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Quality of Root Canal Fillings Performed by Undergraduate Dental Students in the School of Dentistry, University of Sulaimani

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Abstract:
Objective: *The purpose of this study was to evaluate the quality of root fillings using radiographs of teeth treated by undergraduate dental students at a dental teaching center in School of Dentistry, University of Sulaimani.* ***Methods and Materials:*** *A random sample of records of patients who had received endodontic treatment by 5th year undergraduate students at the School of Dentistry, Sulaimani University during the period of 2014to 2015 were evaluated by two investigators (and in case of disagreement by a third investigator) regarding the presence or absence of short fillings, over fillings and perforations. For each tooth, preoperative, working and postoperative radiographs were checked. Statistical analysis of the data was carried out using statistical package for the social sciences (SPSS 12.0, SPSS Inc., Chicago, IL, USA) with Chi-square test. P < 0.05 was considered as significant.****Results:*** *From 184 cases 28.3% was acceptable and 71.7% was unacceptable, under-filled teeth was 32.6% and over-filled was 23.9%,adequate fillings were found more in maxillary than mandibular teeth (P < 0.005), anterior were more accepted compared to posterior teeth (P < 0.05)* ***Conclusion:*** *The technical quality of root canal treatment performed by undergraduate dental students using step-back preparation and lateral condensation was found to be less than 50%.*
Keywords: *Dental student education; periapical radiograph; root canal treatment; undergraduate student*

I. Introduction

Retention of a high number of natural teeth is becoming more popular in contemporary society. [1] Hence, endodontic therapy is becoming an increasingly routine part of general dental practice. [2] Success of root canal treatment has been shown in the range between 53% and 94%. [3,4]

It is known that the standard of root canal treatment carried out by general dental practitioners in Europe is poor.[5,6,7,8]It has been reported that one of the causes of such poor quality treatment in general practice may be that students graduate with a lack of expertise and a poor understanding of the principles involved.[9]

The technical quality of root fillings is determined by its length in relation to the apex and by its homogeneity. 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%. [10,11]

The quality of root canal treatment performed by general practitioners in different populations has also been extensively investigated. [12,13,14,15] The results from these studies showed high percentages of inadequate root canal treatment. The reasons for this are complex and may be related to the endodontic teaching that was undertaken at the dental schools. [16]

Some of the problems in endodontic teaching may be due to limitation of time allocated to endodontics, poor staff to student ratio and that teaching was mostly not undertaken by endodontists. [17]

II. Materials and methods

A random sample of records of patients who had received endodontic treatment by 5th year undergraduate students at the School of Dentistry, Sulaimani University during the period of 2014to 2015 were evaluated. Undergraduate students did not treat teeth with excessive root curvature. Records that did not include pre- and post-operative periapical radiographs, those where the endodontic treatment was not completed, and those in which the radiographic quality was poor were excluded.5th year undergraduate students performed all root canal treatments. An aseptic technique with rubber dam isolation was applied in all cases. Working lengths were determined with the use of radiographs. All teeth were instrumented with passive step-back technique using stainless steel K-files (Dentsply, Tulsa, OK, USA) of 0.02 taper and irrigation with Normal Saline. Root fillings were carried out with lateral compaction technique using gutta-percha and Zinc Oxide Eugenol sealer (Dentsply). The teeth were restored with temporary filling materials.

Clinical supervision was provided by teaching staff of the department with an average staff to student ratio of 1:3.

The radiographs were examined independently by two investigators using a magnifying lens (×2) and an X-ray viewer. The results were compared and a final consensus was agreed. In case of disagreement, a third investigator was asked to read the radiograph and a final agreement was reached.

The tooth was considered as a unit with the highest score of all roots contributing the score.

The quality of endodontic treatment was determined by the length of the root filling in relation to the radiographic apex and the density of the obturation according to presence of voids [Table 1]. "Acceptable" filling quality was defined as adequate length and density with the absence of any procedural error.

Table [1]: Assessment criteria for endodontic treatment performed by undergraduate students.

Parameter	Criteria	Definition
Length of root canal filling	Adequate	Root filling ending ≤2 mm from radiographic apex
	Over-filling	Root filling beyond the radiographic apex
	Short-filling	Root filling >2 mm from radiographic apex
Density of root canal filling	Adequate	No voids present in the root filling or between root filling and root canal walls
	Inadequate	Voids present in the root filling or between root filling and root canal walls

III. Results

The teeth were classified according to their location in the arches. The number of teeth examined in this study is shown in [Table 2]. Hundred teeth were from the maxilla and 84 were from the mandible. Each root was scored individually and the tooth was considered as a unit. The highest score of all roots (in multi-rooted teeth) was assigned and ultimately, failure of one root will lead to failure of the tooth as a whole. As the prognosis regard as bad for the tooth that had been treated in accurately.

Table 2Distribution of teeth in maxillary and mandibular arches

Arch and teeth type	No.	%
Maxillary	100	54.3
Maxillary anterior teeth	65	35.3
Maxillary posterior teeth	35	19.0
Mandibular	84	45.7
Mandibular anterior teeth	54	29.3
Mandibular posterior teeth	30	16.3
Total	184	100

Quality of root canal treatment, length and density of root canal filling are shown in [Table 3]. 52 of 184 teeth (28.3%) fulfilled the criteria of an acceptable root canal filling. Adequate length of the root filling was found in 43.5% of teeth, while 32.6% were short and 23.9% were overfilled. Adequate density was found in 54.3% of teeth.

