

Prevalence of post-endodontic flare-ups and host-related factors

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ABSTRACT

Background. Root canals feature a high incidence of post-treatment flare-ups, characterized by pain, swelling, or discomfort following endodontic procedures, which remain a concern in dental practice. This study aims to evaluate the host-related factors behind the prevalence of post-endodontic flare-ups.

Methodology. A retrospective study was conducted on the records of 93 patients who were treated endodontically between January 2017 and December 2021. Data extracted from records included age, medical conditions, diagnosis, and tooth type. SPSS 27.0 was used to analyze the data. Multivariate logistic regression analysis was employed to identify significant predictors while controlling for potential confounding factors.

Results. The flare-up rate among patients who had received endodontic treatment was 31.2% in the study population. Multivariate logistic regression analysis demonstrated that age and the presence of a vital pulp were significant predictors of flare-ups. Older patients exhibited an increased likelihood of experiencing flare-ups ($p < 0.05$), suggesting age-related factors may influence post-treatment outcomes. Additionally, patients with a vital pulp had significantly higher odds of flare-ups ($p < 0.05$), underscoring the importance of preserving pulp vitality during endodontic procedures. Medical condition, arch, and tooth type did not emerge as significant predictors ($p > 0.05$).

Conclusion. The study provided insights into the frequency of post-endodontic flare-ups and the impact of host-related factors on their occurrence. Age and vital pulp were found to be important predictors, highlighting the significance of individualized treatment planning. These results highlight the possibility of improved patient outcomes through a thorough understanding of post-endodontic problems and contribute to evidence-based endodontic practice.

Keywords: flare-up, prevalence, endodontic, tooth status, vital pulp

INTRODUCTION

Endodontic therapy, commonly termed root canal treatment, is fundamental to the practice of dentistry and aims to preserve the health and function of the natural dentition. Recent years have shown great advances in endodontic techniques. Despite this, complications from endodontic interventions persist, such as flare-ups, that continue to be a challenge to the dental fraternity. Flare-ups following endodontic treatment are most commonly defined

as post-treatment pain and/or swelling that results in unscheduled patient visits for pain relief [1]. Moreover, it is highly preventable and affected by a number of factors related to the patient, i.e., gender and age; to the treated tooth, such as type of tooth and pulp status; and to the treatment performed, i.e., retreatment or root canal therapy [2].

While there is no consensus regarding the causes of flare-ups, scholars generally acknowledge that the phenomenon is multifactorial, involving factors pertaining to the host, the treatment, and endodon-

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tic infection [3]. Patient age, gender, periapical condition, tooth position, systemic disorders, and pre-operative symptoms, as well as the skill of the dentist performing the treatment, have all been studied as potential factors behind flare-ups [4]. Previous research indicates that many etiological factors, including mechanical, chemical, and microbial factors, contribute to the development of post-endodontic flare-ups [5]. Additionally, the degree of injury to the peri-radicular tissue, the severity of the injury, and the intensity of the inflammatory response appear to be closely related to flare-ups [6].

Several studies have shown that the size of the apical foramina is larger in young individuals and tends to decrease with age [7]. This leads to more extrusion of irrigants and infected debris in younger teeth, which may be a causative factor for flare-ups [8,9].

The hormone cortisol is involved in the processing of pain mechanisms and the regulation of the feeling of pain. It is excreted in higher amounts in males than in females, which may be the reason why flare-up incidence is higher in females [10,11]. Acute inflammatory responses, caused by the extrusion of debris during the chemo-mechanical preparation of canals, are suppressed by steroids. Therefore, patients who use systemic steroids to treat systemic diseases exhibit lower post-endodontic flare-up rates [11]. Notably, pre-treatment pain is strongly related to the incidence of post-treatment pain [12]. Additionally, mandibular molars have a higher risk of postoperative pain [13].

An understanding of the factors resulting in post-endodontic flareups facilitates successful and complete endodontic intervention. Hence, the current study was undertaken to evaluate the prevalence of flare-ups following endodontic treatment and to assess the host-related factors that may contribute to their prevalence. By quantifying the prevalence of post-endodontic flare-ups in a diverse patient population, this study provides valuable insights into the frequency of this phenomenon, allowing for better patient counselling and expectation management.

METHODOLOGY

A retrospective study was conducted to determine the prevalence of endodontic flare-ups and their associated host factors. Ethical clearance was obtained from the Deanship of Scientific Research at Najran University (442-40-53051-DS). The study was conducted as per the guidelines of the World Declaration of Helsinki, and every effort was made to ensure the confidentiality of all records included. The clinical records of 93 patients who had undergone root canal treatment between January 2017

and December 2021 were examined. Patients, aged 18 years and above, of both genders, who had complete dental records and completed their treatment were included in this study. Patients who did not complete their treatment or who presented with a history of systemic conditions that affected the immune response were excluded.

