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ORIGINAL ARTICLE

Determination of success rate of root canal therapy performed by dentistry students in the Department of Endodontics at Birjand University of Medical Sciences, Birjand, Iran, during 2014-2017

Elahe Allahyari[1], Mahdi Amini[2], Sediqe Ebrahimipour[3]✉

[1]*Assistant Professor of Biostatistics, Social Determinants of Health Research Center, Faculty of Health, Department of Epidemiology and Biostatistics, Birjand University of Medical Sciences, Birjand, Iran*

[2]*Dentistry Student, Department of Dentistry, Student Research Committee, Birjand University of Medical Sciences, Birjand, Iran*

[3]*Associate Professor of Endodontics, School of Dentistry, Social Determinants of Health Research Center, Birjand University of Medical Sciences, Birjand, Iran*

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Abstract

Introduction: Root canal treatment, including pulp removal, mechanical and chemical cleaning, and canal filling is an important part of a dentist's job. This study aimed to evaluate the quality and success rate of root canal therapy performed by dentistry students in the Department of Endodontics, School of Dentistry, Birjand University of Medical Sciences, Birjand, Iran.

Methods: This retrospective study was conducted from 2014 to 2017. In total, 62 students were randomly divided into two equal groups of males and females. For each tooth, four radiographs, including the periapical images of the initial radiograph, master apical file, master cone, and final obturation radiographs, were reviewed under the supervision of an endodontist. The investigated technical errors included transport, ledge, perforation, underfilling, overfilling, and presence of void and broken instrument. Data were analyzed in SPSS software (Version 22). A P-value less than 0.05 was considered statistically significant.

Results: According to the results, only 79.3% of the students committed at least one type of root healing error, and there was no significant difference between males and females regarding the overall prevalence of error (P=0.12). However, errors, such as underfill, broken instrument, and transport were more common among males; moreover, void and perforation errors were slightly more prevalent among females. It should be noted that this difference was not statistically significant.

Conclusions: The results of the present study can help identify the weaknesses of treatment in order to improve the quality of root canal treatment, especially regarding student gender in the School of Dentistry affiliated to Birjand University of Medical Sciences, Birjand, Iran.

Key words: Dentistry, Gender, Medical errors, Root canal therapy

Introduction

Traumas to the teeth damage the pulp and affect the tissues around the root. Changes in the pulp can lead to the complete death of the pulp tissues and cause chronic pulpitis and sometimes

@2019Journal of Surgery and Trauma
Tel: +985632381203
Fax: +985632440488
Po Box 97175-379
Email: jsurgery@bums.ac.ir

✉**Correspondence to:**
Sediqe Ebrahimipour, Associate Professor of Endodontics, School of Dentistry, Social Determinants of Health Research Center, Birjand University of Medical Sciences, Birjand, Iran;
Telephone Number: +9805632381709
Email Address: sdent22@gmail.com

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acute pulpitis that may require root canal treatment (1). The health sector is one of the most important sectors of social and economic activity in any country with huge resources devoted to meeting health and treatment needs each year (2). Despite the efforts of physicians, dentists, nurses, and other medical staff and with extensive and advanced facilities, the level of patient dissatisfaction and complaints have been increased recently (3). Errors committed by medical staff, including dentists, cause stress in patients and lead to distrust and public complaints (4). Error avoidance in this filed increases credibility as well as patient and staff satisfaction; in addition, it reduces surgical costs and levels of stress among service providers (5).

Root canal treatment, including pulp removal, mechanical and chemical cleaning, and canal filling is an important part of a dentist's job. The poor quality of each of these steps increases the likelihood of dental treatment failing and progression or persistence of periapical inflammation (6). Unfortunately, canal cleaning and shaping procedures, especially in the case of curved canals, are not always without complications. The most difficult area to clean in the canal system is the apical region (7). The length of the canal filling also affects the outcome of root canal treatment (8). If the filling limit is shorter than 2 mm apex, the success rate ranges from 68% to 77%, and the filling beyond the apex is 75% successful. In addition, if the filling is homogeneous and free of voids, it reduces the risk of root canal failure (9). Root perforations also cause periodontal ligament and alveolar bone infection and can lead to root canal failure. Furthermore, some studies have observed a relationship between the broken device in the canal and the poor outcome of root canal therapy (10).

