

## Quality of Endodontic Treatment Rendered by General Dental Practitioners in Hail, Saudi Arabia. A Radiographic Study

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### Abstract

**Aim:** The aim of endodontic treatment is to remove or reduce the bacterial load from root canal space by chemo mechanical preparation. This study will help to identify the common procedural errors that cause failure of endodontic treatments rendered by the general dental practitioners and to avoid them.

**Material and Method:** This descriptive cross sectional study was carried out at College of Dentistry, University of Hail, Saudi Arabia. A total of 200 radiographic data in college clinics with evidence of endodontic failure were randomly studied. Patients with full permanent dentition and close apices of the teeth were included in the study.

**Results:** Two hundred teeth with problems and failures in root canal treatment were recorded into the study. According to tooth types, Maxillary anterior teeth were 28 (14%), maxillary premolars 40 (20%) and maxillary molars 35 (17.5%). Mandibular anterior teeth were 6 (3%), mandibular premolars 28 (14%) and mandibular molars 63 (31.5%).

**Conclusion:** Endodontic treatment failure was most commonly seen in underfilled canals followed by poorly filled canals. Posterior teeth showed higher failure rate compared to anterior teeth.

**Keywords:** Endodontic Treatment; Failure; Radiographic Study

### Introduction

The main objective of endodontic treatment is to remove or reduce the microbes from root canal space by chemo mechanical preparation and to prevent recurrence of infection and promote periapical healing by proper sealing of the space [1]. When root canal treatment (RCT) is performed with highest standards, the success rate can be as high as 90 - 95% [2,3]. There are many factors responsible for endodontic treatment failure. These factors include residual necrotic pulp tissue, broken instruments, mechanical perforations, root canal overfilling, root canal under fillings, missed canals or unfilled canals, presence of peri-radicular infection, periodontal disease and root fractures [4-6]. Preoperative status of teeth plays a major role in RCT success rate. It's been reported that teeth with periapical radiolucent lesion have reduced rate of success by 20% [7]. Teeth with existing apical periodontitis have lower rate of success compared to that of teeth without apical periodontitis [8-10]. On the other hand, evidence also suggests that RCT performed with adequate chemo mechanical preparation and complete obturation, there is no difference in the success rate between teeth with periapical radiolucent lesion and without periapical radiolucent lesion [11]. The risk of missing anatomy is mostly due to the variation in root canal system. Teeth may be found with extra roots/or canals, and this variation is reported

more in premolars and molars [12]. Endodontic treatment failure can be identified by radiographic evaluation and presenting clinical signs and symptoms of the treated tooth [13]. Radiographic evaluation determines the quality of treatment as the dentist can observe contrast, density, taper and homogeneity of the quality of root canal filling [14,15]. Root canal preparation and obturation confined within the root canal space that is 0 - 2 mm from the radiographic apex has reportedly better prognosis as compared to that beyond the apex [16]. According to European Association of Endodontists, a satisfactory root canal treatment shows a tapering form from crown to apex and completely filled with root canal filling material with no voids within the material or between the material and root canal wall. Also, it should end 0 - 2 mm shorter than the radiographic apex to prevent post treatment failure [17]. Research has confirmed that root canal fillings shorter than 2 mm from the radiographic apex, extruded beyond the apex and non-homogenous with voids between the fillings increase the risk of endodontic treatment failure [18]. If any of these procedural errors occur, the failure carry higher risk. It was noticed that the primary cause of endodontic failure is the presence of pathogens in the poorly treated or untreated root canal system [19]. Coronal restoration has a direct role in the success or failure of endodontic treatment, root canals with poor filling but good coronal restora-

tion may remain successful and survive for long time. On the other hand well treated root canal with poor coronal restoration could fail in a short time [20].

This study will help general dental practitioners and endodontist identify and appreciate the most common procedural errors that occur during endodontic treatment to reduce iatrogenic failures and improve treatment success.