The procedure for root canal treatment in all patients followed a standardized protocol. The pulpal canals were chemo-mechanically prepared and irrigated in the first appointment, following which a temporary filling was placed. At the subsequent visit, the patients underwent obturation and restoration. The instrumentation of the canals was performed with hand and rotary files using 2.5-5.25% sodium hypochlorite in standard needle irrigation. Following instrumentation, calcium hydroxide (CaOH₂) was placed in the canal(s), and the tooth was temporized. The patients then scheduled an appointment to complete the root canal procedure at a later date.

The data was collected from patient records. Variables extracted were

1. Status of the root canal at the time of treatment (i.e., vital pulp, non-vital pulp, or previously initiated therapy)
2. Host-related factors
3. Age (patients are divided into three age groups)
4. Tooth type (i.e., incisor, canine, premolar, or molar)
5. Arch (i.e., maxillary or mandibular)
6. Medical conditions (e.g., asthma, diabetes, epilepsy, hypertension)
7. Smoking status

Flare-up was marked as present when it was clearly mentioned in the records. Data on their symptoms, frequency, and management was also collected during the follow-up.

Statistical Analysis

Excel 2016 spreadsheets and the Statistical Package for Social Sciences (SPSS) 27.0 version were used for the analysis of the collected data. To measure the impact of multiple variables. The association of flare-ups with host factors was tested using Pearson's chi-square (2) test. A multiple logistic regression model was run to predict the relationship between flare-ups and different host-related factors. The statistical significance level of 5% ($P < 0.05$) was used for all analyses.

RESULTS

Patient characteristics:

A total of 93 patient records were recruited for the study, out of 330 reviewed. The remaining 237

patients were excluded because they took antibiotics before treatment or did not complete their treatment. An equal distribution of gender was noted, with 48% males and 45% females. Patients were categorised into three age groups. 54 (58%) were less than 30 years old, 38 (41%) were between 31 and 60 years old, and 1 (1%) subject was above 60 years old. Multi-canal teeth were recorded in 46% of the cases. The majority (61%) of the participants reported pain as a pre-operative symptom.

Occurrence of endodontic flare-ups:

A total of 29 (31.2%) patients with flare-ups were identified, as seen in Table 1. A prevalence of 18.5, 47.7, and 100% was reported in patients 30, 31-60, and 61 years old, respectively. This distribution of flare-up prevalence between the age groups was statistically significant (P = 0.004). A total of 23 (37.1%) patients in the vital group experienced flare-ups, while 22 (27.3%) did in the non-vital group; no flare-ups were observed in the retreatment group. This finding was significant (p = 0.043). 33.9% of the conditions examined were seen in the maxillary arch and 26.5% in the mandibular arch. The type of tooth treated or the arch reported did not affect flare-up prevalence significantly.

Association of flare-ups with host-related factors

A multivariate logistic regression analysis was performed to identify significant predictors of post-endodontic flare-ups while controlling for potential confounding factors as observed in Table 2. The analysis considered various host-related factors, including age, medical condition, diagnosis, and tooth type. Age was found to be a statistically significant predictor of post-endodontic flare-ups (p <0.05). For each year of increase in age, the odds of experiencing a flare-up increased by 9.54 times, holding all other variables constant. The presence of a vital pulp was also identified as a significant predictor of post-endodontic flare-ups (p >0.05). Patients with a vital pulp had 3.293 times greater odds of experiencing a flare-up compared to those without a vital pulp, controlling for other variables. However, medical condition and tooth type were not found to be statistically significant predictors of post-endodontic flare-ups in the multivariate analysis (p >0.05).

DISCUSSION

The present study investigated the prevalence of post-endodontic flare-ups and explored the poten-

TABLE 1. The impact of host factors on flare-up prevalence

Variables	No. of cases	Flare-up	Percentage	Cramer's V	χ2	Statistical power	p-value
Age							
≤30	54	10	18.5	0.342	10.882a	0.521	0.004
31-60	38	18	47.7				
≥61	1	1	100				
Medical condition							
Normal	81	21	25.9	0.335	10.414	0.521	0.064
Diabetic	3	2	66.7				
Hypertension	4	2	50.0				
Allergy	1	1	100.0				
Epilepsy	2	2	100.0				
Asthma	2	1	50.0				
Arch							
Maxillary	59	20	33.9	0.077	0.555	0.521	0.456
Mandibular	34	9	26.5				
Tooth type							
Incisor	25	7	28.0	0.179	2.974	0.521	0.396
Canine	1	1	100.0				
Premolar	17	4	23.5				
Molar	50	17	34.0				
Diagnosis							
Vital Pulp	62	23	37.1	0.237	5.245*	0.521	0.043
Non-vital	22	6	27.3				
Retreatment	9	0	0.0				
Total	93	29	31.2				

Non-significant (P >0.05); Significant (P<0.05); ** = Highly significant (P<0.01)

TABLE 2. Summary of results from the logistic regression analysis to determine the host factors contributing to flare-up

	Regression coefficient (B)	Wald	p-value
Tooth	0.195(0.204, 0.914)	0.352	0.339 (NS)
Diagnosis	-0.985(0.499, 3.892)	3.293	0.049 *
Medical condition	0.685(0.352, 3.792)	1.04	0.051 (NS)
Age	0.061(0.023, 6.778)	9.54	0.009*

tial host-related factors contributing to these complications. Our findings revealed significant insights into the multifaceted nature of post-endodontic outcomes, particularly with regard to age and the presence of a vital pulp as predictive factors. Overall, 31.2% of the patients assessed in this study experienced flare-ups – a notably high rate.

