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Clinical and radiographic study of the causes of primary endodontic treatment failure

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Abstract

Objective: The aim of the present study was to determine clinically and radio graphically the different causes of primary root canal treatment failure

Methodology: In this descriptive study sixty patients referred for root canal retreatment in total of 78 teeth were asked about details of previous root canal treatment and subsequently examined for clinical findings and correlated with radiological observations before performing retreatment. Various reasons of failure of endodontic treatment like quality of coronal restoration, quality of obturation, missed canals, separated instruments and procedural errors were evaluated.

Results: Results showed that in most of the cases more than one cause can be attributed for failure of primary root canal treatment. Pain in root canal treated tooth was most common complaint of patients (45%) with half of cases (50%) having teeth sensitive to percussion and more than one third cases had draining sinus (35%). Both coronal restoration (66.6%) and quality of obturation (90.9%) was found below standard in majority of cases along with missed canals (24.3%), perforations (6.4%) and separated instruments (6.4%).

Conclusion: The outcome of root canal treatment is significantly affected by the quality of obturation and the presence and quality of coronal restoration. There is immense need of improving knowledge and skills of practioners to bring success rate of primary root canal treatment at par with institutions following standard protocols and procedures.

Keywords: Coronal restoration, Obturation, RCT failure, retreatment, success, failure

Introduction

The primary goal of endodontics is to eliminate or reduce the microbes from root canal space, prevent re-infection and promote healing of periapical tissues by hermetically sealing canal space^[1]. The methods for determination of success or failure of treatment are histological and clinical examinations associated with radiographic observations. As histological examination is not clinically viable therefore, clinical findings (signs and symptoms) along with radiographic evaluations are the practical methods for determination of success or failure in endodontic treatment^[2]. Despite the high success rate of primary endodontic treatment reported in the literature, failures still occur due to lack of adequate knowledge and training required for performing endodontic treatment or from not following evidence based guidelines and principles of endodontics. The successful endodontic outcome is defined as complete absence of clinical signs and symptoms and radiolucency. Failure has been defined as recurrence of clinical symptoms along with radiographic appearance of periapical lesion which had not existed before or persistence or enlargement of pre-existing radiolucency after primary endodontic treatment^[3].

The most common reasons of failure are: inadequate control of aseptic conditions^[4], inadequate access leading to missed canals, improper instrumentation of canals, procedural errors in the form of perforations, separated instruments, inadequate obturation^[5, 6] (short, non-homogeneous, or overextended) and microleakage of temporary or definitive coronal restoration^[7]. Complex anatomy of the root canal system can sometimes lead to failure even when root canal treatment was properly performed and procedures fully followed, as non instrumented regions of root canals can harbor bacteria and necrotic tissue even though not visible on radiograph^[8].

Also the persistence of periapical radiolucency after thorough root canal treatment can be caused by extra-radiolar infection, true cysts, foreign bodies, presence of cholesterol crystals or scar healing of the tissue [9].

The aim of this study was to analyze clinically and radiographically the causes of failure of primary endodontic treatment and determine treatment needs for teeth with failed primary endodontic treatment.

Methodology

The study was conducted in the Postgraduate Clinic of Conservative Dentistry and Endodontics, Govt. Dental College Srinagar. Sixty patients of both genders (26 Male and 36 Female) referred for retreatment in the total of 78 teeth, in the time period of June 2015 to December 2016 were included in the study. The study was approved by the institutional ethical committee. The inclusion criteria were patients with previous root canal treatment presenting with clinical signs and symptoms or asymptomatic patients whose endodontic treatment was not considered satisfactory for prosthetic rehabilitation. Exclusion criteria were patients who discontinued treatment in between, fractured teeth, non-restorable teeth or periodontally compromised teeth referred for extraction. Informed consent was taken from the patients. After recording previous dental history, clinical examination was performed and related with radiographic findings in the area of interest. Demographic information like age, gender, affected tooth, number of affected teeth was recorded. Patient's chief complaint was documented: pain, pain and tenderness, swelling and pus discharge or prosthetic need. Time duration since last root canal treatment, place of treatment, qualification of the treating person, use of rubber

dam, use of antibiotics and whether treatment was performed in single visit or multiple visits was also recorded. Clinically, area of interest was examined for swelling and tenderness and presence or absence of crown or fixed partial denture. For teeth indicated for retreatment, coronal restoration was observed for presence and absence along with quality of coronal restoration, presence of residual caries, draining sinus, extension of previous access cavity, perforations and missed canals. Radiographic observations included presence or absence of periapical pathology, quality of obturation (properly obturated, under obturated, over obturated or poorly obturated and unobturated), missed canals, and presence of separated instruments.

