IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 9 Ver. VII (Sep. 2017), PP 49-58
www.iosrjournals.org

Trends To Determine Different Methods of working Length Used By National Dentists

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Abstract
Aim: The aim of our study was to access the attitude of general dentists, and specialist dentists in and around Mumbai city about the methods they use to determine working length during root canal treatment.
Materials and method-A crosssectional contact survey was conducted including 500 dental professionals in and around Mumbai city who performed root canal treatments. Specially prepared format to record and determine what working length method was adopted and preferred. Data was tabulated in Microsoft excel and analyzed using SPSS 22.0 software
Conclusion: *From the survey we determined thatrecently graduated dentists and many Endodontistsprefer apex locators and radiographs. There is apparently less knowledge of benefits and proper usage of apex locator in routine practice. Continuing dental education should be given from the base level for the same.*
Keywords: *electronic apex locator,radiographs, survey,working length.*

Date of Submission: 11 -09-2017 Date of acceptance: 22-09-2017

I. Introduction

Root canal access, biomechanical preparation (and irrigation) and obturation form the key triad of a successful endodontic therapy which directly or indirectly depends on the precise working length.[1]Working length is defined in the endodontic glossary as the distance from a coronal reference point to the point at which Canal preparation and obturation should terminate.[2]Working length too long results in perforation through apical constriction, overfilling or over extension, prolonged healing period or lower success rate of root canal treatment. Working length too short can cause incomplete cleaning, under filling, persistent discomfort, incomplete apical seal or apical leakage.[3]According to contemporary views, the place to which the root canal preparation and obturation should be performed is the narrowest apical part of the root canal called the apical constriction which is located 0.5 to 1.0 mm coronal to the apical foramen.[4] Working length determination can be establishedby two methods- radiographic methods or non-radiographic methods.[3]Radiographic methods include; Best's method, Bregman's method, Grossman method, Ingle method, Weine's method, Kulter's method, radiographic method, Xeroradiography, Direct digital radiography.[3] Non radiographic methods -digital tactile sensation, apical periodontal sensitivity, electronic Apex locator, paper point method.[3] Hence we formulated and conducted a survey to find out the different methods of determining accurate working length during root canal treatment by dentists and Endodontists in and around Mumbai city.

II. Materials & Methods

The questionnaire used in this survey wasvalidated by competent authority (MUHS Advanced course, FAIMER Fellow).The questionnaire of 26 questions included demographic information (age, gender, the year of graduation, etc.) and some questions about the use of radiography and Electronic Apex Locators(EAL) (from any generation) amongst general dentist practioner (GDP) during the various stages of endodontic treatment. To estimate the content validity index (CVI), sixEndodontists commented on each question. The CVI of each question was in the range of 0.8 to 1, which confirmed the validity of the questionnaire. A pilot study on 20 dentists was conducted. The participants acquired 35% of total score. In this regard, the sample size with α=0.05 and d=0.04 was calculated as 500. To determine the reliability of the questionnaire, a testretest method was used. After 10 days, the subjects completed the questionnaire again. The reliability for each question showed that the questionnaire had kappa index more than 0.60 indicating an acceptable reliability limit. The questionnaire was personally distributed among 500 randomly selected dentists. All participants were given an explanation regarding theobjective and potential benefit of the study and they were ensured of the

confidentiality of information provided. A total of 408 questionnaires were returned. The collected data was entered into SPSS 22.0 software for windows and was analyzed using the chi-square test with the level of significance set at 0.05. The results were then calculated as frequencies and percentages.

III. Results

The number of respondents was 408 who filled and completed the survey out of 500 dentists. The respondents in the age category 20 to 30 were 64 percent and in the age category 30-40 were 21.6 percent and in age category ranging from 40 to 50 were 13.5 percent and the 0.9 % is 50-above years (Graph 1).62.2% male and 37.8% female respondents took part in the survey (Graph 2).50.5% were bachelor of dental surgeon and 44.1% were masters of dental surgeon and the 5.4 % were specialty courses or PhD or mph out of the respondents(Graph 3).

Out of the respondents who took the survey, the specialists in conservative dentistry and Endodontics was 58.2%, and prosthodontics were 11.9%, pedodontics and preventive dentistry were 7.7%, and oral and maxillofacial surgery were 3.1%, orthodontics and dentofacial orthopedics 4.6%, periodontology 3.1% ,oral medicine and radiology 1.5%, 2.1% oral pathology and microbiology and 7.8 % others. (Graph 4)Out of the respondents, 45% did single chair practice, 15.3% were attached to university or Institute, 19.8% were doing Locum(ad hoc), 9% basic general dentalpractice (mass practice), 5.5% student, 0.9% first year PG student, 0.9% Masters Student and 2.1% intern,0.9% central government,0.9% private pracrice,0.9%consultation. (Graph 5)As a survey was done on various categories of Dentist, 16.2% had 80-100% practice, 36.9% had 60 to 80% practice in Endodontics, 27% had 40 to 60% practice in Endodontic, none had 40- 60% practice, 13.5% had 20 to 40% practice, 35.4% had 0 to 20% practice and 0.9% has had none. (Graph 6)Out of root canals done in a week, 54.1% respondents did 1 to 10 root canals in a week, 27 % did 10 to 20 root canals in a week, 11.7 percent did 20-30 root canals in a week,5.4% did more than 30 in a week and 1.8% did none as we came to know from the survey. (Graph 7)From the different types of methods used for working length 73.9% of our respondents use radiographic methods, 35.1% use digital textile sensations, 14.4 % used an apical periodontal sensation, 57.7% used electronic methods, 6.3% use paper point method,40.5% used radiovisiography and 0.9 % use Apex locator confirmed by radiograph. They could have used more than one method to determine working length (multiple responses expected)(Graph 8). 48.6% of the respondents checked working length after access opening, 55.9% before cleaning and shaping, 31.5% during cleaning and shaping, 25.2% after cleaning and shaping and 57.7% before obturation, 0.9% almost every step and 0.9% after access opening and before obturation as, Dentists check working length more than once.(Multiple responses expected) (Graph 9)Out of the respondents, 27.9% respondents did not know what generation Apex locator was used, 19.8% use the fifth generation Apex locator,12.6% use the 6th generation Apex locator, 12.6% None, 11.7% 4th generation Apex locator, 10.8% 3rd Generation Apex locator, 1.8% second generation,1.8% first generation and 0.9% frequency based electronic apex locator(Graph 10).From our various respondents, 21.6% used Apex locator for 1 to 6 months, 10.8% 6 to 12 months, 10.8% 1 to 2 years, 14.4% used for 2 to 4 years and 6.3% used for 4 to 6 years, 15.3% more than 6 years and 20.7% none. (Graph 11)

