

# Attitude, materials, and methods employed by endodontists to determine the working length of root canal in Chennai - A survey

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## ABSTRACT

**Aim:** The aim of this study is to find the attitude, materials, and methods employed by endodontists in working length (WL) determination for root canal treatments (RCTs). **Objective:** The objective is to determine the attitude, materials, and methods employed by endodontists in WL determination for RCTs. **Background:** WL determination is an important step in endodontic treatment to ensure the success of the RCT. It helps to find the length and the anatomy of the root canal and provides a foresight for proper shaping and obturation. Different methods and materials have been found and recently introduced such as the digital tactile sense and electronic apex locator. Recent advances in dentistry has made root canal determination more easier and more accurate which would help to provide better treatment and better success rate for endodontically treated teeth. **Conclusion:** This survey shows that the endodontists practicing in Chennai have a thorough and proper knowledge on WL determination and use appropriate materials and methods for proper diagnosis.

**KEY WORDS:** Attitude, Electronic apex locators, Endodontists, Root canal, Working length

## INTRODUCTION

Root canal treatment (RCT) is provided by dentists all over the world and has been perfected and using advanced technology, and the failure rates of RCT teeth have decreased. An accurate working length (WL) determination of root canal during endodontic treatment is very essential. The WL determination makes endodontic treatment easier for the dental practitioner to remove necrotic pulp and prepare canals precisely.<sup>[1]</sup> WL is defined as the distance from a coronal reference point to the point at which canal preparation and obturation should terminate. WL determines how far into the canal the instruments are placed and worked and how deeply the tissue and debris are removed and limit the depth to which the canal filling may be placed. It is important as it helps to determine the success of the RCT. There are two main methods in WL determination which are

radiographic methods and non-radiographic methods for proper WL distribution. The radiographic methods use X-rays as an aid in proper determination, while non-radiographic methods do not use them and thereby reduce radiation exposure. The radiographic methods are Ingle's method, Grossman's formula, Best method, Bramante, radiographic grid, Bregman method, and Weines method. The non-radiographic methods are using paper points, electronic apex locator, digital tactile sense, and apical periodontal sensitivity. Non-radiographic methods are much more preferred as they reduce the radiation dose and are preferred for pregnant patients, but both radiographic and non radiographic methods are to be used together for proper and accurate WL determination.

A primary goal in RCT is to reduce intraradicular microorganisms to a level below that necessary to induce or sustain apical periodontitis.<sup>[2]</sup> An essential prerequisite is the establishment of correct WL during root canal preparation, as failure to do so may result in accidental extrusion of irrigant, dressing or filling, and persistent periapical inflammation and post-operative pain.<sup>[3]</sup>

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The importance of WL control is evident in epidemiological studies,<sup>[4]</sup> and histological evidence confirms that optimal healing is obtained when there is minimal contact between canal filling material and periapical tissue.<sup>[5]</sup>

Although the exact landmark for the termination of RCT remains controversial, there is general agreement that the apical constriction is appropriate.<sup>[6]</sup> The apical constriction is considered to be the narrowest region of the apical portion of the root canal system.<sup>[7]</sup> However, it is not always present in cases of root resorption associated with pulp and periapical pathosis or in teeth with open apices.<sup>[8]</sup> Most studies that have evaluated the anatomy and diameters of apical constrictions are confined to the fully developed apices of permanent teeth, with pathological condition unstated and with limited age groups or sample size.<sup>[9]</sup>

Despite radiographs being the key method of determining WLs, there are several factors influencing their accuracy.<sup>[10]</sup> Paralleling techniques produce more reliable tooth length determination than the bisecting angle method.<sup>[11]</sup>

A WL established beyond the minor diameter may cause apical perforation and overfilling of the root canal system. This may increase post-operative pain and delay or prevent healing. Alternately, a WL established short of the minor diameter may lead to inadequate debridement and underfilling of the canal. Retained pulp tissue may persist and cause prolonged pain. In addition, microleakage into the canal space may result in impaired healing.<sup>[12]</sup>

