

Radiographic Practices & The Use of Apex Locators In Endodontic Treatment In Mumbai – A Comparison of Perceptions Between Endodontists & Other Dental Practitioners.

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Abstract:

Aims and Objective: The aim of our study was to assess the attitudes of general practitioners, endodontic specialists & other specialists in and around Mumbai in relation to the use of electronic apex locator and the radiographic practices prevailing among them for root canal therapy.

Materials and Methods: A cross-sectional contact survey was conducted including 400 dental professionals in and around Mumbai who performed endodontic procedures. A specially prepared format exclusively designed for recording all the required relevant general information and information related to working length determination method was used as a tool for data collection. Data was tabulated in excel sheet and analyzed using SPSS 22.0 software.

Discussion and Conclusion:

From the survey, it was observed that the Endodontists employed apex locators and RVG more frequently than their colleagues' in general dental practice and this finding was statistically significant. It was also observed that there was a reticence amongst older practitioners to adopt more recent techniques. There is a very apparent deficit in the knowledge of potential benefits of using Electronic Apex Locators in routine endodontic treatment.

Keywords: Electronic Apex Locator, RVG, Survey.

I. Introduction

Working length determination is one of the critical steps that influence the successful outcome of root canal therapy. The cleaning, shaping & obturation of the root canal cannot be accomplished accurately unless the working length is determined precisely. Traditional methods for establishing working length include the use of radiography¹, anatomical averages and knowledge of anatomy, tactile sensation² and moisture on a paper point. Each of these methods have limitations^{3,4} and do not allow precise localization of apical constriction and CDJ and do not guarantee that instrumentation beyond the apical foramen will be avoided⁵.

The use of conventional radiography remains the most common method of determining working length in Indian dental practices, though the use of Electronic apex locators is slowly becoming popular. But the absorption of their use into practice has not reflected enthusiastically. In our survey, we have assessed the attitudes of general practitioners, endodontic specialists & other specialists in relation to the use of electronic apex locator and the radiographic practices prevailing among them for root canal therapy.

II. Materials And Methods

This cross-sectional contact survey included 400 dental professionals in and around Mumbai who routinely performed endodontic procedures. A specially prepared format exclusively designed for recording all the required relevant general information and information related to working length determination method was used as a tool for data collection (Appendix 1). Survey fundamentals: Guide to implement & design survey were adhered to.⁶

The dental professionals were required to fill out the questionnaire consisting of questions with multiple choices. The questions were based on those asked in previous surveys developed in the UK¹. Practitioners were asked to record information about their method of working length determination during endodontic procedures. Every individual who participated in the survey signed an informed consent form.

Ethical clearance was obtained from the institutional ethical committee and permissions were obtained from the University Board of Clinical Studies.

The questionnaire was distributed to 410 dentists. 331 replies were received out of which 323 were complete and used for the study. A database was created for further analysis. Data description was carried out by frequency tables. When obtaining the numerical representation by percentages, the total number of answers for each query was taken into account. The Chi-square test was performed to check for significance of association.

III. Results

Table 1 shows the response percentages for each question in the questionnaire.

IV. Discussion

Dental professionals' profile.

The proportion of male Endodontists (46.6%) and General Dental Practitioners (GDP) (47.8%) were lower than the proportion of female Endodontists (53.4%) and GDP (52.2%). In other specialists, proportion of male (51.9%) was higher than females (48.1%). There was no significant association between Clinician and incidence of male /female ($p > 0.05$). GDP group had a greater number of individuals less than 30 years of age, while the Endodontists and other specialists were of greater number in 31-49 age groups. There was significant association between Clinician and age of the respondent.

The majority of total respondents (57.83%) graduated between 2005-2014. Maximum Endodontists (45.3%) and other specialists (58.1%) had finished their undergraduate training between 1995-2004. There was significant association between Clinician and year of graduation. Majority of Endodontists (54.0%) and other specialists (55.2%) completed their post-graduation in 2005-2014. There was no significant association between Clinician and year of post-graduation.

The majority of Endodontists (67.2%) & other specialist (68.6%) reported working solely within private practice, and this was slightly higher than that of GDP (65%). There was no significant association between Clinician and type of practice. Though, no significant association was found between the use of apex locator & year of graduation, incidence percentage showed recent GDP and post graduates (after 1995) used Electronic Apex locators more often than older GDP and post graduates (before 1995).

Radiographic practices.

One of the main concerns in root canal treatment is to determine how far working instruments should be advanced within the root canal, and at what point the preparation and obturation should terminate⁷. The root canal terminus is considered by many to be the CDJ⁸. In clinical practice, the minor apical foramen is a more consistent anatomical feature that can be regarded as being the narrowest portion of the canal system and thus the preferred landmark for the apical end-point for root canal treatment⁹. In our study, the majority of GDP (57.6%) reported that they would retake the radiograph when the distance was 1-2 mm from radiographic apex. 47.6% Endodontists and 58.4% other specialists reported that they would retake the radiograph when the distance was 2-3mm from radiographic apex. This difference was statistically significant.

