



Faculty of Science - University of Benghazi

Libyan Journal of Science & Technology

(Formerly known as Journal of Science & Its Applications)

journal home page: www.sc.uob.edu.ly/pages/page/77

Attitudes, techniques and trends in endodontic treatment by general dental practitioners in Benghazi- Libya

Nagat H. Bubteina*, Nadine I. Shakeer

Department of conservative and endodontic, Faculty of Dentistry, University of Benghazi, Benghazi, Libya

ARTICLE INFO

Article history:

Received 27 November 2017

Revised 17 December 2017

Accepted 23 December 2017

Available online 30 December 2017

Keywords:

Root canal procedure, endodontic trends, general dental practitioners, questionnaire survey

* Corresponding author:

E-mail address: nagat_bub@yahoo.com

N.H. Bubteina

ABSTRACT

Introduction: The success of the root canal treatment depends on the attitudes, techniques and different approaches that carried out by the dental practitioners who made major impact on performing a high standard level of dental treatment to get a great quality of work.

Aim: The objective of this research was to investigate the current trends and attitudes in endodontic treatment exhibited by general dental practitioners worked in private and public dental clinics in Benghazi- Libya.

Materials and Methods: This study was accomplished in March 2017 included 170 general dental practitioners worked in private and public dental clinics in Benghazi Libya. Each participant received structured questionnaires to assist the attitudes, techniques, current trends, materials and new technology used in a daily endodontic practice. All returned forms were evaluated by a single operator. Descriptive statistics and frequency distribution were analyzed using SPSS version 21 and Chi-square test.

Results: The respond of participants was 150 represent 88.23% response rates. The results showed that 78% (117) of the respondents they did not build up the tooth before starting RCT and the majority preferred multiple visits per endodontic treatment. The main isolation method was cotton roll with saliva suction (77.3%). About (43.3%) of the practitioners used step-back technique for canal preparation and the most common used hand instruments was a K-files in conjunction with hedstrom files (50%). The finding of this study indicated that (52.7%) of the practitioners took 0.5 mm working distance from the apex. Sodium hypochloride was the common irrigant (55.3%) and (38%) of respondents used calcium hydroxide as intracanal medication. Lateral condensation was more common among the respondents (64%) and the zinc oxide-eugenol was the common type of sealer used among them (45.3%). The most common restorations were composite materials (34.7%).

Conclusion: It was concluded that the general participant dentists in Benghazi city did not keep up with the newly introduced techniques in endodontic as they were used more conventional methods in their work which could be attributed to lack in expertise and recognition of new technology in a daily endodontic work.

© 2017 University of Benghazi. All rights reserved.

Introduction

Endodontic is a basic phase in the multidisciplinary dental treatment that deals with the etiology, prevention, diagnosis and treatment of the pulp diseases (Peculiene *et al.* 2009). It is considered as challenging procedure to dental practitioners due to many reasons such as the different shape and configuration of the root canal system, accurate identification and widening of all canals without procedural mishaps, correct working length determination and maintaining of an adequate irrigation and perfect obturation (Gupta Rai, 2013). It is well confirmed that root canal procedure is strictly technically demanding and usually be unsuccessful when treatment falls short of the acceptable standards (Gorni and Gagliani, 2004). Many researchers believed that the failure rate of root canal treatment could be projected higher for teeth treated by general dentists than endodontic specialists, because dentist's skills and attitudes were more important causes of failure of endodontic therapy than endodontic pathogens (Weiger *et al.*, 1998 and Friedman, 2002). Other studies showed that the dissimilarity between daily general work in dentistry and the academic training were attributed to the majority of general practitioners ignored nearly all the basic principles of root canal treatment and the treatment procedures were carried out under less than most favorable

conditions (European Society of Endodontology 2006 and Whitten *et al.*, 1996).

Therefore, the main objective of this research was to assist the attitude, techniques, trends and the current use of new endodontic technology in different aspects of root canal treatment exhibited by general dental practitioners worked in private and public dental clinics in Benghazi- Libya.

