

# Effect of Apical Patency on Postoperative Pain after Single-visit Endodontic Treatment in Necrotic Teeth with Asymptomatic Apical Periodontitis: A Randomised Control Trial

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## ABSTRACT

**Objective:** To find out the effect of apical patency on postoperative pain after single-visit endodontic treatment in necrotic teeth with asymptomatic apical periodontitis.

**Study Design:** Single blind randomised clinical trial.

**Place and Duration of Study:** Department of Operative Dentistry, Armed Forces Institute of Dentistry, Rawalpindi, Pakistan, from June to December 2020.

**Methodology:** A total of 240 patients with good general health presenting with asymptomatic apical periodontitis in their mandibular first molar teeth were selected and randomly divided into two equal groups with the help of scientific number table. Endodontic therapy was initiated and root canals were prepared with ProTaper Next system. In the Patency group, a size 10 K-file was used as patency file and carried 01mm beyond working length between successive files. In the non-patency group, the file was carried till the working length. Obturation was done with cold lateral condensation using Pro Taper Next GP points, and permanent restoration was done with composite. The patients were informed to record pain scores after 24 and 48 hours and bring the VAS after one week. The data was analysed using SPSS version 22.

**Results:** There were 137 (57.08%) female and 103 (42.92%) male patients; 78 (65%) of patients in Patency group and 67 (55.83%) in Non-patency group, had no pain after 24 hours ( $p=0.345$ ). In Patency group, 101 (84.17%) patients had no pain after 48 hours as compared to 98 (81.67%) patients of Non-patency group ( $p = 0.649$ ). So apical patency reduced pain, but not in statistically significant proportion.

**Conclusion:** Maintaining apical patency in necrosed teeth with asymptomatic apical periodontitis does not significantly reduce postoperative pain after single visit endodontic treatment.

**Key Words:** Apical patency, Postoperative pain, Asymptomatic apical periodontitis.

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## INTRODUCTION

Postoperative pain is a frequent complication during and after endodontic treatment; and has been estimated to be between 3-58%.<sup>1</sup> In necrotic teeth with asymptomatic apical periodontitis, there is a local balance between the microbial flora and the host defense mechanisms.<sup>2</sup>

During canal preparation, various irritants like dentinal debris, necrotic pulp remnants, medicaments and irrigating solutions can gain access to the peri-apical tissues disturbing this balance to cause peri-apical inflammation and pain.<sup>1,2</sup> The incidence of postoperative pain is low in patients with a vital pulp without any peri-radicular pathosis; and is highest in patients who present with severe preoperative pain and swelling, particularly with a necrotic pulp and peri-radicular pathosis. Thus any procedure in close proximity to the peri-apical tissues has a potential to cause postoperative pain.<sup>3</sup>

Instrumentation in apical third part of the root canal system can lead to iatrogenic mishaps including blockage either due to dental hard and soft tissue debris or pulpal remnants, transportations, ledges and perforations.<sup>4</sup> Adequate debridement of the root canals, especially the apical third portion, is quite essential for the long term success of a root canal treated tooth.<sup>5</sup>

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However, complete debridement of the apical portions presents challenges because of its complex and unpredictable anatomy; and to overcome this problem, maintaining apical patency has been suggested in the literature.<sup>5</sup>

The American Association of Endodontists has defined apical patency as a technique in which the apical portion of the root canal is maintained free of debris by recapitulation, using a small size file through the apical foramen.<sup>6</sup> Maintaining apical patency has the advantage of preventing accumulation of debris in the apical third with the decreased possibility of procedural accidents, like ledges and perforations; which increases the success of endodontic treatment.<sup>7,8</sup> In addition, helping to maintain the working length throughout the procedure, it improves tactile sensation, and facilitates irrigation in the apical third of the root canal system.<sup>8,9</sup>

However, the use of this technique is quite controversial owing to the risk of extrusion of debris and irrigating solutions resulting in inflammation of the peri-apical tissues as shown by Adham *et al.*<sup>10</sup> However, study by Snigdha *et al.*<sup>11</sup> reported significantly less postoperative pain when apical patency was maintained in teeth with necrotic pulps. A study by Arora *et al.* showed that apical Patency group had significant less pain (34%) as compared to Non-patency group (52%,  $p = 0.163$ ).<sup>12</sup>

The aim of this study was to compare the incidence of postoperative pain with and without apical patency after 24 and 48 hours with single-visit endodontic treatment with necrotic pulp and asymptomatic apical periodontitis.

## METHODOLOGY

After taking approval from the Ethical Committee of this Institution, a prospective randomised clinical study was planned at Operative Department from 01 June 2020 to 31 December 2020. This trial was registered on clinical trials database of U.S. National Library of Medicine with registration # NCT04551209. After taking informed consent, 240 patients of 20-50 years of age from both genders with good general, mental and physical health, were selected for this study.

