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PROFICIENCY EVALUATION OF SINGLE-SESSION ENDODONTIC THERAPY FOR PULPAL NECROSIS AND ASYMPTOMATIC PERIAPICAL PERIODONTITIS

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ABSTRACT

Introduction: Effective infection control and minimizing post-obturation pain are critical aspects for the success of root canal treatment (RCT), irrespective of whether it's performed in single or multiple sessions. Single-visit RCT is increasingly recognized as a viable substitute for the traditional multiple-visit approach, reflecting its potential to enhance treatment outcomes.

Objectives: To. The objective of this study is to assess the short-term post-operative pain outcomes following single-visit endodontic treatment in patients with pulpal necrosis and asymptomatic periapical periodontitis.

Study design: Descriptive Cross-Sectional Study

Settings: Department of Operative Dentistry, Faryal Dental College, Lahore

Study duration: From March 2021 to August 2021.

Materials & Methods: Total 150 patients presenting with teeth affected by pulpal necrosis and asymptomatic periapical periodontitis were included based on clinical and radiographic examination findings. Single-visit endodontic treatment was performed on eligible teeth by experienced endodontists following standardized protocols. This included access cavity preparation, thorough cleaning and shaping of root canals using rotary instrumentation, irrigation with antimicrobial solutions, and obturation with biocompatible materials. Clinical and radiographic evaluations were conducted at baseline and follow-up appointments (at 1st day or 24 hours & 7th day post-treatment). Pain intensity was measured using the Visual Analog Scale (VAS), and patients' responses were documented accordingly. Outcome measures included pain assessment and successful treatment. Data were collected using standardized forms and radiographs.

Results: The mean age of the participants was 42.5±11.3. Gender distribution showed that 46.7% were male and 53.3% were female. Regarding dental arch, 68% of cases were maxillary and 32% were mandibular. A total of 130 patients (86.7%) experienced successful treatment. Overall, 87.33% of patients experienced no pain at 24 hours, increasing to 94% by the 7th day. Conversely, the

proportion reporting pain decreased from 12.66% to 6%. For patients with pulpal necrosis, 81.33% experienced no pain at 24 hours, increasing to 86% by the 7th day, with pain decreasing from 18.66% to 14%. In cases of pulpal necrosis with periapical periodontitis, 73.33% had no pain at 24 hours, rising to 88.6% by the 7th day, with pain decreasing from 26.66% to 11.3%. In the maxillary region, 75.33% had no pain at 24 hours, increasing to 82% by the 7th day, while in the mandibular region, 84.0% had no pain at 24 hours, rising to 90.6% by the 7th day.

Conclusion: In conclusion, our study demonstrates that mean post-obturation pain remains low in single-visit endodontics conducted on teeth with pulpal necrosis and asymptomatic periapical periodontitis, steadily decreasing from 24 hours to the 7th day post-treatment.

Keywords: Infection, Pain, Post-obturation, Root canal treatment (RCT), Single visit, Success

INTRODUCTION

Pulpal necrosis, a serious dental condition, arises from the death of the dental pulp within the tooth. This vital tissue, comprising nerves, blood vessels, and connective tissue, can succumb to various factors, including extensive decay, trauma, or infection. Pulpal necrosis often manifests as excruciating pain, abscess formation, and discoloration of the affected tooth. Left untreated, it can lead to severe complications such as dental abscesses or even systemic infections.[1,2] Asymptomatic periapical periodontitis is a common yet potentially concerning dental condition characterized by inflammation and infection surrounding the tooth's apex (root tip) in the absence of noticeable symptoms. Typically initiated by bacterial invasion through dental decay or trauma, this condition often progresses silently, without causing pain or discomfort initially. However, it can lead to bone destruction around the tooth's root, ultimately jeopardizing its stability.[3,4] Diagnosis usually involves clinical examination and dental X-rays revealing characteristic radiolucent lesions at the tooth's apex. Treatment options range from root canal therapy to tooth extraction, depending on the extent of damage. Timely intervention is crucial to prevent further dental and systemic complications. According to the World Health Organization (WHO), the global prevalence of pulpal and periapical diseases can vary significantly depending on Periapical periodontitis. Studies have shown that periapical lesions are prevalent in around 20-40% of the adult population worldwide.[5]

The pathophysiology of pulpal and periapical diseases involves a complex interplay of microbial invasion, host response, and tissue destruction. This provides a gateway for bacteria to infiltrate the pulp chamber, leading to inflammation and ultimately necrosis of the pulp tissue. As the infection progresses, it can spread through the root canal system and into the periapical tissues, resulting in periapical periodontitis.[6,7] Etiologically, dental caries is a primary contributor to pulpal necrosis, as the demineralization of tooth structure allows bacteria to penetrate deeper into the pulp. Traumatic injuries, such as fractures or luxations, can also disrupt the pulp's blood supply and introduce bacteria, accelerating pulp degeneration. Additionally, iatrogenic factors such as poorly performed dental procedures may inadvertently damage the pulp tissue, predisposing it to infection and necrosis.[8]