Material and Methods

This cross-sectional study was conducted in March 2017 included 170 general dental practitioners worked in private and public dental clinics in Benghazi Libya. Each participant received structured questionnaires to evaluate the attitudes, techniques, current trends utilized among them in root canal treatments. Before starting the survey, ethical committee approval was obtained. A total of 150 forms fully filled were returned. The questionnaire included 20 closed-ended questions focused on general aspects of endodontic treatment including: first part incorporated demographic information while the second part inquired about the isolation methods, root-canal preparation techniques, working length determination, material and technique employed in irrigation, intra- canal medication and obturation. Based on the years of experience the participants were divided into 3 groups Group A: 1-10 years, Group B:

11-20 years, Group C>20 years. All returned forms were assisted by a single investigator. Descriptive statistics and frequency distribution were analyzed using SPSS version 21. Chi-square test was used to evaluate the statistical significance. The selected level of significance was accepted at $P < 0.05$. The missing answers were treated as missing values.

Results

The finding of this study, as shown in Table 1, specified that the response rate was 88.23%. About fifty-four percent were females and 46% were males. Amongst them, 56% were working in private dental clinic, while 44% were working in public services. Finally, the result showed that group A composed of more than half of the total percentage of the participants 67%.

Table 1

Frequencies of practicing place, genders and years of professional activity

Practicing place	N	%	Gender	N	%	Professional activity	N	%
Private	85	56.7	F	81	54	A (1-10 ys)	101	67.3
Public	34	22.7	M	69	46	B (11-20 ys)	38	25.3
						C (>20 ys)	11	7.3

For tooth build up, the result showed that the highest percentage of the respondents 78% did not build up the tooth before starting the endodontic treatment (Fig. 1). Statistical analysis showed significant differences in response rates between place of work, gender and years of experiences [$P < 0.05$]. Regarding number of visits per endodontic treatment, the finding indicated that 50% of them preferred multiple visits treatments rather than doing a single visit, 50% always, 32% often and 16.7% occasionally (Fig. 2). There was a statistically association between gender and the number of visits where 60% of female preferred multiple visits rather than single visit [$P < 0.05$].

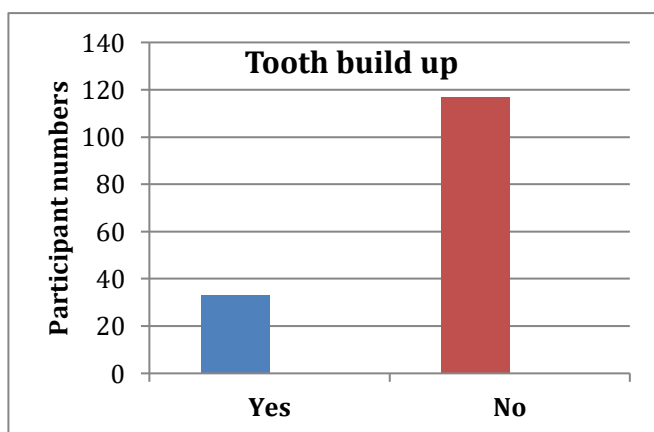


Fig. 1. Statistical analysis for Tooth build up

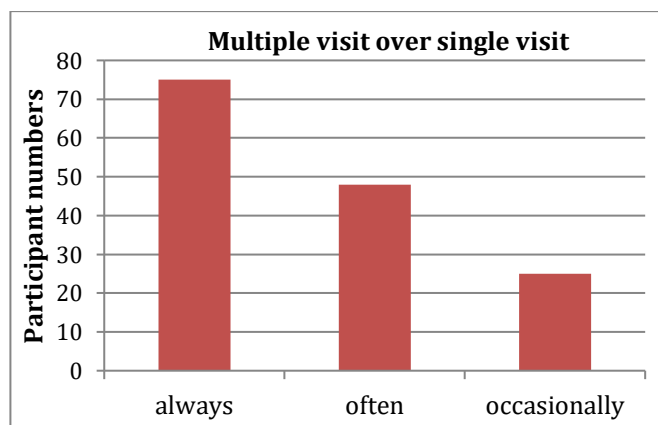


Fig. 2. Statistical analysis for Number of treatment visits

Regarding the isolation methods, only 11.3% of respondents used rubber dam isolation during endodontic treatments (Fig. 3). Majority of practitioners (77.3%) used cotton rolls with saliva ejector for isolation. (92.1%) of group B who had professional activities of 11 to-20 years used cotton rolls with saliva ejector followed by group A 73.3% then group C 63.6%. Statistically, there were significant differences in response rates between genders regarding the uses of the rubber dams where 79% of females and 75.4% of males used cotton roll with saliva suction while 18.8% males used rubber dam only.