The root filling more than 2mm short of the radiographic apex was considered as under obturated while fillings that extended beyond the radiographic apex were considered overfilled. Presence of voids or radiolucent space running along the entire or some of the working length of root filling was considered as poorly obturated. Non surgical root canal treatment was performed in all the teeth except where surgical endodontics was considered necessary after retreatment.

Results

Among 60 patients included in the study, 43.3% were male and 56.7% were females with mean age of 32 years (max. 56 and min 16 yrs). Out of 78 teeth taken for retreatment, 43.6% were anterior teeth and 56.4% were posterior teeth. Maxillary teeth comprised 68% while as mandibular teeth formed 32% of total retreated teeth (Table 1). Failure was observed commonly in maxillary incisors (27%) and premolars (25.6%) followed by mandibular molars (16.6%).

Table 1: Distribution of Root Canal Retreated Teeth

	Maxillary (n = 53)				Mandibular (n = 25)			
	Incisors	Canines	Premolars	Molars	Incisors	Canines	Premolars	Molars
Number	21	05	20	07	07	01	04	13
Percent	27	6.4	25.6	09	09	1.2	5.1	16.6

The most common complaint of patients was pain (45%), pain associated with swelling (8.3%) or tenderness (16.3%) in the root canal treated tooth. Clinically, in 50% of the failed cases,

teeth were sensitive to percussion while as draining sinus was observed in 35% of patients (Table 2).

Table 2: Distribution of Patients According To Symptoms/Chief Complaint and Clinical Findings

Symptom/Chief complaint	Number of Patients	Percent (%)	Clinical Finding	Number of Patients	Percent (%)
Pain	27	45	Tenderness to Percussion	30	50
Pain and Tenderness	10	16.7	Swelling	05	8.3
Pain and Swelling	05	8.3	Draining Sinus	21	35
Pus Discharge	06	10	Mobility of Teeth	04	6.7
Pain on Biting	06	10			
Prosthetic Need	06	10			

In 39.7% of re-treated teeth improper coronal restoration in the form of temporary restoration or defective marginal seal was observed while as in 26.9% of teeth, there was complete absence of coronal restoration, that was lost after endodontic treatment or the chamber was completely filled with gutta-percha. Defective margins of crowns and fixed partial dentures were observed in 15.3% of retreated teeth. Periapical

pathology was present in 74.3% of cases whereas almost all of the teeth had serious flaw in obturation in the form of poor obturation, under obturation and over-obturation (44.8%, 42.3% and 3.8% respectively). Missed canals were observed in 24.3% of teeth whereas the incidence of separated instruments was 6.4% (Table 3).

Table 3: Distribution of Teeth According To Clinical and Radiographic Observations

Clinical Finding	Number of Teeth (Total = 78)	Percent (%)	Radiographic Finding	Number of Teeth (Total = 78)	Percent (%)
Crown/ Fixed Partial Denture with Faulty Margins	12	15.3	Periapical Pathology	58	74.3
Dislodged Coronal Restoration	21	26.9	Missed Canals	19	24.3
Faulty Coronal Restoration	31	39.7	Under-Obtured Teeth	33	42.3
Residual/Secondary caries	05	6.4	Poorly Obtured Teeth	35	44.8
Overextended Access	05	6.4	Over Obtured Teeth	03	3.8
Under Extended Access	07	8.9	Un Obtured Canal	02	2.5
Perforation	05	6.4	Separated Instrument	05	6.4

More than half of the failed cases (51.2%) were treated by the general dental practitioner and 18% of cases by the dental assistants who do not possess the requisite qualification for performing the endodontic treatment. Junior residents in the department of endodontics contributed 14.1% of the failed primary root canal treatment cases (Table 4). Among the different practices, three - fourth of the cases (74.4%) were treated in private practices while as almost one fourth of the cases (23%) were previously treated in teaching institutes (Table 5).

All the cases of primary root canal treatment failure were treated in multiple visits, with history of rubber-dam use in only 2 patients (3.3%). Eight cases (13.3%) reported with symptoms within 6 months of primary root canal treatment while in 40 cases (66.7%) root canal treatment was performed 1-5 years before they reported for retreatment while in 6 cases (10%) root canal treatment was done more than 5 years ago. All of these cases reported use of antibiotics on multiple occasions before seeking retreatment. Only 6 cases (10%) were symptomless and root canal re-treatment was deemed necessary from radiographic findings before prosthetic rehabilitation. Only two cases (3.3%) needed endodontic surgery along with orthograde re-treatment due to incomplete resolution of symptoms and signs after non-surgical retreatment in one of cases and inability to bypass impediment in one of canals in the second case.