Table 3 Overall quality, length and density of root canal fillings

Number of teeth (%)	Quality		Length			Density	
	Acceptable (%)	Unacceptable (%)	Adequate (%)	Short-Filling (%)	Over-Filling (%)	Acceptable (%)	Unacceptable (%)
184	52 (28.3)	132 (71.7)	80 (43.5)	60 (32.6)	44 (23.9)	100 (54.3)	84 (45.7)

There was statistical significant difference between maxillary and mandibular teeth according to the quality of the root fillings (P = 0.007). Furthermore, there was significant difference between maxillary and mandibular teeth according to the length (P = 0.039) and density (P = 0.005) of the root fillings. 29.8% of mandibular and 35% of maxillary teeth had short fillings, while 27% of maxillary and 20.2% of mandibular teeth were overfilled. Adequate density was found in 53% of maxillary teeth and 56% of mandibular teeth [Table 4].

Table 4Quality, length and density of root canal fillings in relation to teeth position

Arch	Number of teeth (%)	Quality		Length			Density	
		Acceptable (%)	Unacceptable (%)	Adequate (%)	Short-Filling (%)	Over-Filling (%)	Acceptable (%)	Unacceptable (%)
Maxillary	100	29 (29)	71 (71)	38 (38)	35 (35)	27 (27)	53 (53)	47 (47)
Mandibular	84	23 (27.4)	61 (72.6)	42 (50)	25 (29.8)	17 (20.2)	47 (56)	37 (44)

There was relationship between tooth type and the quality of root filling. A significant difference was observed between anterior and posterior teeth. (P = 0.000). The frequency of root canals with an "acceptable" filling was significantly greater in the anterior teeth (34.5%) than in posterior teeth (16.9%)

Table 5Quality, length, and density of root canal fillings according to teeth type

Tooth type	Number of teeth (%)	Quality		Length			Density	
		Acceptable (%)	Unacceptable (%)	Adequate (%)	Short-Filling (%)	Over-Filling (%)	Acceptable (%)	Unacceptable (%)
Anterior	119	41 (34.5)	78 (65.5)	49 (41.2)	47 (39.5)	23 (19.3)	54 (45.4)	65 (54.6)
Posterior	65	11 (16.9)	54 (83.1)	31 (47.7)	13 (20)	21 (32.3)	46 (70.8)	19 (29.2)

IV. Discussion

In this study a radiographic evaluation of the quality of root canal fillings was carried out among adult population referring to the endodontic treatment by 5th year undergraduate students at the School of Dentistry, Sulaimani University during the period of 2014to 2015.

Many studies have considered the acceptable apical extent of the RCF within 2 mm from the radiographic apex [18-21].

The quality of the root fillings was evaluated according to the criteria of Barrieshi-Nusair*et al*. [16] Studies evaluating the radiographic quality of root canal treatment were mostly based on the evaluation of the length and the density of the root filling. [22,23,24,25] The result of the present study indicated that adequate quality of the root fillings was achieved in 38% of teeth, which was similar to study performed by Barrieshi-Nusair*et al*.[16] Such frequency was lower than the 91.05% reported by Benenati and Khajotia,[26] 76% reported by Al-Yahya,[27] 63% reported by Lynch and Burke[28] and 55% reported by Eleftheriadis and Lambrianidis.[29] Furthermore, the result was higher than 13% reported by Hayes *et al*.[30]

The result of this study showed less than ideal root canal filling. The reasons for this are complex and may be related to the endodontic teaching that was undertaken at the dental schools. [16]

The quality of maxillary root fillings was better than mandibular in this study (P = 0.007). This may be explained by the anatomy of mandibular molars for example multi-canalled roots and their curvature. The frequency of teeth with an "acceptable" root filling was significantly greater in the anterior teeth (34.5%) than posterior (16.9%) (P = 0.000). Such results are consistent with the findings of Boucher *et al*. [31] and Eleftheriadis and Lambrianidis[29] who reported that the technical quality was "acceptable" more often in anterior teeth. This may be explained partly by the anatomy of such teeth.

The percentage of root fillings with adequate length was 43.5% in the present study, which was less than the results (72.4%) compared with those reported by Barrieshi-Nusair*et al*.[16]

However, estimation of the root filling length was probably not reproduced correctly in all radiographs because post-operative radiographs taken by undergraduate students used bisecting-angle technique.

In the present study, short fillings were found in 32.6% of all the teeth. The highest percentage of short fillings was found in anterior teeth. This finding inconsistent with studies of Barrieshi-Nusair*et al*. [16].

In this study, over filling was found in 32.3% of all the teeth. The highest percentage of over fillings was found in posterior teeth, but there was no significant difference between tooth types.

Inadequate density of root canal filling may lead to failure of root canal treatment because of microleakage along the root filling. [24] Eriksen and Bjertness reported that the incidence of apical periodontitis was higher in root filled teeth with inadequate densities. [32]

In Dental School, Sulaimani University, passive step-back instrumentation using conventional stainless steel files and cold lateral condensation has been taught to our undergraduate dental students. These techniques are the most widely taught and used technique in the dental schools. [33]

Overall, to improve the technical quality of root canal treatment performed by the undergraduate dental students, the endodontic curriculum has to be revised. Thus, the period of training of the students at the preclinic and clinic has to be extended and subsequently the clinical requirements for the endodontics have to be increased, with the result that the student will be given more time to treat more cases. The clinical training course has to be arranged to provide the students with the proper skills in endodontics starting with the basic principles in clinical endodontics.

V. Conclusion

The technical quality of root canal treatment performed by undergraduate dental students using step-back preparation and lateral condensation was found to be less than 50%. Review of the endodontic curriculum requirements, specialized clinical supervision and increasing the time of training at the preclinical and clinical levels should improve this quality.

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