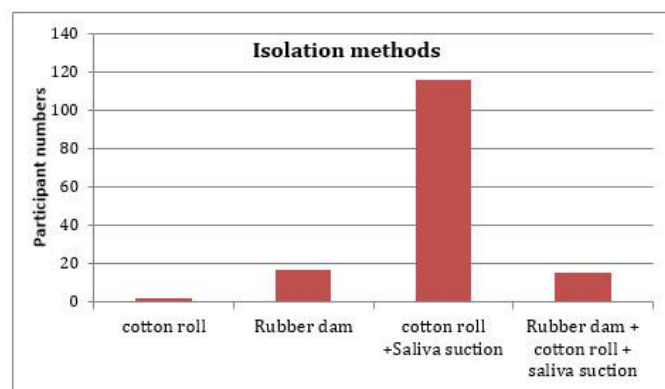


Fig. 3. Statistical analysis for Isolation Methods

For working length determination, the result showed that 41% of the practitioners used digital radiograph, 30.7% conventional dental film radiograph and only a few dentists 3.3% used apex locator. It was recorded that the place of work and gender had Significant influence on the working length determination [$P < 0.05$]. Around 51.2% used digital radiograph in private clinics, while 64.7% in public services used the conventional dental film radiography. 41.3% of females among the respondents used conventional radiograph for working length determination and 52.2% of males used digital radiograph. The statistical analysis showed that there were no significant differences between groups of years of professional experience [$P > 0.05$].

For instrumentation and obturation techniques, it was reported in (Fig. 4) that the majority of practitioners 43% used step-back technique in canal preparation, followed by 24% used rotary technique and 14% used a combination of step-back and rotary technique. There was statistical difference between genders regarding the use of rotary technique in the canal preparation. The results showed that 39.7% of males used rotary technique and only 11.1% of females used same technique.

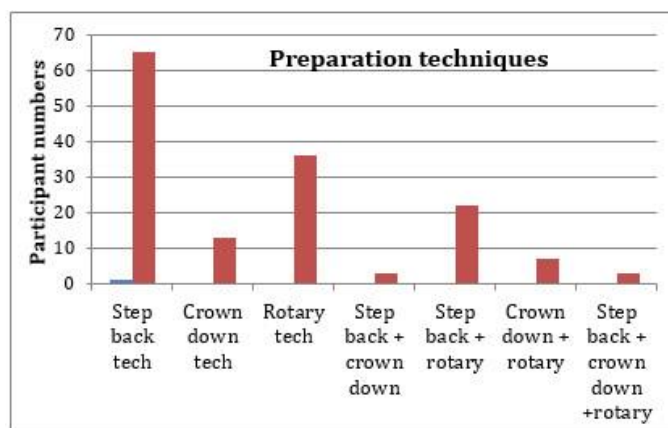


Fig. 4. Statistical analysis for preparation techniques

The proportion of the respondents using the step-back technique and practicing in public dental clinic 61.8% were significantly higher than that who were working in private dental clinic 42.9% [$P < 0.05$]. No statistical difference was found between professional experience groups. It was found that 50% of the practitioners used

K-files in conjunction with headstrom files for root canal preparation, while 38% used K-files only. In addition, the result showed that there was significant association between the types of the working places with the type of instruments used [$P<0.05$]. Forty-seven percentage of the respondents who were practicing in private clinic relied on K-files to shape root canals, while 50% of those who practiced in public services preferred using both k-files and headstrom files. Disposal of the endodontic files after single use was practiced by 8.7% only, and endodontic file was reused after sterilization by 61.3%.

