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ORIGINAL ARTICLE

ASSESSMENT OF QUALITY OF ROOT CANAL FILLINGS PERFORMED BY UNDERGRADUATE DENTAL STUDENTS

Vineet Galhotra[1], Tarunvir Rai[2], Inderdeep Kaur[2]

[1]Assistant Professor, Department Of Dentistry, Dayanand Medical College and Hospital, Ludhiana, Punjab, India,
[2]B.D.S., Canada

ABSTRACT:
Background: Root canal therapy is widely recognized as an intricate dental procedure. Previous reports indicate that the therapy is often of poor quality. Aim of this study was to evaluate the radiographic quality of root canal fillings performed by final year and internship dental students. **Materials and methods:** The study was conducted in the Department of Conservative and Endodontics in the institution. For the study, a random sample of 200 radiographs of patients who had undergone root canal treatment in a year in the institution was selected. The final sample included 246 root canal fillings of 135 teeth in patients treated by undergraduate dental students. The examination of the radiographs was done by three observers- a endodontist specialist with 14 years clinical experience (TK), an endodontist specialist with 8 years' experience (SD), and a general dentistry practitioner (MB). **Results:** Females comprised 81 subjects of the sample and males comprised 54 subjects of the sample. The percentage of GQEW-T was 60% in females and 40% in males; the difference between the genders was not statistically significant (P>05). Fifty three (39.25%) teeth were treated by final year undergraduates, and 82 (60.74%) were treated by interns. Of the 460 teeth, 3 (2%) were re-treatments. There were no significant differences between the final year dental students and interns for all types of teeth (anterior, premolar, and molar) (P>.05). **Conclusion:** The quality of root canal fillings in anterior teeth performed by undergraduate dental students was satisfactory. However, to improve the success with molar teeth, education about newer techniques and instruments must be incorporated into the preclinical and clinical curriculum.

Keywords: undergraduate, endodontic treatment, root canal, final year

Corresponding author: Dr. Vineet Galhotra, Assistant Professor, Department Of Dentistry, Dayanand Medical College and Hospital, Ludhiana, Punjab, India

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INTRODUCTION

Root canal therapy is widely recognized as an intricate dental procedure. Previous reports indicate that the therapy is often of poor quality.[1-3] The biological and therapeutic aim of root canal treatment is to prevent apical periodontitis or to create optimal conditions for healing of the periapical tissues. Removal of infection and the elimination of bacteria from the root canal system will help avoid re-infection.[4]

Failed root canal fillings are associated with inadequate treatment, through either technical error or insurmountable difficulty in the canal system of the tooth.[5]Some of the factors that determine the technical quality are length and quality of the filling and coronal restorations.[6-8] The quality of root canal filings is assessed radiographically. Also, the availability and reliability of radiographs makes them suitable for epidemiological studies.[9]

Radiographic technical quality of root canal treatment is determined by a number of factors. Some of the prominent ones are instrumentation and obturation level, as well as obturation density. Instrumentation and obturation level positioned 0–3 mm from the radiographic root apex is associated with less untoward events in endodontically treated teeth.[10-12] Obturation density is considered adequate if the root filling is homogenous with no visible voids within or between the filling and the root walls. Also, it is stated that extrusion of endodontic materials and dentine particles into the periapex causes failures of endodontically treated teeth.[13] Likewise, iatrogenic mistakes, such as fractured instruments and apical perforations, are found to be one of the reasons for nonsurgical root canal treatment failure. Further, canal curvature and tooth position influence the final outcome of root canal treatment, since they can hinder proper shaping of the canals. [14] Hence, all of these variables

should be taken into consideration when radiographically evaluating the technical adequacy of root canal fillings.

Some studies show that the technical quality of root canal treatments performed by undergraduates demonstrates a good quality of endodontic work in a very wide range, between 13% and 70%.[15-17]

The aim of this study was to evaluate the radiographic quality of root canal fillings performed by final year and internship dental students.