Some medicines, such as piroxicam, dexamethasone, and deflazacort, effectively reduce post-operative pain when taken pre-operatively. These three medicines have been shown to have roughly equal effects in the treatment of post-endodontic flare-ups [14]. It had been demonstrated in previous studies that preoperative antibiotics reduce the likelihood of flare-ups [15]. Ibuprofen alone or in combination with other medicines has been shown to have the best effects when used within six hours of the procedure; therefore, it is the drug of choice for use in the early hours following root canal treatment [16].

There is a complex and controversial correlation between pain and pulp (vital or non-vital) status prior to treatment, but several reports indicate that there is a significant relationship between the two factors [17]. This study identified a significant difference in the occurrence of flare-ups between subjects in the vital group and subjects in the non-vital and retreatment groups: the rate of flare-ups in the vital group was high (37.1%) relative to that of flare-ups in the non-vital group (27.3%) and the retreatment group (0.0%). These results differ from those of a previous study, which reported that the vital group did not experience any post-operative pain [18]. Preserving the vitality of the dental pulp not only maintains the tooth's natural functions but also appears to contribute to improved post-endodontic healing. A vital pulp possesses the intrinsic ability to mount a localized immune response and stimulate reparative processes, potentially reducing the risk of post-treatment inflammation and discomfort. Additionally, the preservation of pulp vitality minimises the risk of endodontic-induced flare-ups, which can lead to patient dissatisfaction and additional clinical interventions.

This study highlighted the relationship between age and flare-ups. The rate of flare-up occurrence among those 30 or younger was 18.5%, while that among those aged 31-60 was 47.7%. There was only

one patient 61 or older, and that patient experienced a flare-up. Specifically, older patients demonstrated a lower likelihood of experiencing flare-ups. This observation suggests that age-related factors may play a crucial role in influencing post-endodontic outcomes. These results align with those of Azim et al., who found that patients 50 years of age or older had a flare-up rate eight times higher than that of patients between 20 and 49 years old [18]. Additionally, they align with another previous study that reported a higher rate of flare-up prevalence in patients aged 40-60 years [15]. Changes in humoral response and cell-mediated immunity with ageing are related both qualitatively and quantitatively to the incidence of flare-ups [19]. Several plausible explanations can be considered for this age-related phenomenon. It is conceivable that older individuals may exhibit a more robust immune response, which can contribute to better healing and reduced susceptibility to post-treatment complications. Additionally, age-related changes in pulp tissue, such as decreased vascularity or nerve density, may influence the overall response to endodontic procedures. The accumulation of dental and healthcare experiences over time could also lead to improved coping mechanisms and reduced anxiety related to dental procedures, potentially affecting the incidence of flare-ups [19]. Though our study establishes age as a significant predictor, further research is warranted to delve deeper into the specific mechanisms and biological factors associated with age-related variations in post-endodontic outcomes. Such investigations could contribute to more precise risk stratification and tailored treatment planning for patients across different age groups. The medical conditions of patients were recorded in the study of Fouad and Burleson, who reported that diabetes can be a pre-vailing factor for flare-ups [20].

Flare-ups are common after root canal treatments, and there is no surefire way to prevent them. Thus, patients should always be educated on the potential for post-treatment pain. Post-operative endodontic pain has multiple contributing factors; thus, practitioners should try to avoid iatrogenic injuries. The working length of root canals should be monitored strictly during the preparation process and the canal-shaping, cleaning, and obturation phases of all endodontic treatments.

The clinical implications of this finding are significant. Dental practitioners should prioritise strategies that promote pulp vitality, such as vital pulp therapy and conservative endodontic techniques, when managing cases requiring endodontic treatment. This approach aligns with the principles of minimally invasive dentistry and patient-centred care, emphasising the preservation of natural dental tissues and promoting better patient outcomes.

Certain limitations of the study need to be acknowledged. The retrospective design of the study exposes it to inherent biases and limitations associated with data collection from patient records. Prospective studies with larger, more diverse populations are needed to confirm and further elucidate the identified predictors. Our study particularly focused on certain host-related factors, but other variables, such as operator skill, treatment techniques, and anatomical factors, may also influence post-endodontic outcomes and could be confounding factors. Future research should incorporate a comprehensive approach to exploring these multifactorial interactions.

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CONCLUSION

This study revealed that age and flare-up prevalence are significantly correlated. However, this result should be interpreted carefully, as this study was limited by an insufficient number of samples. Additionally, further studies are required to firmly establish a link between medical conditions and immune responses that cause flare-ups.

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