With concerns over radiation exposure and the increased use of electronically stored patient records, several types of digital radiography machines have been introduced¹⁰ to clinical practice today. In our study, Endodontists used more Radiovisiography (RVG) (42.2%) compared to GDP (27.5%) and other specialists (32.2%). Since p -value was less than 0.05 this indicated there was significant association between Clinician and use of RVG. However many studies have shown that canal lengths determined radiographically vary from actual root canal lengths by a considerable amount^{11,12}. Although radiographs are a critical and an integral part of endodontic therapy¹³, there is an ongoing need to reduce exposure to ionizing radiation whenever possible. Figure 1-Graph 1 shows the use of RVG and radiographic films by the participants of the survey.

One of the most remarkable innovations in root canal treatment has been the development and production of electronic devices for detecting the canal terminus, thereby providing a method of reducing the number of radiographic exposures in root canal treatment by 85%¹⁴. A number of researchers have stressed the benefits of combining both radiographic and electronic methods to optimize measurement accuracy. In 1918, Custer¹⁵ was the first one to report the use of electric current to determine working length of a root canal.

Because of the hazards of radiation, the technical problems associated with radiographic techniques and to avoid over-instrumentation beyond the canal terminus⁵, electronic working length determination has gained popularity amongst both general dentists and endodontists. Electronic apex locators reduce the number of radiographs required and assist where radiographic methods create difficulty. The development of the electronic apex locator has helped make the assessment of working length more accurate and predictable¹⁶.

90.85% Endodontists and 88.5% Other Specialists in our study used Electronic Apex locator for both single and multirooted teeth. This finding was statistically significant in comparison to GDP. Endodontist and other specialist practitioners use apex locator for both single and multirooted teeth while most of the GDP used it for multi rooted teeth(Figure 1, Graph 3).

95.2% of Endodontists in our survey owned apex locators, while only 27.5% of GDP & 31.9% of other specialist owned apex locators. *p*-value less than that of 0.05 indicated that there was a significant association between Clinician and use of Apex locator. In our survey, 90.8% of Endodontists used a combined technique of using both radiographs and electronic apex locator to determine working length which is also statistically significant amounts. Figure 1-Graph2 shows the frequency of possession of Electronic Apex Locators among the participants and Figure 1-Graph3 shows the use of Apex Locators among them. A reticence to use apex locators has also been reported within continental Europe with Bjørndal & Reit (2005)¹⁷ reporting that only 23% of Danish dentists used electronic apex locators (EALs) often with a further 19% of respondents classified their use of apex locators as only occasional. Similar findings were observed within clinical practice in Belgium with 16% of dentists using EALs occasionally and a further 4.9% reporting seldom use¹⁸. In North America, 38.6% of Endodontists reported using EALs alone to determine working length with a further 52.5% using a radiographic examination, but only 8.9% of respondents reported using a combined technique¹⁹. The reason behind the reticence to routinely rely solely on the measurements derived from an apex locator appears to be multi-factorial. These include anatomical issues²⁰, medico-legal implications¹⁹ and apex locator accuracy²¹. Endodontists and other specialists wanted to buy an apex locator but GDP responded most negatively in our survey as most felt radiograph was enough. This finding was statistically significant.

The present study found recently graduated GDPs and post graduates (after 1995) used apex locators more often than older GDPs and post graduates. Incidence percentage showed younger Endodontists and GDPs more likely to use an apex locator but the association was statistically not significant. This could be attributed to introduction of newer technologies in clinical practice of endodontics and in curriculum, which improved confidence in using new technologies. Maximum respondents in all groups were of the opinion that working length should be 0.5 mm short of the radiographic apex (Figure 1-Graph4). There was no significant difference between the three groups of respondents with regard to their views. Majority (79%) of the respondents in all 3 groups agreed that the tactile sensation helped in judgment of working length. This finding was not statistically significant. Literature reveals substantial differences between European practices compared with treatment conducted in North America²¹. The European concept is to leave the root filling 1–2 mm short of the apex, whilst in North America clinical practice is to shape the canal to the 'radiographic apex terminus'²². It was noticeable that 47.6% of Endodontists and 58.4% of other specialists in our survey reported taking a further radiograph when the difference between the end of the file and the radio-graphic apex was between 2 to 3 mm. The latter is in agreement with the current UK guidelines (Faculty of General Dental Practitioners 2004). Present study indicates a trend to follow the European practice of adopting the minor diameter as point of terminus of working length.