The sample size was calculated by using the Clin Calc calculator. With a level of significance 5%, with power of test kept at 80%, a total sample size of 236 patients was calculated, which was increased to 240, with 120 patients in each of the two groups without any lost-to-follow-up, based on the population proportion A = 34% and population proportion B = 52%.<sup>12</sup>

The first mandibular molar teeth with asymptomatic apical periodontitis with necrotic pulps, without any intra-oral or extra-oral swelling or any draining sinus tract, were selected for this study. Patients on preoperative analgesics and antibiotics, immunocompromised patients, pregnant and lactating mothers were all excluded from this study.

The patients reporting to the Department of Operative Dentistry, who were advised endodontic treatment of their mandibular first molar, were screened for inclusion by taking history, performing relevant clinical examination and necessary investigations

along with peri-apical radiographs. The whole procedure of the study was explained to the patients in Urdu. After taking written informed consent from the willing participants of this study, the procedure was started.

Two groups were formed by simple randomisation with the help of scientific number table into group A (Patency group) and Group B (Non-patency group).

Root canal treatment was initiated under local anesthesia (lignocaine septodont). Working length was obtained with Root ZX II J MORITA apex locator and confirmed with a radiograph. The root canals were instrumented with Dentsply ProTaper Next system under copious irrigation with 5.25% sodium hypochlorite (NaOCl) (Parcan Septodont) and 17% EDTA solution (PDSwiss).

In Patency group, a size 10 K file (MANI Japan) was passed beyond the apical foramen between each instrument change to maintain apical patency, while in Non-patency group, K file was carried up to the working length only. A final peri-apical radiograph was taken in the patency group with the 10 K patency file 01mm beyond the apical foramen to confirm patency.

Obturation was done with cold lateral condensation using Dentsply Pro Taper Next GP points and permanent restoration was done with Spectrum Dental Composite Dentsply. At the end of this appointment, patients were given a visual analogue scale (VAS), and were advised to mark at the scale according to his pain intensity after 24 hours and 48 hours, and were asked to bring these readings with them on the next scheduled visit after one week for tooth preparation for definitive indirect restorations. VAS scores of less than 4 were considered as no pain, score between 4-7 were considered as mild and/or moderate pain, and scores of 8 and above were considered as severe pain. (no pain = <3, moderate pain = >4 to 7, severe pain = > 8). The data was analysed using SPSS version 22. Frequencies and percentages were calculated for categorical variables like gender, age-groups and inter-appointment pain. Chi-square test was used to compare the frequency of pain between the two groups after 24 and 48 hours of endodontic treatment. The p value of <0.05 was considered significant.

## RESULTS

Total sample was 240 patients having necrotic mandibular first molar teeth with asymptomatic apical periodontitis on single side. Out of total sample, 103 (42.92%) were males, out of which 55 (45.83%) were in Patency group and 48 (40%) in Non-patency group; 137 (57.08%) were females, out of which 65 (54.17%) were in Patency group and 72 (60%) in Non-patency group. Majority of the patients were in age group range of 20-40 years. Gender was found to have no significant association with the incidence of postoperative pain. The p values after 24 hours for male gender and female gender were 0.142 and 0.650; and after 48 hours it were 0.144 and 0.470, respectively. Gender and age distribution were calculated, and data is presented in Table I. In Patency group after 24 hours, 78 (65%) of patients had no pain; while in Non-patency group, 67 (55.83%) had no pain with  $p = 0.345$ . Patency group patients had less pain after 48 hours as well ( $p = 0.649$ , Table II).

**Table I: Gender and age distribution and frequency in Patency group & Non-patency group.**

Variables		Patency group (n=120)		Non patency group (n=120)	
		Frequency(n)	Percentages (%)	Frequency (n)	Percentages (%)
Gender	Male (n=103)	55	45.83%	48	40%
	Female (n=137)	65	54.17%	72	60%
Age	20-30	50	41.67%	53	44.17
	31-40	51	42.5%	60	50%
	41-50	19	15.83%	7	5.83%

**Table II: Association between gender and postoperative pain in Patency group and Non-patency group after 24 hours and 48 hours.**

Post op hours	Gender	Groups	Pain severity n (%)			Total	p-value*
			No pain	Mild pain	Severe pain		
24 hours	Male	Patency	35 (33.98%)	16 (15.53%)	4 (3.88%)	55 (53.40%)	0.14
		Non Patency	22 (21.36%)	23 (22.33%)	3 (2.91%)	48 (46.60%)	
	Female	Patency	43 (31.39%)	17 (12.41%)	5 (3.65%)	65 (47.45%)	0.65
		Non Patency	45 (32.85%)	18 (13.14%)	9 (6.56%)	72 (52.55%)	
48 hours	Male	Patency group	48 (44.86%)	6 (5.61%)	1 (0.93%)	55 (51.40%)	0.14
		Non patency	38 (35.51%)	10 (9.35%)	4 (3.74%)	52 (48.60%)	
	Female	Patency	53 (39.85%)	9 (6.77%)	3 (2.25%)	65 (48.87%)	0.47
		Non patency	60 (45.11%)	5 (3.76%)	3 (2.25%)	68 (51.13%)	

Incidence of pain in Patency group & Non-patency group after 24 hours and 48 hours.

