



Assessment of Pain Scales Used in Endodontic Postoperative Pain Evaluation: Frequency, Advantages, and Limitations

Fatma Pertek Hatipoglu ^a

^a Department of Endodontics, Faculty of Dentistry, Recep Tayyip Erdogan University, Rize, Turkey

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CORRESPONDENCE

Fatma Pertek Hatipoglu
Department of Endodontics, Faculty of
Dentistry, Recep Tayyip Erdogan University,
Rize, Turkey
E-mail: pertekk_165@hotmail.com

CLINICAL SIGNIFICANCE

The study highlights the dominance of VAS and NRS in assessing endodontic postoperative pain. Selecting the appropriate tool improves pain management, enhances patient outcomes, and ensures consistency in research, ultimately standardizing clinical practices.

ABSTRACT

Objectives: Postoperative pain is a critical outcome in endodontic research and clinical practice, directly impacting patient satisfaction and treatment success. Various pain assessment tools, such as the Visual Analog Scale (VAS) and Numeric Rating Scale (NRS), are employed to quantify and evaluate pain. This study aimed to analyze the frequency of use of different pain assessment tools in endodontic postoperative pain research across different databases.

Materials and Methods: A bibliometric analysis was performed using PubMed, Web of Science, and Scopus. The search strategy included commonly used pain scales: VAS, NRS, Heft-Parker Visual Analog Scale, Verbal Rating Scale, Faces Pain Scale, Short-Form McGill Pain Questionnaire, and Brief Pain Inventory. The results were synthesized to determine the prevalence of these scales in published research.

Results: VAS was the most frequently used tool, with 571 studies in PubMed (75.4%), 581 in Scopus (77.8%), and 346 in Web of Science (74.1%). The NRS followed, with 65 (8.6%), 71 (9.5%), and 51 (10.9%) studies, respectively. Other scales, such as the Heft-Parker Visual Analog Scale, Verbal Rating Scale, and Faces Pain Scale, were used less frequently. Comprehensive tools like the Short-Form McGill Pain Questionnaire and Brief Pain Inventory had minimal representation.

Conclusion: VAS and NRS dominate endodontic postoperative pain research, reflecting their ease of use and widespread acceptance. Less commonly used tools, while valuable in specific contexts, are underrepresented. Future research should explore the reasons for this disparity and assess the potential of hybrid tools to standardize pain evaluation practices.

1. Introduction

Postoperative pain is a common and significant concern in endodontic treatment, often influencing patient satisfaction and clinical outcomes. The evaluation of pain intensity and its management are critical aspects of clinical practice, as they guide both diagnosis and therapeutic decisions. However, pain is inherently subjective, making its accurate assessment a challenging yet essential task in dentistry.¹

Various pain measurement scales have been developed to quantify pain intensity and characteristics, providing clinicians with tools to evaluate and compare treatment modalities effectively. Among these, the Visual Analog Scale (VAS) is widely recognized and frequently used due to its simplicity and reliability.² Other scales, such as the Numeric Rating Scale (NRS), the McGill Pain Questionnaire (MPQ), and the Heft-Parker Visual Analog Scale, also play significant roles in assessing pain in both clinical and research settings.³

Endodontic postoperative pain evaluation is particularly complex due to the multifactorial nature of pain perception, which can be influenced by factors such as individual pain thresholds, procedural variables, and the psychological state of the patient.⁴ The selection of an appropriate pain scale is crucial to ensure accurate data collection and meaningful interpretation of pain outcomes.

Despite the widespread use of these scales, there is a lack of comprehensive analysis regarding their application in endodontics. Specifically, it remains unclear which scales are most commonly employed in the literature, their respective strengths and limitations, and their suitability for different clinical scenarios. Addressing this gap is essential to standardize pain assessment in endodontics and enhance the comparability of research

findings.

This study aims to evaluate the frequency of use of different pain scales in endodontic postoperative pain research, describe their methodologies, and discuss their advantages and limitations. By providing a critical overview of these tools, this work seeks to assist clinicians and researchers in selecting the most appropriate scale for their specific needs and contribute to the standardization of pain evaluation in endodontics.

2. Materials and Methods

2.1. Study Design and Objectives

This study utilized a bibliometric approach to evaluate the frequency and application of pain assessment scales in endodontic postoperative pain research. The objectives were to identify commonly used scales, analyze their distribution across the literature, and discuss their strengths and limitations.

