

Retrospective Data Analysis of Endodontic Procedures on Inter Appointment Pain

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ABSTRACT

Background: Acute periradicular (periapical) inflammation is the most common cause of interappointment or postoperative pain. The causative factors of interappointment pain comprise mechanical, chemical, and/or microbial injury to the pulp or periradicular tissues. The use of an antimicrobial, intracanal medicaments are important tool in controlling endodontic infection. Pain management in endodontic treatment is an important clinical consideration.

Aims: The aim of the study was to determine the frequency of use of different endodontic procedures by dentists and the influence of these on inter appointment pain.

Materials and Methods: In the present study reply to planned questionnaire from 173 dentists had obtained after getting due ethical clearance. Frequency of preferred methods used by dentists in endodontic treatment were determined. The retrospective data collected was subjected to statistical analysis using SPSS version 23 using various methods i.e. Chi square (χ^2) test, Linear-by-Linear Association test under Monte Carlo probability (*P*-value) distribution. The relationship between each endodontic step and interappointment pain was analysed.

Results: Retrospective analysis of data suggests that Hand files were mostly preferred (87.3%) by dentists in endodontic procedures. There had been very limited use of rubber dam for isolation (38%). All the dentists (39.9%) routinely prescribed

systemic analgesics. Sodium hypochlorite (93.6%) and calcium hydroxide (44.5%) was the preferred irrigant and intracanal medicament respectively. No trend has been observed for interappointment pain to increase with use of crown down technique, use of intra canal corticosteroids and intra canal antibiotics.

Conclusion: Crown down technique should be the preferred method for root canal preparation. Intra canal use of medicaments had been more effective than systemic use.

Keywords: Crown Down Technique, Interappointment Pain, Intracanal Medicament.

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INTRODUCTION

The endodontic therapies are mostly done to eliminate the causative agents of periapical pathosis. The occurrence of inter appointment pain during endodontic therapy is not rare and reported in 10-30% of cases.¹ According to research data, the flare-up rate after endodontic treatment varies from 1.4% to 16%.^{2,3} Pain during or after endodontic procedures is an undesirable occurrence for both patients and clinicians. Acute periradicular (periapical) inflammation is the most common cause of interappointment or postoperative pain.⁴ The various causative agents in inter appointment pain consist of microbial, mechanical and chemical insults in the form of infected debris extruded into the periradicular tissues during root canal treatment.⁵ Acute periradicular inflammation can develop due to any insult from the root canal system. Intensity of the tissue injury is directly

proportional to the intensity of the periradicular inflammatory response. As a result of periradicular tissues injury, a myriad of chemicals get activated and released, which will result in cascade of events of inflammation, i.e. vasodilatation, increase in vascular permeability, and chemotaxis to inflammatory cells. The chemical mediators of inflammation are histamine, arachidonic acid metabolites, cytokines, neuropeptides, lysosomal enzymes, nitric oxide, oxygen derived free radicals, and plasma-derived factors.⁶ Most of these mediators have been detected in periradicular lesions.⁷ These mediators cause pain either by direct effects on sensory nerve fibers or by compression of nerve fibers because of edema.⁸ Dental pain being a complex process consisted of biological, biochemical, environmental and psychogenic factors. Endodontic therapy is aimed at creating favorable environment for

periradicular tissue healing without inciting any pain incidence. Advancements in dentistry are taking both to improve patient care and ease of patient management. Multiple treatment protocol and different endodontic techniques are available to dentist that limit the apical extrusion of root canal debris. Various intra canal medicaments, systemic analgesics and antibiotics are used to control the interappointment or post endodontic pain. Here, the study is carried out to have a view of different methods opted by dentists and to learn any influence of these endodontic methods on inter appointment pain.

MATERIALS AND METHODS

Preparation of Questionnaire and Study Design

Transverse questionnaire was prepared based on common endodontic procedures used by the dentists and data was collected.⁹ Practicing dentists were given the questionnaire consisting of twelve questions. The questionnaire consisted of different aspects of endodontic treatment *i.e.*, frequency of use of rubber dam, systemic analgesic and antibiotic prescriptions,

technique of root canal instrumentation, choice of irritants, choice of intra canal medicaments. A structured Likert scale questions were formed to provide a range of options to dentists except one which was about the use of rubber dam in endodontic procedures (box 1). Retrospective data recorded from the questionnaire which was collected from 173 responded dentists out of 500. Data was spread in MS Excel (2016). Data was analysed using statistical analysis software using IBM SPSS version 23. Chi-square (χ^2) model.