MATERIALS AND METHODS

The study was conducted in the Department of Conservative and Endodontics in the institution. For the study, a random sample of 200 radiographs of patients who had undergone root canal treatment in a year in the institution was selected. Radiographs of patients having age less than 18 years were discarded. Radiographs having radiographic defects such as superimposed anatomical structures, elongation, etc were excluded from the study. Radiographs of third molars were also excluded. In total 65 radiographs were excluded**.** The final sample included 246 root canal fillings of 135 teeth in patients treated by undergraduate dental students. **U**ndergraduate students were able to treat endodontic cases, including those with irreversible pulpitis and apical periodontitis, and to perform intentional treatment of teeth with vital pulps. Only those cases were referred to the post graduate clinics that required specialist treatment such as teeth with perforations, fractured instruments, posts, and teeth with extremely severe curved roots canals. Step back and lateral compaction techniques with guttapercha were used in all the cases of root canals. A post-obturation radiograph was taken with the long-cone paralleling technique. The post-obturation radiograph showed the entire length of the root and the periapical area. The examination of the radiographs was done by three observers-aendodontist specialist with 14 years clinical experience (TK), an endodontist specialist with 8 years' experience (SD), and a general dentistry practitioner (MB). Before evaluation, the observers participated in calibration training, which consisted of 75 randomly selected periapical radiographs of endodontically treated incisors, premolars, and molars. Strength of agreement was determined by calculation of the Kappa value (<0.20=poor, 0.21–0.40=fair, 0.41–0.60=moderate, 0.61–0.80=good, 0.81–1.00=very good).[18] Observers evaluated the samples with agreement levels of 'good' and 'very good'.

Periapical radiographs were evaluated in a darkened room via a standard fluorescent light box and a magnifying viewer (3.5X) while mounted in a black cardboard slit to block off surrounding light from the viewer.[19,20] The technical quality of the root filling was evaluated according to the density of the filling and the distance between the end of the filling and radiographic apex and scored as follows:

Length of the root filling:

1. Root filling terminating 0–2 mm from the radiographic apex (acceptable).
2. Root filling terminating >2 mm from the radiographic apex (unacceptable).
3. Root filling extending beyond the radiographic apex (unacceptable).

Homogeneity of the root filling:

1. Homogeneous root filling, good condensation, no voids visible (acceptable).
2. Inhomogeneous root filling, poor condensation, voids visible (unacceptable).

A root canal with an acceptable filling length and a homogeneous root filling was defined as being good quality endodontic work (GQEW).[21,22] A treated tooth was defined as having good quality endodontic work tooth (GQEW-T) when all its canals had a GQEW.

STATISTICAL ANALYSIS

Statistical analysis of the data was performed using SPSS 10.0 for Windows (SPSS Inc., Chicago, IL, USA). The data regarding gender and location of the teeth were analyzed with a Chi-square (χ^2) analysis, and it was also used to determine statistically significant differences between the technical qualities of the root canal treatment according to the tooth type and clinical experience of dental students. A Chi-square (χ^2) test at the 0.05 significance level was used for the statistical analysis of the data.

RESULTS

Females comprised 81 subjects of the sample and males comprised 54 subjects of the sample. The percentage of GQEW-T was 60% in females and 40% in males; the difference between the genders was not statistically significant (P>05). Fifty three (39.25%) teeth were treated by final year undergraduates, and 82 (60.74%) were treated by interns. Of the 460 teeth, 3 (2%) were retreatments.

Table 1 and figure 1 shows the quality of root fillings in terms of homogeneity and length. One hundred ninety nine root fillings were defined as GQEW.

Table 2 and figure 2 summarizes the GQEW-T in terms of dental students and type of tooth. There were no significant differences between the final year dental students and interns for all types of teeth (anterior, premolar, and molar) (P>.05). The relationship between the technical quality of root fillings and the tooth types was statistically significant (P<.001). Most of the GQEW-T were defined in anterior teeth, whereas the fewest were in molar teeth for both the first and second clinical year dental students (P<.001).

Table 1: Homogeneity and length of root filling

	N
Homogeneity acceptable, length acceptable	199
Homogeneity acceptable, terminating >2mm	11
Homogeneity acceptable, beyond the radiographic apex	8
Homogeneity unacceptable, length acceptable	12
Homogeneity unacceptable, terminating >2mm	11
Homogeneity unacceptable, beyond the radiographic apex	2