Post op hours	Pain	Patency group (n=120)	Non patency group (n=120)	p-value*
24 hours	No pain	78 (65%)	67 (55.83%)	0.345
	Mild pain	33 (27.5%)	41 (34.17%)	
	Severe pain	9 (7.5%)	12 (10%)	
48 ho48 hours	No pain	101 (84.17%)	98 (81.67%)	0.649
	Mild pain	15 (12.5%)	15 (12.5%)	
	Severe pain	4 (3.33%)	7 (5.83%)	

Chi-square tests applied\*

## DISCUSSION

The idea of apical patency was first advocated by Buchanan, describing a patency file as a small K-file, which would passively move through the minor apical diameter and beyond the apical foramen without widening it.<sup>13</sup> Over the years, numerous authors have advocated the use of a patency file because it causes less apical leakage, prevents bacterial inoculation of peri-apical tissues, and improves debridement and irrigation of the apical third of the root canal system, thus reducing the chances of postoperative pain.<sup>14,15</sup> There have also been conflicting studies on the use of a patency file. Tinaz *et al.* reported greater extrusion of irrigant solution into the peri-apical tissues;<sup>16</sup> Goldberg *et al.* reported transportation of apical third of the canal with maintaining apical patency.<sup>17</sup>

In the present study, postoperative pain in teeth with necrotic pulp with and without apical patency was compared. Both groups showed a reduction in pain over the 24 hours period after endodontic treatment. In the Patency group after 24 hours, 65% of patients had no pain; while in Non-patency group, 55.83% had no pain. Patency group patients had less pain after 48 hours as well. Although the patients in the patency group had comparatively less pain, the results were found to be statistically insignificant. A

similar study by Arslan *et al.* compared incidence of postoperative pain with apical patency in teeth with apical periodontitis having necrosed pulps;<sup>18</sup> they also concluded that although apical patency did reduce pain more than the control group and there was less incidence of flare-up, but the results were not statistically significant. Another study compared postoperative pain; while maintaining apical patency in teeth with necrotic pulp and asymptomatic apical periodontitis also concluded that pain was significantly less in the Patency group compared to the Non-patency group during the first five days, after which the results were insignificant.<sup>19</sup> Likewise, other studies also concluded that maintaining apical patency reduced the incidence of flare-up.<sup>20-22</sup>

A study by Ahmed *et al.* on the effect of apical patency on postoperative pain concluded that apical patency significantly decreases postoperative pain in teeth with necrotic pulp and apical periodontitis.<sup>23</sup> This is similar to the present study in which the authors found no statistically significant differences in postoperative pain reduction between the Patency and Non-patency group. The less incidence of pain in the Patency group can be attributed to the fact that maintaining apical patency helps in clearing bacterial and pulpal debris in the apical third along with improving irrigation which leads to less peri-apical inflammation and subsequently reduced pain.<sup>15</sup>

Analysing a single variable as a factor responsible for postoperative pain is difficult as pain is a subjective phenomenon and is influenced by multiple factors. It is influenced by psychological, emotional, cultural and social behaviors. Different individuals respond differently to varying degrees of pain depending on their threshold for it. The preoperative pain also influences postoperative pain in endodontics.<sup>24</sup> Pain can also be strongly influenced by the element of fear. The dental treatment is often a fear and anxiety provoking event for many patients that could influence their current treatment outcome and response to that treatment in the future.<sup>25</sup>

It is also important to point out that the present study included mandibular first molars with necrotic pulp and asymptomatic apical periodontitis only; and due to the specific nature of the tooth, the results of this study cannot be generalised to teeth with vital pulps without apical periodontitis. Sample size should also be increased for future studies on the topic. The overall success of apical patency on the success of root canal treatment could form a basis for future studies.

This was a single blind randomised control trial, thus it would have been better if we had done double blinding. But as in this trial, a single operator was doing the whole clinical procedure so it was not possible for him to do double blinding. Preoperative pain was not calculated. The effect of this on the present results is, therefore, unknown.

## CONCLUSION

Maintaining apical patency in necrosed asymptomatic apical periodontitis teeth does not significantly reduce postoperative pain after single-visit endodontic treatment.

### DISCLOSURE:

The article is original and not presented anywhere else.

### FUNDING:

All patients were entitled for free treatment.

### ETHICAL APPROVAL:

Ethical approval was taken from Institutional Review Board of Armed Forces Institute of Dentistry, CMH, Rawalpindi prior to the initiation of study. (AFID No. 905/Trg-ABP1K2, dated 26 May 2020).

### PATIENTS' CONSENT:

Informed consents were taken from all patients before writing the article.

### CONFLICT OF INTEREST:

The authors declared no conflict of interest.

### AUTHORS' CONTRIBUTION:

AY: Supervised the study, helped in manuscript writing, finalised the study.

FA: Literature review, data collection and results.

FB: Reference citation and proofreading of the article.

MA: Data collection and manuscript writing.

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