**Materials and Method**

This descriptive cross sectional study was carried out at College of Dentistry, University of Hail, Saudi Arabia. The study was approved by the college ethical committee. A total of 200 radiographic data in college clinics with evidence of endodontic failure were randomly studied. Patients with full permanent dentition and close apices of the teeth were included in the study. The exclusion criteria were patients having apicoectomy, cyst enucleation, open apex, vertical root fracture, periodontally compromised teeth and non-restorable teeth. The third molar was also not included in the study. Each radiograph were examined twice by two examiners using magnification to ensure accurate investigation. All radiographs were examined again after two weeks by the two examiners to ensure accurate results and not miss any important information. Data regarding causes of treatment failure was recorded in specially designed form for this study. Information like gender, affected tooth, name of the affected canals, total number of canals that have problems and the reason/reasons of endodontic treatment failures were recorded. Obturation shorter than the apex more than 2 mm considered as under filling, while beyond the apex recorded as over filling.

Presence of any broken instrument e.g. file or reamer in the canal itself or at the apex area was recorded as separated instrument. In case of multiple canal teeth, any canal missed during endodontic treatment marked as missed canal. Poor filling referred to obturation that was nonhomogeneous or voids were present in the canal. Multi-rooted teeth with filling material extrusion through the furcation area diagnosed as furcation perforation. Coronal leakage recorded for teeth with poor or missing coronal restoration that caused treatment failure. Main point while assessing coronal restoration is through focusing on the coronal seal. Poor seal of restoration lead to micro leakage of microorganisms into the root canal and causing failure of endodontic treatments.

**Statistical Analysis**

Data were displayed as descriptive statistics and shown as number and percentage using statistical Package for the Social Sciences, version 24.

**Results**

**Problems and failures in root canal treatment**

A total of two hundred teeth with problems and failures in root canal treatment were recorded into the study. According to tooth types, Maxillary anterior teeth were 28 (14%), maxillary premolars 40 (20%) and maxillary molars 35 (17.5%). Mandibular anterior teeth were 6 (3%), mandibular premolars 28 (14%) and mandibular molars 63 (31.5%). There was unexpected result of the increased failure ratio in Maxillary Premolars compared to maxillary molars, and there is significant difference in the failure ratio of Mandibular molars compared to Maxillary molars (Table 1).

Teeth group	Failure ratio	Reason							
		Under filling	Over filling	Separated instrument	Missed canal	Poor filling	Furcation perforation	Lateral perforation	Coronal leakage
Maxillary Anterior (28)	28 (14%)	6 (21.4%)	0 (0%)	0 (0%)	0 (0%)	17 (60.7%)	0 (0%)	0 (0%)	5 (17.9%)
Maxillary Premolar (40)	40 (20%)	20 (50%)	0 (0%)	1 (2.5%)	0 (0%)	15 (37.5%)	0 (0%)	0 (0%)	4 (10%)
Maxillary molar (35)	35 (17.5%)	11 (31.4%)	0 (0%)	0 (0%)	6 (17.1%)	16 (45.7%)	0 (0%)	1 (2.9%)	1 (2.9%)
Mandibular Anterior (6)	6 (3%)	2 (33.3%)	0 (0%)	0 (0%)	0 (0%)	1 (16.7%)	0 (0%)	1 (16.7%)	2 (33.3%)
Mandibular Premolar (28)	28 (14%)	10 (35.7%)	1 (3.6%)	0 (0%)	0 (0%)	8 (28.6%)	0 (0%)	0 (0%)	9 (32.1%)
Mandibular Molar (63)	63 (31.5%)	30 (47.6%)	2 (3.2%)	1 (1.6%)	11 (17.5%)	5 (7.9%)	4 (6.3%)	1 (1.6%)	9 (14.3%)
Total	200 (100%)	79 (39.5%)	3 (1.5%)	2 (1%)	17 (8.5%)	62 (31%)	4 (2%)	3 (1.5%)	30 (15%)

**Table 1:** Problems and failures in root canal treatment.

**Reasons of Endodontic Failure**

The most common reason of endodontic failure was under filling n = 79 (39.5%) followed by poor filling n = 62 (31%) then coronal leakage n = 30 (15%), missed canal n = 17 (8.5%), furcation perforation n = 4 (2%), over filling n = 3 (1.5%) same of lateral perforation n = 3 (1.5%) and finally separated instrument n = 2 (1%) (Table 2).