Single-visit endodontics, a modern approach to root canal therapy, the entire root canal procedure is completed in one appointment, streamlining the treatment process. After numbing the area, the dentist accesses the tooth's pulp chamber, removes infected or damaged tissue, cleanses and shapes the root canals, and then fills them with a biocompatible material to prevent reinfection.[9] Finally, a restoration such as a filling or crown is placed to protect and restore the tooth's function. This efficient approach reduces patient discomfort, minimizes the risk of contamination between appointments, and often provides immediate relief from symptoms, making it an attractive option for many individuals needing root canal therapy.[10]

By evaluating patient outcomes and treatment success rates, it will contribute crucial insights into the feasibility and effectiveness of this approach within the Pakistani population. This research addresses existing gaps in the literature by specifically focusing on the local context, considering factors such as socioeconomic status, access to dental care, and prevalent oral health practices.

Additionally, it will provide valuable data on the applicability and impact of single-visit endodontic therapy in resource-limited settings, informing evidence-based dental care strategies tailored to Pakistan's unique healthcare landscape.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at Department of Operative Dentistry, Faryal Dental College, Lahore March 2021 to August 2021. Ethical approval was obtained from institutional review board of hospital before the commencement of the study. Patients presenting with teeth affected by pulpal necrosis and asymptomatic periapical periodontitis were recruited based on clinical and radiographic examination findings. Informed consent was obtained from all participants before enrollment. Exclusion criteria included patients with systemic diseases affecting treatment outcomes and those requiring retreatment or with incomplete root canal instrumentation.

Single-visit endodontic treatment was performed on eligible teeth by experienced endodontists following standardized protocols. This included access cavity preparation, thorough cleaning and shaping of root canals using rotary instrumentation, irrigation with antimicrobial solutions, and obturation with biocompatible materials. Clinical and radiographic evaluations were conducted at baseline and follow-up appointments (at 1st day or 24 hours, post-treatment). At the post-operative recall, patients underwent evaluation to assess the presence of pain following obturation. Pain intensity was measured using the Visual Analog Scale (VAS), and patients' responses were documented accordingly. Outcome measures included pain assessment and successful treatment. Data were collected using standardized forms and radiographs.

Descriptive statistics were used to summarize patient demographics and baseline characteristics. Inferential statistics, such as chi-square tests was applied to analyze treatment outcomes. Statistical significance was set at $p < 0.05$.

STUDY RESULTS

The mean age of the participants was 42.5±11.3. The majority (60%) of patients fell within the age range of 20-40 years, while 40% were aged between 41-55 years. Gender distribution showed that 46.7% were male and 53.3% were female. Regarding dental arch, 68% of cases were maxillary and 32% were mandibular given in table 1. Table 2 displays the frequency and percentage of teeth involved in each tooth position. Among premolars, 40 (53.3%) were on the left and 35 (46.7%) on the right, totaling 75 (100%). For canines, 25 (45.5%) were on the left and 30 (54.5%) on the right, with a total of 55 (100%). Incisors showed 15 (42.9%) on the left and 20 (57.1%) on the right, totaling 35 (100%).

Table 3 presents the treatment outcome of patients following endodontic treatment. A total of 130 patients (86.7%) experienced successful treatment. The p-value for treatment success was found to be statistically significant at 0.001.

In Table 4, the frequency distribution of pain at 24 hours post-operative and the 7th day is presented. Overall, 87.33% of patients experienced no pain at 24 hours, increasing to 94% by the 7th day. Conversely, the proportion reporting pain decreased from 12.66% to 6%. For patients with pulpal necrosis, 81.33% experienced no pain at 24 hours, increasing to 86% by the 7th day, with pain decreasing from 18.66% to 14%. In cases of pulpal necrosis with periapical periodontitis, 73.33% had no pain at 24 hours, rising to 88.6% by the 7th day, with pain decreasing from 26.66% to 11.3%. In the maxillary region, 75.33% had no pain at 24 hours, increasing to 82% by the 7th day, while in the mandibular region, 84.0% had no pain at 24 hours, rising to 90.6% by the 7th day.

Table 1: Demographic characteristics of included patients

Variables	Characterstics	N(%)
Age	Mean±SD	42.5±11.3
	20-40	90(60%)
	41-55	60(40%)
Gender	Male	70 (46.7%)
	Female	80 (53.3%)
Arch	Maxillary	102(68%)
	Mandibular	48(32%)

Table 2: Frequency and percentage of teeth involved in each tooth position

Teeth Position	Left	Right	Total
Premolar	40 (53.3%)	35 (46.7%)	75 (100%)
Canine	25 (45.5%)	30 (54.5%)	55 (100%)
Incisor	15 (42.9%)	20 (57.1%)	35 (100%)

Table 3: Treatment outcome of patients following endodontic treatment

Variables	Characterstics	N(%)	P-value
Successful Treatment	Yes	130 (86.7%)	0.001
	No	20 (13.3%)	

Table 4: Frequency distribution of pain at 24 hours among both arches, in cases of pulpal necrosis and pulpal necrosis with periapical periodontitis