Study Type

A cross sectional survey was conducted to determine the preference of dentist in selecting different procedures in root canal treatment and the reporting frequency of inter appointment or post endodontic pain.

Sample Size and Selection

Study population was practising dentists who were randomly selected. The questionnaire mailed both personally and electronically to 500 practising dentist and out of this 173 dentists responded. The response rate was 34.6%.

Box 1 Transverse questionnaire

Endodontic procedures used	Always	Frequently	Occasionally	Rarely	Never
Endodontic hand instruments					
Endodontic rotary instruments					
Step back technique					
Crown down technique					
Sodium hypochlorite					
Calcium hydroxide medicament					
Prescription of Systemic analgesic					
Prescription of systemic antibiotics					
Intra canal corticosteroid					
Intra canal antibiotic paste					
Experiencing interappointment pain in patients					
Use of rubber dam	Yes				No

Statistical Analysis

Collected data was subjected to statistical analysis using IBM SPSS version 23. Chi-square (χ^2) test is used to assess whether the frequency of a condition is significantly different between two or more groups. Linear-by-Linear Association test used to test a trend in the frequency of outcome across an ordered exposure variable. Monte Carlo method is used when cells with small numbers (less than 5). The Monte Carlo *P* value is based on a random sample of probability distribution rather than a chi-square (χ^2) distribution which is an approximation.

RESULTS

As per figure 1 the results indicated that Endodontic hand file method was always been used by 151 (87.3%) dentists and this method was used at least once by all the dentists. Endodontic rotary file method was always used by 44 (25.4%) dentists and never used by 61 (35.3%) dentists. Step back technique method was always used by 93 (53.8%) dentists and never used by 1.7% of dentists. Crown down technique method was always used by 46 (26.6%) dentists and never used by 5.2% dentists. Systemic analgesics method was always used by 69 (39.9%) dentists and this method was used at least once by all the dentists. Systemic antibiotics method was always used by 64 (37%) dentists and

never used by 5.2% dentists. Intra canal corticosteroids method was always used by only 5 (2.9%) dentists and never used by 56 (32.4%) dentists. Intra canal antibiotics was never used by 81 (46.8%) dentists and rarely used by 58 (33.5%) dentists. Calcium hydroxide had been frequently used by 77 (44.5%) dentists and always used by 36 (20.8%) dentists and this method was used at least once by all the dentists. Sodium hypochlorite as irritant method was used frequently (6.4%) or always (93.6%) by all the dentists. Inter appointment pain rarely encountered by 54.9% of dentists and occasionally 45.1% of dentists. 68.8% of dentists were not using rubber dam. In the second phase, analysis for predicting any relationship between these endodontic variables and inter appointment pain was carried out (Table 1). Null hypothesis was assumed that there is no relation between interappointment pain and each variable. To show any relation Pearson chi square (χ^2) test was done (Table 3). Pearson chi square (χ^2) test showed that there is statistically significant relation between interappointment pain and use of hand files, use of rotary files, crown down technique, systemic use of analgesics, systemic use of antibiotics, use of intracanal corticosteroids, intracanal antibiotics intracanal calcium hydroxide and sodium hypochlorite irritant having $p < 0.05$ (Table 3).

Use of step back technique and rubber dam showed no relation with inter appointment pain having $p > 0.05$. Linear-by-linear association test indicated that there was no significant trend for inter appointment pain to increase with use of endodontic hand file, use of crown down technique, use of intracanal antibiotics and

intracanal corticosteroids having $p > 0.05$ (Table 3). Use of rotary files, use of systemic analgesics, use of systemic antibiotics, use of intracanal calcium hydroxide, sodium hypochlorite irrigant showed significant trend for increase in interappointment pain having ($p < 0.05$).

Table 1: Cross tabulations and relationships between endodontic procedures and interappointment pain

