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REASONS AND PATTERN OF DEMAND FOR ROOT CANAL TREATMENT AMONG PATIENTS ATTENDING A TERTIARY CARE CENTER OF MADHESH PROVINCE: A DESCRIPTIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: *Root canal treatment (RCT) for permanent teeth involves the use of biologically acceptable chemical and mechanical treatment of the root canal system to promote healing and repair of the periradicular tissues. The aim of the study was to analyze the reasons and pattern of demand for root canal treatment among patients attending a tertiary care center of Madhesh Province, Nepal.*

Materials and methods: *This was a descriptive cross-sectional study of patients who received root canal treatment in the Department of Conservative Dentistry and Endodontics, National Medical College, Birgunj, Nepal between September 2022 and February 2023. The demographic and clinical data of patients were recorded and statistical analysis was performed using SPSS version 24. Association between the variables was analyzed by Fischer exact tests. P-value <0.05 was considered as statistically significant.*

Results: *206 patients who received root canal treatment participated in this study. More mandibular teeth (53.9%) were root-treated compared to maxillary teeth (46.1%). The first molars constituted the most prevalent root-treated teeth (43.7%), followed by the second molars (26.7%) and the central incisors (10.7%). The most common chief complaint was pain (66%) and caries (75.7%) was the most frequently encountered pathology. The association of age category and dental arch with the type of root-treated teeth was statistically significant ($p < 0.001$ and $p < 0.004$, respectively).*

Conclusion: *Irreversible pulpitis caused by caries was the predominant indication for root canal treatment, with pain being the most common presenting complaint. The demand for treatment was higher in females and among patients within 21-40 years age category. More teeth from the mandibular arch were root-treated while the first molar was the most frequently treated tooth.*

Keywords: *Cross-sectional studies; Dental Caries; Endodontics; Root Canal Therapy*

INTRODUCTION

Root canal treatment (RCT) for permanent teeth involves the use of biologically acceptable chemical and mechanical treatment of the root canal system to promote healing and repair of the periradicular tissues.[1] As part of dentistry's chief goal to preserve a healthy, natural dentition for the public, the aim of root canal treatment, also known as endodontic treatment, is to preserve functional teeth without prejudice to the patient's health.[2] There are many potential pathways that may allow bacteria to invade the root canal system, the most common of which is dental caries. Other common routes of infection include cracks, trauma, exposed dentinal tubules, and iatrogenic causes.[3] Nonsurgical root canal treatment is indicated primarily in cases of irreversible pulpitis and when pulp necrosis with and without periapical pathosis occurs.[4]

Untreated dental caries (tooth decay) in permanent

teeth is the most common health condition according to the Global Burden of Disease 2019.[5] Increased education and awareness among patients along with technological advances, have encouraged the view that the teeth should remain functional throughout life, a condition which has theatrically augmented the need to perform root canal treatment.[6] Though the effectiveness of endodontic treatment is well-established, misinformation continues to circulate that may cause patients to query the safety of endodontics.[7]

The state of health, disease, or a treatment intervention in a population is best measured by a cross-sectional study.[8] There are limited studies relating to the reasons and pattern of demand for root canal treatment in Nepal. To the best of our knowledge, no such study has been done in the Madhesh province of the country. Thus, little is known about the presenting features in patients and the major reasons for starting root canal treatment. Such data is important, not only for the dentists but also for the health authorities, by highlighting issues that should be a focus of oral health prevention programs and also by recognizing measures which could decrease the need for costly invasive procedures, such as root canal treatment. The objective of the present study therefore, was to analyze the reasons and pattern of demand for root canal treatment among patients attending a tertiary care center of Madhesh Province.

MATERIALS AND METHODS

This was a descriptive cross-sectional study of patients who received conventional root canal treatment in the Department of Conservative Dentistry and Endodontics, National Medical College, Birgunj, Nepal between September 2022 and February 2023. Ethical approval of the study was obtained from the Institutional Review Committee of National Medical College, Birgunj (Ref. F-NMC/596/079-080). Patients whom root canal treatment was advised and who started with the treatment were invited to participate in the study. From those who agreed to participate, a written informed consent was obtained.

The inclusion criteria were the following:

- Starting root canal treatment during the selected time period.
- Aged 16 years and above.
- Ability to give voluntary informed consent.
- The exclusion criteria were the following:
- Retreatment
- Intentional RCT
- Immature teeth

We included 400 patients in this study. The calculated sample size was 384. Convenience sampling method was used. The need for root canal treatment was confirmed by clinical examination, vitality testing and periapical radiograph. A flow diagram of the patient enrollment procedure is given in Figure 1.

