

RADIOGRAPHIC TECHNICAL QUALITY OF ROOT CANAL FILLINGS PERFORMED BY HOUSE SURGEONS IN THE ISLAMIC INTERNATIONAL DENTAL COLLEGE: A PILOT STUDY

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ABSTRACT

The aim of this study was to evaluate the technical quality of root canal treatment carried out by house surgeons at a dental teaching hospital in Islamabad. Radiographic records of the 64 root canal treated teeth of patients were analyzed to find the adequacy of treatment they received. The final sample consisted of 60 teeth. Root treatment was considered adequate if the apical length of obturation was 0-2mm from the radiographic apex and no voids were discernable on the radiograph.

27(45%) out of 60 teeth could be classified as being adequate. 35(58.3%) were obturated to the correct radiographic apical length (≤ 2 mm) and 44(73.3%) had an absence of voids on the radiograph. 5 teeth had broken instruments and this was significantly correlated with a canal curvature of more than 20° ($p=0.01$). No correlation was found for adequacy of treatment and tooth type or for adequacy of treatment and canal curvature.

Adequate root treatment, as evaluated on the radiograph, was performed in only 45% of treated teeth.

Key words: Radiographic Technical quality, Root Canal Fillings

INTRODUCTION

Awareness about retaining one's natural dentition has risen steadily in Pakistan and as a result, more people seek endodontic treatment to save their natural dentition rather than resort to extractions to alleviate pain and to treat grossly carious teeth.

At the Islamic International Dental College, pre-clinical endodontics is taught in third year during a two-month rotation. In final year, the students are expected to perform root canal treatments on patients in the hospital under supervision. During the mandatory one-year house job, they are again expected to perform root canal treatments on patients. They may seek help from faculty when necessary. The quality of root canal treatment done by house surgeons reflects the level of treatment offered to the community, especially now since guidance from seniors who supervise may not be available.

When done correctly, endodontic treatment is very successful, with reported success rates varying from 85% to 95% (Orstavik et al. 1987) when performed by specialists but reduced to 65% to 75% when performed by general dentists (Eriksen 1991, Friedman 1998).

This may be due to the fact that when success rates are studied in an experimental setting, the standard of

endodontic treatment is much higher. In other settings, this may not be so. Boltacz-Rzepkowska and Pawlicka (2002) found that in dental outpatients departments in the Lodz region of Poland, 71% of root treated teeth were inadequately filled.

Teeth with adequate root filling have a greater chance of a healthy periapical condition than those with an inadequate filling (Kirkevang et al. 2000). Voids in the canal filling and inadequate lateral seal are also correlated with periapical disease in endodontically treated teeth (Chugal et al. 2003, Kirkevang et al. 2000, Dugas et al. 2003). Broken instruments have also been proved to cause a greater rate of endodontic failure (Crump et al. 1970).

This study aims to assess the quality of endodontic treatment given by house surgeons in the Islamic International Dental College by evaluation of post-treatment periapical radiographs. Apical limit of obturation, presence of voids, and broken instruments will be noted and correlated with tooth type and root curvature.

Our hypothesis was that root canal treatment is more likely to be inadequate in teeth and roots with at least 20° root curvatures and that molar root canals tend to be poorly performed more often regardless of the presence or absence of root curvature.

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METHODOLOGY

64 teeth having 119 roots were included in the study. These were the first 64 root canals completed after January 1st, 2008. They were completed in the first three months of 2008. They were carried out by house surgeons in the Operative Dentistry Department of the Islamic International Dental College. Poor quality of radiographs rendered 4 cases excluded. Therefore, 60 teeth having 112 roots were finally included in the study.

Cases done by house surgeons included pulpal and periapical disease, elective endodontics and retreatment. Working length was determined by the radiographic method. Radiographs were exposed by the bisecting angle technique. The canal was prepared by the step-back method using stainless steel k-files (Mani). Obturation was by the cold lateral condensation of gutta percha and the sealant used was endomethasone (Septodont). EDTA was sometimes used when pulp stones were present in the pulp chamber or suspected in the root canals otherwise irrigation was limited to the use of normal saline.

Post-obturation radiographs were retrospectively analyzed using a magnifying lens (×2 and ×4) and an X-ray viewer in a dark room examined the radiographs. A transparent scale with 0.5mm calibrations was used for measurements.

Root canal curvature was determined by measuring the inner angle formed by the intersection of two lines, one drawn from the orifice through the coronal part of the root and another from the apex to the apical part of the curve.

Adequate root canals were defined as those whose apical length of obturation was ≤2mm from the radiographic apex with no voids visible in the canal filling or adjacent to the walls.

Inadequate root fillings were those which were >2mm short of the apex or were extended beyond the radiographic apex. The presence of voids within the filling or between the canal wall and filling rendered the obturation inadequate.

