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Dentistry Section

The Adoption of New Endodontic Technology by Indian Dental Practitioners: A Questionnaire Survey

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ABSTRACT

Aim: To ascertain the adoption of new endodontic technology in general dental practice in India in 2011.

Methodology: A postal questionnaire survey comprising 26 questions was sent to 700 general dental practitioners. The questions covered professional activity, root canal preparation and instrumentation, choice of irrigants and intracanal medicaments, choice of obturation techniques and other aspects of endodontics. The data were analyzed using descriptive statistics and the Chi-square (χ^2) test at 0.05 level of significance.

Results: The overall response rate was 88%. The results showed that rubber dams were used by 27% of dental practitioners in India. The most widely used irrigant was sodium hypochlorite, which was used by 33% of the respondents. Thirty nine percent of the practitioners were still incorporating only hand files during the cleaning and shaping phase of treatment. The technique of choice was both step back and crown down (35%). Calcium hydroxide was found to be the most frequently used (62%) intracanal medicament. Lateral condensation with guttapercha (61%) was the most common method used for obturation. Majority used zinc oxide eugenol as a sealer (55%). The post obturation restoration was done mostly by composite material (46%). Most of the respondents placed crowns after root canal treatment. Digital radiography was reported as being used by 17% of the respondents. There was no difference between males and females with respect to the incorporation of new technologies in dentistry. They had been incorporated significantly more by respondents who held postgraduate qualifications and had professional activities of <5 years.

Conclusion: The results indicated that new endodontic technology and materials are slowly being incorporated in clinical practice of endodontics in India. This survey shows the importance of continuing dental education for practitioners to update their knowledge.

Key words: Survey, Endodontics, General dental practitioner, Root canal treatment, Ni-Ti instruments, Obturation

INTRODUCTION

Endodontics is one of the fastest-growing disciplines in daily clinical practice, whereas contemporary endodontics involves the introduction of many new instruments, materials and techniques. Root canal treatment is technically demanding and it fails when treatment falls short of acceptable standards. In an effort to provide patients with most recent and predictable treatment planning, clinicians must be well informed about the outcome of endodontic treatment. It is important to acknowledge that outcome of root canal treatment is dependent not only on specific factors like root canal infection, complexity of root canal morphology, but is also very much influenced by less specific, more distinct causes such as dentist's skills and attitudes. These factors may be even more important causes of failure of endodontic therapy than directly related endodontic pathogens.Research data on attitude of general dental practitioners towards endodontic therapy is rare. Several studies have investigated the attitudes of general dental practitioners towards various aspects of endodontic treatment in England,UK, Belgium, Nigeria, Sudan, Australia, Denmark, USA, Sweden, Turkey, Jordan and Iran.[1-20] But there has been no survey of the current status of endodontic practice in India. So, the primary purpose of this survey was to determine the attitude of general dental practitioners towards endodontic treatment and current use of new endodontic technology and materials by them.

MATERIAL AND METHODS

The target population of this investigation was the general dental practitioners in India. A sample of 700 general dental practitioners was chosen from a list of registered dentists in India, to represent the target population. Before starting the survey, ethic committee approval was obtained.The selection was randomly done, to prevent any bias. An anonymous researcher- designed questionnaire written in English was used. The questionnaire was kept short, i.e. one-page, double-sided [Table/Fig-1]. Question categories included different aspects of endodontic treatment, including root canal therapy stages, materials, choice of instruments, isolation methods, use of canal irrigants, use of intracanal medicaments, choice of obturation technique and temporary and permanent coronal restoration. In order to evaluate validity and reliability of the questionnaire, 20 dental practitioners were asked to fill in the questionnaire as a control. The questionnaire was accompanied by a signed covering letter on headed paper; a participant information sheet and a prepaid first-class addressed return envelope. To prevent the feeling of a mass mailing, the name of the participant was hand written on each covering letter, and the postal address of the participant was hand written on each envelope. Respondents were instructed to complete the questionnaire and return them within a week.Three weeks after the first mailing, non-respondents were identified through a unique identifying number. Non-respondents were sent reminders. Briefly, the covering and reminder letters explained the aim of the study and specified that all information obtained would be kept confidential. Risks and benefits were mentioned to the participants.The 2-page questionnaire contained 26 questions which were related to different aspects of endodontic practice.Whenever multiple answers were received, each answer was counted. Percentages were then calculated, based on the number of respondents to each question. The percentages calculated for each section of the questionnaire have been shown in [Table/Fig-2] through 7.The data was analyzed using descriptive statistics and the Chi-square (χ^2) test at the 0.05 level of significance.