Various methods have been discovered by dentists all over the world to help in determining the correct WL of the root canal. These include the use of conventional radiography (using silver halide films), digital radiography,<sup>[12]</sup> tactile method,<sup>[13]</sup> and moisture on paper point.<sup>[14]</sup> All these methods have their limitations. Radiographs are subjected to distortion and magnification. It comprises accurate location of root apices.<sup>[14]</sup> They are technique sensitive in exposure and interpretation. Furthermore, in many cases with conventional radiography, it is difficult to establish the actual length of the canal with a two-dimensional image.<sup>[12,13]</sup> They are technique sensitive in exposure and interpretation. They also provide a two-dimensional image of a three-dimensional structure which may not represent real position of apical region.<sup>[15]</sup> It becomes even more difficult to establish correct WL with radiography when root canal system is superimposed radiographically by anatomic structures. In such cases, electronic method using apex locator is very useful.<sup>[16]</sup> Different generations of electronic apex locators have been developed to measure root canal length with superior accuracy.<sup>[17]</sup> The tactile perception because

of the simplicity of the technique and its virtual effectiveness are factors that motivate a few clinicians in endodontic practice to still follow this technique. However, this technique is generally inaccurate in root canals with immature apex, with excessive curvature and if the canal is constricted throughout its length. The cementodentinal junction, where the pulp and periodontal tissue meet is considered as physiological limit to determining working length for biomechanical preparation and obturation in endodontic treatment. This landmark cannot be precisely determined radiographically<sup>[8]</sup> and has been claimed to be determined by modern electronic apex locators with more than 90% accuracy.<sup>[18]</sup> K file (15 no.) was used as an endodontic instrument to determine WL. A study<sup>[19]</sup> was conducted as a pilot study using different endodontic files to determine which file shows the most precise measurements. They recommended to use 15 no K file for WL determination in single-rooted teeth. Further, it has been reported that electronic WL is not influenced by the size of measuring file used.<sup>[20]</sup>

The use of apex locator has gained a lot of attention in determining the WL of canals during RCT.<sup>[21]</sup>

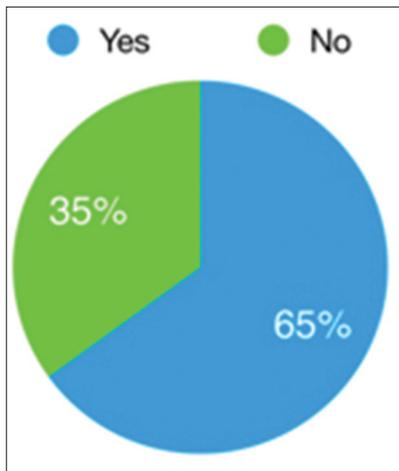
Different studies have been done to assess the success and failure of endodontic treatment,<sup>[22-24]</sup> and these studies demonstrated that the failure could be fundamentally higher for those teeth which are treated by general dental practitioners and not by specialists.<sup>[24]</sup>

In this study, 5.6% of the dentists were utilizing estimation radiographs just to decide the WL. However, the radiographic method has innate errors, as the apical foramen is not detectable on radiograph.<sup>[25]</sup> Electronic apex locators have the favorable position of having the capacity to find the apical foramen.<sup>[26,27]</sup> The use of tactile sensation to determine working length cannot be recommended because the instruments may bind against the canal walls at any position along their length<sup>[7]</sup> or perforate apically.<sup>[28]</sup> The use of the electronic methods for tooth length determination has progressed increasingly and has gained popularity in recent years.<sup>[29]</sup> Therefore, it is extremely legitimate to combine the utilization of electron apex locator and radiographs to make an efficient and exact determination of WL.

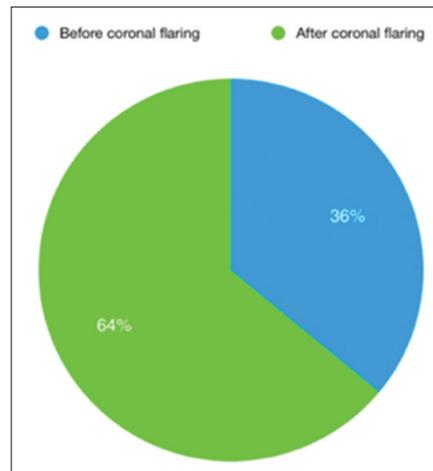
## METHODOLOGY

A questionnaire form is distributed to 80 endodontists practicing in Chennai, to both BDS and MDS qualified general practitioners, which were filled, and the data were analyzed and graphs were plotted to represent the data. The questionnaires were distributed in an online forum which were filled and submitted online.

