

Materials and Techniques used by General Dental Practitioners in Libya during Endodontic Treatment of Permanent Molar Teeth

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Aim: To investigate the current trends in routine endodontic treatment of molar teeth performed by Libyan general dental practitioners (GDPs).

Materials and methods: A total of 750 structured questionnaires enquiring about various aspects of endodontic treatment were dispersed among GDPs who work in public and private clinics in five major Libyan cities (Tripoli, Benghazi, Sabha, Misrata, Albidia).

Results: Of the 750 questionnaires, 337 completed replies were received. The response rate was 44.9%. Amongst those 88.1% performed endodontic treatment for molar teeth, while 11.9% mentioned that they refer difficult clinical cases to endodontic specialists. 21.1% of GDPs used rubber dam for isolation. About 95.3% used radiograph for working length determination and only 4.7% used apex locator. More than half of participants (58.2%) never found MB2 canal in upper molars, and only 2% of them used magnification tools during root canal treatment. The majority of GDPs (90.8%) used sodium hypochlorite as an intra-canal irrigant, while calcium hydroxide was used by 60.5% of GDPs as an intra-canal medicament, followed by formocresol (39.5%). The step-back and crown-down preparation techniques were the methods of choice in this study with a percentage of 61.4% and 24.9% respectively. Hand instruments were used by 64.4% and rotary instruments were used by 35.6% of the GDPs. Cold lateral condensation was used by 76.6%, while the rest used single cone technique for obturation. Zinc oxide eugenol was used by 73.9%. The majority of the GDPs completed root canal treatment in three visits or even more (85.4%).

Conclusions: Majority of Libyan GDPs performed root canal treatment for molar teeth starting with pre-operative radiograph, used variety of endodontic materials and techniques, and implemented new materials and technologies when they became obtainable. Yet, most GDPs used step-back technique for canal preparation and lateral condensation for obturation. Few GDPs used rubber dam which highlights the importance of applying policy and regulations for good-quality practice.

Keywords: Keywords: Molar root canal treatment, endodontic materials & techniques, general dental practitioners, survey study.

Introduction

Dentistry has rapidly developed during the last decades. New materials, devices, and instruments continue to arise and develop altering conventional treatment methods into new ones for better outcomes¹. The objective of endodontic treatment is to preserve and maintain the health of pulp and periradicular tissues. Therefore, root canal treatment is considered an essential element in comprehensive quality dental care¹. Success of root canal treatment has been recognized to depend on pre-operative assessment and correct diagnosis, rubber dam isolation, keep on endodontic treatment protocol, effective cleaning and shaping accompanied with maintenance of disinfected root canal system and hygienic environment in the working area, good quality root canal sealant and coronal restoration^{2, 3}. It has been documented that endodontic treatment has high success rate of more than 90%^{4, 1}. These results were reported from studies per-

formed by endodontic specialists at dental schools clinics, where well established endodontic programs are followed^{4, 5}. On the other hand, the success rate of the endodontic treatment performed by general dental practitioners in general dental practice that approximates 65-75%¹. This variation in success rates may be due to differences in the technical quality, materials and methods employed during endodontic treatment⁶. A range of studies were, therefore performed to investigate the standard and the routinely practice of root canal treatment conducted by general dental practitioners (2, 4, 7, 8, 9, 10).

Many of these studies have publicized that the majority of dentists do not followed guidelines put by the American Association of Endodontics or the European Society of Endodontology^{11, 12, 13}. Whereas other investigators revealed that the recent graduate dentists were more likely to have implemented newer materials and technologies⁷.

Furthermore, many changes and improvements in the concepts and treatment protocols of endodontic have been introduced during the past few years. These innovations in the materials, instruments and techniques have altered the approach of endodontic practice and offering clinicians a wide range of treatment alternatives. These include the use of nickel-titanium (NiTi) rotary files, apex locators, endodontic microscope and other contemporary instrument 1, 4.

These innovations can reduce procedural faults, provide relief for both the clinician and the patient and therefore enhance positively the treatment results.

Libyan General dental practitioners (GDPs), either they work in public or private dental clinics offered endodontic therapy to patients. However, data were not available regarding the details of endodontic treatment practiced and offered to the patients in Libya. Therefore, the aim of this study is to investigate and gather information about the current endodontic practice regarding the materials and techniques used during root canal treatment of molar teeth performed by Libya GDPs, working in public and private dental clinics. The result of this study might help to explore their current level of practice, implementing newer technologies, and to highlight problems and the training need of the Libyan GDPs to improve the quality of their performance.

