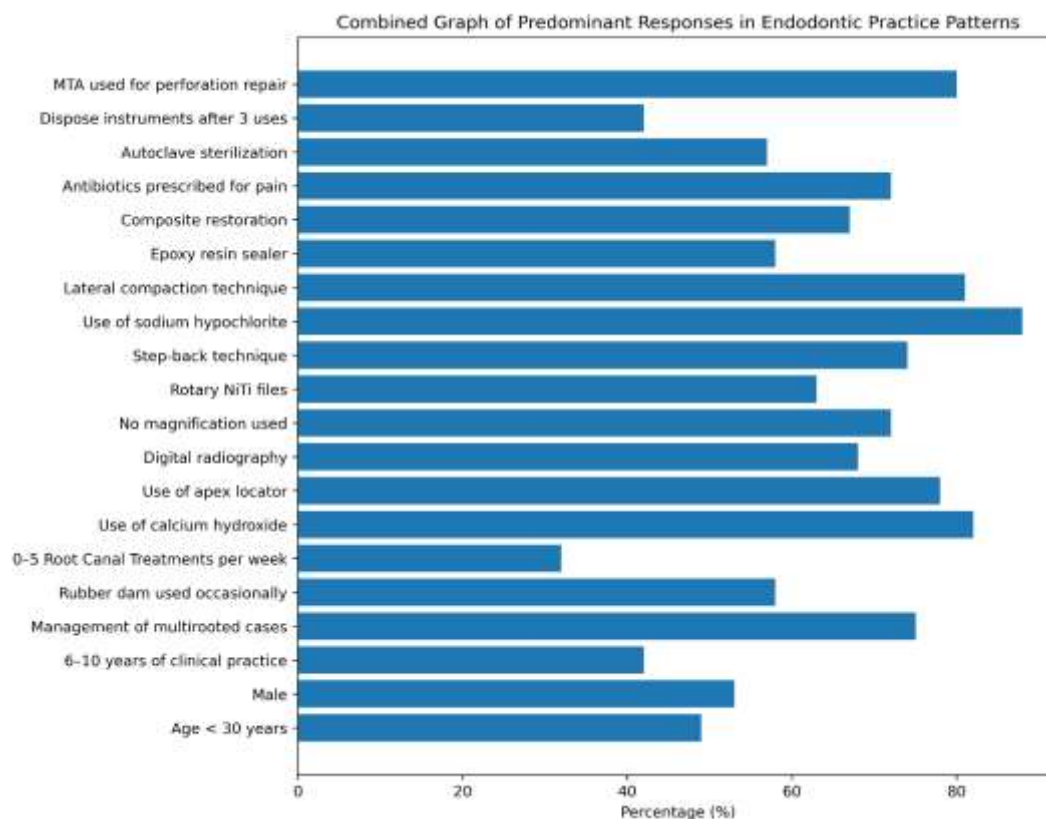
Autoclaving was the most commonly employed sterilization method (57.3%, $n = 63$), followed by chemical sterilization (21.8%, $n = 24$), although no statistically significant difference was observed ($\chi^2 = 3.087$, $p = 0.418$). Most practitioners reported discarding endodontic files after three uses (41.8%, $n = 46$), with no statistically significant variation in disposal patterns ($\chi^2 = 2.198$, $p = 0.745$).

Finally, mineral trioxide aggregate (MTA) was the preferred material for perforation repair and root-end fillings in 80.9% ($n = 89$) of cases, followed by glass ionomer cement (18.2%, $n = 20$), and this difference was statistically significant ($\chi^2 = 18.74$, $p = 0.045$).

Overall, the findings demonstrate distinct trends in clinical practice patterns among GDPs, with statistically significant preferences observed in several key aspects of endodontic management, while other variables showed more evenly distributed practices without significant differences.



Combined Graph of Predominant Responses in Endodontic Practice Patterns:



IV. DISCUSSION

This study evaluated endodontic practice patterns among general dental practitioners (GDPs) in Chhatrapati Sambhajnagar and achieved a satisfactory response rate of 75.1%. The demographic distribution revealed a predominance of relatively young practitioners, with most respondents having fewer than 10 years of clinical experience. Similar demographic trends were reported by Udoye et al. [11] and Ankita et al. [12], indicating a broader pattern of early-career dentists entering general practice. The predominance of younger clinicians may influence clinical decision-making, technology adoption, and reliance on conventional techniques due to limited long-term clinical exposure.

