ORIGINAL RESEARCH PAPER
VOLUME-6 | ISSUE-7 | JULY-2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

RADIOGRAPHIC ASSESSMENT FOR TECHNICAL QUALITY OF ROOT CANAL TREATMENT PERFORMED BY UNDERGRADUATE STUDENTS AT KING GEORGE'S MEDICAL UNIVERSITY, LUCKNOW, INDIA.

Dental Science

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ABSTRACT

The aim of this study was radiographic evaluation of the quality of root canal treatment done by undergraduate students at King George's Medical University Lucknow India.

Total of 525 teeth were prepared by step back technique using K-files of 0.02 taper and filled with gutta-percha using a cold lateral condensation technique.

Periapical radiographs were used to assess the technical quality of the root canal filling, evaluating three variables: Length, Density and Taper. These data were recorded and used to study the "technical success rate".

Length of each root canal filling was classified as acceptable, non-acceptable and based on their relationship with radiographic apex. Density and taper of filling were evaluated based on the presence of voids and the uniform tapering of the filling, respectively.

Statistical analysis was used to evaluate the quality of root canal treatment, considering $p < 0.05$ as a statistical significant level. Overall, acceptability of root canal treatment in anterior and posterior teeth in maxillary and mandibular arch was found to be77.7%. The acceptability was significantly higher among anterior teeth (85.9%) compared with posterior teeth (72.1%). The acceptability was 1.19 times higher in anterior teeth than posterior teeth (p=0.0002). This study showed that the overall technical quality of root canal fillings done by non-specialists (under graduate students) was better than earlier reports.

KEYWORDS:

Endodontics, Radiograph, Root canal Treatment

Introduction

The root canal treatment is indicated when pulp is irreversibly damaged and/ or elective need of root canal treatment for any abutment purpose [1]. Success of root canal treatment very much depends upon the quality of root canal filling, it is also detrimental for long term prognosis [2–4]. After completion of treatment, radiographic evaluation of root canal is mandatory to evaluate its condensation and homogenicity of obturation [5]. Success root canal treatment can be evaluated by radiographic or clinical findings alone, or both [6,7]. Thus radiographic evaluation represents a very frequent method of assessment [8]. Several studies reported a lower incidence of apical periodontitis in teeth with adequate root fillings, so this important variable should be taken into consideration when evaluating the success of root canal treatment [9,10].

In a study done in Ireland, has determined that 70% of the teeth showed an acceptable quality [11] whereas another study from Turkey [12] has shown a higher level of acceptability of 79%. Chueh et al (2003) reported 62 % radiological acceptance level in Taiwani population and Barrieshi-Nusair et al shows 61% acceptance in Jordan [13,14].

The aim of this study was to evaluate the technical quality of root fillings using radiographs of teeth treated by undergraduate students and also assess the impact of preclinical training on the treatment outcome with a null hypothesis that there is no impact of preclinical training on quality of root canal treatment done by undergraduate students.

Materials and methods:

Records of patients who had received root canal treatment (RCT) at the Department of Conservative Dentistry & Endodontics during January 2013 to December 2014 were scrutinized with following inclusion and exclusion criteria.

Inclusion criteria- All adult patients of any gender treated in the department for irreversible pulpitis, pulp necrosis, apical periodontitis and intentional root canal treatment of teeth.

Exclusion criteria

a) Patients younger than 15-year-old.

b) Records that did not include preoperative and postoperative periapical radiographs or having poor quality radiographs like poor coverage of periapical region, marked changes in the radiographic density and images suggestive of unrelated periodontal /endodontic disease.

c) Post endodontic surgical lesion.

The final sample consisted of 525 root canal treated teeth. The root canal treatment was performed by 4th year undergraduate students and 5th year students (interns). An aseptic technique with rubber dam isolation had been applied in all cases. Working length had been determined with the help of no 10 or 15 k-file applying standard radiographic techniques. All teeth had been instrumented with the step back technique using K-files of 0.02 taper (Dentsply-Maillefer) and the canals had been irrigated with 2.5% NaOCl and final rinse done with normal saline. All teeth were obturated with gutta-percha points

of 0.02 taper (Dentsply-Maillefer) and AH Plus (Dentsply DeTre yGmbH, Konstanz, Germany) sealer, using cold lateral condensation technique. Post obturation radiograph was taken for the evaluation of technical quality of root canal treatment.