Procedural steps	Inter appointment pain	Never	Rarely	Occasionally	Frequently	Always	Total
Use endodontic hand file	Rarely	0	2	4	0	89	95
	Occasionally	0	0	8	8	62	78
	Total	0	2	12	8	151	173
Use of rotary files	Rarely	23	18	16	14	24	95
	Occasionally	38	10	6	4	20	78
	Total	61	28	22	18	44	173
Use of step back technique	Rarely	3	24	15	5	48	95
	Occasionally	0	15	7	11	45	78
	Total	3	39	22	16	93	173
Use of crown down technique	Rarely	3	24	16	26	26	95
	Occasionally	6	2	39	11	20	78
	Total	9	26	55	37	46	173
Use of systemic analgesics	Rarely	0	9	34	21	31	95
	Occasionally	0	0	5	35	38	78
	Total	0	9	39	56	69	173
Use of systemic antibiotics	Rarely	9	17	13	23	33	95
	Occasionally	0	5	13	29	31	78
	Total	9	22	26	52	64	173
Use of intracanal cortico-steroids	Rarely	32	21	28	9	5	95
	Occasionally	24	30	21	3	0	78
	Total	56	51	49	12	5	173
Use of intracanal antibiotics	Rarely	46	25	24	0	0	95
	Occasionally	35	33	10	0	0	78
	Total	81	58	34	0	0	173
Intracanal calcium hydroxide	Rarely	0	8	35	43	9	95
	Occasionally	0	1	16	34	27	78
	Total	0	9	51	77	36	173
Sodium hypochlorite as irrigant	Rarely	0	0	0	11	84	95
	Occasionally	0	0	0	0	78	78
	Total	0	0	0	11	162	173

Table 2: Cross Tabulations and Relationships

Use of rubber dam	Inter appointment pain		Total
	no	yes	
Rarely	64	31	95
Occasionally	55	23	78
total	119	54	173

Table 3: Critical values of Chi Squares Distribution

Relation between inter appointment pain and endodontic procedures	hand file	Rotary File	Step back technique	Crown down technique	Systemic analgesics	Systemic antibiotic	Intracanal cortico-steroids	Intra canal antibiotics	Intra canal CaOH2	Sodium hypochlorite irrigant	Rubber dam
Pearson chi square	14.632	14.912	8.747	34.762	33.426	14.77	10.159	6.757	21.108	9.645	.197
	$p = 0.001^{\square}$	$p = 0.005^{\square}$	$p = 0.059$	$p = 0.000^{\square}$	$p = 0.000^{\square}$	$p = 0.004^{\square}$	$p = 0.036^{\square}$	$p = 0.038^{\square}$	$p = 0.000^{\square}$	$p = 0.003^{\square}$	$p = 0.657$
Linear by Linear Association	2.884	4.336	3.135	0.029	21.350	8.318	2.730	0.570	19.619	9.589	.196
	$p = 0.110^{\dagger}$	$p = 0.037$	$p = 0.079$	$p = 0.895^{\dagger}$	$p = 0.000$	$p = 0.005$	$p = 0.116^{\dagger}$	$p = 0.494^{\dagger}$	$p = 0.000$	$P = 0.003^{\dagger}$	$P = 0.65$

$^{\square}$ p value < 0.05 shows the relation exists rejecting the null hypothesis.

† p value > 0.05 shows no significant trend for increase in interappointment pain

† For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results.

DISCUSSION

A continuous effort in technological advancement in the field of endodontics is taking to preserve the tooth peridontium integrity without causing much discomfort to patients. Earlier, numerous comprehensive surveys that have been conducted to determine the frequency with which endodontic technologies and material were used in endodontic practice by several authors Michelle Lee *et al* in 2009¹⁰, Selen *et. al.* in 2015¹¹, Gatewood *et. al.* 1990.¹² This survey was conducted to determine the preferred materials and methods opted by practitioner and how these variables influence the occurrence of interappointment pain. Predominant factors causing pain of pulpal or periapical origin are bacteria or local tissue damage producing inflammation there by inciting pain. The bacterial originated pain is relieved with antimicrobial agents and pain as a result of tissue injury is relieved with anti-inflammatory agents. Clinically pain causing factors may be categorized as patient related or treatment related. The patient related factors *i.e.* Pre-existing pulpal and periapical status have greater influence on inter appointment or post endodontic pain.⁸ All instrumentation techniques promote apical extrusion of debris but the amount of extruded material varies depending on type of technique.^{13,14} Crown-down techniques, both hand or engine-driven instruments extrude less debris and should be preferred for the root canal instrumentation. Low incidence of flare up was reported with crown down modified technique.¹⁵ In the present study inclination was seen for no significant trend for increase in interappointment pain with crown down technique and stills only 26.6% of dentists were always using this technique. Hand instruments compared to rotary instruments associated more with interappointment pain.¹⁶ Hand instruments used in step back technique has caused more apical extrusion than hand protaper and rotary instruments.¹⁷ Significant trend for increase in interappointment pain has been seen with rotary instruments and no increase in trend had been observed with hand instruments in this study. Though almost all the rotary instruments follow crown down technique in root canal preparation but control on its apical progression is required. There was moderately lesser amount of debris and irrigant extrusion observed by ProTaper hand as compared to M-two rotary.¹⁸ Hand or engine-driven instrumentation that uses rotation seemed to reduce significantly the amount of debris extruded apically when compared with a push-pull (filing) technique. Decreased apical extrusion of debris has a strong implication for a decreased incidence of postoperative inflammation and pain. In this present data probably, dentists were using hand protaper as these are cheaper and better alternative.