2.2. Literature Search Strategy

A comprehensive search was conducted across three major scientific databases: PubMed, Web of Science, and Scopus. For each database, a tailored search query was applied to account for variations in search syntax. The general strategy involved replacing "Visual Analog Scale (VAS)" with other commonly used pain scales to comprehensively capture studies utilizing different methodologies. Details of the advanced queries used in each database are provided in Table 1. The search was iteratively modified for each pain scale. This approach ensured the inclusion of studies using diverse methods for postoperative pain assessment. Screening was completed on the 1st November 2024.

2.3. Inclusion and Exclusion Criteria

Studies were selected based on specific inclusion and exclusion criteria. Inclusion criteria required studies to be published in English, involve human participants, assess postoperative pain following endodontic procedures, and use specific pain scales such as VAS, NRS, MPQ, or Heft-Parker. Exclusion criteria included reviews, editorials, and conference abstracts without original data, studies focusing on non-endodontic procedures or experimental animal models, and articles lacking detailed methodology on pain assessment scales.

2.4. Statistical Analysis

Jamovi Software (2.3.28) was used for statistical analysis. Descriptive statistical analysis was conducted to determine the frequency of use of each pain scale. Results were presented as percentages and visualized through heat maps and tables.

3. Results

The bibliometric analysis revealed that the VAS was the most frequently used tool for evaluating postoperative pain in endodontic research across all three databases. Specifically, VAS was reported in 571 studies in PubMed (75.4%), 581 studies in Scopus (77.8%), and 346 studies in Web of Science (74.1%), highlighting its dominance as the preferred pain assessment scale (Fig. 1).

The NRS was the second most commonly used scale, with 65 studies in PubMed (8.6%), 71 studies in Scopus (9.5%), and 51 studies in Web of Science (10.9%). This finding reflects the growing preference for simple, numeric-based scales in pain evaluation (Fig. 1).

The Heft-Parker Visual Analog Scale (HP-VAS) also demonstrated a notable presence, with 66 studies in PubMed (8.7%), 48 in Scopus (6.4%), and 34 in Web of Science (7.3%). Although not as widely utilized as VAS or NRS, this scale remains relevant, particularly in studies requiring a modified visual approach to pain assessment (Fig. 1).

Other scales, such as the Verbal Rating Scale (VRS) and the Faces Pain Scale (FPS), showed moderate use. The VRS was identified in 27 studies in PubMed (3.6%), 22 in Scopus (2.9%), and 20 in Web of Science (4.3%). The FPS, often used in pediatric populations, appeared in 24 studies in PubMed (3.2%), 21 in Scopus (2.8%), and 12 in Web of Science (2.6%) (Fig. 1).

Table 1. The used search strategies in information sources

Database	Advanced Search strategy
PubMed	(("root canal instrumentation" OR "root canal retreatment" OR "apexification" OR "endodontic*" OR "root canal*" OR "endodontics") AND ("Visual Analog Scale" OR "VAS"))
Web of Science	TS=(("root canal instrumentation" OR "root canal retreatment" OR "apexification" OR "endodontic*" OR "root canal*" OR "endodontics") AND ("Visual Analog Scale" OR "VAS"))
Scopus	TITLE-ABS-KEY(("root canal instrumentation" OR "root canal retreatment" OR "apexification" OR "endodontic*" OR "root canal*" OR "endodontics") AND ("Visual Analog Scale" OR "VAS"))

Less commonly employed scales included the Short-Form McGill Pain Questionnaire (SF-MPQ), with only a few mentions: 3 studies in PubMed (0.4%), 2 in Scopus (0.3%), and 3 in Web of Science (0.6%). Similarly, the Brief Pain Inventory (BPI) and the Pain Intensity Numerical Rating Scale (PI-NRS) were minimally reported, with BPI appearing in just 1 study in Scopus (0.1%) and PI-NRS recorded in only 1 study (0.1%) across all three databases (Fig. 1).

Overall, the findings emphasize a reliance on VAS in endodontic postoperative pain research, while alternative scales remain underutilized despite their potential advantages in specific clinical and demographic contexts.

4. Discussion

Postoperative pain evaluation plays a vital role in understanding and managing patient outcomes in endodontic treatments. It is not only a key determinant of patient satisfaction but also a critical measure of clinical success.^{4,5} In this study, tools like the VAS and NRS emerged as the most commonly utilized methods for assessing pain, reflecting their wide acceptance and practicality. Meanwhile, less frequently used scales, such as the HP-VAS and FPS, demonstrate value in specific clinical scenarios. This discussion aims to critically analyze these pain assessment tools, exploring their strengths, limitations, and applicability across diverse patient populations and clinical contexts. Summary of pain assessment tools used in endodontic postoperative pain measurement was presented in Table 2.