RESULTS

The response rate was 88%. 55% were males and 45% were females [Table/Fig-1]. Amongst them, 64% were undergraduates, while 36% were postgraduates 29% of respondents had worked for 6 to 10 years, and 48% reported that they had worked for less than 5 years; both groups consisted of more than half of the total respondents.

The autoclave was the main mode of sterilization (48%) [Table/Fig-2].There were no significant differences in response rates between males and females with regards to use of autoclave. The proportion of respondents who had postgraduate degrees and used autoclaves (66%) was significantly higher than that of respondents who had undergraduate degrees and used autoclaves (5%) (χ^2 = 56.090, d.f. = 1, p < 0.001). The proportion of respondents who had professional activities of >15 years and used autoclave (45%) was significantly lower than the proportions of respondents who had professional activities of <5 years (72%) (χ^2 = 12.595, d.f. = 1, p < 0.001).

Only 27% of respondents did rubber dam isolations during endodontic treatments [Table/Fig-2]. A majority (63%) used cotton rolls for isolation.A significantly higher proportion of respondents who had postgraduate qualifications carried out root canal treatment using rubber dams (97%) as compared to respondents who did not have postgraduate qualifications (79%) (χ^2 = 5.531, d.f. = 1, p = 0.019). There were no significant differences in response rates between males and females with regards to use of rubber dams. The proportion of respondents who has professional activities of <5 years and used rubber dams (76%) was significantly higher than the proportion of respondents who had professional activities of >15 years (50%) (χ^2 = 10.813, d.f. = 1, p = 0.001).

Digital radiography was used by 17% of the respondents [Table/Fig-2]. A significantly higher proportion of respondents had postgraduate qualifications and uses digital radiography (28%) as compared to respondents who did not have postgraduate qualifications (7%) (χ^2 = 12.526, d.f. = 1, p < 0.001). The proportion of male respondents who used digital radiography (19%) was significantly higher than that of female respondents (1%) (χ^2 = 13.730, d.f. = 1, p < 0.001). The most common apical limit of root canal preparation was 0.5-1mm short of the radiographic apex (86%), whilst 2% respondents prepared it as far as the radiographic apex [Table/Fig-3]. Various working length determination methods were employed. Approximately 15% of respondents used electronic length determination. About 6% of respondents relied on tactile sensation.

For root canal preparation and debridement, 39% of the respondents used stainless steel hand files; and about 61% reported using rotary nickel-titanium instruments, out of which protaper rotary system was most common (38%) [Table/Fig-3]. The proportion of respondents who were post graduates and used rotary instruments (28%) was significantly higher than that of respondents who were undergraduates (9%) (χ^2 = 6.210, d.f. = 1, p = 0.013). The proportion of respondents who had professional activities of <5 years and

	Percentage
Gender	
Male	55%
Female	45%
Years of professional activity	
0-5 years	48%
6-10 years	29%
10-15 years	14%
>15 years	9%
Education Level	
BDS (undergraduate)	64%
MDS (postgraduate)	36%

[Table/Fig-1]: Professional activity

	Percentage
Mode of sterilization **Boiling**	 8%
Glutaraldehyde solution	8%
Formalin Chamber	8%
Glass bead sterilizer	
Autoclave	28%
Mode of protective wear used	
Apron	48%
Facemask	33%
Headcap	39%
Protective eye wear	17%
Means of Diagnosis	11%
Mirror	36%
Digital radiography	17%
IOPA X-ray	33%
Pulp tester	13%
Others	1%
Mode of isolation	–
Cotton rolls	63%
Rubber Dam	27%
Suction	10%
None	–

