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# CLEANING, SHAPING AND OBTURATION PROTOCOLS FOLLOWED BY DENTISTS IN INDIA – A SURVEY

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**Abstract**

**Introduction:** The main objective of endodontic therapy is the complete elimination of microbes and their by-products from the root canal system. Despite the high success rate of root canal treatment, there are failures too. Hence, our survey aimed to investigate the differences in cleaning, shaping, and obturation protocols followed among general dentists and endodontists in India. **Method:** A multiple choice questionnaire was designed and distributed to 700 dentists in India through a social media application. The questions covered all the protocols and techniques for root canal treatment. The collected data was analyzed using descriptive statistics at a 0.05 level of significance to get the results as frequencies and percentages. **Results:** A total of 332 dentists among 700 participated in the survey. Among 332 dentists, 181 were non-endodontists and 149 were endodontists. The highest number of participants used K- hand files for instrumentation followed by NiTi rotary instruments in a torque with gear reduction handpiece following the Step-back technique. Participants polled for calcium hydroxide as a choice of interappointment intracanal medicament in case of lesion and the patients were recalled after 7 days. 99.69% of participants favored the usage of gutta-percha with zinc oxide eugenol for root canal obturation. Most of the participants used composite restoration as post-endodontic restoration and advocated crowns in all cases **Conclusions:** Though there were only 332 participants in this survey, the study was able to provide the details of the dental practice among the population. This survey could also show the standard of care, knowledge, and skills that have improved due to continual dental education through conferences, seminars, and workshops. However, further studies are necessary to evaluate this trend.

**Keywords:** Root Canal Treatment, Endodontics, Dental Practice, Survey.

## INTRODUCTION

The main objective of endodontic therapy is the complete elimination of microbes and their by-products from the root canal system. Cleaning, shaping, and obturation are indeed the endodontic triad of successful root canal therapy. Emphasis is laid on three-dimensional obturation as it provides a fluid-tight seal and prevents the reinfection of root canals. Despite the high success rate of endodontic treatment, failures do occur. This may be due to inadequate knowledge about the tooth anatomy, improper mechanical debridement, bacterial persistence in the canals, poor obturation quality, and coronal leakage. (1) Thus, root canal therapy is a technically challenging procedure, that fails, when it falls short of acceptable standards. Although chemo-mechanical root canal preparation using instruments and irrigation systems are effective in reducing microorganisms. With an ever-increasing number of endodontic treatments being done each day, it has become imperative to avoid or minimize the most fundamental reasons leading to endodontic failure. Several studies have been conducted in many countries about the attitudes of dentists toward various aspects of

endodontic treatment. (2-5) Ruchi *et al* surveyed to determine the attitude of dentists towards endodontic treatment and the current use of new endodontic technology and materials in India. The authors concluded most of the dentists used conventional diagnostic, preparation, and obturation techniques. (6) However, on reviewing the literature, various intricate details about the diagnostic methods used, and biomechanical preparation such as file selection, shaping strategies, irrigation protocols, and patient recalls were not discussed in detail in any survey, which may significantly influence the endodontic outcome. Hence, our survey aimed to investigate the differences in cleaning, shaping, and obturation protocols followed among general dentists and endodontists in India.

## MATERIAL AND METHODS

The questionnaire survey was presented and approved by the Institutional ethical committee (SRMU/M&HS/SRMDC/2021/S/029). A self-designed questionnaire was formulated comprising of a total of 25 elaborate questions were posted on an online survey website (Survey Monkey software), with topics including the use of magnification and radiographs, file selection, instrumentation methods, materials, choice of irrigants and irrigation devices, intracanal medicaments, obturation technique, and temporary and permanent coronal restoration. The questionnaire link (https://www.surveymonkey.com/r/kolconsurvey) was piloted and distributed to 700 dentists in India through a social media application (WhatsApp). The questionnaire was designed in such a way that participants were allowed to choose multiple answers wherever required. The questionnaire was evaluated for face and content validity. Data on protocols followed before, during, and after the root canal procedures were collected. The collected data was analyzed using descriptive statistics at a 0.05 level of significance to get the results as frequencies and percentages.