For determination of the working distance from radiographic apex, the results showed that 52.7% of the respondents located the apical limit of root canal preparation at 0.5 mm shorter than the radiographic apex, while 28.7% prepared it at 1-2 mm away from the radiographic apex and only 12% prepared it at the radiographic apex. Statistical analysis showed that there were significant differences in response rates between the groups of the years of professional experiences concerning the position of apical limit of root canal preparation [$P<0.05$]. From the study, it was found that 63.2% of the group B, 51% of group A and 36.4% of group C preferred to place the apical stopper of root canal preparation 0.5mm away from the radiographic apex.

Concerning canal irrigation, it was found that 55.3% of respondents used sodium hypochlorite for canal irrigation, 26% used both sodium hypochlorite and normal saline and only 9.3% used normal saline as primary irrigant (Fig. 5). The finding of the study reported that there were no significant differences in response rates between genders, the groups of years of experiences and place of practicing regarding to the type of irrigation used during canal preparation. As intracanal medicament, the majority of the respondents 38% used calcium hydroxide, 26.7% used CMCP, 10.7% used both calcium hydroxide and CMCP and 4% still using formaldehyde. The choice of intracanal medicament was affected by years of experience [$P<0.05$]. About 44.3% of the respondents of group A used calcium hydroxide, 32.4% of group B used calcium hydroxide and CMCP equally while formaldehyde was the least preferred medicament to be used in the group C.

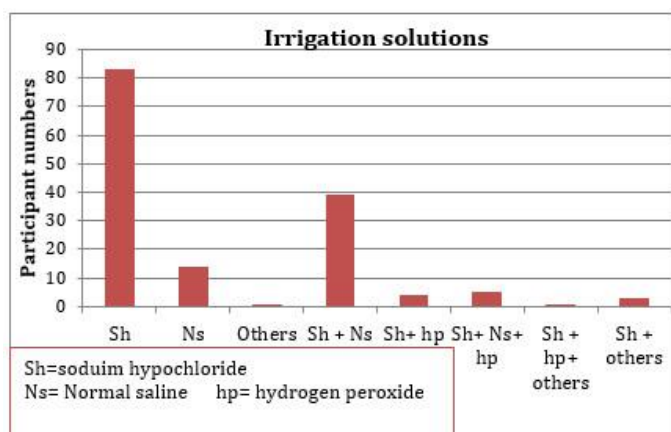


Fig. 5. Statistical analysis for irrigation solutions

Regarding the obturation technique, majority of participants 64% used the lateral condensation technique for obturation, followed by single cone in combination with lateral condensation 16% in case of using both hand instruments and rotary technique in preparing the canals. A significant association was found between the practicing place and the gender with the obturation techniques [$P<0.05$]. Lateral condensation and single cone 62.4%, 12.9% respectively were mostly preferred by dentist practicing in private clinics. 82.4% of the practitioners in public services used lateral condensation technique. Genders affected the preference of lateral condensation technique [$P<0.05$] where 75.3% of females used lateral condensation technique and 50.7% of males used same technique. The most common type of sealer used among practitioners 45.3% was zinc oxidugenol, followed by sealpex 28.7% and 10.7% used other cements and only 3.3% used endomethazon. It

was reported that 51.3% of dentists in private clinics used zinc oxide eugenol and 25% used sealpex. In addition, the data showed that the place of practicing did not affect the type of sealer used in obturation techniques [$P<0.05$]. The years of experience revealed a significant difference with type of sealer used [$P<0.05$].