[Table/Fig-2]: Mode of sterilization and isolation followed

	Percentage
Method of measuring working length Arbitrary	 6%
Radiograph	44%
Metallic scale / Endogauge Apex locator	35% 15%
Working length	
1st tug back / Tactile stop	10%
0 mm from radiographic apex	2%
0.5-1mm from radiographic apex	86%
Hand file used	
Stainless steel K-file	41%
Hand Protaper	34%
H- file	21%
Rotary system used	
Gates-Glidden Drill	14%
Protaper	38%
Hero	2%
Other None	7% 39%
BMP technique	
Crown down	35%
Hybrid	18%
Step back	35%
Circumferential Ultrasonic	10% 2%
Retrieval of fracture instrument	
Ultrasonic	17%
By- pass the instrument	46%
Apical surgery	22%
Obturate it	15%

[Table/Fig-3]: Biomechanical Preparation of root canal

	Percentage
Irrigant Normal saline	36%
Water	1%
Hydrogen Peroxide	14 %
Sodium Hypochloride	33%
Chlorhexidine	13%
Intracanal medicament	
Formocresol	28%
Corticosteroid paste	2%
Calcium Hydroxide paste	62%
Other	8%

[Table/Fig-4]: Choice of Irrigantand intracanal medicament used

	Percentage
Sealer Eugenol based sealer	55%
Calcium Hydroxide based sealer	12%
Resin based sealer	31%
Obturating material	
Sealer paste	1%
GuttaPercha	60%
Silver cone	0%
Resilon	2%
ProtaperGuttapercha	35%
Obturation technique	
Single cone technique	26%
Vertical condensation	10%
Lateral condensation	61%
Temporary filling material	
Zinc oxide eugenol	33%
Cavit	52%
IRM	14%
Post–obturation restorative material	
Composite	46%
Amalgam	27%
Miracle mix Crown placement after RCT Always Sometimes Commonly Never	22% 50% 10% 40% 0%
Post and Core used	
Customized cast post	32%
Bonded Fiber post	39%
Metallic Screw post	22%
Other	7%

[Table/Fig-5]: Method of obturation used

	Percentage
Reasons for endodontic referral Retrieval of silver point	4%
Surgical intervention	16%
Post retrieval	1%
Perforation repair	12%
Curved root canal	17%
Large apical lesion	12%
Calcified canal	15%
Never refer	23%

[Table/Fig-6]: Reasons for endodontic referral

used rotary instruments (68%) was significantly higher than the proportion of respondents who had professional activities of >15 years (51%) (χ^2 = 4.833, d.f. = 1, p = 0.028). No statistical difference was found between males and females regarding use of rotary instruments. Ultrasonic root canal preparation was practised by 2% of respondents. Both the step back and crown down techniques were the techniques of choice (35% each).

Sodium hypochlorite (33%) and normal saline (36%) were the most popular irrigating agents which were used [Table/Fig-4]. Calcium hydroxide, as an interappointment dressing, was used by 62% of the respondents.These agents were used equally by males and females, undergraduates and post graduates and respondents with professional activities of different years.

Cold lateral compaction of gutta-percha was used by 61% of respondents [Table/Fig-5]. The proportion of respondents who did not have postgraduate qualifications and used cold lateral compaction (97%) was significantly higher than respondents who had postgraduate qualifications (81%) (χ^2 = 11.565, d.f. = 1, p = 0.001). There was no statistical difference among males or females regarding cold lateral obturation technique. Other less popular options included warm vertical compaction (10%), single cone obturation (26%). The majority used zinc oxide eugenol as a sealer (55%). Cavit was the choice of temporary filling material (52%). The composite was the choice of permanent material for post–endodontic restoration (46%). A significantly higher proportion of respondents who were postgraduates with professional activities of <5 years used composite for post endodontic restorations (99%) as compared to respondents who were undergraduates or who had professional activities of >15 years(56%) (χ^2 = 53.715, d.f. = 1, p < 0.001).There was not much difference between males and females regarding use of composite as post endodontic restoration.

Both customised cast post (32%) and fibre post (39%) were used by general practitioners. Most of the practitioners placed crowns after root canal treatment. The most common reasons for referring the patients were curved root canals (17%), surgical interventions (16%) and calcified canals (15%) [Table/Fig-6]. A vast majority of undergraduate respondents (99%) referred patients, and this was significantly higher than that of postgraduate respondents (90%) (χ^2 = 5.765, d.f. = 1, p = 0.016).Similar results were obtained by males and females regarding the referral pattern. The fractured instrument was usually bypassed (46%). The proportion of post-graduate respondents who bypassed the fractured instrument (68%) was significantly higher than the proportion of undergraduate respondents (51%) (χ^2 = 4.833, d.f. = 1, p = 0.028).