Out of the respondents 0.9% used 6 number K file, 11.7% used 8 number K file, 61.1% used 10 number K file, 39.6% used 15 number K file, 10.8% use 20 number K file, 0.9% depends upon canal width, 0.9 % depends upon the size.(multiple responses expected) (Graph 12)From our survey, 48.3% of the respondents kept the file at the apex and checked the working length, 34.2% kept at the 0.2 mm short then pushed towards apex, 10.8% kept it 0.2 mm Apical and then adjusted it towards apex, 3.6% kept 0.5 mm short then pushed it towards Apex, 2.2% kept 0.5 mm Apical then adjusted it towards apex,0.9% had no idea. (Graph 13)Out of the respondents, 70.3% respondents rechecked the root canal Apex with radiograph, 27% used only Apex locator, 0.9% had no idea, 0.9 % checked with master cone and 0.9% both(Graph 14)From our survey we came to know, 56.8% respondents checked preoperative radiograph, 79.3% check radiographically between treatments, and 58.6% check post treatment radiograph, 0.9% only to correlate The Apex locator reading in cases of open apex and 0.9% before starting the treatment.(multiple responses expected)(Graph 15)From our respondents, 54.5% respondents said the sound made by the apex locator is appealing, 25.5% said it is none, 10.9% said other and 9.1% said sound to be disturbing. (Graph 16)From the respondents, 24.3% respondents preferred visual reading, 13.5% sound,58.6% said they prefer both sound and visual and 3.6% prefer none. (Graph 17)Out of the responding dentists 48.8% Use radiographic methods if wet canal, 22.4% use radiovisiography, 21.4% use tactile sensation, 15.6% None, 0.9% use edta ,0.9% paper point. (Graph 18)

Out of the medical conditions contraindicated 54.3% respondents said pacemaker contraindicated, 33.3% said none, 1.9% said asthmatic and 10.5% said cardiac pathology (Graph 19)From our survey we came to know that, 50.6% respondents said radiographic methods preferred if electronic apex locator contraindicated,40% said radiovisiography, 29.4% tactile sensation, 4.7 % none, 2.4% radiograph.(multiple responses expected) (Graph 20)In our survey, 45.9% responding dentists were more confident to use only Apex locator, 35.1% were not, and 18.9% said maybe. (Graph 21)From our respondents, 70.3% of our respondents

cross checked with Radio graph, 20.7% with tactile sensation, 7.2% electronic methods, 9% paper point method, 33.3% by radiovisiography.(multiple responses expected) (Graph 22)Out of the respondents, 46.7% respondents sterilize the parts of Apex locator with spirit, 30.8% with chemical sterilization and 22.4% autoclave(Graph 23)From the answers received from respondents,76.6% said Apex locator is better than other methods of apex location, 18.9 % said maybe and 4.5% said it is not better(Graph 24)Out of the respondents, 90.1% of the respondents suggest Apex locator to be used and 9.9% do not(Graph 25)Out of the respondents in our survey, 91.9% of the respondents recommend Apex locator to other dentists and 8.1% maybe. (Graph 26)

IV. Discussion

Most experts agree that the canal preparation should terminate at the Cemento-Dentinal Junction (CDJ)[5.] However, the term "CDJ" is a histological term and a scanning electronmicroscope is needed to find it[5],which is clinically not possible. In the early days of endodontics, when radiographs were not being used in dentistry, working length was approximated to where the patient experienced pain. This obviously led to multiple errors. If vital tissues were left in the canal, the calculation of working length would be too short. If a periapical lesion were present, the calculation of working length would be long.[5]

Locating the appropriate apical position always has always been a challenge in clinical endodontics. The cement–dentinal junction, where the pulp tissue changes into the apical tissue, is the most ideal physiologic apical limit of the working length [1, 6].Working length determination in endodontics is very crucial because of possible damage to successive steps due to over instrumentation and overfilling [1], [7-10]. The only accepted, available, and reliable method of working length determination is conventional radiography[1.] But it has short comings, such as image distortion, superimposition of roots and/or anatomical structures like the presence of underlying permanent tooth buds, exposure to ionizing radiation, increased appointment time, and patient management[1]. The other important problem associated with intraoral periapical radiograph is the positioning of the film inside the mouth, processing the film, and its storage[1]. Therefore only few people in our survey reliedonly on radiograph readings.