Evaluation of the technical quality of RCT and detection of the iatrogenic errors was based on the immediate postoperative radiograph of each case. Inter-observer reliability were found to be K=0. 88. All radiographs were examined independently by two observers. Afterwards, the results were compared and the researchers came to a consensus. In case of disagreement a third investigator was asked to evaluate the radiographs and a final agreement was reached. Radiographs were interpreted in a darkened room using an illuminated viewer box (Dentsply Rinn Corp. Elgin, IL, USA) with magnification (4x) whilst mounted in a cardboard slit to block off ambient light emanating from the viewer.

Criteria for the radiographic evaluation

1. Length of root canal filling-

a) Root filling, ending 0–2 mm of radiographic apex-Acceptable

b) Root filling, ending beyond the apex-not acceptable

c) Root filling, ending >2 mm short of radiographic apex- not acceptable

2. Density/Homogeneity of root filling

a) Uniform density of root filling without voids or space- Acceptable

b) No uniform density of root filling with clear space is visible- not acceptable.

3. The taper of root canal filling

a) Consistent taper from the coronal to the apical part (better reflect to canal shape) – Acceptable

b) No consistence taper from coronal to apical part-not acceptable

The quality of endodontic treatment was determined by the length of the root filling in relation to the radiographic apex, the density of the obturation according to presence of voids and the taper of root canal fillings.

Results

This study includes 525 teeth. All the teeth filled by cold lateral condensation of gutta-percha using AH plus sealar. Length of final preparation was assessed with master cone intraoral periapical radiograph followed by complete obturation of canal of the 525 teeth of this study ,47.24% (n=248) were mandibular teeth and 52.76% (n=277) were maxillary teeth.Among the 47.24% (n=248) of mandibular teeth, 27.19% (n=68) were anterior teeth and 72.58% (n=180) were posterior teeth. While 52.76 % (n=277) of the maxillary teeth, 52.34 % (n=145) were anterior teeth and 47.65 % (n=132) were posterior teeth.

Overall, acceptability of root canal treatment in anterior and posterior teeth in maxillary and mandibular arch was found to be 77.7%. The acceptability was significantly higher among anterior teeth (85.9%) compared with posterior teeth (72.1%). The acceptability was 1.19 times higher in anterior teeth than posterior teeth (RR=1.19, 95%CI=1.09-1.30), p=0.0002) (Table 1).

Table 2 shows the comparison of acceptability between anterior and posterior teeth among Maxillary teeth in which the acceptability was 82.8% and 72% in anterior teeth and posterior teeth respectively. The difference was found to be statistically significant (p=0.03). While in case of mandibular teeth the acceptability was 1.28 times higher in the anterior (92.6%) than posterior (72.2%) teeth (RR=1.28, 1.15-1.44, p=0. 0006). The difference was statistically significant (Table 3).

Discussion

In this study 85.9% of maxillary and mandibular teeth anterior teeth having acceptable radiographic criteria while 72.1% of posterior teeth from both maxillary and mandibular arches are in acceptable criteria (Table 1). Assessment was done by using immediate post-obturation radiograph of each cases.

Previous epidemiological studies have used different criteria when categorizing root fillings as adequate or inadequate. Some studies have concentrated merely on the length of the root fillings [15]. Whilst most of the studies used both length and lateral adaptation of root fillings [10,14,16,17]. our study evaluated the quality of root canal filling based on length, homogeneity and taper. However, there are some limitations in the interpretation of endodontic radiographs because radiographs provide only a two dimensional image. Therefore, it is not possible to separate superimposed anatomical structures, such as the root canals. In addition, length of the roots and canal fillings may not be reproduced accurately. Especially in the region of maxillary molars, over projection of anatomical structures like maxillary antrum, zygomatic bone, zygomatic process of the maxilla may contribute to difficulties in radiographic interpretation [18,19]. To overcome these inherent limitations we have exclude most of the radiographs with superimposed canal fillings or over projections of anatomical structures, because of the possibility of radiographic misinterpretation and also follow the guidelines set by European Society of Endodo ntology to enhance comparability [20].