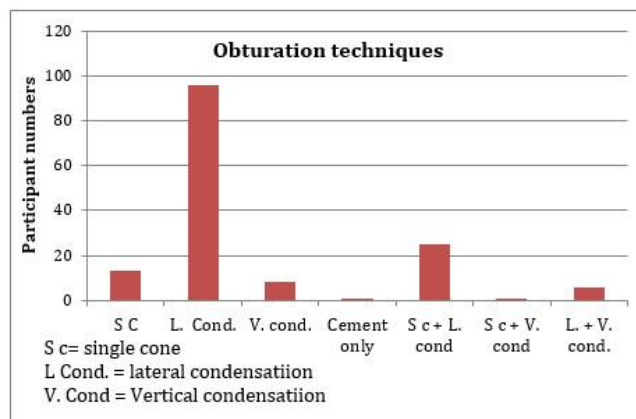


Fig. 6. Statistical analysis for obturation techniques

In addition, the study revealed that the most common faults that happened during biomechanical preparation or obturation procedures during root canal treatments were under filled obturation 32.7%, followed by 17.3% ledge creations, 10.7% for overfilled obturation and 8% for file transportation. On the other hand, the respondents were asked to give an estimate of the number of patients felt pain after filling and the result was 56.7% of patients occasionally suffer of pain after filling. About the time of the placement of the final restorations, Fig. 7 showed that 48.7% of the participants performed the permanent coronal restoration after one week subsequent to canal obturation while 34.9% placed the final restorations once the obturation step was completed and only 10% of them placed the final restorations after more than one week following canals obturation. 56.3% of females preferred to place the final restorations after one week and 47% of males placed the restoration in the same appointment. The professional activity had significant influence on the placement of final restorations [$P<0.05$]. About (43.3%) of group A and 10% of group B preferred to place the final coronal restoration after more than one week of root canal treatment. The final finding of the study pointed out that the composite resin was the most common restorative material used as a final filling for endodontically treated tooth 34.7% followed by amalgam 33.3% then 16.7% preferred to use both composite and amalgam restorations.

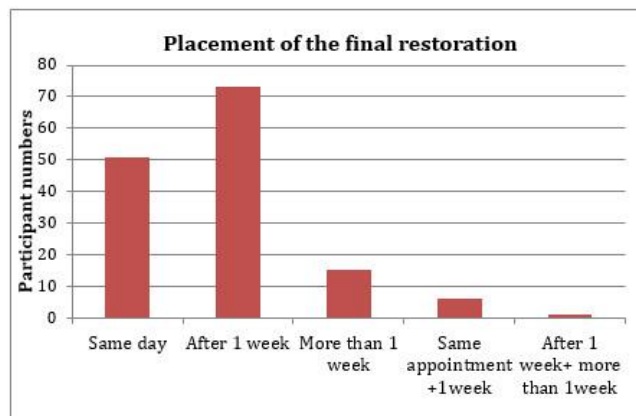


Fig. 7. Statistical analysis for the time of placement of the final restoration

Discussion:

This study was carried out to assist the performance of the general dental practitioners based on attitudes, techniques and trends employed by them during root canal treatment in public and private dental clinic in Benghazi Libya in a daily endodontic practice

through answering questioners distributed among them. The result of the study showed that the general response rate was 88.23%, which indicated that the study was representative for practitioners. This response rate was similar to study conducted in India and was higher when compared to different surveys performed in Jordan (72%) (Al-Omari, 2004), Turkey (43%) (Kaptan, 2012), but lower when compared to Flemish dentists (99.4%) (Hommez and Moor, 2002).

Although recent studies revealed that single visit RCT had gained more popularity and increased reliability in endodontic teaching (Kaptan, 2012) the finding of this study reported that 50% of the participants performed the endodontic treatment in multiple visits rather than single visit treatment. This result could be attributed to the deficiency in the clinical experiences in treating the cases in a single treatment visit, or they might prefer to wait until pain and other symptoms subsided before the obturation visits were done (Slaus and Bottenberg, 2002). Further possible explanation could be based on that the first visit should be done for pain relieve and treating the acute symptoms (Mehta *et al.*, 2013). Building up of the missing tooth structures before starting the RCT is considered an essential step in endodontic therapy as it helps in creating an appropriate and constant reference point for determination of the working length according to European Society of Endodontology (ESS, 2006). In addition, in performing four walled access cavity that helps in biomechanical preparation and irrigation of the root canal space and to accomplished appropriate isolation of the working area by proper placement of the rubber dam according to European Society of Endodontology (ESS, 2006). The current finding showed that 78% of the practitioners did not build up the tooth before starting the root canal procedure, while 22% preferred to build up the tooth.