Radiographs in dentistry came about in 1899. However, the thought at that time was that the dental pulp extended through the tooth, past the apical foramen, into the periapical tissue and that the narrowest portion of the tooth was at the extreme apex.[5]The radiographic apex was thought to be the correct site to terminate the canal preparation.[5]Sunada took these principles and constructed a simple device that used direct current to measure the canal length.[11] It worked on the principle that the electrical resistance of the mucous membrane and the periodontium registered 6.0 kX in any part of the periodontium regardless of the person's age or the shape and type of teeth[11]

In the current survey, maximum number of people did 10-20 root canal treatment it is in a week that is 54.5% people and 26.8% people did 10 to 20 root canal treatments in a week.

First generation electronic apex locator devices, also known as resistance apex locators, measure oppositionto the flow of direct current or resistance.[12] Second generation EALs, also known as impedance apex locator, measure opposition to the flow of alternating current or impedance.[12] Third-generation devices of apex locator are largely frequency based and use multiple frequencies to determine the distance from the end of the canal. Some third-generation apex locator devices use a ratio algorithm between two electrical currents and are designed to make accurate readings regardless of fluid electrolytes being present within the canal.[13] Fourth generation apex locators using two or more non-simultaneous continuous frequencies in order to measure the difference or ratio between two currents.[21]The fifth generation of apex locators can measure pulp space lengths accurately even in the presence of conductive fluids. The device provides the operator with a digital read out, graphic illustration, and an audible signal[13]. In our study we came to know that maximum people did not know what generation of Apex locator they were using,and the ones who knew mostly used5thgeneration (19.8%), 6thgeneration (12.6%), or 4thgeneration (11.7%).

Within ±0.5 mm, the accuracies were 73.9% for radiographic working length (RWL using paralleling technique), 57.7% for electronic working length, 63.5% for tactile working length (TWL using ISO 25 K file), 6.3% for paper point working length method (using ISO size 80 paper point), 95% for combined electronic and radiographic working length (CERWL) and 99.5% for combined electronic, tactile and paper point working length (CETPPWL) method[1]. Electronic apex locators are particularly useful when the apical portion of the canal is obscured by certain anatomic structures, such as impacted teeth, tori, the zygomatic arch, excessive bone density, overlapping roots, or shallow palatal vaults[1].Electronic apex locators do not produce pain, help to reduce the treatment time, and help avoid unnecessary radiation which makes it more superior in endodontic procedures .Thus, they are recommended for endodontic treatment. [1]

According to our current survey 70.3% were using only apex locator and rechecked with radiograph, and very few 27% used only apex locator and 2.7% checked with master cone or paper point method.Also, the number of files that were used mostly were 10 number k file or 15 number k file, or the one which fits snugly.

It is recommended to use the technique of apical setback to establish the WL using EAL. This consist of the introduction of the file to the foramen (which appears on the devices' screen as "0.0" or "APEX"), and then performing the setback until the apical constriction is reached. This technique allows the user to identify the first contrition toward the apex-crown. According Ricucci (1998)[15], this constriction is located 0.5 to 1.0mm coronal to the foramen and is considered an ideal spot for instrumentation and obturation of the root canals.[14]In our study dentists refer to check the apex by keeping the file at the apex and 34.2% keep the file 0.2 mm or 0.5 mm short of the apex and then pushed it towards the apex and very few people keep the file 0.2 or 0.5 mm apical to the apex and then retrieve it towards the apex.

The sound made by the apex locator is mostly appealing and rarely disturbing.Electrical devices such as electric pulp tester, EALs, and electrosurgical instruments has been potential interfere with cardiac pacemaker[16]. As there are many therapeutic uses and types of pacemakers some may not be influenced by electric pulp tester's use.[17-19]Author reported a caseof a patient with a cardiac pacemaker requiring root canal treatment. Under consultation with the patient's cardiologist, an EAL was used.[20]Thereforein our survey many people use apex locator cautiously in patient using pacemaker or cardiac patients. Also many of the dentist said they sterilize the apex locator parts with spirit 46.7% and auto clave 31%Hence Many dentists are confident enough to use apex locator and said that it was better than other methods of apex location. Also recommended other dentists to use apex locators.

V. Conclusion

The use of EAL will be useful for protecting patients from exposure to recurrent ionizing radiation, over instrumentation, overfilling, damage to the permanent tooth germs, discomfort associated with film placement and in cases where radiographic determination of root lengths has some limitations.Within the limitations of the results from the current study, we found that more than half dentists use electronic apex locator,though few use it correctly. And also many of them have started using it in the last few years.The senior generation dentists are more comfortable with old methods generally. The dentists who use apex locators most of the times combine it with radiograph or radiovisiography.The dentists using it also recommend it to be used by all dentists doing root canal treatments. So dentists should be taught the correct use and working of electronic apex locators, and it should be put more in practice.