Figure 1: Homogeneity and length of root filling

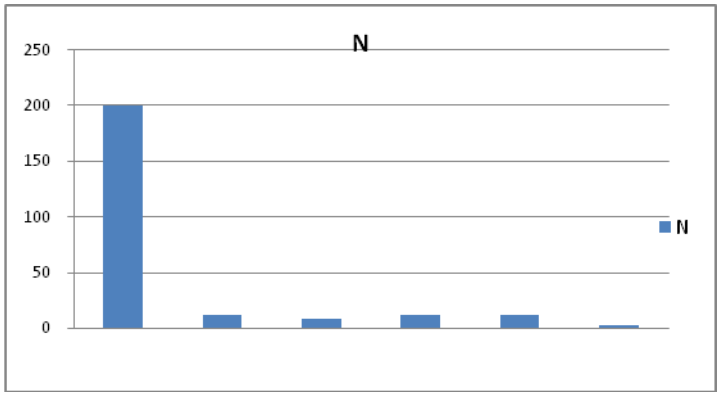
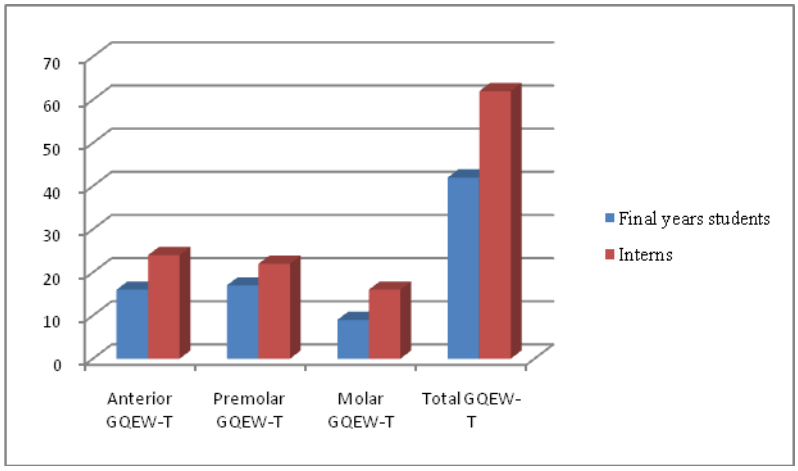


Table 2: Prevalence of GQEW-T according to dental students and type of tooth

	Final years students	Interns	Total
Anterior GQEW-T	16	24	40
Premolar GQEW-T	17	22	39
Molar GQEW-T	9	16	25
Total GQEW-T	42	62	104

Figure 2: Prevalence of GQEW-T according to dental students and type of tooth



DISCUSSION:

The material used in this investigation consisted of the dental records and periapical radiographs of patients who had received root canal treatment. Panoramic radiographs were not used for this study as it has been shown that they provide less inter-examiner reliability and give difficulty in reading panoramic view radiographs[23]. Periapical radiographs have some limitations because a single radiograph provides only a two-dimensional image. Therefore, it is not possible to separate superimposed anatomical structures, such as the root canals. In addition, the length of the roots and canal fillings may not be reproduced accurately.[24] Anatomical structures

(maxillary antrum, zygomatic bone, zygomatic process of the maxilla) may contribute to difficulties in radiographic interpretation. Radiographs with superimposed canal fillings or over-projections of anatomical structures were excluded because of the possibility of radiographic misinterpretation.

Amongst the 246 root canals examined, acceptable filling length was observed in 77.03% and homogeneous root filling in 90% of the root canals. In this study, both acceptable filling length and homogeneous root filling in the whole root canal were used as the criteria for defining a GQEW. Similar criteria are advocated by ESE, i.e., a radiographically dense filling with its end located between 0 and 2 mm from the apex. By this definition, 79.5% of the treated root canals fulfilled the criteria and, thus, qualified as being a GQEW.[25]The published data relating to the quality of root filling performed by undergraduates showed an acceptability range between 13 and 70%. The discrepancy in percentage of endodontically treated teeth that qualified as GQEW could be due to the use of different parameters to score the endodontic quality. Some of these studies adopted both acceptable or adequate root filling length and homogeneous filling as the criteria for a GQEW. In addition to these criteria, the taper of the root filling was also considered in some studies.However, a few investigations used the level of the root filling as the only criterion for judging a GQEW.

Adebayo ETet al conducted a study to evaluate the technical quality of root canal fillings done in a general dental clinic with emphasis on the effects of professional experience of the operator, whether tooth was anterior or posterior and whether it was a maxillary or mandibular tooth. Retrospective study of case notes and periapical radiographs of patients with completed root canal fillings seen between 2008 and 2011. Inclusion criteria included cases of primary treatment with available case notes, good quality pre-operative and post-operative periapical radiographs. Technical quality that was assessed was root canal length and homogeneity. Root canal fillings were classified either as Good Quality Endodontic Work (GQEW) or Non- Good Quality Endodontic Work (NGQEW). Fifty-one patients aged between 8 and 54 years (mean 28) fulfilled the inclusion criteria for this study. From these, there were 62 root filled teeth giving a ratio of 1.2 root canal filled teeth per person. There were acceptable length of root canal fillings in 71% of teeth, 58.1% were homogeneous while 53.2% were GQEW. There was no statistically significant difference in whether tooth was root filled by junior or senior dentist (p=0.43), anterior or posterior (p=0.11). There was significant association between GQEW and maxillary teeth (p=0.03). This study showed that the overall technical quality of root canal fillings done by non-specialists was better than earlier reports but lower than that done by endodontists. Since many patients receive treatment from non-specialists in developing countries, it is necessary to improve technical quality of root canal fillings done in general dental clinics. These could be through improvement in the quality of undergraduate training and more post graduate continuing education courses for skills update.[26]