The demographic and clinical data of patients was recorded on a proforma. The variables included were: the age of patient, gender, chief complaint of the patients, tooth that received root canal treatment, primary pathology of the affected tooth, the pulpal and periapical diagnosis arrived at before the initiation of the root canal treatment.

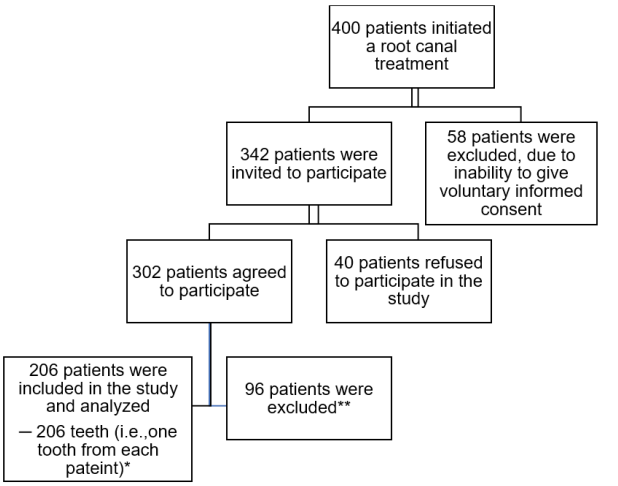

Figure 1. Flow diagram of the study.

* Among 206 patients, fourteen patients had root canal treatment started in two teeth and four patients had treatment started in three teeth. However, only first tooth was included in the study and rest were excluded.

** Reasons for exclusion were: retreatment – 54 teeth, intentional RCT – 18 teeth, immature teeth – 10 teeth and treatment not initiated during the selected time period – 14 teeth.

The data was transferred to a Microsoft Excel sheet (Microsoft Office Excel 2010; Microsoft Corporation, Redmond, WA). Data analysis was carried out using Statistical Package for the Social Sciences (SPSS) version 24 (IBM, Chicago, Illinois, United States). The statistical tests employed were descriptive statistics, frequency counts, percentage, mean, standard deviation and cross tabulations. Association between the variables was analyzed by Fischer exact tests. P-value <0.05 was considered as statistically significant.

RESULTS

Two hundred and six patients met the selection criteria. The patients age ranged from 16-76 years with a mean age of 39.80 years (Standard Deviation = 15.50). As

shown in (Table 1), all the patient were divided into four age groups, ≤ 20 years, 21-40 years, 41-60 years and > 60 years. The majority of the patients in whom root canal treatment was indicated fall under 21-40 years age group (45.6%), followed by 41-60 years (34%). Gender wise, a higher percentage of female patients (59.7%) needed endodontic treatment compared to the males (40.3%).

Table 1: Gender and age distribution of the study population

Variables	Categories	Frequency	Percentage
Gender	Male	83	40.3
	Female	123	59.7
Age category	≤20 years	23	11.2
	21-40 years	94	45.6
	41-60 years	70	34
	>60 years	19	9.2
Total		**206**	**100**

Table 2 shows the features of root canal treated teeth. More mandibular teeth (53.9%) were root-treated compared to maxillary teeth (46.1%). The teeth located on the right side of the dental arch accounted for 54.4% of the teeth that received root canal treatment. The first molars constituted the most frequently root-treated teeth (43.7%), followed by the second molars (26.7%) and the central incisors (10.7%).

Table 2: Features of the root canal treated teeth

Features		Frequency	Percentage
Arch	Maxilla	95	46.1
	Mandible	111	53.9
Side of the dental arch	Right	112	54.4
	Left	94	45.6
Tooth type	Central incisor	22	10.7
	Lateral incisor	3	1.5
	Canine	7	3.4
	First premolar	7	3.4
	Second premolar	15	7.3
	First molar	90	43.7
	Second molar	55	26.7
	Third molar	7	3.4
Total		206	100

Table 3 depicts the gender wise comparison of the chief complaint, pathology, pulpal diagnosis and periapical diagnosis in root canal treated teeth. The most common chief complaint of the patients was pain (66%) and the most frequently encountered pathologies in both males and females were dental caries (75.7%) followed by trauma (10.2%), non-carious tooth loss (7.8%) and failed restoration (6.3%). Among the root canal treatment indicated patients, symptomatic irreversible pulpitis (68.4%) was the most prevalent pulpal diagnosis made and the most common periapical diagnosis made was symptomatic apical periodontitis (68.4%). There were no statistically significant differences between males and females and the pulpal and periapical diagnosis made (p= 0.374 and p = 0.440, respectively).

In the maxillary arch, the most frequently root canal treated teeth were the molars (66.3%) followed by the incisors (21 %), while in the mandibular arch, the most frequently root-treated teeth were the molars (80.1%) followed by the premolars (11.7 %) and this was statistically significant (p < 0.004). Similarly, the association of age categories with the type of root-treated teeth was found to be statistically significant (p < 0.001) (Table 4).