Table 4: Distribution of teeth according to practitioner

	Number of Teeth	Percent
Endodontist	01	1.28
Periodontist	01	1.28
Prosthodontist	05	6.4
Oral Pathologist	01	1.28
G.D.P	40	51.2
Junior Residents	11	14.1
Interns	05	6.4
Dental Assistants	14	18

Table 5: Distribution of teeth according to practices

	Number of teeth	Percent
Private Clinic	58	74.4
Teaching Institutes	18	23
Periphery Hospital	02	2.6

Discussion

Endodontic therapy is essentially directed toward one specific set of aims: to cure or prevent periradicular periodontitis [10] so that patients can retain their natural teeth in function and esthetics. In recent years clinical endodontics has been through some major technological and biological advances, resulting in the development of conservative pulp therapy strategies [11] contemporary instrumentation and disinfection procedures [12] and the use of the operating microscope in

endodontic treatment, endodontic re-treatment and during surgical endodontic procedures [13]. All these factors have improved the success rate of root canal treatment above 95%. Successful outcome of root canal treatment needs adequate removal of micro-organisms from the root canal system and prevention of recolonization or propagation of micro-organisms through the placement of well extended homogeneously dense root canal filling and adequate coronal restoration [4-7].

The results showed that in most of cases multiple causes of failure of primary root canal treatment were present with overlapping of findings. Although routine use of rubber dam is considered as standard of care [14] to prevent cross contamination of root canal system and as an excellent barrier to spread of infectious agents [15]. Out of 60 cases, only two patients reported use of rubber dam during primary root canal treatment that may have contributed to incomplete disinfection and contamination of root canal system from saliva and other tissue fluids.

In our study 26.9% of failed teeth had complete absence of coronal restoration that was either lost after root canal treatment or chamber filled with gutta percha only. Also 39.7% of cases had faulty coronal restoration in the form of temporary restoration or non-bonded restoration showing cracks and defective margins. Studies have shown that sealing the coronal aspect of tooth is of paramount importance for the overall success of root canal treatment [16, 17]. Since gutta-percha and root canal sealers are not effective barriers to the oral environment, studies showed that in teeth with leaking coronal restorations all the root canals were recontaminated in less than 30 days. In complete absence of coronal restorations, root canals are contaminated at a faster rate as observed in the study of Torabinejad *et al.* [18] where 50% of root canals were completely contaminated with staphylococcus epidermidis only after 19 days of exposure. Ray and Trope [19] reported that condition of coronal restoration was more important than the quality of endodontic treatment whereas Hommez *et al.* [17] found that a good coronal restoration as well as good root canal filling is most influential factors for the healing of periapical tissues after root canal treatment.

Teeth that are poorly obturated are poorly prepared as obturation is a reflection of the cleaning and shaping and is evaluated on the basis of length, taper, density, and level of gutta-percha removal [20]. So three dimensional obturation is essential to long-term success of root canal treatment since unprepared areas of root canal system harbor bacteria and necrotic tissues that may result in root canal treatment failure [8]. In the present study, the quality of obturation was found to have profound contribution to the failure of primary root canal treatment as 42.3% of cases showed under-obturation, 44.8% of cases were poorly obturated and in 2.5% of cases an unobturated canal was detected. Together these flaws in obturation reflected the poor quality of shaping and cleaning

and hence the persistence of bacteria or recontamination due to association with improper coronal restoration in majority of cases. 24.3% of cases had one or more canals unprepared and unobturated.

Procedural errors are an important factor for long term success of endodontically treated teeth. Errors characterize disability, non-observance of therapeutic protocol and low level of knowledge involving the endodontic principles^[21]. In 5 cases (6.4%) a separated instrument was found in one of the canals. Poor filling quality and the stage of disinfection at the time of instrument separation clearly have influence on the success of endodontic treatment. Instrument separation may be caused by improper use, limitations in physical properties, inadequate access, root canal anatomy and possibly manufacturing defects. Most commonly instrument separation occurs due to improper use in the form of overuse or not discarding an instrument and replacing it with new one when needed^[22]. This may also be related to the inadequate knowledge of anatomy of teeth as observed in the form of inadequate access in 8.9% of cases in the present study. Perforations were detected clinically in 6.4% of cases of primary root canal treatment failure associated with overextension of access cavity in 6.4% of teeth. In most of the cases, more than one cause can be associated with primary root canal failure due to overlapping of findings in most of cases as can be appreciated from percentage of clinical and radiographic observations in Table 3. The multi-factorial etiology of root canal failures observed in this study may be reason for high percentage of cases with periapical pathology (74.3%).

Majority of failed root canal treatment cases were done by general dental practitioner (51.2%) and dental assistants (18%) in private practices (74.4%) (Table 4 and 5) highlighting the fact that principles and standard techniques of endodontic treatment taught at dental schools are not being followed and there is need for more postgraduate courses and continued dental education to improve the clinical skills of endodontics^[23]. McColl *et al* also found that success rate of teeth treated by endodontists was significantly higher than those treated by general practitioner. Similar results were observed in our study with only 1.28% of failed cases treated by endodontists showing that highly skilled dentists are less likely to perform procedural errors that may compromise prognosis.