Chueh LH evaluated the current technical quality of root canal treatment (RCT) in Taiwan. A total of 1085 RCT cases, randomly selected from a large sample and representative of the Taiwanese population from April to September 2000, were evaluated by eight endodontic specialists. The qualitative evaluation of RCT cases was based on two variables: length of the root filling and density of the obturation. A root canal with both adequate filling length (the apical termination of the root filling within 2 mm of the radiographic apex) and complete obturation (no lateral or apical canal lumen visible in the apical one-third of the root canal) was defined as having good-quality endodontic work (GQEW). A tooth was defined as having a GQEW when all its canals were categorized as GQEW. From a total of 1867 root canals, overfilling occurred in 235 (12.6%), adequate filling length in 1152 (61.7%), underfilling in 466 (25.0%) and no filling in 12 (0.6%). Of the 1867 root canals, 710 (38.0%) demonstrated complete obturation and 1157 (62%) demonstrated incomplete obturation. GQEW was found in 650 (34.8%) root canals and 329 (30.3%) teeth. The percentage of teeth with GQEW in hospital cases (38.1%) was significantly greater ($P < 0.001$) than that in private clinic cases (24.3%). In addition, the frequency of teeth with GQEW in the anterior teeth (40.4%) or in the premolars (33%) was significantly greater ($P < 0.001$) than that in the molars (18.4%). Approximately 70% of the teeth receiving RCT in Taiwan were either of inadequate filling length or sealing density.[27]

Vukadinov T concluded the radiographic technical quality of endodontic treatment performed by undergraduate students at the School of Dentistry, Faculty of Medicine, University of Novi Sad, Serbia.[28] Electronic records of 220 patients treated by final-year undergraduate students during the school year 2011/2012 were examined, and the final sample consisted of 212 patients, 322 teeth, and 565 root canals. The criteria for overall radiographic adequacy of root canal fillings were defined as the presence of adequate length and density and absence of iatrogenic errors (ledge, fractured instrument, untreated canal, and apical transportation). Chi-square test was used to determine statistical significance between different parameters. Adequate root canal fillings were found in 74.22% of the teeth. The percentage of root fillings with adequate length and density was 89.73% and 92.6%, respectively. Fractured instruments and ledges were present in 16 root canals (2.8%), while the presence of missed canal and apical transportation was observed in 2 cases, each (0.3%). The authors concluded that the technical quality of root canal fillings performed by undergraduate students was satisfactory.

CONCLUSION:

The quality of root canal fillings in anterior teeth performed by undergraduate dental students was satisfactory. However, to improve the success with molar teeth, education about newer techniques and instruments must be incorporated into the preclinical and clinical curriculum.

REFERENCES:

