



“A Cross-Sectional Survey on Radiographic Practices & Use of Apex Locator in Endodontics Among General Practitioners in CHH. Sambhajinagar (Aurangabad) Maharashtra.”

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Date of Submission: 03-04-2026

Date of Acceptance: 14-04-2026

ABSTRACT:

AIM:

To assess and evaluate the radiographic practices and the utilization of apex locators in endodontic procedures among general dental practitioners in Aurangabad (Chh. Sambhajinagar).

MATERIALS AND METHODS:

A questionnaire-based cross-sectional survey was conducted among 96 dental practitioners using a structured 17-item questionnaire. Data were analyzed using descriptive statistics and chi-square tests.

RESULTS:

62.5% of clinicians used a combination of radiographs and apex locators for working length determination, while 25% used EAL alone and 12.5% relied only on radiography. These findings support existing evidence that the combined method provides superior accuracy and is considered the gold standard, while also reflecting adherence to radiation safety and professional guidelines.

CONCLUSION:

The study shows a clear preference for combining electronic apex locators with radiography for accurate working length determination. Increased use of digital radiography and adherence to ALARA principles indicate a shift toward safer, technology-driven endodontic practice, with EALs becoming essential tools.

KEYWORDS:

WL- working length, EAL- Electronic apex locator, IOPA- Intraoral periapical radiograph, RCT- Root canal treatment

I. INTRODUCTION:

Endodontics is a specialized branch of dentistry concerned with the diagnosis, prevention, and treatment of diseases affecting the dental pulp and periapical tissues. Root canal treatment (RCT) remains a cornerstone of endodontic therapy and is considered essential for the preservation of natural teeth. Despite its importance, RCT is often regarded

as a complex and technique-sensitive procedure, particularly for general dental practitioners (GDPs). Studies indicate that a significant proportion of endodontic failures are related to errors in working length (WL) determination, leading to incomplete cleaning, shaping, or obturation of the canal system [1,2]. One of the most critical factors influencing the success of RCT is the accurate computation of the working length (WL). Working length determination has been performed by a variety of methods, with radiography being the most extensively used and accepted technique [3,4]. Radiographic working length determination forms an integral part of endodontic practice, from diagnosis and treatment planning to the mechanical and obturation phases of therapy [5]. However, conventional radiographs provide only a two-dimensional image of a three-dimensional structure, leading to limitations such as image distortion, magnification errors, and superimposition of adjacent anatomical structures. Additional drawbacks include subjectivity of interpretation, tooth angulation, operator variability, and repeated exposure to ionizing radiation [6,7]. To overcome these shortcomings, electronic apex locators (EALs) have been developed and introduced into routine endodontic practice. EALs work on the principle of electrical impedance and allow accurate, reproducible, and radiation-free determination of the canal terminus.

Several in vitro and in vivo studies have demonstrated their precision and reliability compared with traditional radiographic techniques [8]. Moreover, literature supports the combined use of radiographs and EALs to optimize accuracy, minimize errors, and enhance treatment outcomes [9]. Despite their proven advantages, variations in the acceptance and application of EALs exist among dental practitioners worldwide. Factors such as accessibility, cost, operator training, and familiarity influence their utilization [2,6]. In some regions, dentists still rely predominantly on radiographs for working length estimation, while others combine both



methods for better results [10]. The present study, therefore, aims to evaluate the perception and practice of general practitioners towards radiographic working length determination and the use of electronic apex locators in endodontics. Although several international and national studies have evaluated dentists' perceptions and practices regarding working length determination and the use of electronic apex locators, there is limited evidence available from the Aurangabad region. This area represents a unique mix of urban and semi-urban dental practices, where variations in access to advanced technology, training opportunities, and patient awareness may influence clinical decision-making.