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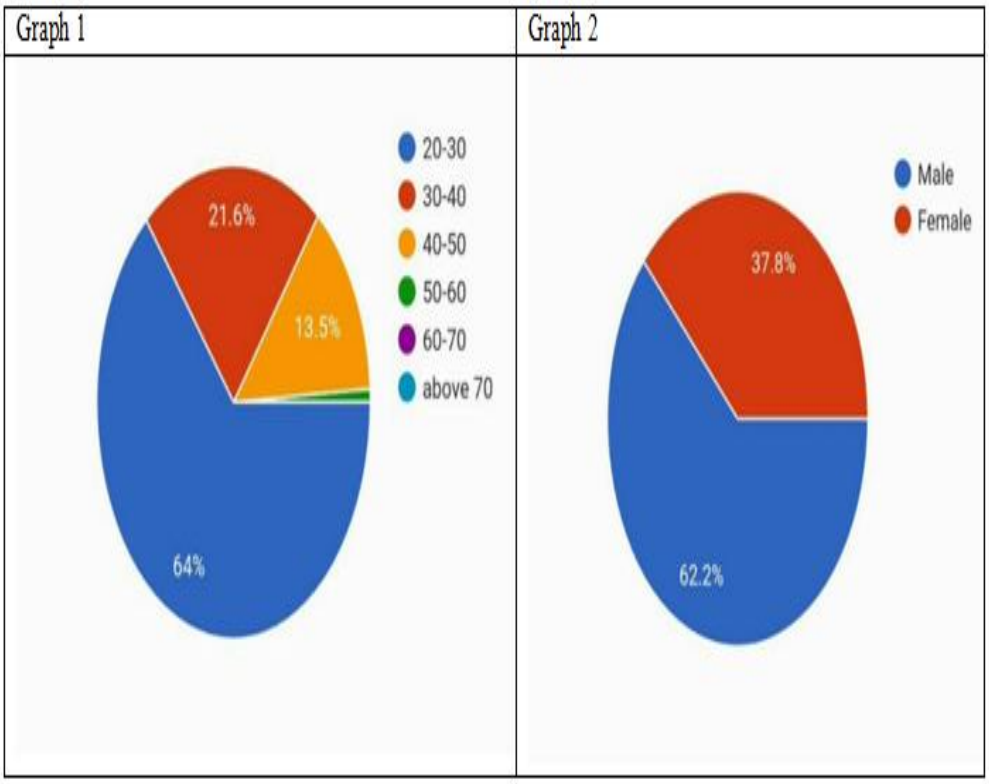
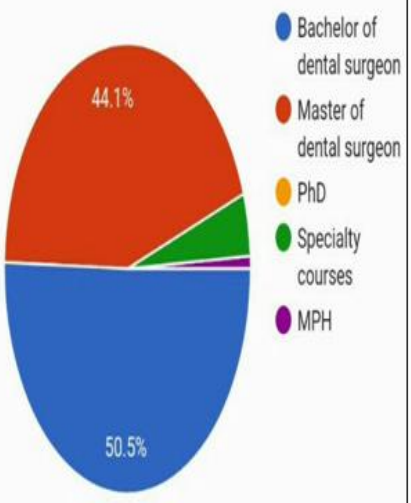
Legends To Figure

Graph 1 - the percentage of age of the respondents
Graph 2- the percentage of sex of the respondents
Graph 3- the percentage of Education of respondents
Graph 4- the percentage of the specialty of the respondents
Graph 5- the percentage of occupation of the respondents
Graph 6- percentage of how much practice is endodontics of the respondents
Graph 7- percentage of how many root canal treatments done in a week by the respondents
Graph 8- percentage of different types of working length determination is used by the respondents
Graph 9- percentage of how many times working length checked by the respondent
Graph 10- percentage of which generation of apex locator used by the respondents.
Graph 11- percentage of since how many years apex locator used by the respondents
Graph 12- the percentage of which number of k file used while Apex location by the respondents
Graph 13- percentage of how respondents prefer to check the Apex
Graph 14- percentage of whether only Apex locator used by respondents or rechecked with anything else
Graph 15- percentage of how many times respondents checked working length radio graphically
Graph 16- percentage of how the sound made by the apex locator of appeals to the respondents
Graph 17- percentage of whether visual or sound reading is preferred in Apex locator by respondents
Graph 18- percentage of what method is used if it's a wet canal by respondents
Graph 19- percentage of any medical conditions contraindicated
Graph 20- percentage of what alternative is used by respondents if contraindicated
Graph 21- percentage of how many dentists (Respondents) feel confident enough to use only apex locator
Graph 22- percentage of how many respondents cross check with any other method
Graph 23- percentage of what method used to sterilize parts of Apex locator by respondents
Graph 24 – percentage whether Apex locator better than other methods of Apex location
Graph 25- percentage of how many respondents suggest Apex locator to be used
Graph 26- percentage of how many respondents recommend Apex locator to other dentists.



Graph 3



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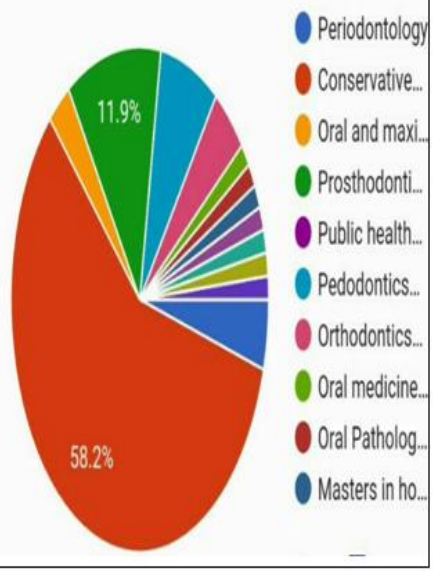

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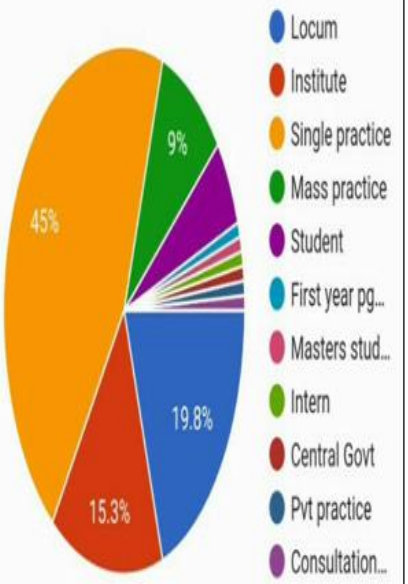