The type of measurement employed by pain assessment scales significantly impacts their effectiveness and suitability in various clinical scenarios. Visual tools, such as the VAS and HP-VAS, rely on patients marking their pain on a visual continuum, which allows

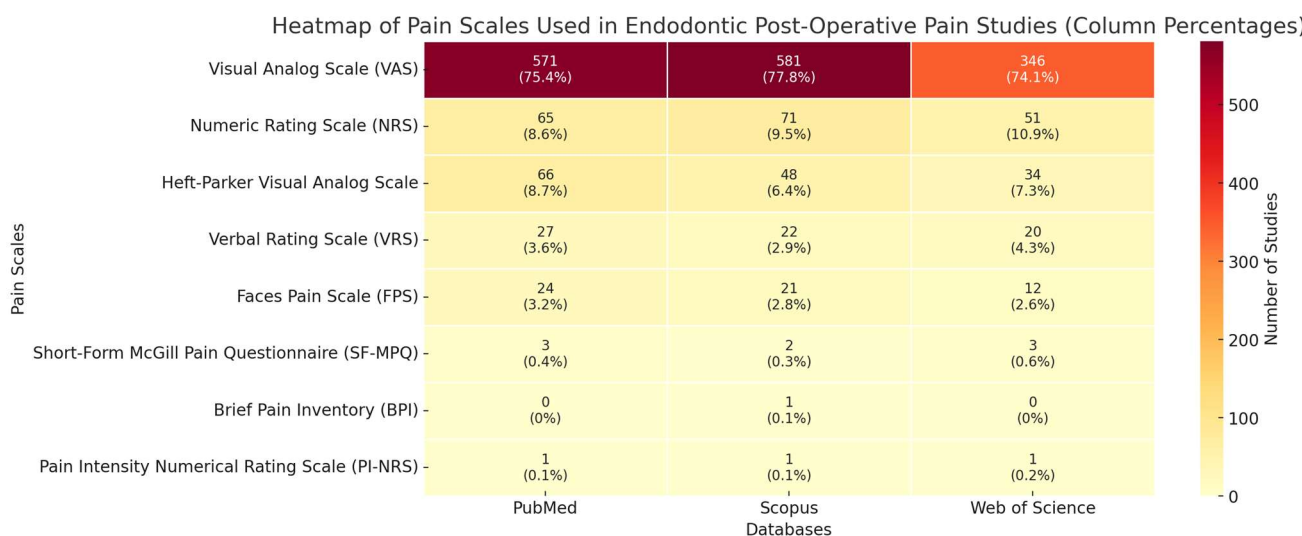


Fig. 1. Heat map of pain scales used in endodontic post-operative pain studies

Table 2. Summary of Pain Assessment Tools Used in Endodontic Postoperative Pain Measurement

Scale Name	Measurement Type	Purpose of Use	Ease of Use	Advantages	Disadvantages	Limitations	Reliability and Validity	Populations Used	Time of Assessment
Visual Analog Scale (VAS)	Visual	Measures pain intensity	Simple, quick	High sensitivity, widely accepted	Subjective, potential for misinterpretation	Requires patient understanding of scale	High; validated across studies	Adults, general	Immediately
Numeric Rating Scale (NRS)	Numeric	Quantifies pain on a 0-10 scale	Very easy	Quick, suitable for broad populations	Limited detail, lacks qualitative data	May miss subtle differences in pain levels	High; reliable in clinical settings	Adults, elderly	Immediately, 24-72 hours
Heft-Parker Visual Analog Scale	Visual	Modified VAS with categories	Moderate	Combines VAS precision with clarity	Less commonly used	Limited to specific studies or contexts	Moderate; validated in specific settings	Adults, pediatrics	Post-procedure
Verbal Rating Scale (VRS)	Verbal	Descriptive pain assessment	Easy, no tools required	Simple for communication	Less precise, subjective descriptions	Cultural/language barriers may impact use	Moderate; less validated	Adults, elderly	Immediately
Faces Pain Scale (FPS)	Visual (Faces)	Pediatric pain evaluation	Simple, child-friendly	Useful for children and non-verbal	Limited for adults, less precision	Suitable only for specific populations	High for pediatrics	Pediatrics, elderly	Immediately, post-procedure
Short-Form McGill Pain (SF-MPQ)	Mixed (Quantitative/Qual.)	Measures pain intensity & quality	Complex, time-consuming	Detailed, multidimensional	Time-consuming, less practical	Limited use in routine clinical practice	High; validated for qualitative data	Chronic pain patients	Long-term follow-up
Brief Pain Inventory (BPI)	Mixed	Evaluates pain severity & impact	Moderate	Measures functional interference	Longer administration time	Limited applicability to acute pain	High; validated for chronic pain	Chronic pain patients	Extended post-procedure
Pain Intensity NRS (PI-NRS)	Numeric	Quantifies pain severity	Very easy	Simplified for quick assessments	Lacks detailed pain information	Limited to numeric severity	High; validated for quick measures	Adults, elderly	Immediately

for nuanced and sensitive measurements. This is particularly advantageous when capturing small changes in pain intensity.⁶ However, visual scales can pose challenges for populations with cognitive impairments, visual limitations, or difficulty understanding abstract concepts, such as elderly patients or those with low health literacy.⁷⁻⁹

