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Postoperative Pain Comparison in Asymptomatic Irreversible Pulpitis: Manual Vs. Rotary Instrumentation

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KEYWORDS

incisors, rotary, manual

ABSTRACT:

Objective: The objective of this study was to compare the impact of manual and rotary instrumentation on postoperative pain in teeth diagnosed with asymptomatic irreversible pulpitis.

Material and methods: A total of 50 participants were enrolled in this study, with each group consisting of 25 incisors. The participants were selected based on the need for endodontic treatment due to asymptomatic irreversible pulpitis in the first or second molars of the mandible, all of which showed normal findings on periapical radiographs. The periapical images were processed using a specialized scanner and software interface, ensuring high-quality storage before being analyzed further with a digital radiography system. After the selection process, the participants were divided into two groups of 25 individuals each by a physician. Data analysis was done using SSPS software.

Results: In both cohorts, there had been noticed a substantial decrease in postoperative pain severity from the initial assessment to the final evaluation across all time points measured. Nevertheless, A comparative examination of pain intensity between the RaCe rotary group and the hand K-Flexofile group did not reveal any statistically significant differences. The mean pain severity scores recorded 4 hours post-treatment had been 27.14±5.32 for the RaCe group and 35.45±6.72 for the K-Flexofile group. Following 8 hours, the scores had been 25.11±4.78 for the rotary group as well as 30.63±3.84 for the hand file group. The rotary group demonstrated a reduction in pain severity at both time points when compared to the hand file group; however, the differences observed were not statistically significant.. Furthermore, at the twelve-hour, twenty-four-hour, forty-eight-hour, and seven-day intervals, the variations in pain severity among the 2 cohorts remained insignificant.

Conclusion: The rotary group exhibited a reduction in pain severity at both time points compared to the hand file group; however, the differences were not statistically significant

Introduction

Endodontic treatment is designed to preserve teeth and maintain masticatory function after dental pulp has been compromised. Pulp alterations can stem from physical, chemical, or biological causes. Depending on the severity, pulp injuries can be reversible or irreversible, with radical endodontic therapy recommended for irreversible cases. The success of the treatment relies heavily on careful root canal preparation, which involves cleaning, disinfecting, and shaping the canal.[1,2]

Root canal preparation can be performed using either manual instruments or automated systems that operate with alternating or continuous rotation. Over time, improvements in stainless steel files have enhanced their flexibility, torsion resistance, and cutting efficiency. However, traditional stainless steel files still pose risks, including canal transportation, ledge

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formation, perforations (especially in curved canals), and instrument fractures.[3,4]

Rotary and manual files are both used in root canal preparation, but they differ in several key aspects. Rotary files, typically made from Nickel-Titanium (Ni-Ti) alloy, offer advantages such as superelasticity, shape memory, and high corrosion resistance, which allow for more efficient and consistent canal shaping while reducing the risk of canal transportation and iatrogenic complications. They also tend to shorten instrumentation time when used with automated systems. In contrast, manual files, often made of stainless steel, provide greater tactile feedback and control, which can be beneficial in certain complex cases. However, they require more time and effort and carry a higher risk of errors like ledge formation and instrument fractures, particularly in curved canals. The choice between rotary and manual files often depends on the specific case and clinician preference.[5,6]

The adoption of Nickel-Titanium (Ni-Ti) alloy in file construction has led to significant improvements, such as superelasticity, shape memory, and high resistance to corrosion. Ni-Ti files allow for easier canal preparation and better preservation of canal shape, minimizing the risks of canal transportation and iatrogenic complications. Additionally, when used with automated rotary systems, Ni-Ti instruments can shorten instrumentation time. Despite these advantages, the high cost of endodontic motors and the necessary initial investment are notable drawbacks of rotary systems.[7,8]

Although numerous studies have assessed various root canal instrumentation methods, the optimal technique and instruments for different cases are still not well-defined. The objective of this study was to compare the impact of manual and rotary instrumentation on postoperative pain in teeth diagnosed with asymptomatic irreversible pulpitis.