Clinical studies have estimated the success rate of endodontic treatments at 84%-90%. Data from these studies were collected from academic clinics and root canal specialists. The success rate of root canal treatment performed by general dentists is from 60% to 75% (11). The results of a study conducted by Moradi et al. showed that 79.7% and 65.8% of the teeth had proper filling length and suitable filling density, respectively (12). In the same line, Balto et al. showed that 23% of the student performed root filling with acceptable quality (13). Radiographic competencies for the evaluation of pulmonary cancers include convergence, filling length, and density. There were variations in the quality of root canal treatment performed by dentistry students among different studies, which may be related to different educational practices in universities (14). In addition, there is a necessity to conduct studies to evaluate the status of root canal therapy education and help develop educational programs. With this background in mind, and since there has been no study to determine the success rate and performance quality of dentistry students in Birjand, this study aimed to determine the success rate and quality of root canal treatment performed by dentistry students in the Endodontics Department affiliated to School of Dentistry, Birjand, Iran, during 2014-2017.

Methods

In this cross-sectional retrospective study, considering the low number of male students in the School of Dentistry affiliated to Birjand University of Medical Sciences, Birjand, Iran, all cases of root canal therapy performed by male students were investigated from 2014 to 2017. Moreover, females were selected randomly. Therefore, 62 students (31 female and 31 male) were assessed after obtaining the approval from the Ethics Committee of Birjand University of Medical Sciences, Birjand, Iran (ir.bums.Rec.1397.236).

The students were entered into the study if four radiographs, including the periapical images of initial radiograph, master apical file, master cone, and final obturation radiographs, were recorded for each tooth.

In addition, the standard root canal treatment strategy used in Birjand School of Dentistry was considered to be followed with respect to these teeth (i.e., filled with lateral condensation technique, isolated with rubardam, and canal preparation with Kfile). All radiographs had to be made with a biosect technique and the teeth restored with Cavit (Golchai, Iran) temporarily. Clinical monitoring of the student performance was performed by faculty members with a ratio of 1:4 (i.e., teacher to student ratio).

The errors observed in the radiographs during operation included transport (i.e., deviation from the original canal path during canal preparation), ledge (i.e., root filling which was at least one millimetre shorter than the original measurement length, or deviation from the primary canal path which was seen in curved canals), apical perforation (i.e., the apical end of the filled canal which was different from the apical end of the primary canal, or gutta-percha and sealer which were removed from the apical foramen), filling length (i.e., appropriate length: 0-2 mm distance from apex, long length: expanded apex filling, short length: more than 2 mm distance from apex), void existence (i.e., the space

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between filling materials or between the filling material and the canal wall), and the fractured device (i.e., the presence of a fractured fragment of the device in the canal space or in the periapical area) (11). Finally, the data were analyzed in SPSS software (version 22). A P-value less than 0.05 was considered statistically significant.

Results

Out of 62 students, 31 cases were female. A total of 49 students under study committed one type of error in root canal treatments. The error rates for male and female students were 71% and 87.1%, respectively, with no significant difference (P=0.12) (Table 1).

According to Tables 1-2, the overfill error (48.4%) is the most common type of error among dentistry students in the Endodontics Department, School of Dentistry, Birjand, Iran. Underfill and void are the second most prevalent errors (0.5%) followed by other types of errors (1%). The prevalence of overfill and ledge errors is the same among females and males. However, males are more likely to make the mistakes of underfilling, breaking instruments, and transporting. Additionally, void and perforation errors are slightly higher among females than males. It should be noted that the observed difference is not statistically significant in any of the above cases (P<0.05).