Failure cause	Frequency	Percent
Under filling	79	39.5%
Over filling	3	1.5%
Separated instrument	2	1%
Missed Canal	17	8.5%
Poor filling	62	31%
Furcation perforation	4	2%
Lateral perforation	3	1.5%
Coronal leakage	30	15%
Total	200	100%

**Table 2:** Reasons of endodontic failure.

**Multi-rooted teeth with filling material**

Excluding coronal leakage and furcation perforation as the cause of failure, in multirooted teeth, the affected canals that caused failure came as the following: Maxillary premolar (22): booth canals affected n = 15 (68.2%) palatal canal n = 5 (22.7%) buccal canal n = 2 (9.1%). Maxillary Molars (35): all canals affected n = 16 (45.7%) Mesio Buccal canal n = 9 (25.7%) Distobuccal canal n = 8 (22.9%) palatal canal n = 2 (5.7%). Mandibular Premolars (2): lingual canal n = 1 (50%) both canals n = 1 (50%). Mandibular molars (50): Mesio Buccal canal n = 18 (36%) Distal canal n = 15 (30%) all canals affected n = 9 (18%) Mesiolingual canal n = 8 (16%) (Table 3).

Multirooted teeth				
Maxillary premolars (22)	Buccal Canal	Palatal Canal	Booth canals	
	2 (9.1%)	5 (22.7%)	15 (68.2%)	
Maxillary molars (35)	MesioBuccal canal	DistoBuccal canal	Palatal Canal	All canals
	9 (25.7%)	8 (22.9%)	2 (5.7%)	16 (45.7%)
Mandibular premolars (2)	Buccal Canal	Lingual Canal	Booth canals	
	0	1 (50%)	1 (50%)	
Mandibular Molars (50)	MesioBuccal canal	MesioLingual canal	Distal Canal	All canals
	18 (36%)	8 (16%)	15 (30%)	9 (18%)

**Table 3:** Multi-rooted teeth with filling material.

**Discussion**

When Endodontic treatment failure occurs, that means treatment has not been done on the acceptable standards [21-23]. The major factors responsible for failure are persistent microbial infection in the periradicular tissue and root canal system [13,24]. In this study, the most common cause of endodontic treatment failure was underfilled canals (39.5%). Similar findings from other studies shows that underfilled canals were also the most common cause of endodontic treatment failure with a percentage more than 33% among all other reasons [25-28]. Underfilling (more than 2

mm short of the radiographic apex) of the root canals often occurs due to incomplete preparation which is associated with inaccurate measurement of working length and poor irrigation of the root canal system which may cause debris to block the apex. It was found by Chugal and colleagues that if there is a loss of 1 mm in working length there will be increase in the chance of failure by 14% in teeth with pre-existing apical periodontitis. Irritation to peri-radicular tissue is due to remaining necrotic and infected pulp tissue in canals with poor instrumentation and filling [29]. In a 5 year follow up study Burke, *et al.* reported that length of the root canal filling is the most important factor for the success of endodontically treated teeth [30]. It was contrary to the studies by Dadresanfar, *et al.* [31] and Er, *et al.* [32] who reported 18% under fillings in their studies and poor filling as the main reason of treatment failure as 29.25%. The present study shows that failure is more common in molar teeth compare to other teeth as molars teeth are first erupted and more prone to be affected by caries and pulpal pathology. In addition to that root canal treatment of molar teeth requires more skills to get standard result due to the complex anatomy and variation of such teeth. Previous studies shows similar result for molars being the most common teeth with endodontic treatment failure [27-33]. Poor fillings were found in 31% in our study as the second cause of failure. Similar study also showed it was the second most common cause of failure at 28.5% [26], while another study recorded poor filling as the first cause of failure at 29.25% [33]. Over filling was shown in only 3 cases (1.5%) in this study which was contrary to two similar studies that recorded over filling in 13% and 18% of the cases [26-31]. Modern endodontic practice adjuncts such as electronic apex locators and rotary nickel-titanium instruments were not used during the treatment of these cases. It has been shown that electronic apex locators are more accurate than radiographs to identify the working length of the root canal. Furthermore Ni-Ti rotary instruments shape the root canals better than conventional stainless steel instruments with less iatrogenic errors [34].

**Conclusion**

Within the limitations of this study it was concluded that endodontic treatment failure was most commonly seen in underfilled canals followed by poorly filled canals. Posterior teeth showed higher failure rate compared to anterior teeth.

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