Most respondents reported treating multirrooted teeth more frequently than single-rooted teeth or retreatment cases, reflecting growing confidence in managing moderately complex endodontic cases. Comparable findings were reported by Ankita et al. [12]. The relatively low proportion of retreatment cases may indicate referral of failed or complex cases to specialists.

Rubber dam usage was notably low, with only a small percentage consistently applying it

despite being considered the standard of care. This finding is consistent with Ahmad [13], who highlighted the persistent underutilization of rubber dam isolation globally. Similar barriers, including patient discomfort and time constraints, were reported by Madarati et al. [14]. Lawson et al. [4] also found that a significant proportion of GDPs in the United States did not routinely use rubber dam isolation. These consistent findings across regions emphasize the ongoing gap between recommended guidelines and clinical practice.

Encouragingly, calcium hydroxide was the most commonly used intracanal medicament, in agreement with findings by Udoye et al. [11], reflecting adherence to evidence-based protocols. Sodium hypochlorite was the primary irrigant, consistent with its well-documented antimicrobial and tissue-dissolving properties as discussed by Eleazer et al. [15]. The widespread use of electronic apex locators demonstrates a positive shift toward modern working length determination techniques, as supported by Patel et al. [16] and Gupta et al. [17], who emphasized improved accuracy and reduced radiation exposure compared to radiographic methods alone.



Digital radiography was widely adopted; however, magnification devices were underutilized. De Carvalho and Zuolo [18] demonstrated that operating microscopes significantly enhance canal orifice detection, while Kiraz et al. [19] reported limited magnification use among practitioners due to economic and logistical factors. These findings align with the present study and highlight potential areas for improvement in visualization and precision during endodontic procedures.

Rotary nickel–titanium (NiTi) instrumentation was used by a majority of practitioners, consistent with contemporary recommendations highlighting its flexibility and reduced risk of canal transportation. Buchanan et al. [20] advocated for careful instrument usage to minimize fracture risk. However, similar to findings by Ankita et al. [12], conventional preparation techniques such as step-back remain prevalent, indicating gradual rather than complete transition to modern systems.

Lateral compaction was the preferred obturation technique, and epoxy resin–based sealers were commonly used, aligning with trends reported by Eleazer et al. [15] and Marian et al. [21]. Emerging materials and activation techniques have been discussed by Gupta et al. [17], suggesting evolving advancements in endodontic obturation and irrigation protocols. Composite resin was the most commonly selected post-endodontic restorative material, consistent with findings by Singh et al. [22], reflecting global emphasis on aesthetic and durable restorations.

Antibiotics were primarily prescribed in symptomatic cases; however, prescribing trends observed in this and other studies raise concerns regarding antimicrobial stewardship. Vengidesh et al. [23] reported inappropriate antibiotic prescribing practices among practitioners, underscoring the need for stricter adherence to guidelines. Regarding sterilization, autoclaving was the most common method, and most practitioners reported limited reuse of files. Similar infection control patterns were noted by Madarati et al. [24], though compliance with single-use protocols remains suboptimal.

Mineral trioxide aggregate (MTA) was the preferred material for perforation repair and root-end filling, consistent with literature supporting its superior sealing ability and biocompatibility as reported by Mahmoud T. et al. [25]. While Marian et al. [21] reported variability in material selection among Romanian dentists, the strong preference for MTA in the present study reflects alignment with contemporary evidence-based recommendations.

Overall, the findings indicate satisfactory adoption of core endodontic principles among GDPs in Chhatrapati Sambhajnagar, particularly in the use of sodium hypochlorite, calcium hydroxide, apex locators, and MTA. However, gaps remain in rubber dam application, magnification use, and rational antibiotic prescribing. Although the voluntary nature of participation may limit generalizability, this study provides important baseline data for the region. Future research with larger and more diverse samples is recommended to further explore barriers to guideline implementation and to inform targeted continuing dental education programs aimed at improving the quality and standardization of endodontic practice.