Conclusion

Within the limitation of this study it can be concluded that

1. Failure of primary endodontic treatment is usually multifactorial.
2. Improper shaping and cleaning of root canal system associated with defective coronal restoration are the major causes of endodontic treatment failure.
3. There is need for continuous dental education to improve the knowledge and skill of endodontics for successful root canal treatments.

References

1. Schilder H. filling root canals in three dimensions. *Dent Clin North Am.* 1967; 11:723-44.
2. Stabholz A, Walton RE. Evaluating success and failure. In: Walton RE, Torabinejad M, editors. *The Principles of endodontic treatment.* 2nd Edition. Philadelphia: WB Saunders, 1996, 324-35.
3. Daokar S, Kalekar A. Endodontic failures – A review. *IOSR J Dent Medi Sci.* 2013; 4:5-10.
4. Watimo T, Trope M, Haapasalo M, Ostravik D. Clinical

efficacy of treatment procedures in endodontic infection control and one year follow-up of periapical healing. *J Endod.* 2005; 31(12):863-6.

5. Torabinejad M, Lemon RL. Procedural accidents. In: Walton RE, Torabinejad M, editors. *Principles and Practice of endodontics.* 2nd ed. Philadelphia; W.B. Saunders, 1996, 306-23.
6. Simon S, Machtou P, Tomson P, Adams N, Lumley P. Influence of fractured instruments on the success rate of endodontic treatment. *Dent Update.* 2008; 35(3):172-9.
7. Gillen BM, Looney SW, Gu LS, Loushine BA, Weller RN, Loushine RJ *et al.* Impact of the quality of coronal restoration versus the quality of root canal fillings on success of root canal treatment: a systematic review and meta analysis. *J Endod.* 2011; 37(7):895-902.
8. Ricucci D, Siqueira JF Jr. Fate of the tissue in lateral canals and apical ramification in response to pathologic conditions and treatment procedures. *J Endod.* 2010; 36(1):1-15.
9. Nair PNR. On the causes of persistent apical periodontitis: a review. *Int Endod J.* 2006; 39(4):249-81.
10. Trope M. The vital tooth – its importance in the study and practice of endodontics. *Endod Topics,* 2003; 5:1.
11. Nakashima M, Akamine A. The application of tissue engineering to regeneration of pulp and dentin in endodontics. *J Endod.* 2005; 31:711-18.
12. Haapasalo M, Endal U, Zandi H, Coil JM. Eradication of endodontic infection by instrumentation and irrigation solutions. *Endod Topics,* 2005; 10:77-102.
13. Ruddle CJ. Nonsurgical retreatment. *J Endod.* 2004; 30:827-845
14. Cohen S, Schwartz SF. Endodontic complications and the law. *J Endod.* 1987; 13:191.
15. Cochran MA, Miller CH, Sheldrake MA. The efficacy of rubber dam as a barrier to the spread of microorganisms during dental treatment. *J Am Dent Assoc.* 1989, 119:141.
16. Tronstad L, Asbjornsen K, Doving L *et al.* influence of coronal restorations on the periapical health of endodontically treated teeth. *Endod Dent Traumatol.* 2000; 16(5):218-21.
17. Hommez GM, Coppens CR, De Moor RJ. Periapical health related to the quality of coronal restorations and root fillings. *Int Endod J.* 2002; 35(8):680-9.
18. Torabinejad M, Ung B, Kettering JD. *In vitro* bacterial penetration of coronally unsealed endodontically treated teeth. *J Endod.* 1990; 16(12):566-9.
19. Ray HA, Trope M. periapical status of endodontically treated teeth in relation to the technical quality of the root filling and the coronal restoration. *Int Endod J.* 1995; 28(1):12-18.
20. William TJ, James CK. Obturation of the cleaned and shaped root canal system. In: Hargreaves KM, Cohen S, editors. *Pathways of the pulp.* 10th edition. St. Louis: Mosby. 2012, 350.
21. Estrela C, Holland R, Araujo C, Alencar A. Characterization of successful root canal treatment. *Braz Dent J.* 2014; 25(1):3-11.
22. Roda R, Gettleman BH. Nonsurgical retreatment. In: Hargreaves KM, Cohen S, editors. *Pathways of the pulp.* 10th edition. St. Louis: Mosby. 2012, 924-27.
23. McColl E, Smith M, Whitworth J, Seccombe G, Steele J. Barriers to improving endodontic care: the views of NHS practitioners. *Braz Dent J.* 1999; 86(1):564-8.