In spite of intracanal irrigants being cytotoxic, clinical trials had shown that substances used for irrigation or intracanal medication might have no influence on the occurrence of postoperative symptoms.¹⁹ However, severe reactions had been reported after extrusion of some commonly used substances to the periradicular tissues.²⁰ In the present study with the use of calcium hydroxide and sodium hypochlorite significant trend for increase in inter appointment pain had been seen. In the present study 20.8 % of dentist always used calcium hydroxide as intracanal medicament and 93.6 % of dentist always used sodium hypochlorite as irrigant. The calcium hydroxide, a widely used intra canal medicament, has antibacterial and tissue altering properties (tissue coagulation, bone necrosis, tissue dissolution and cytotoxicity effect)²¹⁻²⁴, so

has a tendency to initiate periapical inflammation if comes in contact with periapical tissues. Calcium hydroxide was not very effective in reducing post-treatment pain when used alone. With the exception of placement of intracanal steroids placing nothing in the prepared canal would have reduced effect in interappointment pain.⁸ In the present study 37 % of dentists had always prescribed systemic antibiotics. Antibiotics were frequently prescribed for endodontic pain.^{25,26} Use of systemic antibiotics in endodontic had carried no justification; it could only be indicated in case of fever or associated swelling.²⁷ In our survey 39.9% of dentists always prescribed analgesics. In this study significant trend for increase in inter appointment pain had been seen with the use of systemic antibiotics and analgesics. Prophylactic administration of antibiotics was not related to reduce post operative pain based on clinical trials. NSAIDS are effective in reducing endodontic pain.² In intracanal antibiotics usage, 46.8% of dentists never used it locally in the root canals whereas 37% of dentists always had used systemic antibiotics. For antibiotics, to show antimicrobial activity, it should reach to the site of infecting microbes through circulation therefore systemic action of antimicrobials became less effective in necrotic and pulp less tooth.²⁸ Systemic use of antimicrobial is also associated with various side effects, hypersensitivity, toxic reactions. Local application of antimicrobial is more effective as higher localized concentration of antibiotic is available. Local antimicrobial application is also effective in reimplantation and regenerative endodontics. 32.4% of dentists had never used intra canal corticosteroids and only 2.4 % of dentists definitely used intra canal corticosteroids. Oral 30 mg prednisolone administration in endodontic treatment had significant impact on post endodontic pain.²⁹ Intracanal use of corticosteroid antibiotic paste had rapidly and significantly reduced inter appointment pain.³⁰ In present analysis no significant trend for increase in inter appointment pain was seen with the use of intra canal antibiotics and intra canal corticosteroids. Intracanal use of ledermix paste was less associated with pain of acute apical periodontitis compared to calcium hydroxide or no dressing.³¹ Rubber dam is mandatory for endodontic treatments.³² Only 32.2 % of dentists used the rubber dam in this survey. Less than 30% of respondents in Belgium used dam for isolation.³³ 30.3% of dentists in North West of England routinely used the rubber dam.³⁴ Rubber dam is an imperative tool in infection control in the present time of SARS like (COVID-19) infections as it prevent spread of aerosols besides improving visibility and clinical efficacy moreover it is potentially dangerous and legally indefensible doing endodontic practice without rubber dam.

CONCLUSION

Cross sectional study was carried out to find frequency of use of different endodontic procedures then further the relationship of these endodontic techniques used by dentist and inter appointment pain observed in clinical setting. After applying chi square (χ^2) tests study indicated that there is no significant relationship between inter appointment pain and use of step back techniques. Whereas significant relationship was observed with the use of endodontic hand file, endodontic rotary file, crown down technique, systemic analgesics, systemic antibiotics, intra canal corticosteroid, intra canal antibiotics, calcium hydroxide and sodium hypochlorite as irritant. On application of the linear-by-

linear association test, the interappointment pain showed decrease trend with crown down technique, use of intra canal corticosteroid and intra canal antibiotics. In the present study data was gathered from the clinician. This gave the indirect insight into the factors that could help in controlling the interappointment pain in the patients. Certainly, quantitatively more data is required to get conclusive information.

ETHICAL APPROVAL

Ethical approval was taken from IEC (Institutional Ethical Committee), Government Medical College and Hospital, Jammu (Ethical clearance no. 542/SCRA dated 8/5/18).

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