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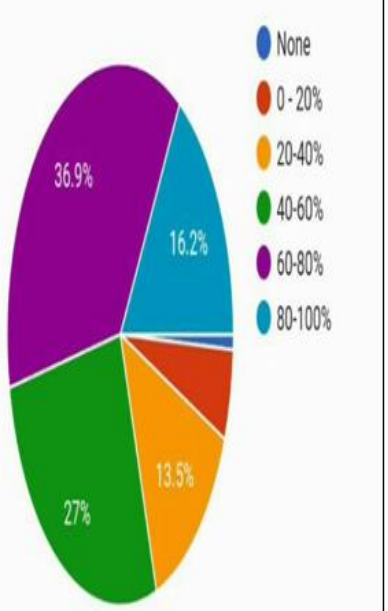

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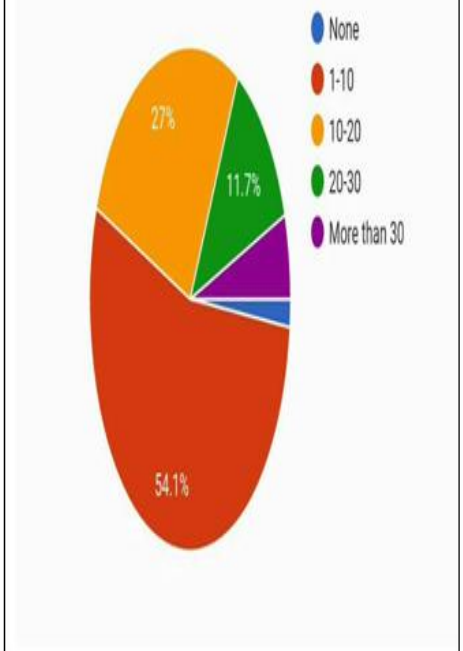
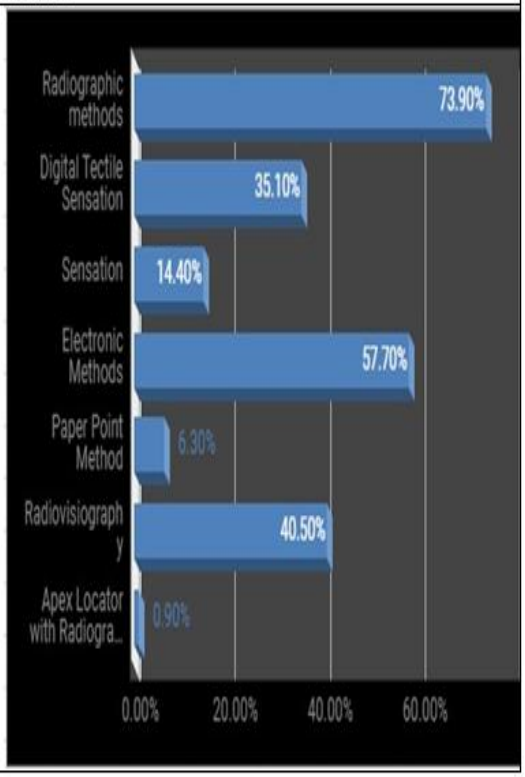
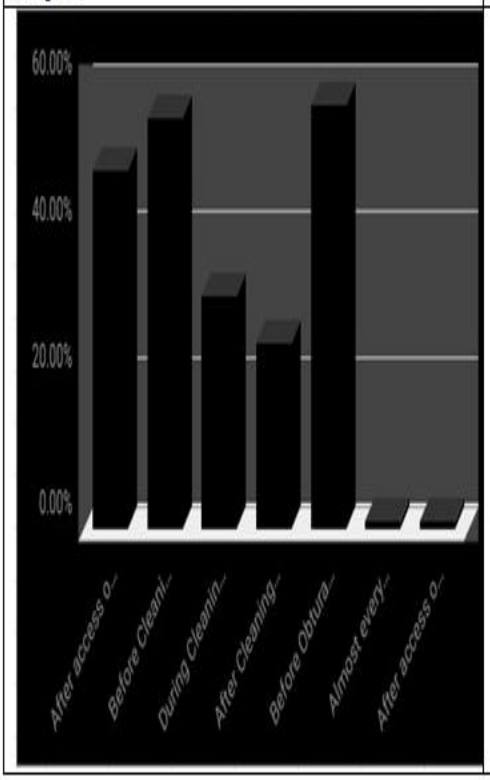