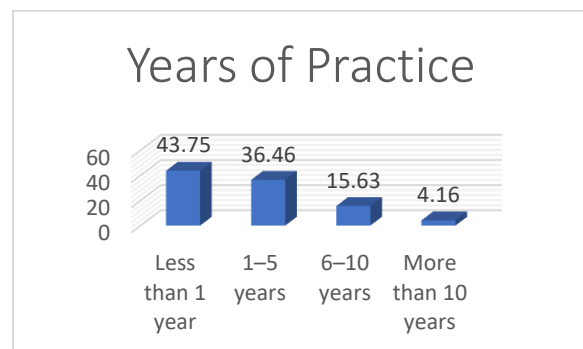
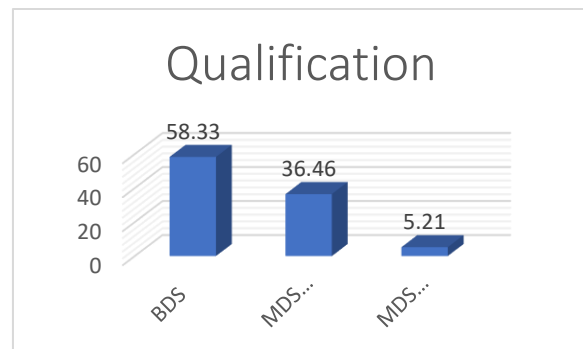
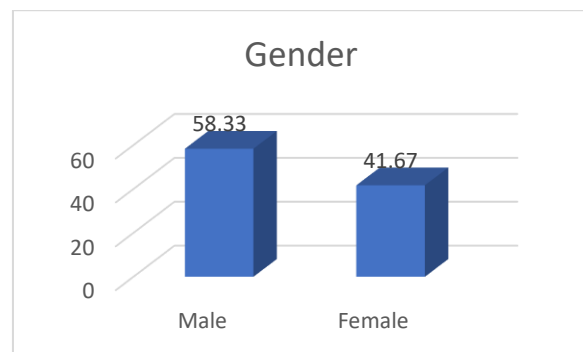
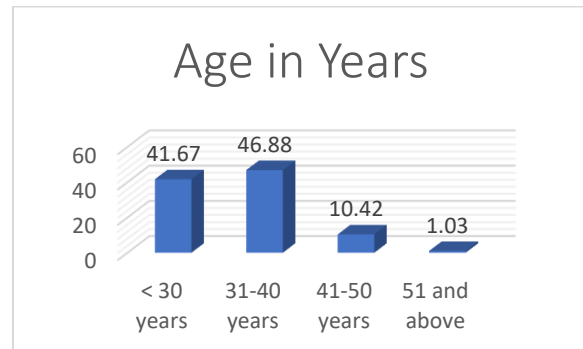
II. METHODS:

An online questionnaire-based survey was conducted among endodontists and general dental practitioners practicing in the Aurangabad district of Maharashtra. A structured questionnaire on rotary instrument use was sent to 96 dentists. The questionnaire comprised 17 questions, including close-ended formats. There were neither time limitations nor true/false-based questions. The questions covered aspects such as the type of instruments used, frequency of use, reasons for preference, limitations during clinical practice. The questionnaire was sent via email and social media platforms (e.g., WhatsApp) to the participants, along with an explanation of the study's purpose and assurance of confidentiality. Participation was entirely voluntary and anonymous, and no personal data was collected. Only completely filled questionnaires were considered for analysis. Inclusion criteria comprised Dentists who consented to participate in the survey. Dental practitioners are actively involved in endodontic practice. Practitioners practicing in the Aurangabad region (including urban and rural locations). Practitioners with less than 1 year or more than 1 year of experience in endodontic practice.

III. RESULTS:

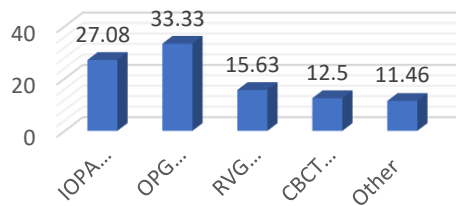
In our survey, 62.5% of clinicians replied on a combination of radiographs and apex locators, while 25% used EAL alone and only 12.5% relied solely on radiography. This supports previous research demonstrating superior WL accuracy when combining radiography with EAL. Half the clinicians consistently cross-verified EAL findings radiographically, whereas one-third occasionally did so. These observations align with best-practice guidelines recommending EAL-assisted WL determination confirmed with selective radiographic verification. Reinforcing the combined method as the gold standard. Our results reflect ethical considerations toward radiation safety and accuracy,

paralleling guidance from professional endodontic societies.