Although the use of a rubber dam for isolation considers as primary request in performing a root canal treatment based on the guidelines of the European Society of Endodontology (ESE, 2006), the result of current result showed that only 11.3% of respondents used rubber dam isolation during endodontic procedure. This result was coincidence with a survey amongst, Belgium general dental practitioners which showed that only 3.4% of practitioners used rubber dam as an isolation method during root canal procedure (Hommez and Moor, 2002). Other survey performed in the United Kingdom showed that 44.5% of practitioners had never used rubber dam during root canal treatment (Jenkins *et al.*, 2001). The reasons for not using rubber dams by the participants in this study could be contributed to the lack or shortage of experiences in its application, time consuming, additional cost, absence of patient's acceptability or shortage in the teaching program itself. The determination of working length of the root canal is an important step in RCT procedure as it permits proper biomechanical preparation and accurate obturation of the root canals (Weine, 1996). Failure to achieve an accurate working length often results in apical perforation, under extension or overextension of the obturating materials into the periradicular area (Mehta *et al.*, 2013). The data of this study showed that 41% of the practitioners used digital radiograph, 30.7% conventional dental film radiograph and only 3.3% used electronic apexo locators for determination of the working length of the root canal during their works. It is obvious that the radiographic methods have inherent inaccuracies such as the apical foramen cannot be traced on the conventional radiograph (Olson *et al.*, 1991) but the electronic apex locator gives the benefit of being able to locate the apical foramen (Pagavino, 1998 and Moor *et al.*, 1999). It was indorsed to use both the electron apex locator (EAL) and the conventional radiographs to make an efficient and precise determination of working length (Pagavino, 1998). The existing data of this study showed 6% of respondents used EAL in combination with conventional radiograph, while only 3.3% used EAL in combination with digital radiograph. The finding of this study reported that 52.7% of the practitioner took the optimal working length at 0.5 away from the radiographic apex and 28.7% obtained the full working length at 1-2mm distance short of the radiographic

apex. Flemish survey showed that 38.9% of the dental practitioners prepared root canals at 1 mm short of the radiographic apex (Slaus and Bottenberg, 2002). Iranian study showed that 80% of the general dentists located the canals at 0.5-1 mm short of the radiographic apex (Ravanshad, 2008). Another study reported that 75% of the dentists obtained the optimal working length of the root canals at 0.5 mm away of the radiographic apex (Whitten, 1996).

The current result indicated that disposal of the files after single use was practiced by only 8.7%, and endodontic file was reused after sterilization by 61.3%. A previous survey reported that disposal of the endodontic files after single use was practiced by 18.7% only, and endodontic file was reused after sterilization by 50% (Siddiqui *et al.*, 2015) while, other study reported that only 2% of the respondents disposed files after a single use (Pagavino, 1998). On other hands, the study showed that 50% of the respondents used a combination of k-files and hedstrom files for canal preparation, about 38% used k-files and only 3.3% used a combination of k-files in and reamers for the mechanical preparation procedure.

According to the result of this study, the step back technique was the most common technique used for biomechanical preparation of the root canals 43% followed by rotary technique 24% and 14% used a combination of step-back and rotary technique. This finding explained that the dental practitioners used more conventional methods in canal preparation and they were away of the new developments new technology in endodontic procedures. Likewise, the general dental practitioners in Jordan and Denmark (Al-Omari, 2004 and, Bjorndal and Reit, 2015) used hand instruments and are not inclined to use more advanced engine driven techniques

Sodium hypochlorite is considered as the best and the most common root canal irrigant because of its effective antimicrobial and tissue dissolving action (Slaus and Bottenberg, 1993). In the present study 55.3 %of respondents used sodium hypochlorite for canal irrigation during RCT while 26% used a combination of sodium hypochloride and normal saline and only 9.3% of respondents preferred to use normal saline. As intra canal medication, calcium hydroxide is considered to be the standard medicament for inter-appointment dressing (Wadachi *et al.*, 1998) and its use should be encouraged among general dental practitioners in developing countries due to its effectiveness against most canal pathogens. (Gatewood *et al.*, 1991, Bierenkrant *et al.*, 2008). In Dutch (Bjorndal and Reit, 2008), Flemish (Slaus and Bottenberg, 2002) and North Jordan studies (Al-Omari, 2004) the percentage of respondents using calcium hydroxide was 86.2%, 63% and 64.6% respectively. In the current survey 38% of respondents used calcium hydroxide, followed by 26.7% used CMCP and 10.7% used both calcium hydroxide and CMCP as intracanal medicaments.