Undergraduate students at the Department of Conservative Dentistry and Endodontics King George's Medical University used cold lateral condensation technique with gutta-percha points and AH Plus sealer. Numerous dental teaching Institute In Europe and The United states using cold lateral condensation techniques, however single cone obturation technique are easy and less time consuming [21,22].

Over extended and under extended root canal obturation have a significant role in determining success of endodontic treatment [23].Chueh et al.(2003) found that acceptability higher in anterior teeth (40.4%) compares to posterior teeth (34.5%) [24]. While in this study, 82.8% of maxillary anterior teeth and 72% of posterior teeth are in the acceptable range. (Table/Fig-2) Same comparison in the mandibular arch shows 92.6% of anterior teeth and 72.2% posterior teeth are having acceptable radiograph appearance. (Table/Fig-3) Overall, acceptability of root canal treatment in anterior and posterior teeth in the maxillary and mandibular arch was found to be 77.7%. The acceptability was significantly higher among anterior teeth (85.9%) compared with posterior teeth (72.1%). The acceptability was 1.19 times higher in anterior teeth than posterior teeth (RR=1. 19, 95%CI=1.09-1.30), p=0. 0002) (Table1).

Results of this study remain at a high level, even when compared to studies that used the same length criteria, such as 65% in a study by Sidaravicius et al (1999) and 26.52% reported by Kirkevang et al (2000) [25,26].

In developing countries like India most of dental treatments are offered by non-specialist Dental Surgeons due to less number of specialists Dental Surgeons (Endodontists). The assessment of the quality of obturation is thus very important to judge the working skill of budding dentists. Also, the influence of preclinical and clinical endodontic course and teaching methods used here can be assumed to be very strong. Clinical training of endodontic practice is started during 2nd year on extracted teeth. From 3rd year onwards students are allowed to do the root canal treatment of maxillary and mandibular anterior teeth in their clinical posting. 4th year students and Interns are allowed to do endodontic treatment in all teeth except 3rd molars.

The quality of root canal filling has been variable in the literature due to technical and competency issues. As compared to earlier studies our results shows the overall quality of root canal filling was good.

Main limitation of this study was the comparing the radiographic criteria to determine the Success/failure of the endodontic treatment which did not solely depend on the radiographic interpretation.

Strength of this study to restablish the role of preclinical training of the undergraduate students has greatly benefitted from the insights gained. Provide our students with a solid foundation for building their future clinical dental skills.

Conclusion:

Within the limitations of the presented study, it can be concluded that 77.7% root canal fillings performed by undergraduate students at the King George Medical University Uttar Pradesh were radiographically adequate, which is satisfactory. Mandibular teeth had higher success rates than Maxillary teeth. A comprehensive preclinical training to the students plays a major role in the quality of the root canal treatment outcome. It should be remembered that factors other than radiographic quality must be considered when determining the outcome of root canal therapy.

Tables

Table 1: Comparison of acceptability between anterior and posterior teeth in maxillary and mandibular teeth

	No. of Teeth	Acceptable No. %	Not acceptable No. %	RR(95%CI), p-value
Anterior teeth	213	183 85.9	30 14.1	1.19 (1.09-1.30), 0.0002*
Posterior teeth	312	225 72.1	87 27.8	
Total	525	408 77.7	117 22.3	

RR-Relative risk, CI-Confidence interval, *Significant

Table 2: Comparison of acceptability between anterior and posterior teeth among Maxillary teeth

	No. of Teeth	Acceptable No. %	Not acceptable No. %	RR(95%CI), p-value
Anterior teeth	145	120 82.8	25 17.2	1.15 (1.02-3.46), 0.03*
Posterior teeth	132	95 72.0	37 28.0	
Total	277	215 77.6	62 22.4	

RR-Relative risk, CI-Confidence interval, *Significant

Table 3: Comparison of anterior and posterior teeth among Mandibular teeth

	No. of Teeth	Acceptable No. %	Not acceptable No. %	RR(95%CI), p-value
Anterior teeth	68	63 92.6	25 17.2	1.28 (1.15-1.44), 0.0006*
Posterior teeth	132	130 72.2	37 28.0	
Total	248	193 77.8	55 22.2	

RR-Relative Risk, CI-Confidence Interval, *Significant

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