## RESULTS

A total of 332 dentists among 700 participated in the survey. Among 332 dentists, 181 were non-endodontists and 149 were endodontists. It was observed that only 7.69% of participants used microscope. 86.02% of participants believed in the importance of pre-operative radiographs to avoid diagnostic errors and anomalies. Most dentists respect the apical constriction and avoid violating beyond the apex. The highest number of participants used K-hand files for instrumentation followed by NiTi rotary instruments in a torque with gear reduction handpiece following the Step-back technique (Table 1). Participants polled for calcium hydroxide as a choice of interappointment intracanal medicament in case of lesion and the patients were recalled after 7 days. (Table 2) 99.69% of participants favor the usage of gutta-percha with zinc oxide eugenol (59.93%) for root canal obturation. Most of the participants used composite restoration as post-endodontic restoration and advocated crowns in all cases. (Table 3)

## DISCUSSION

The endodontic specialty has evolved with major developments over the decade both in surgical and non-surgical platforms. Various schools of thought prevail among dentists regarding root canal treatment. (7) Alley *et al* compared the survival of endodontically treated teeth performed by a general dentist or specialist and reported a 98.1% success rate when the procedure was performed by endodontist; probably

due to the clinical expertise of a general dentist. (8) Syngcuk Kim stated that "You can only treat what you can see". Undoubtedly, the clinician can better evaluate and treat something, if he or she sees it more clearly and in magnified form. (9) The advancement in magnification includes the loupes and microscopes. In our survey, it is observed that only 19.69% of practitioners preferred to use loupes whereas only 7.69% used microscopes. This could be a result of the acclimatization period of the new working environment, the high cost of the magnification device and its related accessories, additional steps for infection control, and a slower learning curve. However, numerous studies conclude that the use of magnification has shown improved results. (10-13)

Successful root canal treatment (RCT) depends on several factors, and the prime factor includes the knowledge and skills of the operator. A job well begun is half done; similarly, a well-planned job also ensures better success in completion. The importance of accurate pre-operative radiographs which provide details of the root canal anatomy, cannot be emphasized enough, as they serve as the “eye” of the dentist during diagnosis, treatment, and recall. In this survey, most of the participants take a series of radiographs during the procedure, and weightage is given to pre-operative radiographs (86.02%). Working length (WL) determination is the most critical step in endodontics, on failing of which, over-instrumentation can induce the displacement of infected debris and dentin chips into the periradicular region which can impair healing. The radiographic method described by Ingle is one of the most common and reliable methods used in determining the WL. (14,15) However, the most precise determination of WL is a combination of radiographs and electronic apex locators. (15) According to the results of this study, the use of electronic apex locators and the importance of WL determination is quite high among the participants (Table 2).

The patency file would ensure a smooth gliding path from the root canal orifice to the apical foramen. This has been described in the literature as using a small 10 K file which is inserted passively and intentionally by 1 mm through the foramen, preventing ledge formation, blockages, and perhaps perforations in the crucial area of the root canal. (16)

Chemomechanical preparation of the root canal includes both mechanical instrumentation and canal irrigation, which is principally directed toward the elimination of microorganisms from the root canal system (17). Canal preparation is one of the most important phases of root canal treatment and is mainly aimed at the debridement of the canal (18). Though hand instrumentation is primarily used for cleaning and shaping, these are more time-consuming and can lead to iatrogenic errors such as canal transportation or ledge creation if not used properly. (19) Thus, there is an inclination towards rotary instruments. This is in accordance with the studies conducted by Gluskin *et al.*; Tasmedir *et al.* and Xu *et al.* who suggested that the rotary instrumentation exhibited minimal procedural errors. (20-22) In addition, rotary instrumentation has demonstrated the ability to maintain the original canal morphology with a greater conservation of tooth structure and a lesser degree of transportation. In this survey, the participants believed in the combination of hand and rotary instrumentation for cleaning and shaping which will deliver better results. Also, the engine-driven nickel-titanium systems show less apical extrusion of debris and irrigant than the manual technique. (23) Though there is no consensus as to the exact size to which apical preparation has to be made there are several studies that state that for

efficient cleaning of the canals and penetration of irrigants, the optimum size to which the root canal needs to be enlarged is size 30. (24)