Though various obturating techniques have been introduced for the root canal system, the results of the study showed that lateral condensation was the most common and recognizable technique used among the participants. This technique could produce superior quality of work, with less expensive equipment (Iqbal, *et al.*, 2014 and, Walton and Johnson, 2002). The result of the present study supported this fact where 64% the responders used lateral condensation followed by single cone in combination with lateral condensation 16% if they use both hand instruments and rotary technique in canal preparation. It was interesting to note that 45.3% of the respondents were still using zinc oxide eugenol root canal sealers. This result was in agreement with the result of a study conducted in Iran (Ravanshad *et al.*, 2008), whereas in studies accomplished in Flanders and Turkey, resin based root canal sealers were the most popular ones (Slaus and Bottenberg, 2002 and Kaptan *et al.*, 2012).

In dentistry, Skills and experiences generate good quality of works and reduce the chance to perform accidental mishaps and faults during work, which may compromise the treatment prognosis (Bierenkrant *et al.*, 2008). The present results showed that the most common endodontic mishap performed by the practitioners was underfilled obturation 32.7%, followed by 17.3% undergone

ledge formation, while 10.7% for overfilled obturation and only 8% for file transportation. All participants were inquired about how long they would wait before commencing the final coronal restoration of root canal treated tooth. The results showed that 48.7% of the participant placed the final restoration after one week subsequent to canal obturation, 34% placed the restoration immediately after completion of the treatment, and only 10% preferred to wait up to more than one week before placement of the final filling. Similar study done in South Africa showed that 41% of the participants placed the final restoration once the root canal procedure terminated, 38% preferred waiting for one week, 47% preferred 2-6 weeks delaying final restoration, 4% preferred 2 months and 11% preferred to wait for 3-6 months (Lushen, 2006). On the other hand, the current results showed that Composite was the first choice material to be used as a final restoration of the root canal treated tooth 34.7% followed by amalgam 33.3% and 16.7% prefer to use both composite and amalgam.

Conclusion

It was concluded that the general dental practitioners in Benghazi city did not keep up with the newly introduced techniques in endodontic treatment as they were used more conventional methods in their work which could be attributed to lack in expertise and recognition of new technology in a daily endodontic perform.

Recommendations

To be a good qualified dentist, self-development is essential to achieve a new technology, skills and to gain more experiences through attending seminars, dental training programs or workshops.