1. Sjogren U, Hagglund B, Sundqvist G, Wing K. Factors affecting the long-term results of endodontic treatment. J Endod. 1990;16:498–504.
2. Smith CS, Setchell DJ, Harty FJ. Factors influencing the success of conventional root canal therapy-a five-year retrospective study. Int Endod J. 1993;26:321–33.
3. Strindberg LZ. The dependence of the results of pulp therapy on certain factors. ActaOdontol Scand. 1956;14:1–174.
4. Grahnén H, Hansson L. The prognosis of pulp and root canal therapy. A clinical and radiographic follow-up examination. Odontol Revy. 1961;12:146–165.
5. Ingle JI, Taintor JF, editors. Endodontics: Modern endodontic therapy The Washington Study. Philadelphia, PA: Lea and Febiger; 1985.
6. Abbott PV. The periapical space–a dynamic interface. Aust Endod J. 2002;28:96–107.
7. Dugas NN, Lawrence HP, Teplitsky PE, Pharoah MJ, Friedman S. Periapical health and treatment quality assessment of root-filled teeth in two Canadian populations. IntEndod J. 2003;36:181–192. doi: 10.1046/j.1365-2591.2003.00640.x.
8. Tsuneishi M, Yamamoto T, Yamanaka R, Tamaki N, Sakamoto T, Tsuji K. et al. Radiographic evaluation of periapical status and prevalence of endodontic treatment in an adult Japanese population. Oral Surg Oral Med Oral Pathol Oral RadiolEndod. 2005;100:631–635.
9. Siqueira JF Jr, Rocas IN, Alves FR, Campos LC. Periradicular status related to the quality of coronal restorations and root canal fillings in a Brazilian population. Oral Surg Oral Med Oral Pathol Oral RadiolEndod. 2005;100:369–374.
10. Delano EO, Ludlow JB, Orstavik D, Tyndall D, Trope M. Comparison between PAI and quantitative digital radiographic assessment of apical healing after endodontic treatment. Oral Surg Oral Med Oral Pathol Oral RadiolEndod. 2001;92:108–115.
11. Touré B, Kane AW, Sarr M, Ngom CT, Boucher Y. Prevalence and technical quality of root fillings in Dakar, Senegal. IntEndod J. 2008;41:41–49.
12. Weiger R, Hitzler S, Hermle G, Lost C. Periapical status, quality of root canal fillings and estimated endodontic treatment needs in an urban German population. Endod Dent Traumatol. 1997;13:69–74.
13. Marques MD, Moreira B, Eriksen HM. Prevalence of apical periodontitis and results of endodontic treatment in an adult, Portuguese population. IntEndod J. 1998;31:161–165.
14. Hommez GM, Coppens CR, De Moor RJ. Periapical health related to the quality of coronal restorations and root fillings. IntEndod J. 2002;35:680–689. Moussa-Badran S, Roy B, du Parc AS B, Bruyant M, Lefevre B, Maurin JC. Technical quality of root fillings performed by dental students at the dental teaching centre in Reims, France. IntEndod J. 2008;41:679–684.
15. Segura-Egea JJ, Jimenez-Pinzon A, Poyato-Ferrera M, Velasco-Ortega E, Rios-Santos JV. Periapical status and quality of root fillings and coronal restorations in an adult Spanish population. IntEndod J. 2004;37:525–530.
16. European Society of Endodontology. Consensus report of the European Society of Endodontology on quality guidelines for endodontic treatment. IntEndod J. 1994;27:115–124.
17. Peak JD, Hayes SJ, Bryant ST, Dummer PM. The outcome of root canal treatment. A retrospective study within the armed forces (Royal Air Force) Br Dent J. 2001;190:140–144.
18. Boucher Y, Matossian L, Rilliard F, Machtou P. Radiographic evaluation of the prevalence and technical quality of root canal treatment in a French subpopulation. IntEndod J. 2002;35:229–238.
19. Eleftheriadis GI, Lambrianidis TP. Technical quality of root canal treatment and detection of iatrogenic errors in an undergraduate dental clinic. IntEndod J. 2005;38:725–734.
20. Markova KB, Dakov KV, Stoikova MS. Root canal filling of endodontically treated teeth by dentistry students in clinical offices from 1996 to 1998--radiological results. Folia Medica (Plovdiv) 2001;43:34–37.
21. Burke FM, Lynch CD, NíRíordáin R, Hannigan A. Technical quality of root canal fillings performed in a dental school and the associated retention of root-filled teeth: a clinical follow-up study over a 5-year period. J Oral Rehabil. 2009;36:508–515.
22. Lynch CD, Burke FM. Quality of root canal fillings performed by undergraduate dental students on single-rooted teeth. Eur J Dent Educ. 2006;10:67–72.
23. D. İlgüy, M. İlgüy, E. Fişekçioğlu, et al., "Assessment of root canal treatment outcomes performed by turkish dental students: results after two years," Journal of Dental Education, vol. 77, no. 4, pp. 502–509, 2013.r
24. J. G. Cailleteau, "Prevalence of teaching apical patency and various instrumentation and obturation techniques in United States dental schools," Journal of Endodontics, vol. 23, no. 6, pp. 394–396, 1997.
25. D. Sonntag, R. Bärwald, M. Hülsmann, and V. Stachniss, "Pre-clinical endodontics: a survey amongst German dental schools," International Endodontic Journal, vol. 41, no. 10, pp. 863–868, 2008.
26. Adebayo ET, Ahaji LE, Nnachetta RN, et al. Technical quality of root canal fillings done in a Nigerian general dental clinic. BMC Oral Health. 2012;12:42. doi:10.1186/1472-6831-12-42.
27. Chueh LH, Chen SC, Lee CM , et al. Technical quality of root canal treatment in Taiwan.IntEndod J. 2003 Jun;36(6):416-22.
28. TatjanaVukadinov, Larisa Blažić, IvanaKantardžić, and TijanaLainović, "Technical Quality of Root Fillings Performed by Undergraduate Students: A Radiographic Study," The Scientific World Journal, vol. 2014, Article ID 751274, 6 pages, 2014. doi:10.1155/2014/751274

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