Results were analysed using SPSS. The chi square test was used to find if any significance existed between broken instruments, treatment adequacy and canal curvature and adequacy versus tooth type. Significance was set at a p value of 0.05.

RESULTS

64 teeth having 119 roots were assessed. 4 had radiographs which were not of sufficient quality to be judged therefore they were not included. 60 teeth were finally assessed. They had 112 roots. Out of 60 teeth, 27 (45%) were adequately and 33 (55%) were inadequately obturated.

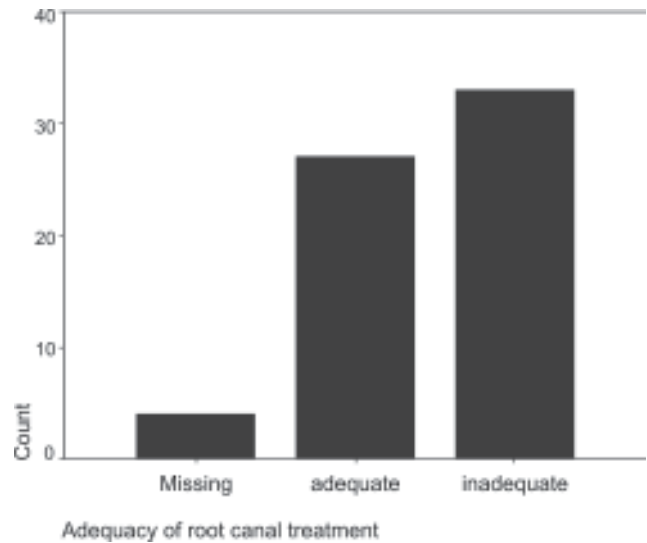


Fig 1: Number of teeth included in the study and the number of missing, adequately and inadequately obturated teeth.

TABLE 1: RADIOGRAPHIC ADEQUACY OF ROOT CANAL TREATMENT ACCORDING TO TOOTH TYPE

		Adequate	Inadequate
Maxillary	28	15	13
Incisor	5	3	2
Canine	5	4	1
Premolar	10	4	6
Molar	8	4	4
Mandibular	32	12	20
Incisor	2	2	0
Canine	1	0	1
Premolar	12	6	6
Molar	17	4	13
Total	60	27	33

Data regarding treated teeth according to obturation distance from the radiographic apex is shown in Table 2.

TABLE 2: APICAL LENGTH OF OBTURATION

Length of Obturation	Teeth Frequency	%	Roots Frequency	%
> 2mm from radiographic apex	16	26.7	27	24.1
0-2mm from radiographic apex	35	58.3	66	58.9
Over obturated	9	15	19	17
Total	60	100	112	100

Out of 60 teeth, 35 were correctly obturated when considering apical length of obturation alone. Therefore, 58.33% of all teeth were obturated satisfactorily according to the criteria for apical length of obturation. 16(26.7%) were short and 9(15%) were over-obturated. Out of 112 roots, 66 (58.9%) were acceptably obturated within 0-2mm of the radiographic apex, 27 (24.1%) were under-obturated and 19 (17%) were over obturated.

Data regarding the treated teeth according to the presence or absence of voids in the obturation.

TABLE 3: VOIDS IN THE OBTURATION

Length of Obturation	Teeth Fre-quency	%	Roots Fre-quency	%
Uniform density of obturation	44	73.3	91	68.8
Void present in obturation	16	26.7	21	25.0
Total	60	100	112	100

Out of 60 teeth, 16(26.7%) showed voids and 44 (73.3%) had compact obturations of adequate density. Out of 112 roots, 21 had voids (18.25%) in the obturation on the radiograph and 91 (81.75%) displayed compact root fillings.

Out of the 112 roots, 33 were curved and 79 were straight or less than 20° curved. 5 teeth or 5 roots contained broken instruments. Therefore, 8.33% of all teeth and 4.46% of all roots contained broken instruments. All teeth containing broken instruments were considered inadequate as the instrument had not been removed or bypassed.

Out of 5 broken instruments, 4 were broken in 33 curved canals and 1 in 79 straight canals. By applying chi square, it was seen that broken instruments were significantly associated with curved canals at a p value of 0.01.

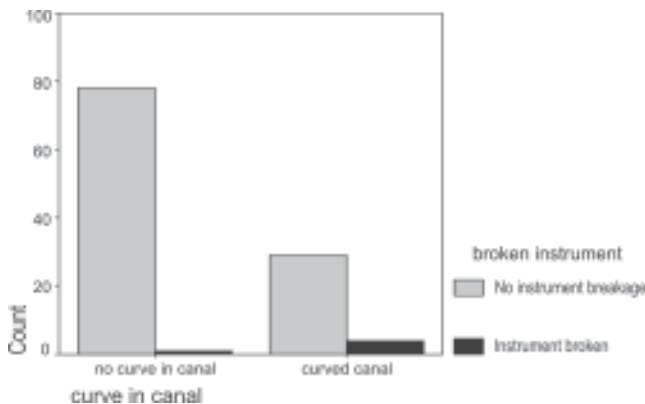


Fig 2: Number of curved and straight roots and the number of broken instruments in curved and straight canals