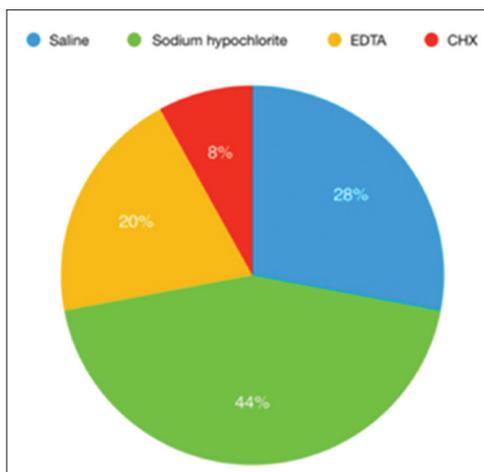
- What methods do you use for determining WL
- What types of radiographic methods do you use in



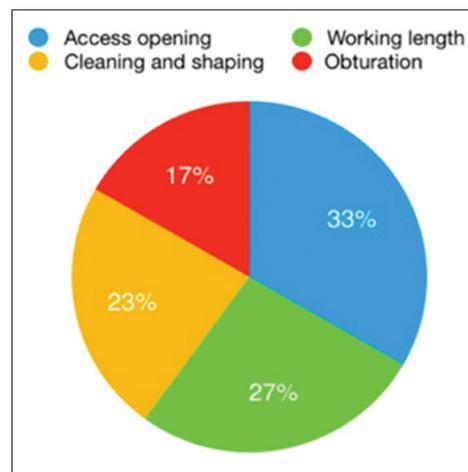
**Graph 1:** Exposure to more radiation due to radiovisiography



**Graph 3:** When is working length determination done?



**Graph 2:** Accurate working length determination using which irrigant



**Graph 4:** Most importance step in root canal treatment

- clinical practice?
- Which of the non-radiographic methods do you use for WL determination in your clinical practice?
- In case of discrepancies (greater or lesser than 2 mm) in WL during radiographic examination, do you repeat the WL determination?
- In case, you are using non-radiographic methods, why do you prefer them?
- In case of radiographic methods, do you use radiovisiography (RVG) or conventional films?
- Do you feel whether WL determination needs radiographic and non-radiographic methods for proper determination. If yes, why?
- Due to the digital technology, are you invariably exposing the patient more number of times than conventional radiographs?
- How do you determine the WL in patients with pacemakers?
- Which irrigant is ideal for WL determination while using apex locator?
- Do you think apex locator give accurate results for all cases? In case no, why
- Which do you think is a gold standard in currently

- available apex locators?
- Do you think apex locators are more efficient in anterior or posterior teeth?
- In what cases do you use paper points for WL?
- Which do you think is the most important step in RCT?
- When should WL determination be done?

## RESULTS

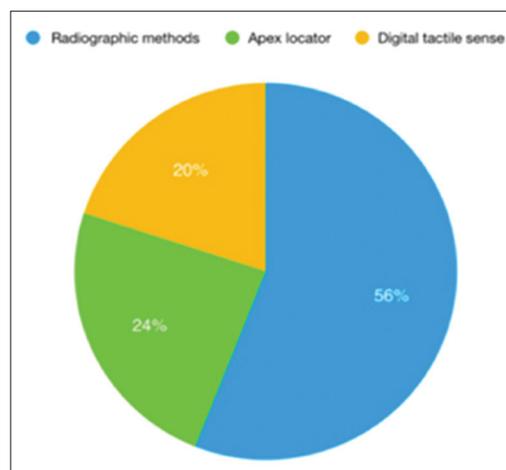
From the data, we find that patients are exposed to more radiation due to careless positioning of the sensor or the cones by the dentist [Graph 1], sodium hypochlorite is much preferred as an irrigant for WL determination [Graph 2], 64% of the dentists are aware that WL determination is done after coronal flaring [Graph 3] 42% and 36% of the dentists feel that access opening and cleaning and shaping are the most important steps in RCT [Graph 4], 56% are aware that radiographic techniques are to only used in case of patients with pacemakers [Graph 5], 80% will repeat the WL if discrepancies are noticed [Graph 6], and majority use Ingle’s technique for Radiographic diagnosis [Graph 7]. From the overall data, we can

assume that the endodontists are very much aware on the importance of WL determination and also follow proper materials and methods for accuracy.