Variables	Characterstics	At 24 hours		At 7th day		P-value
		No Pain	Pain	No Pain	Pain	
24 hours & 7th day Post-operative pain	Overall Postoperative Pain	131(87.33%)	19(12.66%)	141(94%)	9(6%)	<0.05
	Pulpal Necrosis	122(81.33%)	28(18.66%)	129(86%)	21(14%)	<0.05
	Pulpal Necrosis with Periapical Periodontitis	110(73.33%)	40(26.66%)	133(88.6%)	17(11.3%)	<0.05
	Maxillary	113(75.33%)	37(24.66%)	123(82%)	27(18%)	<0.05
	Mandibular	126(84.0%)	24(16.0%)	136(90.6)	14(9.3%)	<0.05

DISCUSSION

Pulpal necrosis and asymptomatic periapical periodontitis are common dental conditions characterized by the death of dental pulp and inflammation around the tooth's apex, respectively. While often asymptomatic initially, both conditions can lead to severe complications if left untreated, including dental abscesses and systemic infections.[11] Single-visit endodontic treatment offers a streamlined approach to managing these conditions, completing the entire root canal therapy in a single dental appointment. This efficient method minimizes patient discomfort and inconvenience while maintaining high success rates, making it an attractive option for patients and clinicians alike in addressing pulpal and periapical pathologies.[12]

In our study, the mean age of participants was higher at 42.5±11.3 years compared to the study by Dall et al. (2010), where the average age was 29.32±9.18 years. While 60% of our patients fell within the age range of 20-40 years and 40% were aged between 41-55 years, Dall et al. found that most patients (68.84%) were between 16 to 35 years of age. Additionally, our study reported a

slightly higher proportion of male patients (46.7%) compared to Dall et al. (51%), although the gender distribution was generally similar.[13]

In our study, a balanced distribution of premolars, canines, and incisors was observed across the left and right sides of the oral cavity. Specifically, among premolars, 53.3% were on the left and 46.7% on the right; for canines, 45.5% were on the left and 54.5% on the right; and incisors showed 42.9% on the left and 57.1% on the right. This contrasts with Ince et al. (2009), where a higher prevalence of incisors and canines was observed in the maxilla (31.4%), followed by premolars (20.3%) and molars (8.2%), with a similar trend noted in the mandible.[14] Additionally, Oliveira et al. (2022) found that incisors were most affected by asymptomatic periapical periodontitis (AAP) in the upper arch (52.8%), while second premolars were most affected in the lower arch (46.2%).[15]These discrepancies underscore the importance of considering regional and population-specific factors when evaluating dental pathology and treatment outcomes. In our study, we observed a treatment success rate of 86.7%, indicating that 130 out of 150 patients experienced successful treatment. This outcome was statistically significant, with a p-value of 0.001, suggesting a strong association between treatment success and the variables studied. Conversely, Paredes et al. (2012) reported a notably higher treatment success rate of 96.57%, where 141 out of 146 teeth in the 1-visit group were classified as healed.[16]

Overall, there was a significant decrease in the proportion of patients reporting pain over time, with 87.33% experiencing no pain at 24 hours, increasing to 94% by the 7th day. Comparatively, Mushtaq et al. (2017) reported in their study, the proportion of patients experiencing no pain was slightly different, with 80.2% in the pulpal necrosis category and 71.1% in the pulpal necrosis with periapical periodontitis category. Furthermore, in terms of pain distribution among different arches, our study showed that 75.33% of patients in the maxillary arch and 84.0% in the mandibular arch experienced no pain at 24 hours post-operative. These percentages increased to 82% and 90.6%, respectively, by the 7th day. Conversely, Mushtaq et al. (2017) reported 74.4% of patients in the maxillary arch and 82.2% in the mandibular arch experienced no pain at 24 hours post-operative.[17]

Our study findings align with several previous studies on short-term follow-up after single-visit endodontic treatment. Su et al. (2015) and Schwendicke (2017), among others, have reported low levels of pain post-operatively, which diminish over time. Similarly, our study observed a significant decrease in pain from 24 hours to the 7th day post-operative, consistent with the pattern reported by these researchers. Furthermore, Alnegrish's (2019) findings mirror our results, indicating higher pain intensity in the initial hours post-operatively, followed by a gradual decrease. These consistent trends underscore the efficacy of single-visit endodontic treatment in managing post-operative pain and emphasize the importance of longitudinal pain assessment for accurate treatment evaluation.[20]

CONCLUSION

In conclusion, our study demonstrates that mean post-obturation pain remains low in single-visit endodontics conducted on teeth with pulpal necrosis and asymptomatic periapical periodontitis, steadily decreasing from 24 hours to the 7th day post-treatment.

Limitations:

The limitations of our study include the relatively short-term follow-up period, which may not capture long-term pain outcomes.

Suggestions / Recommendations

Further research with larger sample sizes and longer follow-up periods is recommended to validate the effectiveness of single-visit endodontic treatment in managing pain

Conflict of Interest / Disclosure

None.

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