Table 3: Gender wise comparison of the chief complaint, pathology, pulpal diagnosis and periapical diagnosis in root canal treated teeth

Variables	Categories	Female n (%)	Male n (%)	Total n (%)	P-value[a]
	Pain	82 (66.7)	54 (65.1)	136 (66.0)	
	Swelling	9 (7.3)	14 (16.9)	23 (11.2)	
Chief complaint	Sensitivity	12 (9.8)	4 (4.8)	16 (7.8)	0.202
	Cavity	12 (9.8)	7 (8.4)	19 (9.2)	
	Others[b]	8 (6.5)	4 (4.8)	12 (5.8)	
	Dental caries	99 (80.5)	57 (68.7)	156 (75.7)	
	Failed restoration	6 (4.9)	7 (8.4)	13 (6.3)	
Pathology	Non-carious tooth loss	7 (5.7)	9 (10.8)	16 (7.8)	0.254
	Trauma	11 (8.9)	10 (12.0)	21 (10.2)	
	Symptomatic irreversible Pulpitis	89 (72.4)	52 (62.7)	141 (68.4)	

Pulpal diagnosis	Asymptomatic irreversible pulpitis	9 (7.3)	8 (9.6)	17 (8.3)	0.374
	Pulp necrosis	22 (17.9)	22 (26.5)	44 (21.4)	
	Previously initiated therapy	3 (2.4)	1 (1.2)	4 (1.9)	
	Normal apical tissue	5 (4.1)	5 (6.0)	10 (4.9)	
	Symptomatic apical periodontitis	89 (72.4)	52 (62.7)	141 (68.4)	
Periapical diagnosis	Asymptomatic apical periodontitis	12 (9.8)	10 (12.0)	22 (10.7)	0.440
	Chronic apical abscess	11 (8.9)	9 (10.8)	20 (9.7)	
	Acute apical abscess	5 (4.1)	3 (3.6)	8 (3.9)	
	Periapical cyst	1 (.8)	4 (4.8)	5 (2.4)	

a = Fischer exact test b = discoloration, pus discharge, food impaction and tooth fracture

Table 4: Association of the type of root canal treated teeth based on gender, age category, type and side of the dental arch

Variables	Categories		Type of tooth			P-value[a]
		Incisors n (%)	Canine n (%)	Premolar n (%)	Molar n (%)	
Gender	Male	13 (15.6)	3 (3.6)	9 (10.84)	58 (69.8)	0.629
	Female	12 (9.7)	4 (3.2)	13 (10.6)	94 (76.4)	
Age category	≤20 years	9 (39.1)	1 (4.3)	0	13 (56.5)	
	21-40 years	10 (10.6)	0	13 (13.8)	71 (75.5)	0.001[b]
	41-60 years	6 (8.5)	4 (5.7)	7 (10)	53 (75.7)	
	>60 years	0	2 (10.5)	2 (10.5)	15 (78.9)	
Arch	Maxilla	20 (21.0)	3 (3.1)	9 (9.5)	63 (66.3)	0.004[b]
	Mandible	5 (4.5)	4 (3.6)	13 (11.7)	89 (80.1)	
Side of the dental arch	Right	12 (10.7)	3 (2.7)	10 (8.9)	87 (77.7)	0.574
	Left	13 (13.8)	4 (4.2)	12 (12.7)	65 (69.1)	

a = Fischer exact test; b = P-value <0.05 was statistically significant

DISCUSSION

Root canal treatment is carried out when the pulp is nonvital or has been extirpated to prevent or treat apical periodontitis. The purpose of root canal treatment is either to maintain asepsis of the root canal system or to disinfect it adequately to conserve the tooth in the dental arch.[2]

In this study, the highest demand for root canal treatment was found among the age group of 21-40 years (45.6%). This was followed by patients in 41-60 years age group (34%). The least demand was seen in > 60 years age group (9.2%). This result is in agreement to previous studies. [9,10] The association of age categories with the type of root-treated teeth was found to be statistically significant (p = 0.001). The possible reason of the higher demand for RCT may be the higher prevalence of untreated dental caries among younger adults.[11]

Gender distribution of the study population showed that more than half of patients in whom root canal treatment was done were females (59.7%). Literature suggests that female are more concerned about their oral health and appear to be more motivated to demand oral health care.[9] Additionally, hypersensitivity to dental pain might have driven them to see health care.[12] Similar trend was observed in various other studies[13-15] which reported a higher demand of root canal treatment by female patients. However, some studies[16-18] reported a higher demand in males.