DISCUSSION

As far as the authors were aware, this study is the first to provide published information on the provision of endodontic treatment by general dental practitioners in India.The response rate of this study was 88% and it was considered as satisfactory for a postal questionnaire. This may be because the questionnaire topic was relevant, as well as the methods used to design and administer the questionnaire. Given the high response rate, it was not expected that there would be any degree of non-response bias. The high response rate ensured that this study was representative for the general dental practitioners in India.

The ratio of male to female respondents was 55: 45 [Table/Fig-1]. To investigate the influence of the years of practical experience on the materials and techniques employed, the sample was divided into groups, based on the years of professional experience. Years in practice were not evenly distributed amongst the total respondents due to the significant increase in the number of graduates in the last 10 years.

The autoclave, as the preferred mode of sterilization, was used by 48% of the respondents [Table/Fig-2]. Some respondents still relied

on boiling and chemical disinfection. Protective eye wear was used during treatment by 11% of practitioners, indicated need of more awareness. Rubber dam isolation is considered the standard of care in modern endodontics. A survey amongst American general dental practitioners showed that 59% of respondents always used rubber dams [19]. Only 27% of practitioners in India used rubber dams routinely during root canal treatments [Table/Fig-2]. The reasons for not using rubber dams could be the extra cost, additional time, lack of adequate skills or training, absence of patient's acceptability or inadequate education in the undergraduate teaching curriculum.

Working length determination is one of the most critical steps in endodontics. In teeth with intracanal infections, over-instrumentation induces the displacement of infected dentine or debris into the periradicular tissues and can impair healing.It is evident that the most precise determination of working length is combination of radiographs and electronic apex locators. According to existing data, the use of electronic apex locators in general daily practice is limited. Digital radiography was used by 17% of the respondents [Table/Fig-2]. Optimal working length appeared to be 0.5 to 1 mm from the radiographic apex. In Flemish study, 38.9% of the respondents prepared root canals 1mm short of the radiographic apex.[18] Such results may have occurred due to the Belgian health insurance authority policy. In the present survey also, it was reported that the most common apical limit of preparation was 0.5-1mm short of the radiographic apex (86%) [Table/Fig-3].

Successful root canal therapy requires a thorough mechanical preparation. Amongst the root canal instruments, K-files were used by 41% of the respondents, H-files were used by 21% and hand protapers were used by 34% [Table/Fig-3]. Results of the survey showed that nickel-titanium files are used by 61% of the respondents in general dental practice.The rotary systems that were used most frequently were the ProTaper and Gates Glidden drills. There is no doubt that use of rotary systems was signicantly associated with shorter instrumentation sessions, as well as only fewer numbers of visits were needed to complete a case. This might have attracted the practitioners. But the other newer rotary systems were not much popular. Despite a substantial body of studies showing superior quality of rotary instrumentation over conventional ones, it could be stated that the diffusion of this technology was at an early phase amongst general dentists [6]. This could be due to the marketing politics which have focused not so much on health effects, as on enhancing the simplicity and the time-saving effects of using NiTi technology. However, in order to change over from conventional to rotary instrumentation technique, the 'trialability' and the 'complexity' aspects seem crucial. Significantly more dentists were willing to adopt a new rotary system to the daily practice, when training was included in the educational package, as compared to just lectures and written information [13]. A majority of dentists instrumented the canal using either the step back technique or the crown down technique (35% each). This might be due to good tactile sensation with step back technique and good irrigant penetration with crown down technique.

Beside mechanical preparations, sodium hypochlorite has been proven to be the first-choice root-canal irrigant [Table/Fig-4]. This opinion was shared by 59.2% of general dental practitioners in Belgium [18]. A vast majority of our respondents were non-users of rubber dams and they used sodium hypochlorite routinely. The use of either sodium hypochlorite or hydrogen peroxide without isolating the field of operation tightly with a rubber dam, presents an obviously hazardous practice in the use of potentially irritant irrigation solutions. The use of other newer irrigants like chlorhexidine or MTAD was at a budding stage.