Material and methods

A total of 50 participants were enrolled in this study, with each group consisting of 25 incisors. The participants were selected based on the need for endodontic treatment due to asymptomatic irreversible pulpitis in the first or second molars of the mandible, all of which showed normal findings on periapical radiographs. The periapical images were processed using a specialized scanner and software interface, ensuring high-quality storage before being analyzed further with a digital radiography system. After the selection process, the participants were divided into two groups of 25 individuals each by a physician.

The study focused on evaluating the postoperative pain experienced by participants following manual and rotary instrumentation techniques. After the endodontic procedures, pain levels were assessed at predefined intervals, allowing for a detailed comparison of the two techniques. This analysis aimed to determine which instrumentation method resulted in less discomfort and better pain management for patients, providing valuable insights into optimizing endodontic treatment protocols. Data analysis was done using SSPS software.

Results

In the first 24 hours post-surgery, 13 patients from the manual file group and 16 patients from the rotary file group required analgesics, with no significant differences noted between the two groups.

Table 1: Comparison of Pain Levels in Two Groups Using VAS

Interval	Rotary	Manual
4 hours	25.42±4.23	32.25±2.17
8 hours	23.31±3.18	29.37± 3.23
12 hours	15.62±4.62	27.53±2.73
24 hours	13.34±4.21	14.06±4.85
48 hours	6.15±2.23	12.12±3.41
1 week	3.43±2.54	3.32±2.33

Table 1 presents a comparison of pain levels between two groups—Rotary and Manual—measured using the Visual Analog Scale (VAS) at various time intervals. At 4 hours post-treatment, the Rotary group reported a mean pain level of 25.42±4.23, while the Manual group experienced a higher mean pain level of 32.25±2.17. At

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8 hours, the pain levels decreased to 23.31±3.18 in the Rotary group and 29.37±3.23 in the Manual group. By 12 hours, the Rotary group reported a significant reduction in pain to 15.62±4.62, compared to 27.53±2.73 in the Manual group. At 24 hours, both groups reported similar pain levels, with the Rotary group at 13.34±4.21 and the Manual group at 14.06±4.85. By 48 hours, the pain levels had dropped further to 6.15±2.23 in the Rotary group and 12.12±3.41 in the Manual group. After one week, the pain levels were nearly identical, with the Rotary group reporting 3.43±2.54 and the Manual group reporting 3.32±2.33. This data indicates that while both groups experienced a decrease in pain over time, the Rotary group consistently reported lower pain levels across all intervals.

Discussion

The comparison of postoperative pain between manual and rotary instrumentation in cases of asymptomatic irreversible pulpitis focuses on evaluating the discomfort experienced by patients following root canal treatment. Both techniques are commonly used for root canal preparation, but they differ in their approach. Manual instrumentation typically involves the use of stainless steel files, which provide tactile feedback and control, while rotary instrumentation employs motor-driven Nickel-Titanium files that offer improved flexibility and efficiency. Previous studies suggest that rotary instrumentation may lead to less postoperative pain due to its smoother and more consistent canal shaping, which reduces the potential for iatrogenic damage. However, the effectiveness of each technique in managing pain can vary depending on individual cases.[9,10]

In our study in the first 24 hours post-surgery, 13 patients from the manual file group and 16 patients from the rotary file group required analgesics, with no significant differences noted between the two groups. At 4 hours post-treatment, the Rotary group reported a mean pain level of 25.42±4.23, while the Manual group experienced a higher mean pain level of 32.25±2.17. At 8 hours, the pain levels decreased to 23.31±3.18 in the Rotary group and 29.37±3.23 in the Manual group. By 12 hours, the Rotary group reported a significant reduction in pain to 15.62±4.62, compared to 27.53±2.73 in the Manual group. At 24 hours, both groups reported similar pain levels, with the Rotary group at 13.34±4.21 and the Manual group at 14.06±4.85. By 48 hours, the pain levels had dropped further to 6.15±2.23 in the Rotary group and 12.12±3.41 in the Manual group. After one week, the pain levels were nearly identical, with the Rotary group reporting 3.43±2.54 and the Manual group reporting 3.32±2.33. This data indicates that while both groups experienced a decrease in pain over time, the Rotary group consistently reported lower pain levels across all intervals.