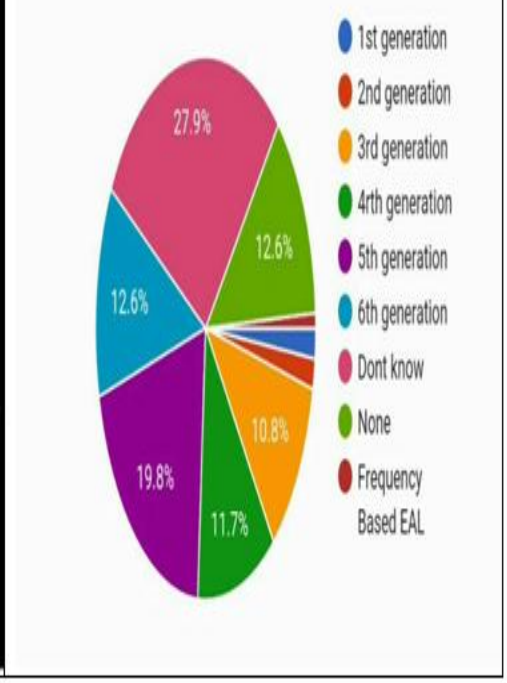
Graph 8



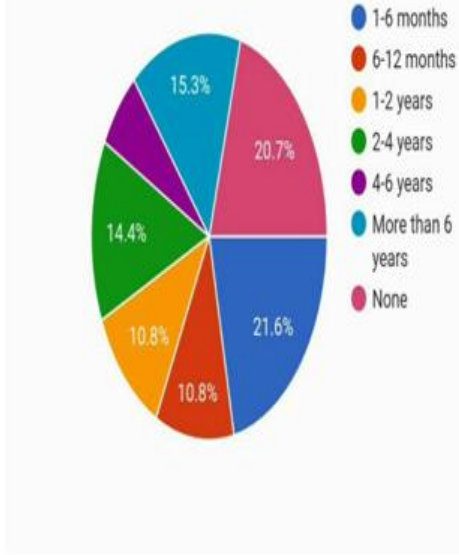
Graph 9



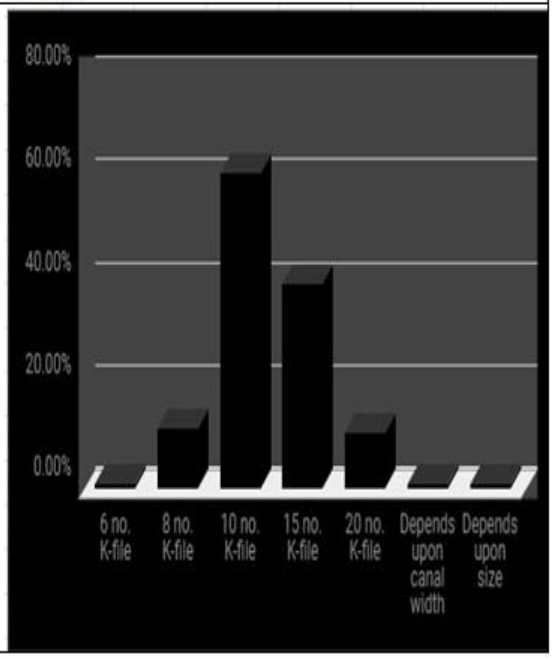
Graph 10



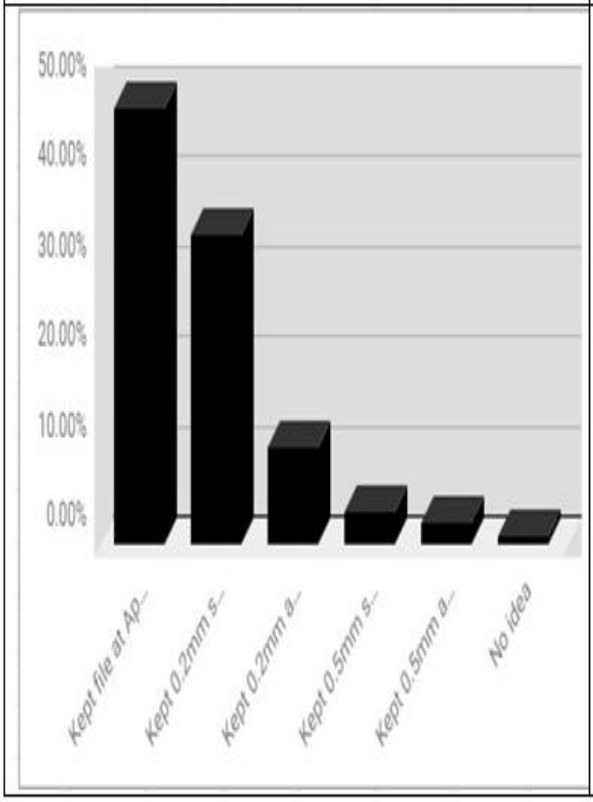
Graph 11



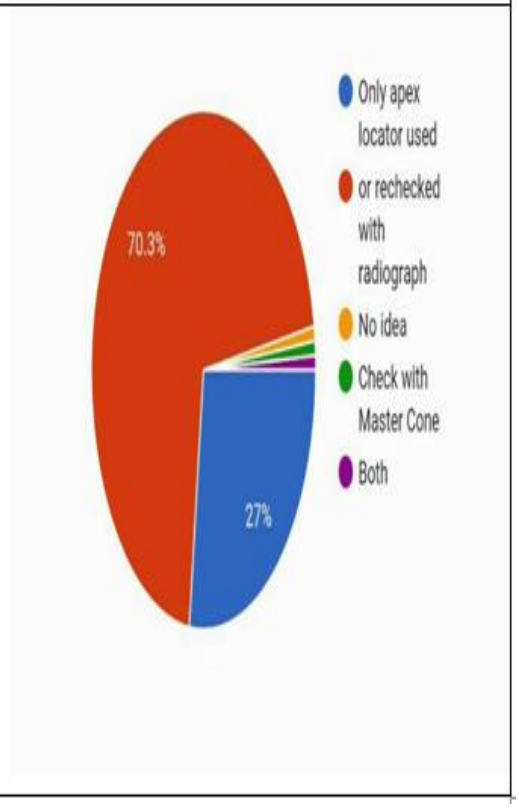
Graph 12



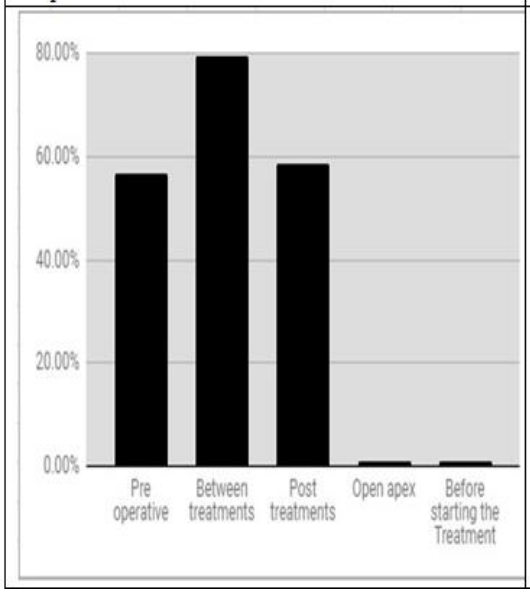
Graph 13



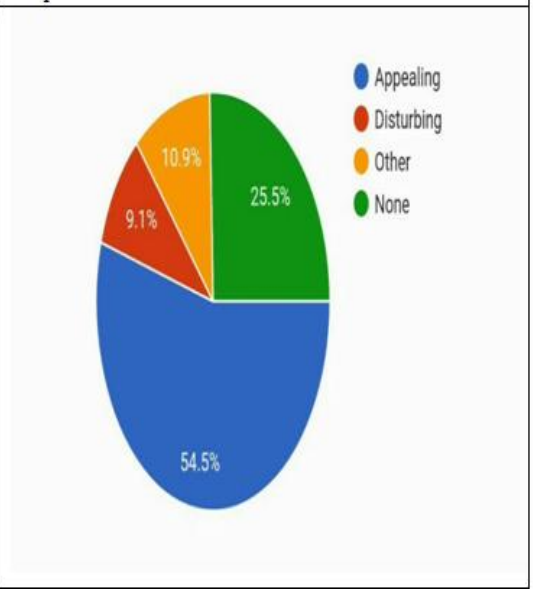
Graph 14