Attitude of general dentists towards the use of an interappointment medicament in between visits differ. About 92% of respondents employed intracanal medicaments for multi-visit treatments. The remaining 8% did not use any form of dressing and usually left root canal space unfilled.Calcium hydroxide, as an interappointment dressing, was used by 62% of the respondents [Table/Fig-4]. A number of factors may contribute to the latter's popularity: low incidence of toxicity, being an injectable formulation, and its reported effectiveness. Caustic products were not used frequently. However, formocresol was still used by 28% inspite of its known mutagenic effects.

Over the years, numerous methods have been advocated to obturate the prepared root-canal system, each with its own claims of ease, efficiency or superiority. However, the most popular obturation technique among general dental practitioners is still cold lateral condensation with guttapercha and it was used by 61% practitioners [Table/Fig-5]. Single-cone gutta-percha placement (26%) is still being used in this country. It will be interesting in the future, to check whether the single-cone technique will increase in popularity, because many of the companies that produce rotary instruments are also marketing gutta-percha cones that match the size of the last rotary file that was used to prepare the canal. Other less popular options included the warm vertical compaction (10%). Seemingly, dentists were not strong advocates of the more recently introduced advanced obturation techniques. This might be attributed to additional costs involved or the lack of skill and training. Even though many new root canal sealers have been introduced, the zinc oxide–eugenol sealers remained the "gold" standard (55%) in this material category.Other sealers like paraformaldehyde containing sealers such as Endomethasone and N2 were used infrequently.

Temporary restorative materials used in endodontics must provide a high quality seal of the prepared access cavity, in order to prevent microbial contamination of the root canal. Fifty-two percent of the respondents used Cavit as temporary filling material.This material has been marketed for over 50 years and, at this time, has not been replaced by any new restorative materials for the purpose of sealing access preparations on a temporary basis. Composite was the material of choice (46%) for post endodontic restorations. This might be due to its good strength, aesthetics and ease of convenience. Most of the practitioners placed crowns after root canal treatment, to prevent fracture of the teeth. Both the customized cast post (32%) and fibre post (39%) were used to strengthen the core, indicated the incorporation of new things in dental practice.

With regards to current referral patterns, majority of respondents (77%) stated they referred patients with endodontic problems.[4] The most common reasons for referring the patients were curved root canals (17%), surgical interventions (16%) and calcified canals (15%) [Table/Fig-6]. The fractured instrument was usually bypassed (46%). The ultrasonic was also used for retrieval of fractured instrument. 15% of practitioners obturated it as such without retrieval of fractured instrument, indicating need for incorporation of newer technologies.

There was a positive attitude amongst general dental practitioners towards performing endodontic treatment and adoption of new technologies in daily endodontic practice.There was not much difference in males and females regarding the incorporation of new technologies in dentistry.The recent advancements and technologies were adopted significantly more by those who held postgraduate qualifications and had professional activities of <5 years. The respondents with postgraduate qualifications (specialists vs. general practitioners) may possess additional knowledge and skills.Exposure to postgraduate education may affect the range of treatments that dental practitioners offer. The standard of endodontics performed by practitioners can be improved by establishing a continuing dental education programme. A mandatory application of follow-up after endodontic treatment is crucial and it might alter practitioners' awareness of their performance in dental practice.

CONCLUSION

During past decade, many innovative concepts, techniques and instruments have been introduced in dental practice. Despite a variety of new instruments and techniques, majority of questionnaires, general dental practitioners used conventional diagnostic, preparation and obturation techniques. Magnifying lenses and operating microscopes were rarely used during endodontic treatment.

This survey showed the importance of establishing higher specialist training or continuing dental education for practitioners, for updating their knowledge.

RECOMMENDATIONS

Although new developments are slowly being incorporated into daily practice, the professional bodies in endodontics should embark on training programs, seminars, and workshops which are aimed at improving the knowledge and skills of the general dental practitioners. Appropriately structured continuing education courses may be able to meet the demands and needs of dental practitioners. More comprehensive questionnaires including qualitative and quantitative use of new endodontic materials, instruments and techniques, should be recommended to assess further changes in endodontic practice.

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