The present study highlighted significant differences between the uses of the preoperative radiograph by GDPs compared with Endodontists & other specialists (Figure 2-Graph5). In the present study, we found that 66.3% of the GDPs, 81.1% of Endodontists & 84.84% of other specialists took preoperative radiographs. This was lower than the results of Palmer et al. (2009)²³ where 98.5% of respondents reported using a preoperative film. Chandler & Koshy (2002) also assessed the use of this radiographic examination by endodontic specialists, finding that a preoperative radiograph was always used by Endodontists, but the sample consisted of only five Endodontists²⁴. The latter was of limited relevance to the current study owing to the small sample size²⁴. At 84.84%, other specialists took maximum preoperative radiographs while 83.3% Endodontists took maximum working length and 86.67% Endodontists took master cone radiograph. Incidence of immediate postoperative radiographs was low in all 3 groups with 41.13%GDP, 36.67% Endodontists and 32.33% other specialists.

Electronic apex locators (EALs) can accurately determine the location of root perforations, making them significantly more reliable than radiographs after root instrumentation. Readings that are significantly shorter than the original working length can be an indication of perforation²⁵. 8.5% GDP and 54.5% other specialist relied on radiographs, while majority of Endodontists (58.6%) followed combined approach of electronic apex locator and radiograph for detection of perforation (Figure 2-Graph6). Endodontic specialists use Apex locator as well as radiograph while most of GDP and other specialists used only radiograph. This is mainly due to increased use of electronic apex locator by Endodontists as compared to GDPs who rely on traditional radiographic methods. There also may be lacunae in the training of GDPs and other specialists at the undergraduate level with regards to use of EAL in handling cases of perforation.

50.0% GDP and 57.9% other specialists did follow up for 15 days while maximum Endodontists (32.5%) did follow up for 6 months. This result was not statistically significant.