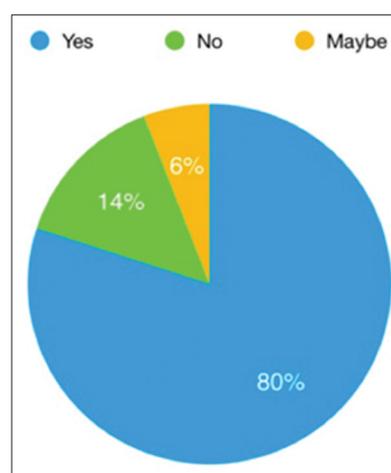
## DISCUSSION

The contemporary endodontics involves the introduction of many new instruments, materials, and techniques which have helped to determine WL, cleaning and shaping, and obturation much easier, accurate, and faster. Controlled studies have shown that RCT brought high success rates of more than 90%.<sup>[22]</sup> However, most of these studies have reported data from specialists and university clinics. Therefore, the data do not determine the success rate of endodontic treatment precisely in general dental practice. The success rate of endodontic treatment in general dental practice approximates to 65–75% only.<sup>[23]</sup> This discrepancy in success rate may show a difference in the dental practitioner's quality of endodontic treatment to be performed. The quality of endodontic treatment is very important. This difference in attitudes toward endodontic treatment performed can lead to the errors that impede the healing process.<sup>[30]</sup> This difference of attitudes toward endodontic treatment can also make it impossible to accomplish the endodontic treatment according to aseptic principles that are essential for the success of endodontic treatment.<sup>[24]</sup> Various studies<sup>[22-24]</sup> have been done to evaluate the success and failure of endodontic treatment, and these studies have shown that the failure could be significantly higher for those teeth which are treated by general dentists not by endodontists.<sup>[24]</sup> Undergraduate curriculum guidelines have been formulated by the European Society of Endodontology to define the acceptable standard of care in clinical endodontics.<sup>[6]</sup> Several studies, however, have reported that the majority of dentists are not in compliance with these guidelines.<sup>[31]</sup>

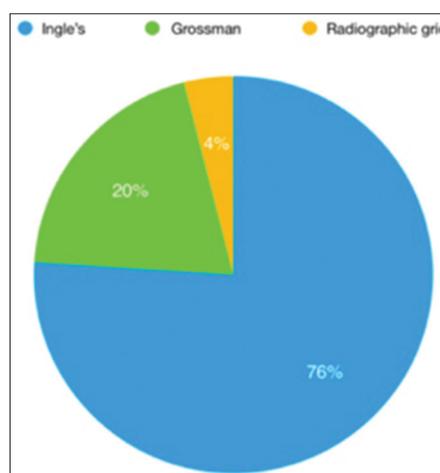
A majority of the general practitioners have been found to use electronic apex locators and prefer Morito ZX for WL determination. It was still surprising to see that a few number of practitioners still use digital tactile sense for WL determination which is an age old technique and may cause damage similar to another study.<sup>[32]</sup> A majority of the dental practitioners use sodium hypochlorite as an irrigant while WL determination followed by saline, of which its properties help in the proper induction of the current while the determination of the root canal length. Due to the ease in procuring radiographic images due to digital radiography, the dental practitioners using RVG machines tend to use them carelessly and expose the patients to higher radiation. The dental practitioners have a mixed opinion on the most important step in RCT while a majority of the dental practitioners were aware to perform coronal flaring before performing



**Graph 5:** Working length determination in pacemaker patients



**Graph 6:** Repetition of working length in case of discrepancies (>2 mm)



**Graph 7:** Radiographic methods used by endodontists

the WL determination. In case of patients with pacemakers, a majority were aware to use only non-radiographic methods and avoid electronic apex locators as it may interfere with the frequency of the

pacemaker. A majority of the dental practitioners were willing to repeat the WL of the root canal in case of discrepancies more than 2 mm to have a successful RCT to be performed. Most of the practitioners preferred to use Ingle's method for radiological WL determination compared to other methods.

This study has brought light on the advancements in materials and methods used by the general practitioners practicing in Chennai to determine the WL.

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