Root canal treatment was more commonly undertaken in mandibular arch teeth (53.9%) compared to maxillary arch, an observation similar to a study by Mozayeni et al. [19] but contrary to other studies.[14,20] This might be due to the role of gravity or anatomical features of lower teeth in food stagnation leading to caries. Moreover, higher proportion (54.4%) of the treatment was done on the right side of the dental arches, similar to a report by Osadolor et al.[15] The first molar was found to be the most common tooth needing root canal treatment. This observation is similar to previous studies[21,22] but different

to others[24,16] which found that the most frequently root canal treated teeth were the premolars and the central incisors, respectively. The first molar has been cited as the most caries-prone tooth in permanent dentition, perhaps due to its early exposure to the oral environment and its morphologic features being pitted and fissured, bringing plaque and caries formation.[23]

More posterior teeth (i.e., molars and premolars) were root-treated compared to anterior teeth (i.e., incisors and canines). This pattern is similar to other published literatures.[13,16,17,25] It has been found that general dentists are more comfortable doing RCT on anterior teeth and they refer posterior teeth needing RCT to the tertiary care centers to be performed by postgraduate residents and consultants.[17] However, another study[20] found high prevalence of endodontic treatment done on anterior teeth.

The most common chief complaint reported among the patients was pain (66%) followed by swelling (11.2%). It has been shown that the pain is the most frequent presenting complaint related to the pursuit of dental care in developing economies.[6] However, this situation is not ideal as the secondary and tertiary prevention are more expensive than primary prevention.[17] Hence there is need for increase in oral health education and awareness among people of Madhesh Province and focus on preventive strategies.

Dental caries was found to be the most prevalent pathology in the root canal treatment indicated teeth. This result is similar to previous reports.[6,16,26] This may be explained by the fact that dental caries is not generally associated with pain till complications set in and the symptoms frequently then make patients to seek care.[16] This also explains why pain was the most common chief complaint reported in this study. The second most commonly encountered pathology for endodontic treatment in this study was dental trauma, which might be associated outdoor activities or with trauma prone dental profile of the patients. Pulpal and periapical diseases have been reported to be most commonly caused by dental caries and trauma.[27] Thus, they were found to be the two most common indications for root canal treatment in this study.

In both the males and females, the most common pulpal diagnosis made in this study was symptomatic irreversible pulpitis (68.4%) followed by pulp necrosis (21.4%) whereas the most prevalent periapical diagnosis was symptomatic apical periodontitis (68.4%) followed by asymptomatic apical periodontitis (10.7%). The finding of symptomatic irreversible pulpitis is in line with previous the studies.[13,28] However, another study[26] found pulp necrosis with apical periodontitis to be the most common diagnosis in root treated teeth.

The most frequently root canal treated teeth in this study were the mandibular molars, a result similar to various previous studies[29,30] but contrary to outcomes of[10,20] that reported maxillary incisors as the most commonly root treated teeth. The vulnerability of the mandibular first permanent molar can be credited to their early eruption that may have exposed them to the cariogenic oral environment for a lengthy time.[31] Furthermore, it is possible that being the first set of permanent teeth to erupt in the oral cavity many parents may fail to identify them as permanent teeth and thus neglect them through poor oral health practices such as ineffective oral hygiene measures.[32] Furthermore, in this study the mandibular molars were followed by the maxillary molars and then the maxillary central incisors in order of prevalence of receiving root canal treatment. These results reflect the desire of patients to retain posterior teeth that are necessary for optimal masticatory efficiency.

In the maxillary arch, the most commonly root-treated teeth were molars followed by incisors and premolars. This is in contrast to a study[10] which found that the maxillary incisors were the most endodontically treated teeth. The reasons the author of the above study[10] attributed to their finding was trauma which is common in younger age group and personal esthetic appeal. Likewise, in the mandibular arch the most frequently root-treated teeth were molars, an observation similar to a previous study,[30] followed by premolars and incisors. The association between the type of root filled teeth and the type of dental arch was found to be statistically significant ($p = 0.004$), a finding similar to the report by Enabulele et al.[16]

The reasons and pattern of demand for root canal treatment were clearly disclosed in this study. This is of utmost importance to understand the disease process, its demand among various age groups, gender, dental arch, tooth type and also to design of future preventive and management strategies.

This study has few limitations. The study was done at a single tertiary care center of Madhesh Province, Nepal. The patient specific characteristics may be different from other health care organizations. The sample size of the study was limited. Future studies on a larger sample of population and covering other patient specific characteristics is warranted.

CONCLUSIONS

Irreversible pulpitis caused by caries was the predominant indication for root canal treatment, with pain being the

most common presenting complaint. The demand for treatment was higher in females and among patients within 21-40 years age category. More teeth from the mandibular arch were root-treated while the first molar was the most frequently treated tooth.

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