Table 1: Differences between females and males regarding dental errors

Gender	Error		P-value
	Yes N(%)	No N(%)	
Female	22 (71%)	9 (29%)	0.12
Male	27 (87.1%)	4 (12.9%)	
Total	49 (79%)	13 (21%)	62

Table 2: Percentage of each type of error by gender

Error	Gender		Total
	Female N(%)	Male N(%)	
Perforation	1 (3.2%)	0 (0%)	1 (1.6%)
Transport	1 (3.2%)	2 (6.5%)	3 (4.8%)
Ledge	5 (16.1%)	5 (16.1%)	10 (16.1%)
Overfill	15 (48.4%)	15 (48.4%)	30 (48.4%)
Underfill	6 (19.4%)	13 (41.9%)	19 (30.6%)
Void	10 (32.3%)	9 (29%)	19 (30.6%)
Broken instrument	3 (9.7%)	4 (12.9%)	7 (11.3%)

Discussion

In total, 49 (79%) students committed errors in the current study. Out of these students, 22 cases were female (71%). According to a study conducted by Yousef et al. entitled "Endodontic Errors: Frequency, Type of Error and Most Treated Teeth", it was reported that out of 1748 students under study, 574 (32.8%) cases committed at least one error. However, 13 students had no errors in a cross-sectional study, and the treatment success rate was estimated at 21% (15).

Furthermore, the results of the aforementioned study on the success rate of root canal therapy revealed that overfill error (62.5%) obtained the highest rate of root canal error. This finding was consistent with the results of the present study (16). A study on the technical quality of root filling by postgraduate students in Saudi Arabia showed that 125 files out of 550 (23%) cases had acceptable root canal treatment with a ledge error (14%), apical transport (7%), and apical perforation (7%). In the present study, the incidence rates of ledge error and transport were 16.1% and 4.8%, respectively (13). Mokhtari et al. performed a study entitled "Radiographic Evaluation of Root Cure Quality Performed by Dentistry Students in Yazd from 2011 to 2012". According to the results, 39.2% of all specimens had all the characteristics of an appropriate root canal treatment, whereas this figure was 21% in our study (17).

In a study performed by Randa Osman Elsaye et al. (2011), the quality of root canal treatment performed by undergraduate dentistry students was assessed at the School of Dentistry, University of Khartoum, Sudan, in 2011. The evaluation was based on periapical radiographs of dental treatment performed by dentistry students. In total, 166 periapical radiographs consisting of 265

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roots were examined in the aforementioned study. Adequate densities were observed in 39% and 17% of maxillary and mandibular teeth, respectively, and the appropriate taper was similarly higher in maxillary teeth than mandibular teeth. Overall, 24.2% of the teeth had proper root canal treatment. In the current study, 30.6% of the teeth were sufficiently dense and 21% of the teeth were successful in filling (18).

Furthermore, Diemah F. Alhekeir et al. indicated that the mean error rate in male students was higher than that in female students, which was in line with the results obtained from this study (19). In the same line, the results of a study carried out by Al Yahya in Saudi Arabia showed that the error rate was higher among male students due to the greater force used by male than female students (20). On the contrary, Balto et al. showed no difference between male and female students regarding the root canal treatment, which was not in line with the findings in our study. It is worth mentioning that not all errors are visible in radiographs, and cases, such as debris passing through the apical foramen are not observed in radiography. They are only detected when the sealer or filler material has passed through the canal.

Conclusions

Overall, the error rate in the present study was higher in male than female students, which could be due to the greater physical force employed by male students during the work process. Moreover, a lower incidence rate of errors can result from the lower statistical population included in this study.

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The study protocol was approved by the Ethics Committee of Birjand University of Medical Sciences, Birjand, Iran (Ir.bums.1397- 45566).

Conflict of Interest

The authors declare no conflict of interest regarding the publication of this study.