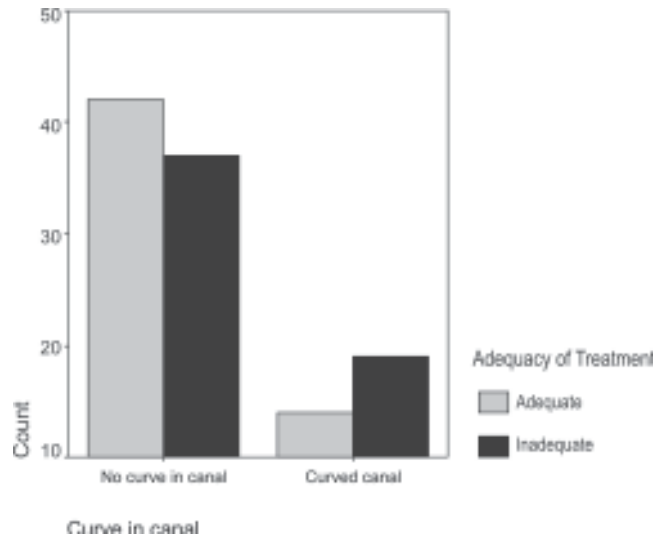


Fig 3: Number of adequately and inadequately treated roots according to root curvature. After application of chi-square, it was found that adequacy of treatment was not significantly affected by root curvature.

DISCUSSION

This study comprised of 60 teeth of all types with curved as well as straight root canals. 45% of all teeth were considered as acceptably obturated. The criteria for success were roots filled within 0-2 mm of the radiographic apex without the presence of voids.

Most studies of radiographic technical quality have used the criteria of 0-2mm from the radiographic apex to signify adequacy (E. Boltacz-Rzepkowsky & H Pawlicka (2003). In others (Kirkevang 2001, Dugas 2003), the limit of obturation is 3mm rather than 2mm.

Eleftheriadis & Lambriadis (2005) retrieved records of six hundred and twenty teeth root treated by undergraduate students and reported that 55.3% were of adequate quality when apical level of root filling and voids in the obturation were considered. 62.7 were filled to within 0-2mm of the radiographic apex and 82.6% were free of voids.

Er et al, did a similar study for undergraduate students in Turkey. They added a third criteria for adequacy, a continuous taper of root filling. Their resultant rate of adequacy was 33%; 69% had adequate apical level of filling, 53.2% had adequate radiodensity and 68.3% had adequate taper.

In Poland, Boltacz-Rzepkowska and Pawlicka (2003) reported 48.9% of the teeth to be adequately filled, with 64% filled adequately in the Institute of Dentistry. The level of seniority of the operator was not discussed so they may have been performed by students, residents and senior faculty. The criterion for adequate obturation was the apical length of obturation alone and this

may have raised the percentage of teeth considered adequate compared to other studies. Voids in the canal obturating material were not used as a criterion for adequate treatment. In this study, 58.9% of roots and 58.33% of teeth were filled within 2mm of the radiographic apex, if voids in the obturation were not considered. These results are closely comparable with each other.

In an audit of endodontic treatment performed by undergraduate first and second year clinical students, Hayes et al (2001) noted that 13% of teeth treated were of adequate standard. This was in conformity with the overall technical standard of endodontic treatment in the UK reported by Drummer (1998) as 10% of teeth adequately filled. The higher value found in this study (45%) could be attributed to the fact that house surgeons supervised by senior staff performed the treatment and not undergraduate students.

Lupi-Pegurier et al (2002), in a study of adequacy of root canal treatments in France discovered that out of 1429 root filled teeth, 31.2% were adequately filled, 58.9% had adequate density of filling and 38.7% were obturated adequately (0-2mm from the radiographic apex). These low values may be explained by the general practice setting which tends to have fewer adequately performed endodontic treatments than those performed in an institutional setting.

Though Hayes et al (2001) believe that more specialist endodontists are needed to improve the treatment standards, Dugas et al (2003) found that specialist training did not significantly improve clinical success rate. However he stated that a greater number of people must be included in the study to validate the results.

Even though it is agreed that radiographic technical quality influences clinical outcome, other factors also play a role e.g. debridement and reduction in bacterial population, placement of an adequate coronal seal (Eriksen et al, 2002) Assessment of these factors is beyond the scope of this study but will contribute to future success and failure.

CONCLUSION

Within the limitations of this study, it was found that 45% of all teeth could be considered as acceptably obturated when evaluated radiographically.

This study did not find any tendency for inadequate obturation in curved roots when compared to straight roots.

There was a significant tendency for instrument breakage in curved canals ($p=0.01$)

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