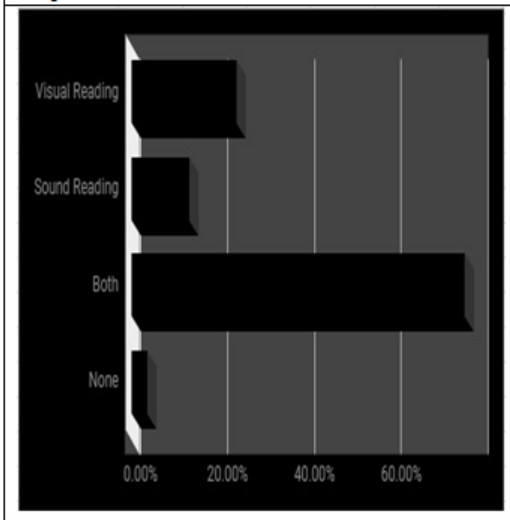
Graph 15



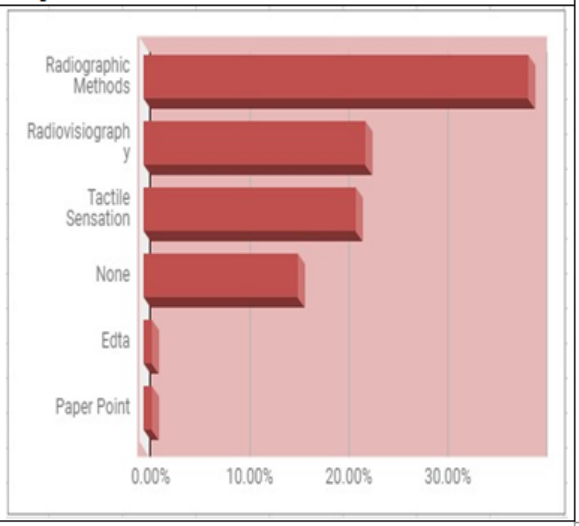
Graph 16



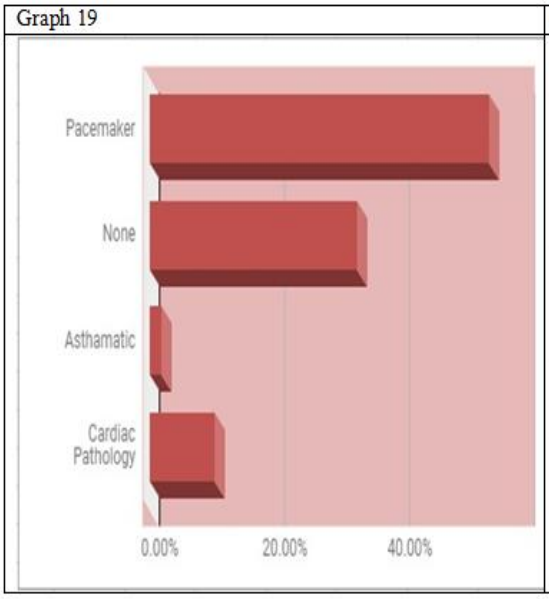
Graph 17



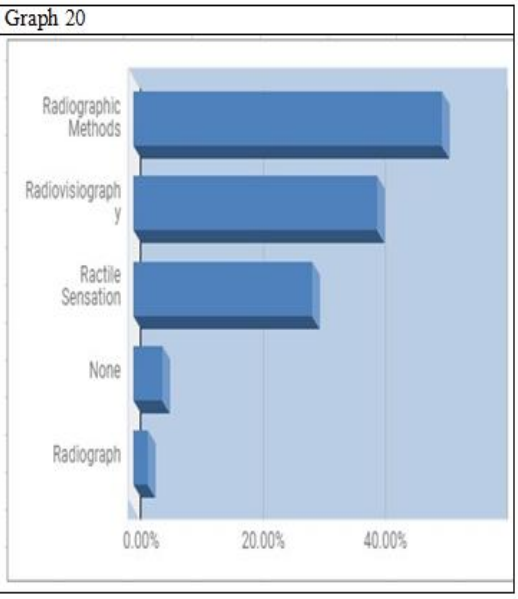
Graph 18



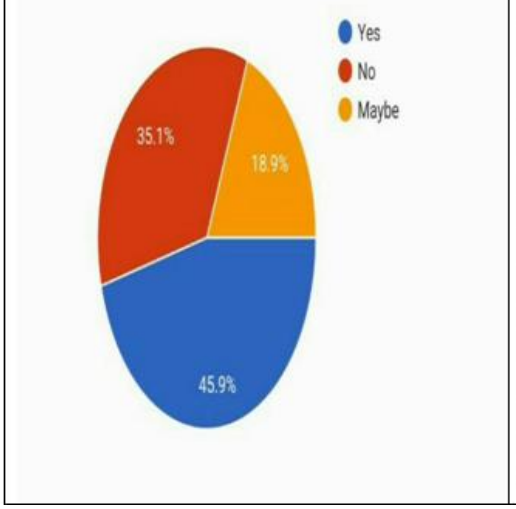
Graph 19



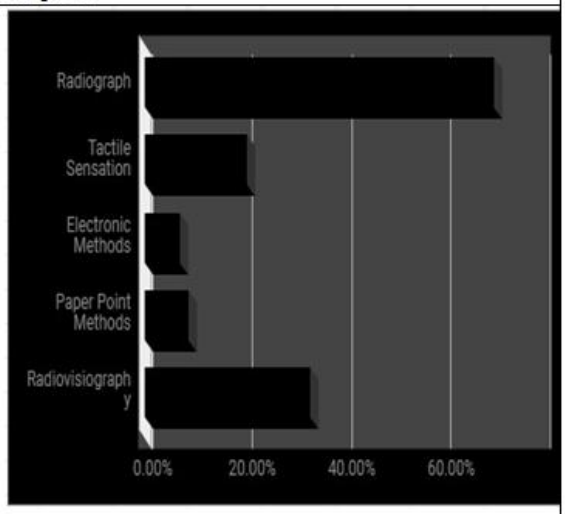
Graph 20



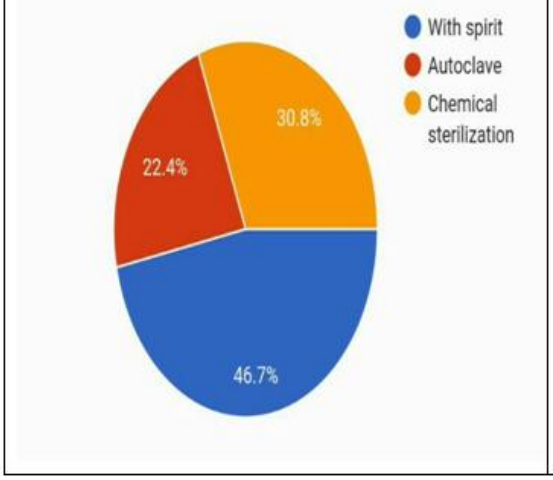
Graph 21