V. CONCLUSION

Overall, general dental practitioners in Chhatrapati Sambhajnagar demonstrate substantial adoption of contemporary endodontic techniques, including rotary instrumentation, electronic apex locators, digital radiography, sodium hypochlorite irrigation, and mineral trioxide aggregate for perforation and root-end management. Nevertheless, routine use of rubber dam isolation, magnification tools, and evidence-based antibiotic prescribing remains limited. Strengthening targeted clinical training, hands-on workshops, and continuing dental education programs could enhance adherence to best practices, improve treatment outcomes, and promote patient safety in general dental practice. Furthermore, similar large-scale studies in other regions are needed to evaluate endodontic practice patterns across diverse settings and to identify additional areas for improvement, supporting evidence-based strategies for clinical training and policy development.

REFERENCES

- [1]. Shrestha, D., Dahal, M., & Karki, S. (2013). An endodontic practice profile amongst general dental practitioners in Kathmandu: A questionnaire survey. *Journal of College of Medical Sciences-Nepal*, 9(4), 40–50. <https://nepjol.info/index.php/JCMSN/article/view/10235>
- [2]. Jouhar, R., Ahmed, M. A., Almomen, H. A. A., BuHulayqah, A. A. J., Alkashi, M. Y. A., Al-Quraini, A. A. A., & Ahmed, N. (2022). Assessment of the current endodontic practices among general dental practitioners in the Kingdom of Saudi Arabia. *International Journal of Environmental Research and Public Health*, 19(11), 6601.



- <https://www.mdpi.com/1660-4601/19/11/6601>
- [3]. Savani, G. M., Sabbah, W., Sedgley, C. M., & Whitten, B. (2014). Current trends in endodontic treatment by general dental practitioners: report of a United States national survey. *Journal of endodontics*, 40(5), 618–624. <https://doi.org/10.1016/j.joen.2014.01.029>
- [4]. Lawson, N. C., Gilbert, G. H., Funkhouser, E., Eleazer, P. D., Benjamin, P. L., Worley, D. C., & National Dental PBRN Collaborative Group (2015). General Dentists' Use of Isolation Techniques during Root Canal Treatment: From the National Dental Practice-based Research Network. *Journal of endodontics*, 41(8), 1219–1225. <https://doi.org/10.1016/j.joen.2015.04.017>
- [5]. Gupta, S. (2025). A systematic review of advances in endodontic irrigation. *BMC Oral Health*, 25(1), 118. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC12244762/>
- [6]. Mohammadi, Z., & Dummer, P. M. H. (2011). Properties and applications of calcium hydroxide in endodontics and dental traumatology. *International Endodontic Journal*, 44(8), 697–730. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3539092/>
- [7]. Khoury, E., Lombardi, T., Bouillaguet, S., & Rocca, G. T. (2024). Endodontic irrigants from a comprehensive perspective. *European Endodontic Journal*, 9(1), 1–12. <https://pmc.ncbi.nlm.nih.gov/articles/PMC11235474/>
- [8]. Dr. Anil K. Tomer. (2020). INTRACANAL MEDICAMENTS - A REVIEW. *International Journal of Medical Science And Diagnosis Research*, 4(7). Retrieved from <https://www.ijmsdr.com/index.php/ijmsdr/article/view/621>
- [9]. Journal of the International Clinical Dental Research Organization. (2022). An update on sterilization and disinfection of endodontic instruments. *Journal of the International Clinical Dental Research Organization*, 14(2), 97–103. https://journals.lww.com/jicd/_layouts/15/oaks.journals/downloadpdf.aspx?an=01793671-202214020-00003
- [10]. Dioguardi, M., Laneve, E., Di Cosola, M., Cazzolla, A. P., Sovereto, D., & others. (2021). The effects of sterilization procedures on the cutting efficiency of endodontic instruments: A systematic review and network meta-analysis. *Materials*, 14(6), 1559. <https://doi.org/10.3390/ma14061559>
- [11]. Udoye, C. I., Sede, M. A., Jafarzadeh, H., & Abbott, P. V. (2013). A survey of endodontic practices among dentists in Nigeria. *The journal of contemporary dental practice*, 14(2), 293–298. <https://doi.org/10.5005/jp-journals-10024-1316>
- [12]. Mohanty, A., Patro, S., Barman, D., & Jnaneswar, A. (2020). Modern endodontic practices among dentists in India: A comparative cross-sectional nation-based survey. *Journal of conservative dentistry: JCD*, 23(5), 441–446. https://doi.org/10.4103/JCD.JCD_408_20
- [13]. Ahmad IA. Rubber dam usage for endodontic treatment: A review. *Int Endod J*. 2009;42(11):963–972. <https://pubmed.ncbi.nlm.nih.gov/19825034/>
- [14]. Madarati AA, Abid T, Al-Nazhan S. Why dentists don't use rubber dam during endodontics and how to promote its usage. *BMC Oral Health*. 2016;16(1):175. <https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-016-0175-2>
- [15]. Eleazer PD, Gilbert GH, Funkhouser E, Reams GJ, Law AS, Benjamin PL; National Dental Practice-Based Research Network Collaborative Group. Techniques and materials used by general dentists during endodontic treatment procedures: Findings from The National Dental Practice-Based Research Network. *J Am Dent Assoc*. 2016 Jan;147(1):19-27. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4706829/>
- [16]. Patel S, Durack C, et al. Contemporary imaging in endodontics: A review. *Int Endod J*. 2009;42(10):775–788. Available from: <https://pubmed.ncbi.nlm.nih.gov/19825034/>
- [17]. Gupta R, Singh A, et al. Comparative evaluation of working length determination using apex locator and radiographs. *J Clin Diagn Res*. 2018;12(5): ZC01–ZC04. Available from:



- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8066668/>
- [18]. de Carvalho MC, Zuolo ML. Orifice locating with a microscope. *J Endod.* 2000;26(9):532–534. <https://pubmed.ncbi.nlm.nih.gov/11002028/>
- [19]. Kiraz G, Yildirim T, Yildirim G, et al. The use of magnification in endodontic treatments by endodontists and postgraduate students in Turkey. *BMC Oral Health.* 2025;25(1):1–7. <https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-025-05599-x>
- [20]. Buchanan, G. D., Gamiieldien, M. Y., Tredoux, S., & Warren, N. (2020). Sterilisation and single-use of endodontic files - a short report. *South African Dental Journal*, 75(4), 189-191. <https://doi.org/10.17159/2519-0105/2020/v75no4a3>
- [21]. Marian, D., Popovici, R. A., Olariu, I., Pitic, D. E., Marta, M.-M., & Veja, I. (2025). Patterns and Practices in the Use of Endodontic Materials: Insights from Romanian Dental Practices. *Applied Sciences*, 15(3), 1272. <https://doi.org/10.3390/app15031272>
- [22]. Exploring dentists' preferences for post-endodontic restoration: A survey among dental practitioners. *Endontology.* 2024; https://doi.org/10.4103/endo.endo_142_23
- [23]. Vengidesh, R., Kadandale, S., Ramachandran, A., Srinivasan, S., Parthasarathy, R., Thanikachalam, Y., & Kumar, P. (2023). Antibiotic Prescription Patterns for Endodontic Procedures in India: A Knowledge, Attitude, and Practices (KAP) Survey. *Cureus*, 15(4), e37804. <https://doi.org/10.7759/cureus.37804>
- [24]. Madarati AA, Habib AA. Modalities of using endodontic nickel-titanium rotary instruments and factors influencing their implementation in dental practice. *BMC Oral Health.* 2018;18(1):1–10. Available from: <https://bmcoralhealth.biomedcentral.com/articles/10.1186/s12903-018-0660-x>
- [25]. Torabinejad M, Chivian N. Clinical applications of mineral trioxide aggregate. *J Endod.* 1999;25(3):197–205. Available from: [https://doi.org/10.1016/S0099-2399\(99\)80142-3](https://doi.org/10.1016/S0099-2399(99)80142-3)