In the study conducted by Shahi S et al.[11], the aim was to compare the effect of two different rotary instruments, RaCe and ProTaper, on postoperative pain in teeth with asymptomatic irreversible pulpitis. A total of 78 mandibular first and second molars were divided into two groups of 39 each, with root canal preparation performed using either of the two rotary systems. All subjects underwent single-visit root canal treatment, and the severity of postoperative pain was assessed at 4-, 12-, 24-, 48-, and 72-hour intervals, as well as after one week, using the visual analog scale (VAS). Additionally, the need for analgesics was recorded. Statistical analysis using repeated-measures ANOVA and Mann-Whitney U test showed no significant differences between the groups regarding pain severity (P=0.10) or the amount of analgesics taken (P=0.25). These results suggest that both RaCe and ProTaper rotary instruments provide similar outcomes in terms of postoperative pain, indicating the clinical acceptability of both systems for root canal preparation.

In the in vitro study conducted by Silva LA et al.,[12] the objective was to compare the cleaning efficiency and instrumentation time of root canals in deciduous molars using manual versus rotary techniques. Thirty-three root canals were stained with India ink and divided into three groups: manual instrumentation with K files (Group I), rotary instrumentation with Profile .04 instruments (Group II), and a control group with no instrumentation (Group III). Instrumentation time was recorded, and the removal of India ink was evaluated in the cervical, middle, and apical thirds of the canals. The findings indicated no significant difference in cleaning efficiency between manual and rotary techniques across the three root thirds, although both methods

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significantly outperformed the control group. Notably, the rotary technique required significantly less time (3.46 minutes) compared to the manual technique (9.06 minutes). The study concluded that while both techniques offer similar cleaning capacity, the reduced instrumentation time with rotary instruments represents a significant clinical advantage in endodontic treatment.

In a study by Barbizam JV et al.[13], the cleaning efficiency of manual and rotary instrumentation techniques in mesial-distal flattened canals was assessed using morphometric analysis. Twenty human mandibular incisors were divided into two groups of ten teeth each: Group 1 utilized the crown-down technique with rotary ProFile .04 instruments, while Group 2 employed the crown-down technique with manual K-files. The evaluation, conducted with an optical microscope connected to a computer, measured the percentage of root canal area containing debris. Statistical analysis using the nonparametric Mann-Whitney U test revealed a significant difference between the techniques at a 1% level. The manual technique demonstrated superior cleaning efficiency in mesial-distal flattened root canals compared to the rotary technique, though neither method achieved complete canal cleanliness.

Kustarci A et al.[14] conducted a study to compare the amount of debris apically extruded during endodontic retreatment using two rotary nickel–titanium (NiTi) instruments (K3 and R-Endo) and Hedström files. Forty-five extracted mandibular premolars were filled and divided into three groups, where gutta-percha was removed using K3, R-Endo, or Hedström files. The extruded debris was collected, dried, and weighed. Statistical analysis revealed that both rotary NiTi systems (K3 and R-Endo) produced significantly less apical extrusion compared to Hedström files, although no significant difference was observed between the two rotary systems. The study concluded that while all techniques resulted in some debris extrusion, rotary NiTi instruments were more efficient in minimizing apical debris extrusion compared to manual Hedström files.

A key drawback of the study comparing postoperative pain in asymptomatic irreversible pulpitis using manual versus rotary instrumentation is the limited sample size. This constraint may reduce the robustness and generalizability of the findings, potentially affecting the ability to draw broader conclusions about the efficacy of the two techniques in diverse clinical settings. Further research with larger participant groups is recommended to validate these results and enhance the reliability of the conclusions.

Conclusion

The rotary group exhibited a reduction in pain severity at both time points compared to the hand file group; however, the differences were not statistically significant.

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