Irrigation protocol should not be confined to the major canal of the root canal system, but also reach the lateral and accessory canals. Sodium hypochlorite (NaOCl) is the most commonly used choice of irrigating solutions among practitioners. The advantages of NaOCl include its tissue-dissolving ability and antimicrobial action. In this survey 68.52% of practitioners preferred NaOCl. Though the NaOCl has its disadvantage of hypochlorite accident if not used properly, the usage of saline will just act as an adjunct to flush the debris. (25) The American Association of Endodontists (AAE) has suggested that the choice of irrigants is based on the case scenario, the choice of sealer, and post-endodontic restoration. (26) Syringe and needle irrigation is the most commonly used method to deliver the irrigants. But it delivers the irrigant only up to 1 to 2 mm beyond the needle tip; moreover the presence of a vapor lock limits irrigant to reach the critical apical portion of the root canals. Research suggests that passive ultrasonic irrigation is a more effective adjunct to root canal irrigation in terms of canal debridement and microbial load reduction. (27,28) The results of our survey are in agreement with this statement as 19.61% of practitioners preferred ultrasonic activation.

Intracanal medicaments (ICMs) are an essential part of the endodontic armamentarium along with chemo-mechanical debridement. Although their use appears to be diminishing due to more single-appointment protocols, they are useful in cases with questionable or unfavorable prognosis. Calcium hydroxide is considered to be the ICM of choice and the best results are found when the medicament is present in the canal for 7 days. (29) This is in accordance with the result of our survey where 97.79% of participants preferred using calcium hydroxide for 7 days (55.10%)

The final stage of the root canal procedure is to obtain a three-dimensional fluid-tight seal. The most preferred biocompatible material for obturation is gutta percha along with a root canal sealer as it plays an important role in the endodontic treatment. The lateral condensation technique is the most preferred obturation technique that is widely accepted and suggested by clinicians in endodontics. In our survey, 99.69% of participants use gutta percha as an obturation material, and 59.93% use zinc oxide eugenol as a root canal sealer. However, Hergt *et al*. stated that AH plus fulfills the requirement of a root canal filling material as defined by the specifications for root canal filling materials and guidelines of the European Society of Endodontology. (30)

Post-endodontic restorations play a crucial role in the prevention of reinfection and increase in the longevity of the tooth. In this survey, 39.15% preferred the usage of composite resin as a core build-up material. The survival of teeth following root canal treatment is affected by a large number of variables which include residual volume of tooth structure, the presence of proximal contacts, tooth location, whether a cuspal coverage restoration has been provided (for molar teeth), and the use of a post. (31). Though there were only 332 participants in this survey, the study was able to provide the details of the dental practice among the population. This survey could also show the standard of care, knowledge, and skills that have improved due to continual dental education through conferences, seminars, and workshops.

## Table 1: Selection of instruments and instrumentation techniques

| | | | | |
|---|---|---|---|---|
| 1 | Size of the patency file for anterior teeth | 6 size K file | 11 | 3.43% |
| | | 8 size K file | 29 | 9.03% |
| | | 10 size K file | 138 | 42.99% |
| | | 15 size K file | 185 | 57.63% |
| 2 | Size of the patency file for posterior teeth | 6 size K file | 29 | 9.03% |
| | | 8 size K file | 81 | 25.23% |
| | | 10 size K file | 212 | 66.04% |
| | | 15 size K file | 66 | 20.56% |
| 3 | Termination of instrumentation | Apical construction | 73 | 22.32% |
| | | Radiographic apex | 29 | 8.87% |
| | | 0.5 to1mm short of the radiographic apex | 245 | 74.92% |
| 4 | Method of measuring working length | Tactile method | 83 | 25.30% |
| | | Ingles method | 166 | 50.61% |
| | | Apex locator | 184 | 56.10% |
| 5 | Type of instrumentation | Hand instrumentation | 66 | 20.12% |
| | | Rotary instrumentation | 16 | 4.88% |
| | | Both | 246 | 75.00% |
| 9 | Type of hand files used | K file | 301 | 92.05% |
| | | Reamer | 43 | 13.15% |
| | | H file | 88 | 26.91% |
| | | NiTi | 115 | 35.17% |
| 10 | Final apical preparation | 3 times the initial apical file | 205 | 66.99% |
| | | 4 times the initial apical file | 46 | 15.03% |
| | | 5 times the initial apical file | 10 | 3.27% |
| | | Keep the apical diameter intact | 59 | 19.28% |