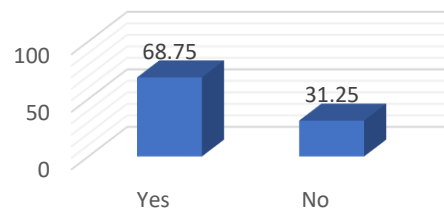




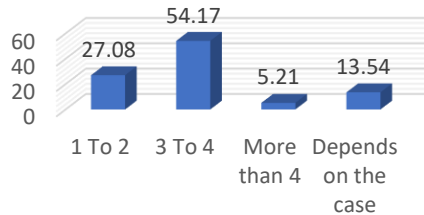
Type of Radiograph



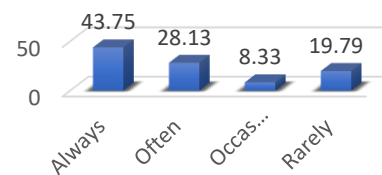
Use of Apex locator



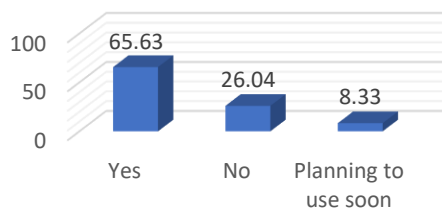
No. of Radiographs



How often use of Apex locator



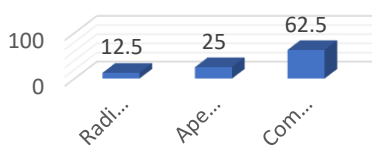
Use of RVG



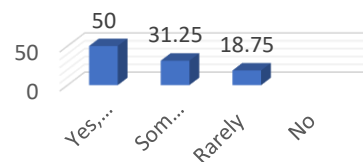
Generation of Apex Locator using



Working length determination

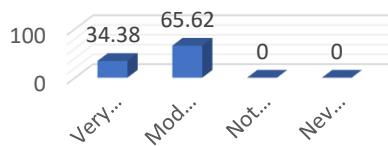


Verification of Apex Locator reading

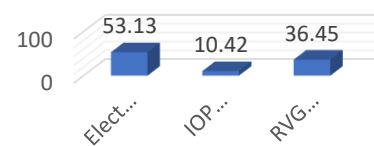




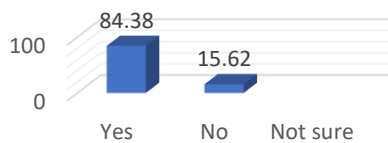
Accuracy of Apex Locator reading



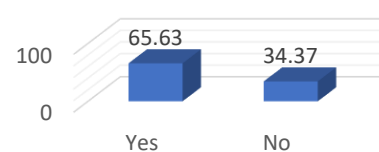
Results while working on C...



Apex Locator reduces radiation...



Detection of perforation while...



IV. DISCUSSION:

The present survey assessed contemporary trends in working length (WL) determination and electronic apex locator (EAL) usage among dental practitioners. Overall, the results demonstrate a progressive shift toward technology-assisted and radiation-conscious endodontic practices, consistent with current evidence-based literature.

Demographic Influence

In this study, the majority of participants were aged 31–40 years, followed by clinicians below 30 years, reflecting higher technological adoption in younger practitioners. This aligns with prior findings reporting increased acceptance of EALs among younger dentists and recent graduates, attributed to enhanced academic exposure and modern training systems (6, 13, 17). Similarly, although BDS practitioners constituted a larger proportion of respondents, both BDS and MDS professionals showed strong EAL adoption, similar to findings by Raouf et al. (2) and Al-Fouzan & Al-Mutairi (8), who observed significant usage even among general dental practitioners.

Radiographic Modality & Exposure Trends

A majority of respondents preferred 3–4 radiographs per endodontic procedure, with digital RVG being the most frequently used modality. These trends are congruent with UK-based clinical audits reporting increased preference for digital radiography

over conventional IOPA due to enhanced diagnostic quality and reduced radiation exposure (5, 16). A substantial proportion of clinicians favored reduced radiation exposure, supporting recommendations by Mahmoud et al. (1) and Gordon & Chandler (4) advocating EAL use to minimize unnecessary radiographs during WL assessment.