References

- Al-Omari, W.M. (2004) 'Survey of attitudes, materials and methods employed in endodontic treatment by general dental practitioners in North Jordan'. *BMC Oral Health* 4:1.
- Bierenkrant, D.E., Parashos, P., Messer, H.H. (2008) 'The technical quality of nonsurgical root canal treatment performed by a selected cohort of Australian endodontists'. *Int Endod J*, (41) pp. 561-70.
- Bjorndal, L. and Reit, C. (2005) 'The adoption of new endodontic technology amongst Danish general dental practitioners'. *Int Endod J*, 38 (1), pp. 52-58.
- Bystrom, A. and Sundqvist, G. (1983) 'Bacteriologic evaluation of the effect of 0.5 percent sodium hypochlorite in endodontic therapy', *Oral Surgery Oral Medicine and Oral Pathology*, 55(3), pp. 307-312
- De Moor, R. J.G., Hommez, G. M. G., Martens, L.C., and De Boever, J. G. (1999) 'Accuracy of four electronic apex locators: an in vitro evaluation', *Endodontics & Dental Traumatology*, 15(2), pp. 77-82
- European Society of Endodontology (2006) 'Quality guidelines for endodontic treatment: consensus report of the European Society of Endodontology'. *Int. Endod. J.*, 39, pp. 921-930.
- Friedman, S. (200) Prognosis of initial endodontic therapy. *Endod Topics*, 2, pp. 59-88.
- Gatewood, R.S., Himel, V.T., and Dorn, S.O. (1990) 'Treatment of the endodontic emergency: a decade later'. *J Endod*, 16, pp. 284-291.
- Gorni, F.G. and Gagliani, M.M. (2004) 'The outcome of endodontic retreatment: a 2-yr follow-up'. *J Endod*, 30, pp. 1-4.
- Gupta, R. and Rai, R. (2013) 'The adoption of new endodontic technology by Indian dental practitioners: A questionnaire survey'. *Journal of Clinical and Diagnostic Research* [cited: 2017 Jul 2], 11, pp. 2610 - 2614
- Hommez, G.M., Moor, B.M. (2002) 'Root canal treatment performed by Flemish dentists. Part 1- cleaning and shaping'. *Int Endod J*, 35, pp. 1-8.
- Iqbal, A., Akbar, I., Qureshi, B., Sghaireen, M.G., Al-Omiri, M.K. (2014) 'A Survey of Standard Protocols for Endodontic Treatment in North of KSA. ISRN Dent, doi: 10.1155/2014/865780. eCollection 2014.
- Jenkins, S.M., Hayes, S.J., Dumme,r P.M.H. (2001) 'A study of endodontic treatment carried out in dental practice within the UK'. *Int Endod J*, 34, pp. 16-22.
- Kaptan, R.F., Haznedaroglu, F., Kayahan, M.B., Basturk, F.B. (2012) An investigation of current endodontic practice in Turkey. *Sci World*, 2012, pp. 1-6.
- Lushen, M.N. (2006) 'A survey of attitudes, materials and techniques used in endodontic treatment by South African Dentists'. *M.Sc. Thesis. School of Oral Health Science, University of the Witwatersrand, Johannesburg*.
- Mehta, N., Raisingani, D., Gupta, S., and Sharma, M. (2013) 'Endodontic trends: Where we are and where we should be -A survey report'. *People's J Sci Res*, 6, pp. 30-7.
- Olson, A. K., Goerig, A. C., Cavataio, R. E., and Luciano, J. (1991) 'The ability of the radiograph to determine the location of the apical foramen'. *International Endodontic Journal*, 24(1), pp. 28-35
- Pagavino, G., (1998) 'A SEM study of in vivo accuracy of the root ZX electronic apex locator'. *Journal of Endodontics*, 24(6), pp. 438-441
- Peciuliene, V., Rasmute, M., Saulius, D., and Jurate, R. (2009) 'Attitudes of general dental practitioners towards endodontic standarts and adoption of new technology: Literature review'. *Stomatologija, Baltic Dental and Maxillofacial Journal*, 11, pp. 11-14
- Ravanshad, S., Sahraei, S., and Khayat, A. (2008) 'Survey of Endodontic Practice amongst Iranian Dentists Participating Restorative Dentistry Congress in Shiraz, November 2007'. *Iran Endod J*, 2, pp. 135-42.
- Slaus, G, Bottenberg, P. (2002) 'A survey of endodontic practice amongst Flemish dentists'. *Int Endod J*, 35, pp. 759-67.
- Talha, M. Siddiqui, Aisha Wali, Azka Anwar (2015) 'Attitudes, techniques and trends in endodontic treatment by the house surgeons in dental institutes', *Karachi International Journal of Contemporary Dental and Medical Reviews*. Article ID 060115, 6 Pages
- Wadachi, R., Araki, K., and Suda, H., (1998) 'Effect of calciumhydroxide on the dissolution of soft tissue on the root canal wall', *Journal of Endodontics*, 24(5), pp. 326-330
- Walton, R.E., Johnson, W.T. (2002) Obturation. In: Walton RE, Torabinejad M, editors. *Principles and Practice of Endodontics*. 3rd ed. Philadelphia, PA, USA: W. B. Saunders; pp. 239-267.
- Weiger, R., and Axmann-Kremar, D., Lost, C. (1998) 'Prognosis of conventional root canal treatment reconsidered'. *Endod Dent Traumatol*, 14, pp. 1-9.
- Weine, F.S. (1996) Calculation of working length. In: *Endodontic Therapy*. 5th ed. St. Louis: Mosby, pp. 395-422.
- Whitten, B.H., Gardiner, D.L., Jeansonne, B.G., and Lemon, R.R. (1996) 'Current trends in endodontic treatment: report of a national survey', *J Am Dent Assoc*, 127, pp. 1333-1341