## Table 2: Methods of root canal disinfection employed

| | | | | |
|---|---|---|---|---|
| 11 | Type of irrigating solution | Normal saline | 250 | 77.61% |
| | | Sterile water | 9 | 2.78% |
| | | Sodium hypochlorite | 222 | 68.52% |
| | | EDTA | 157 | 48.46% |
| | | 2% chlorhexidine | 123 | 37.96% |
| | | combinations | 28 | 8.64% |
| 12 | Final irrigation | Normal saline | 169 | 52.16% |
| | | Sodium hypochlorite | 75 | 23.15% |
| | | EDTA | 49 | 15.12% |
| | | 2% chlorhexidine | 83 | 25.62% |
| 13 | Adjuncts to irrigation | Warming the irrigation solution | 67 | 21.54% |
| | | Sonic activation | 11 | 3.54% |
| | | Ultrasonic activation | 61 | 19.61% |
| | | Sub-sonic activation eg: Endo activator | 22 | 7.07% |
| | | Negative pressure eg: Endovac | 14 | 4.50% |
| | | None of the above | 177 | 56.91% |
| 14 | Type of needle gauge employed during syringe irrigation | 26 gauge | 164 | 52.56% |
| | | 27 gauge | 95 | 30.45% |
| | | 30 gauge | 48 | 15.38% |
| | | 31 gauge | 5 | 1.06% |
| 15 | Type of intracanal medicaments | Calcium hydroxide | 310 | 97.79% |
| | | Chlorhexidine gel | 21 | 6.62% |
| | | TAP (Minocycline, Ciprofloxacin & Metronidazole) | 44 | 13.88% |
| | | Corticosteroid paste | 7 | 2.21% |

## Table 3: Methods and Materials used for root canal obturation

| | | | | |
|---|---|---|---|---|
| 16 | Root canal sealer | Zinc oxide eugenol | 160 | 59.93% |
| | | Resin sealer | 70 | 26.22% |
| | | Calcium hydroxide | 25 | 9.36% |
| | | Calcium silicate based sealer | 12 | 4.49% |
| 17 | Obturation material | Silver points | 0 | 0.00% |
| | | Gutta percha | 323 | 99.69% |
| | | Resilon | 1 | 0.31% |
| 18 | Obturation technique | Lateral condensation | 228 | 70.59% |
| | | Vertical condensation | 38 | 11.76% |
| | | Single cone | 150 | 46.44% |
| | | Thermoplastic compaction | 27 | 8.36% |
| | | Thermomechanical compaction | 14 | 4.33% |
| 19 | Percentage of GP points | 2% | 75 | 24.43% |
| | | 4% | 65 | 21.17% |
| | | 6% | 167 | 54.40% |
| 20 | Type of temporary coronal seal | Zinc oxide eugenol | 141 | 43.79% |
| | | Intermediate restorative material | 58 | 18.01% |
| | | Cavit | 123 | 38.20% |
| 21 | When do you recall the patient for permanent restoration | 1 day | 44 | 14.19% |
| | | 3 days | 108 | 34.84% |
| | | 1 week | 158 | 50.97% |
| 22 | Core build up material | Glass ionomer cement | 108 | 33.44% |
| | | Silver amalgam | 32 | 9.91% |
| | | Composite resin | 214 | 66.25% |
| | | Miracle mix | 86 | 26.63% |
| 23 | Do you give post endodontic crown | Yes | 312 | 96.59% |
| | | No | 11 | 3.14% |
| 24 | Do you recall and review your case? | Yes | 271 | 84.95% |
| | | No | 48 | 15.05% |
| 25 | After how many days do you recall the patients? | 1 week | 67 | 21.61% |
| | | 1 month | 85 | 27.42% |
| | | 3 months | 58 | 18.71% |
| | | 6 months | 49 | 15.81% |
| | | 1 year | 12 | 3.87% |
| | | I don't call for review | 39 | 12.58% |

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