Working Length Determination Practices

In our survey, 62.5% of clinicians replied on a combination of radiographs and apex locators, while 25% used EAL alone and only 12.5% relied solely on radiography. This supports previous research demonstrating superior WL accuracy when combining radiography with EAL confirmation (9, 15, 18). Ravanshad et al. (9) and ElAyouti et al. (10) also emphasized that relying exclusively on radiographs may result in higher frequency of over-instrumentation or WL errors, reinforcing the combined method as the gold standard. Our results reflect ethical considerations toward radiation safety and accuracy, paralleling guidance from professional endodontic societies (12, 20).

Frequency & Type of Apex Locator Usage

Over 70% of participants reported frequent EAL use, consistent with Sharma et al. (7) and Kohli et al. (6), who documented widespread clinical acceptance due to improved accuracy, user-friendliness, and reliability. Fifth-generation locators were reported as most commonly used in our sample, similar to literature supporting advanced generations



offering superior precision, especially in varying canal conditions and irrigants (1, 3, 7, 14). Kaufman et al. (3) and D'Assunção et al. (14) confirmed the high accuracy of modern EALs in both anterior and posterior teeth.

Radiographic Cross-Verification Practices

Half the clinicians consistently cross-verified EAL findings radiographically, whereas one-third occasionally did so. These observations align with best-practice guidelines recommending EAL-assisted WL determination confirmed with selective radiographic verification (4, 12, 21). Mahmoud et al. (1) and Jenkins et al. (5) stress the importance of correlating EAL readings with clinical and radiographic judgment to maximize procedural safety and accuracy.

Confidence & Perceptions Regarding Apex Locators

Nearly all practitioners expressed high or moderate confidence in EALs, comparable with reported clinician confidence in contemporary studies (4, 6, 19). Most respondents believed EALs significantly reduce radiation exposure, consistent with research indicating decreased radiographic reliance without compromising accuracy (1, 7, 21). Earlier literature by McDonald & Hovland (19) similarly documented high reliability of EAL-assisted WL determination.

Special Situations: C-Shaped Canals & Perforation Detection

More than half of the practitioners preferred EALs for WL assessment in C-shaped canals, followed by radiographic support. Sharma et al. (7) verified that EAL accuracy remains reliable even in complex morphologies and micro-CT studies confirm superiority over conventional methods in anatomical variations (1, 7, 14). Regarding perforation detection, approximately two-thirds believed EALs are effective, consistent with literature indicating that abrupt electrical resistance changes help identify perforation and canal deviations (4, 11, 22).

A survey-based study in this region will provide valuable insights into the prevailing trends, barriers, and attitudes of dental practitioners towards the use of radiographs and EALs. Such findings can help identify gaps in knowledge and practice, thereby guiding continuing dental education programs and promoting evidence-based endodontic care.

The findings of the present study clearly indicate a progressive shift in endodontic practice toward evidence-based and technology-driven modalities for working length determination. Dental practitioners demonstrated a strong preference for using electronic apex locators either alone or in

combination with radiographs, reflecting increased awareness of accuracy, patient safety, and radiation-minimization principles. Younger clinicians and those with recent academic exposure showed particularly high adoption rates, suggesting that updates in endodontic education and clinical training are positively influencing clinical trends.

Digital radiography was preferred over conventional IOPA films, and most clinicians maintained ethical radiographic use, with a notable proportion aiming to reduce unnecessary exposures in accordance with ALARA guidelines. Selective cross-verification of EAL readings using radiographs further supports a balanced and judicious approach that integrates technological advancements with clinical judgment. Overall, the study highlights a strong inclination toward precision-focused endodontic practice, where modern apex locators serve as a primary tool for working length assessment, supported by radiographic confirmation when required. These findings align closely with contemporary literature and reinforce EALs as a cornerstone technology in current and future endodontic treatment protocols.

V. CONCLUSION:

The study highlights a shift toward combined use of electronic apex locators and radiography for accurate working length determination, with strong acceptance among clinicians, especially younger practitioners. The preference for digital radiography and adherence to ALARA reflect safer, technology-driven practice, establishing EALs as essential in modern endodontics.

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