Materials and method

A structured questionnaire concerned with the current endodontic practice of GDPs in Libya was developed in the year 2018. A total of 750 questionnaires were sent to randomly chosen Libyan GDPs who practiced dentistry either in public or private dental clinic and offered endodontic treatments to their patients. GDPs from five large Libyan cities participated in this study (Tripoli, Benghazi, Sabha, Misrata, and Albida). These cities were selected based on their population size and ability of their GDPs to practice endodontic treatment of molar teeth (150 questionnaires for each city).

The questionnaire comprised of two parts of close-ended questions with an order answer choice questions, and partially closed-questions where a responder could write in his/her own answer and opinion. No personal data were collected to ensure confidentiality of the respondents. The first part of the questionnaire requested information like gender, and age.

The second part of the questionnaire requested information about the current endodontic practice of the GDPs and details of clinical methods when providing endodontic treatment concerning the following topics; willingness to undertake endodontic treatment of molar teeth, method of isolation of the operating field, in particular regarding the use of a rubber dam during endodontic treatment, the availability and importance of preoperative radiograph, methods of working length determination, type of root canal irrigant used during endodontic treatment, canal preparation technique, the choice of instruments used,

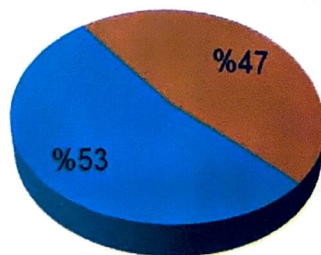
type of intra-canal medications, type of sealer and type of obturation technique, numbers of visits to complete endodontic treatment. Filled-in completed questionnaires were collected from the responders and all data was entered in Excel and analyzed using the statistical software, SPSS version 20.

Results

From 750 questionnaires, only 337 were completed and returned for statistical analysis. The response rate was about 44.9%. Of the total number of the participants 53.4% (n= 180) were male and 46.6% (n=158) were female as shown in figure (1).

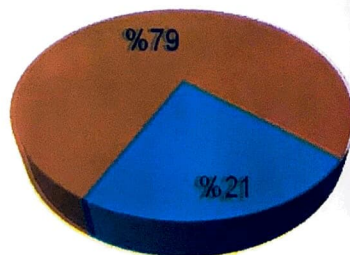
Most of the participants 88.1 % (n= 297) of GDPs mentioned that they perform root canal treatment for permanent molars, while 11.9% (n= 40) stated that they refer their patients to endodontic specialists.

Figure 1: The gender of the respondents



Preoperative radiography was used by the majority of GDPs 91.4% (n=308) of the respondents. About 95.3% of the participants used x-ray to check working length, and only 4.7% used apex locator. Rubber dam was routinely used for isolation during root canal therapy by 21.1% of the GDPs, while 78.9% (n=266) used cotton rolls and high volume suction as main isolation technique (figure 2). Regarding the need for using magnification during root canal treatment, just 34 participants (10.1%) had reported the usage of such device.

Figure 2: A pie chart illustrates the percentage of use of rubber dam among the participants



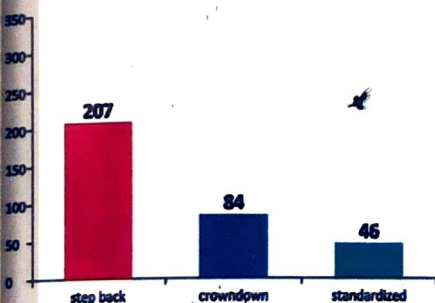
More than half of the participants 58.2% (n=196) never found MB2 in upper molars, and about 75% (n=253) have never found an extra canal in the lower molars. The participants who ended the root canal instrumentation 1mm short of the radiographic apex were 64.4% (n=217). Data of others who prepared the canals at different levels are presented in (Table 1). Sodium hypochlorite was the most commonly used root canal irrigant 90.8% (n=306) followed by chlorhexidine 8% (n=27), while the hydrogen peroxide was the least used (1.2%).

Calcium hydroxide was the intra-canal medicament of choice for 60.5% of the GDPs (n= 204), whereas the remaining 39.5% (n=133) preferred usage of formocresol (figure 3).

Table 1: the distances between the radiographic apex and the instrumentation level

Instrumentation level short of the apex	No. of GDPs	Percentage of (%) GDPs
mm 0	60	17.8
mm 1	217	64.4
mm 1.5	38	11.3
mm 2	22	6.5

Figure 3: Types of irrigation solution used by GDPs



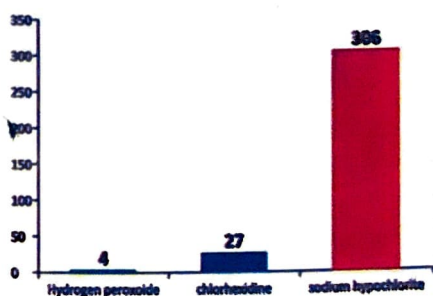
The most popular type of instruments for canal preparation were the hand files 64.4% (n=217) whereas, about one third of participants 35.6 % (n=120) preferred usage of rotary instruments during endodontic treatments. Regarding root canal preparation technique; 61.4% (n=207) of the practitioners prepared the root canal with step back technique, while 24.9% (n=84) used crown-down technique, and the remaining 13.6% (n=46) used standardized technique (Figure 4).