References

1. Torabinejad M, Walton RE. Principles and practice of endodontics. Philadelphia: Saunders; 2002.
2. Tabibi JA, Ebadi Azar F, Sogand T, Khalesi N. Total quality management in health care services. Tehran: Computer World Publication; 2001.
3. Sheikh Azadi A, Ghadyani MH, Kiani M. The investigation methods to dentistry malpractices in Iran. Forensic Med. 2007; 13(3):171-80.
4. Van Den Bos J, Rustagi K, Gray T, Halford M, Ziemkiewicz E, Shreve J. The $17.1 billion problem: the annual cost of measurable medical errors. Health Aff. 2011; 30(4):596-603. PMID: 21471478 DOI: 10.1377/hlthaff.2011.0084
5. Hofer TP, Hayward RA. Are bad outcomes from questionable clinical decisions preventable medical errors? A case of cascade iatrogenesis. Ann Intern Med. 2002; 137(5 Part 1):327-33. PMID: 12204016 DOI: 10.7326/0003-4819-137-5_part_1-200209030-00008
6. Siqueira Jr JF. Aetiology of root canal treatment failure: why well-treated teeth can fail. Int Endod J. 2001; 34(1):1-10. PMID: 11307374 DOI: 10.1046/j.1365-2591.2001.00396.x
7. Lambrianidis T. Ledging and blockage of root canals during canal preparation: causes, recognition, prevention, management, and outcomes. Endod Topics. 2006; 15(1):56-74. DOI: 10.1111/j.1601-1546.2009.00235.x
8. Nekoufar M, Shirani D, Motahari P, Khanzadi S, Ghandi M. Evaluation of healing in the periapical lesions of dogs with or without obturation in prepared root canals. J Islamic Dent Assoc Iran. 2006; 17(4):8-12.
9. Chugal NM, Clive JM, Spångberg LS. Endodontic infection: some biologic and treatment factors associated with outcome. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2003; 96(1):81-90. PMID: 12847449 DOI: 10.1016/s1079-2104(02)91703-8
10. Crump MC, Natkin E. Relationship of broken root canal instruments to endodontic case prognosis: a clinical investigation. J Am Dent Assoc. 1970; 80(6):1341-7. PMID: 5266127 DOI: 10.14219/jada.archive.1970.0259
11. Eriksen HM, Kirkevang LL, Petersson K. Endodontic epidemiology and treatment outcome: general considerations. Endod Topics. 2002; 2(1):1-9. DOI: 10.1034/j.1601-1546.2002.20101.x
12. Moradi S, Gharechahi M, Javan A. Evaluation of iatrogenic error in root canal therapy performed by students of Mashhad dental school 2011-2013. J Mashhad Dent Sch. 2015; 39(3):261-72.
13. Balto H, Al Khalifah SH, Al Mugairin S, Al Deeb M, Al-Madi E. Technical quality of root fillings performed by undergraduate students in Saudi Arabia. Int Endod J. 2010; 43(4):292-300. PMID: 20487448 DOI: 10.1111/j.1365-2591.2009.01679.x

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[DOI: 10.32592/Jsurgery.2019.7.4.104]

14. Khabbaz MG, Protogerou E, Douka E. Radiographic quality of root fillings performed by undergraduate students. Int Endod J. 2010; 43(6):499-508. PMID: 20536578 DOI: 10.1111/j.1365-2591.2010.01706.x

15. Yousuf W, Khan M, Mehdi H. Endodontic procedural errors: frequency, type of error, and the most frequently treated tooth. Int J Dent. 2015; 2015: 673914.

16. Yousuf W, Khan M, Shiekh A. Success rate of overfilled root canal treatment. J Ayub Med Coll Abbottabad. 2015; 27(4):780-3. PMID: 27004321

17. Mokhtari F, Yosefi MH, Jahromi AG. Radiographic evaluation of the quality of root canal treatments performed by dental students at the Yazd faculty of dentistry between 2010-12. J Dent Med. 2014; 27(2):45-51.

18. Elsayed RO, Abu-bakr NH, Ibrahim YE. Quality of root canal treatment performed by undergraduate dental students at the University of Khartoum, Sudan. Aust Endod J. 2011; 37(2):56-60.

19. Alhekeir DF, Al-Sarhan RA, Mokhlis H, Al-Nazhan S. Endodontic mishaps among undergraduate dental students attending King Saud University and Riyadh Colleges of Dentistry and Pharmacy. Saudi Endod J. 2013; 3(1):25. DOI: 10.4103/1658-5984.116277

20. Al-Yahya A. Analysis of student's performance in an undergraduate endodontic's program. Saudi Dent J. 1990; 2:58-61.

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