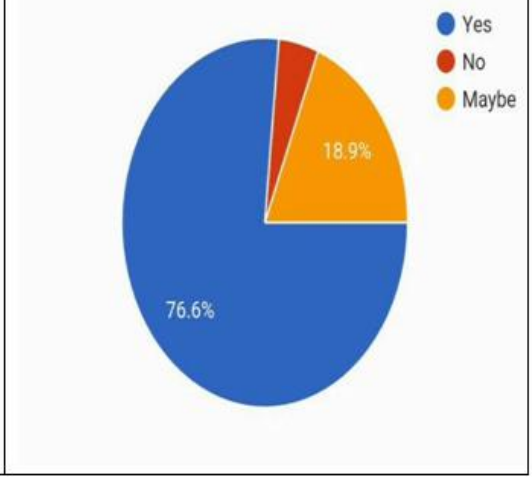
Graph 22



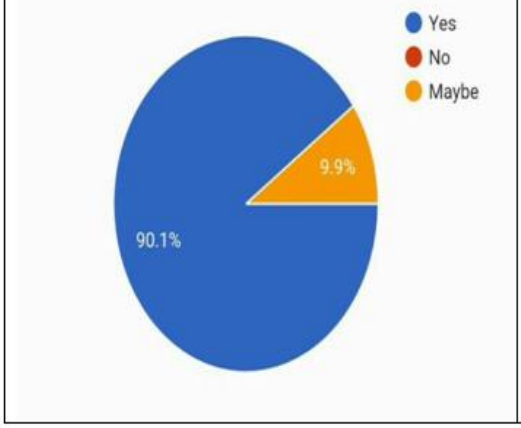
Graph 23



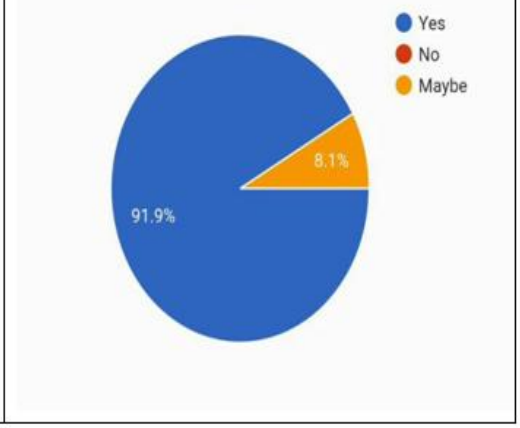
Graph 24



Graph 25



Graph 26



Rucha Patil B.D.S. "Trends To Determine Different Methods of working Length Used By National Dentists." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)* , vol. 16, no. 09, 2017, pp. 49–58.