Lateral condensation of gutta-percha was the most prevalent method of obturation which was used by 76.6% (n=258), while single cone technique was used by 23.4% (n=79). None of the practitioners applied new techniques or devices for root canal obturation. The sealer that was used frequently by the participants, 73.9% (n=249) was

zinc oxide eugenol based sealer, whereas resin based sealer was not very popular; used only by 26.1% (n=88).

Regarding the number of visits required to complete the

Figure 4: Method of root canal instrumentation.



root canal treatment, 85.4% (n=288) of the GDPs needed more than two visits (3 or 4 on an average) to complete their treatment, while only sixteen respondents (4.7%) claimed that they finished the endodontic treatment in one visit, and 9.8% (n=33) of participants needed two visits to finish the therapy (Table 2).

Table 2: The average number of visits required for the treatment

Average visit per treatment	No. of GDPs	Percentage of (%) GDPs
1	16	4.7
2	33	9.8
3	240	71.2
4	48	14.2

Discussion

To date, no study had been established to gather information on the root canal treatment carried out by Libyan GDPs practicing endodontic treatment in Libya. Thus, it is not possible to compare the current treatment approach to earlier periods. The data collected in the current investigation might be of value in providing information and baseline data for future investigations of changes in endodontic practice in Libya.

The questionnaire focused on the clinical materials and methods used during endodontic treatment of molar teeth by Libyan GDPs without asking names to ensure secrecy of the responses. In addition, sending the questionnaires to 750 GDPs from different cities and different clinical practices could provide some valuable information about general endodontic practice in Libya. Then, based on the results of this study it will be conceivable to determine if there are any trends in terms in various aspects of root canal treatment of molar teeth.

The response rate in this study was 44% which was disappointingly not high as that reported in similar studies in Saudi Arabia and North Jordan (63% and 72%) 9, 14. However, other studies reported a comparable low response rate 4, 10, 15, 16. The number and percentage of male (53.4%) and female (46.6 %) respondents were close to each other. This may have led to positive results especially to questions about contemporary techniques and concepts. The content of endodontic training in faculties may change in time as the field develops. Thus, the graduation year of respondents may have an effect on results. The results of this study showed that most of GDPs in private and public dental clinics in Libya undertook molar root canal treatment (88.1%) which was close to that among GDPs in north Jordan and Saudi Arabia (97% and 89% respectively) 14, 9. The use of rubber dam isolation is considered the standard of care in endodontics, and its use was reported to improve the success rate of endodontic treatment 17. More than half of GDPs in America and New Zealand reported using rubber dam routinely in endodontic treatment 18, 19. Whereas in our study, only 21% of the practitioners used rubber dam in endodontic treatment. Even lower percentages were reported in other studies 8, 9, 15, 16, 20, where only 5.1%, 9.4, 3%, and 15% of the dentists use rubber dam. This may be attributed to the underestimation of the importance of rubber dam isolation and to the lack of skills in using it. Other reasons could be time consumes during rubber dam application, being not available, expensive and that patients might feel claustrophobic.

The preoperative radiograph represents crucial element for a successful root canal treatment. A study performed in the UK, presented that 83.9% of GDPs used preoperative X-rays for endodontic treatment 4, while 90.2% and 91.5% of Lithuanian dentists did 10, 21, 22. The findings of these studies approximate our results as 91.4% of GDPs took radiograph for molar teeth before root canal treatment.

The working length can be determined by several methods. Radiograph with some kind of instrument in situ is one of the traditional methods which has been used widely for several years despite the fact that it provides only a two-dimensional image 23. In this survey, about 95.3% performed working length checking X-ray, and only 4.7% used apex locator for working length determination which is comparable to the results of Al-fouzan study 9.