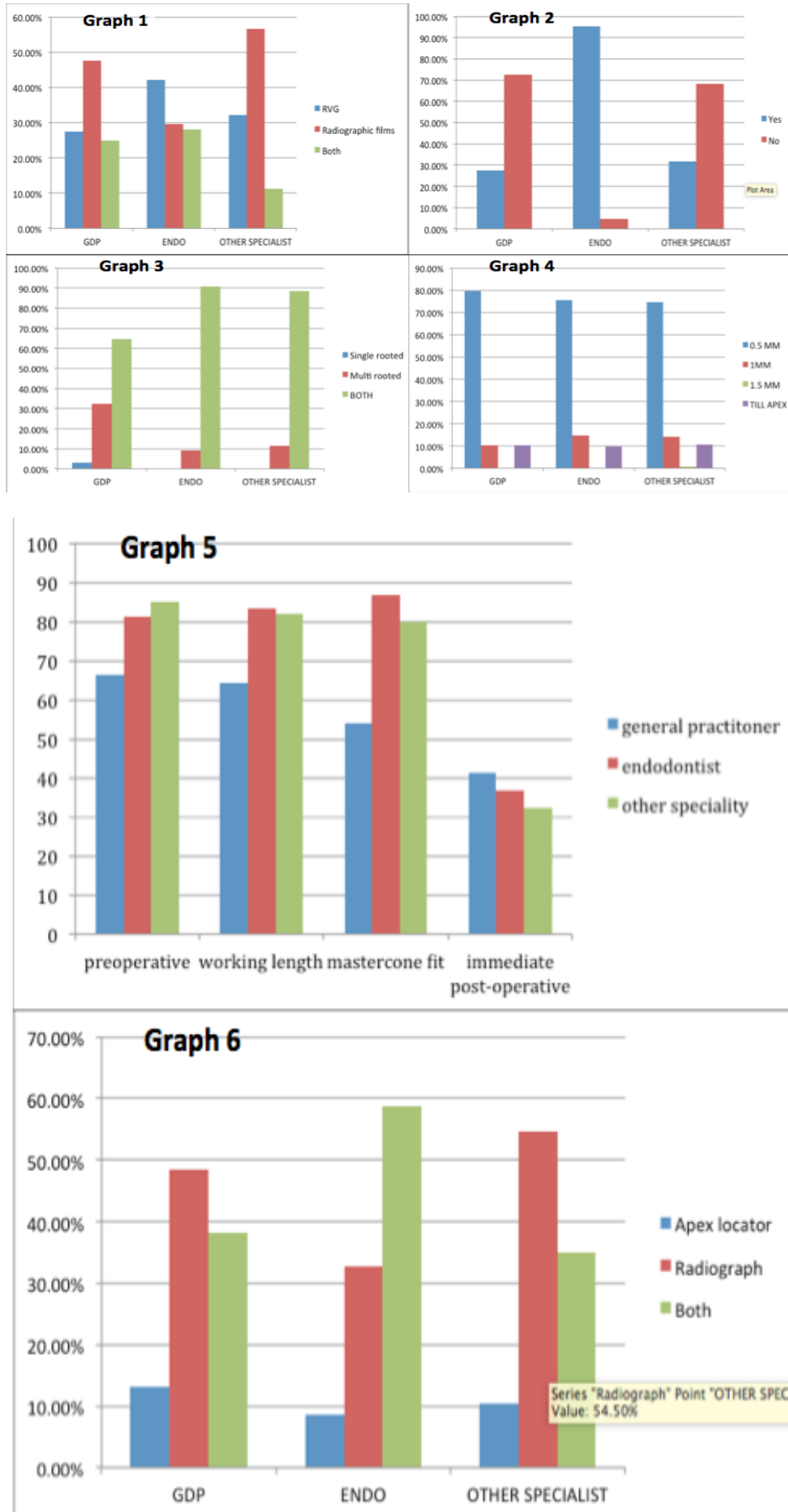
V. Conclusions

Number of female Endodontists was more than number of male Endodontists. Young GDPs were in greater number compared to other groups. Majority of Endodontists finished their post-graduation after 2004. Use of RVG was more by Endodontists and also, majority of them owned electronic apex locator. Young practitioners, who graduated after 1995, were more likely to use an apex locator. Majority of clinicians were of opinion of keeping working length short 0.5mm of apex (Figure 1-Graph4). Maximum other specialists took preoperative radiograph, while maximum Endodontists took working length and master cone radiograph. Overall rate of follow up of treated patients was found to be low; which is not a good practice.

From the survey, it was observed that the Endodontists employed apex locators and RVG more frequently than their colleagues in general dental practice. It was also observed that there was a reticence amongst older practitioners to adopt more recent techniques. There is a very apparent deficit in the knowledge of potential benefits of using Electronic Apex Locators in routine endodontic treatment.

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S. No.	Questions asked in the questionnaire.	General Dental Practitioner	Endodontist	Other specialist
1	Profile of the respondents :- male female	47.8%	46.6%	51.9%
		52.2%	53.4%	48.1%
2	Age of respondents:-less than 30 31-50 More than 50	53.4%	34.4%	35.8%
		46.6%	55.7%	54.9%
		0	9.8%	9.2%
3	Type of practice :-Alone With other dentist	65.0%	67.2%	68.6%
		35.0%	32.9%	31.4%
4	Use of RVG :- RVG Radiographic film Both	27.5%	42.2%	32.2%
		47.5%	29.7%	56.5%
		25.0%	28.1%	11.3%
		0	0	0
5	Limit for radiographic repeats : 1-2mm 2-3mm 3-5mm >5mm	57.6%	15.9%	12.7%
		31.8%	47.6%	58.4%
		10.6%	30.2%	27.7%
		0	6.3%	1.2%
		0	0	0
6	Possession of Electronic Apex Locator: Yes No	27.5%	95.2%	31.9%
		72.5%	4.8%	68.1%
7	Use of Apex Locator : Single rooted Multi rooted Both	3.2%	0	0
		32.3%	9.2%	11.5%
		64.5%	90.8%	88.5%
8	Opinion about Apex locators. :- Yes ,want to buy No, radiographs are enough	88.1%	100	96.9%
		11.9%	0	3.1%
9	Association with age (use of apex locator in all cases i.e anterior & posterior teeth) :- less than 30 30-50 More than 50	58.8%	40.9%	50.7%
		41.2%	45.5%	46.3%
		0	13.6%	3%
		0	0	0
10	Apex locator use by year of graduation(use of apex locator in all cases i.e anterior & posterior teeth) :- 2005 to 2014 1995-2004 1985-1994 Before 1985	50.0%	37.0%	40.6%
		45.0%	43.0%	55.1%
		5.0%	15.2%	2.9%
		0	4.3%	1.4%
		0	0	0
11	Apical limit for BMP 0.5 mm from apex 1 mm from apex 1.5 mm from apex Till apex	79.5%	75.4%	74.6%
		10.3%	14.8%	14.1%
		0	0	0.6%
		10.3%	9.8%	10.7%
		0	0	0
12	Tactile sensation Yes No	78.4%	80.6%	78.4%
		21.6%	19.4%	21.6%
13	Use of radiograph in various stages PREOPERATIVE WORKING LENGTH MASTER CONE FIT IMMEDIATE POSTOPERATIVE	66.3%	81.1%	84.84%
		64.42%	83.3%	81.81%
		53.84%	86.67%	79.8%
		41.13%	36.67%	32.33%
		0	0	0
14	Detection of perforation Apex locator Radiograph Both	13.2%	8.6%	10.4%
		48.5%	32.8%	54.5%
		38.2%	52.6%	35.1%
		0	0	0
15	Follow up 15 days 1 month 3 months 6 months	50.0%	25.3%	57.9%
		19.2%	25%	21.3%
		12.8%	17.2%	15.2%
		17.9%	32.5%	5.6%
		0	0	0