More than half (58.2%) of GDPs in our study had difficulties finding the mesiobuccal canal in upper molars (MB2) even though it is present in the majority of maxillary first and second molars 24. Similar finding was reported in studies performed by Hommez et al and Slaus and Bottenberg 22, 8. Dental microscopes and other forms of magnification facilitate the precise performance of endodontic procedures 3. They reduce the chance of missing canals which can lead to failure of the endodontic treatment 25. However, in our study only 10.1% of the GDPs used magnification devices. This may explain the high percentage

of missing (MB2) in first maxillary molar (58.2%) in this study. Kulild & Peters 24 found that the incidence of finding MB2 was 95.2%. Many respondents in the current study (64.4%) ended the root canal instrumentation 1 mm short of the radiographic apex which was similar to the percentage that was reported by Slaus and Bottenberg 8. By contrast Whitten et al. reported that 0.5 mm was more popular 18. The differences in working length that reported by these studies could be explained by the preoperative status of the pulp. Other factors that may influence instrumentation levels are anatomic variability in the apical region and age. 26 Sodium hypochlorite was found to be the most effective antimicrobial agent 27. Whitten et al. reported that 79% of general dental practitioners used sodium hypochlorite which is less than the percent presented in the current study (90.8%). Similar results were found in a survey by Whitworth et al. 28 in the UK and Paul et al. 29, whereas in Saudi Arabia about 55% of the dentists used normal saline for irrigation 9. Almost all GDPs in this study used intra- canal medication. The routine intra- canal medication was calcium hydroxide (60.5%), which was comparable to a study in Turkey (61.5%), in the USA, the UK, North Jordan and in Saudi Arabia (9%, 7%, 11.5% and 23% respectively) 15, 14, 4, 9. The highest percent was reported in Lithuania (97.8 %) for using such medicament 30, 10. The differences in the results of the previous studies may be attributed to the different clinical regime between universities.

In this study, formocresol was used by 39.5% which is close to that mentioned in a survey of GDPs in private clinics in Saudi Arabia (46%) 9. Despite the superior diffusibility of this group of medicaments, it may have adverse effects and has the potential to be widely distributed in the body 31. In addition, formaldehyde type medication has mutagenic and carcinogenic potential 32. Calcium hydroxide has reached a unique position as dressing in endodontics as it has effective influence against most root canal pathogens and able to denature bacterial endotoxins 33. GDPs should be encouraged to use it instead of formocresol.

A single-appointment treatment appears to have evidence and increased credibility 6. In a survey of 568 actively practicing diplomates of the American Board of Endodontics, it was reported that 34.7% completed treatments in one visit with a normal periapex, while only 16.2% did so if apical periodontitis was present 7. The present survey showed that only 4.7% of the GDPs finished root canal treatment in one visit (4.7%). Similar results were reported in Saudi Arabia, North Jordan, Sudan, and Lithuania 9, 14, 34, 35. This trend may be due to lack of experience, lack of modern endodontic equipment or inadequate clinical time to finish the treatment in a single visit.

The vast majority of the respondents (71.2%) stated that they needed three visits to finish the treatment whereas in other studies treatment by most GDPs was completed

in two visits on average 8, 10, 20, 22 .

Hand files were used by 64.4% of GDPs indicating that they tend to use more conventional methods in canal preparation due to lack of skills in using more advanced techniques for shaping the root canal system. Likewise, GDPs in Jordan and Saudi Arabia used hand instruments (93.1% and 97%) 14, 9 . About 35.6% of Libyan GDPs used NiTi rotary instruments for root canal instrumentation which is higher than the percent mentioned in northern KSA (17.5%) and Belgium (28%), and less than that in USA (74%) and Turkey (76%) 20, 8, 18, 16 .

According to the result of this study, step back technique was the most common technique used for preparation of the root canals (61.4%). Similar finding was mentioned in North Jordan study. 14 The second commonly used technique was crown-down technique (24.9%) which is close to what was mentioned in Selena et. Al study (28.3%) 16 . Only 13.6 % of the respondent used the standardized method of canal preparation, and this percent is quite low compared to a study conducted on Flemish (60.4%) and Saudi Arabian dentists (49%) 22, 9 . The last technique may result in over preparation forming an elliptically shaped defect at the endpoint of preparation making it difficult to completely obturate the canal 36, 37 .

Finally, the obturation materials and techniques employed play an essential role in root canal treatment 38 . Cold-lateral condensation of gutta-percha points in combination with a root canal sealer is the most widely accepted technique for obturating root canals 4, 7 . The present study showed that lateral condensation was the most frequently used technique used by GDPs (76.6%). A similar result was demonstrated amongst dentists in north Jordan and KSA and Lithuania 14, 20, 9, 10 . By contrast, single cone technique was used by 23.4% of GDPs. The most popular root-canal sealer amongst GDPs was zinc oxide eugenol-based sealers (73.9%). This result is in accordance with that of AL-Omari, Jenkins et al. and Ahmed et al. studies 14, 4, 33 . On contrast, the most popular root-canal sealer amongst Turkish and KSA GDPs was AH plus, followed by Endomethasone 15, 9 .

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