In contrast, numeric scales like the NRS and PI-NRS offer simplicity and ease of use by asking patients to directly assign a number to their pain. This makes them particularly suitable for fast-paced clinical settings and broad patient populations.¹⁰ However, these scales may lack the sensitivity to detect subtle differences in pain levels, limiting their utility in research settings where fine gradations in pain are of interest.¹¹ Verbal scales, such as the VRS, offer a categorical approach by using descriptive terms like "mild," "moderate," or "severe." While this is highly accessible and useful for patients unable to engage with visual or numeric scales, the lack of precision and potential for linguistic or cultural interpretation issues can reduce their reliability.¹² Each measurement type thus provides distinct advantages and challenges, and their selection should be guided by the clinical context, patient population, and specific objectives of the assessment.

The intended purpose of pain assessment tools plays a crucial role in determining their appropriateness for specific clinical or research settings. Scales like the VAS and NRS are widely used for their ability to measure pain intensity effectively. These scales are particularly valuable in evaluating the immediate outcomes of interventions, such as the reduction in postoperative pain following endodontic treatments.^{13,14} Their straightforward approach allows clinicians to quickly gauge patient discomfort and make timely decisions regarding pain management strategies.

On the other hand, tools like the SF-MPQ and BPI are designed for more comprehensive pain assessments. These scales not only measure the intensity of pain but also capture its qualitative characteristics, such as the sensory and affective dimensions of the patient's experience.¹⁵ Such detailed assessments are especially useful in research settings or in cases of chronic pain where understanding the multidimensional nature of pain is essential for developing effective treatment plans.

In specific populations, scales like the FPS and VRS are tailored for unique needs. For instance, FPS is highly effective for pediatric patients or individuals with communication difficulties, as it provides a non-verbal method to express pain.¹⁶ Similarly, VRS is often used in situations where simplicity and immediate feedback are prioritized, although its categorical nature may limit its precision.¹⁷ By aligning the choice of pain scale with the intended purpose, clinicians and researchers can ensure more accurate and meaningful pain assessments tailored to their specific objectives.

Despite their widespread use and utility, pain assessment tools are not without limitations, and these must be considered when interpreting their results.¹⁷ The VAS, while highly sensitive to small changes in pain intensity, requires patients to understand and interact with a visual continuum.¹⁸ This reliance on patient comprehension can limit its applicability in populations with cognitive impairments, low literacy, or visual disabilities.¹⁷ Similarly, the NRS, though simple and versatile, may fail to capture the multidimensional nature of pain, reducing its effectiveness in chronic or complex pain scenarios where qualitative insights are necessary.¹⁹

Tools like the VRS and FPS also face challenges. The VRS, for example, relies on predefined categories such as "mild," "moderate," and "severe," which can vary in interpretation based on cultural and linguistic differences. This subjectivity may hinder its reliability in diverse populations. The FPS, while invaluable in pediatric or non-verbal populations, lacks precision and is unsuitable for adult patients or detailed research applications.¹⁷

Comprehensive tools like the SF-MPQ and BPI address many of these limitations by providing detailed, multidimensional assessments. However, their complexity and longer administration times make them impractical for routine clinical use. Additionally, their reliance on patient cooperation and understanding can pose challenges in certain populations.²⁰

Ultimately, no single pain assessment tool is universally applicable. The limitations of each scale highlight the importance of context-specific selection, balancing the need for precision, patient accessibility, and the clinical or research objectives. Addressing these limitations through the development of hybrid or standardized tools could significantly enhance pain evaluation in endodontics and beyond.

5. Conclusion

This study highlights the central role of pain assessment tools in endodontic postoperative care, emphasizing their importance in both clinical practice and research. Among the scales analyzed, the VAS and NRS emerged as the most widely used tools, reflecting their simplicity, reliability, and ease of application. However, less commonly utilized scales, such as the HP-VAS and FPS, demonstrate significant value in specific clinical scenarios, such as pediatric or non-verbal patient populations.

The findings underscore the need for clinicians and researchers to align their choice of pain scales with the specific objectives of their evaluations and the demographics of their patient populations. While VAS and NRS remain the dominant tools, comprehensive scales like the SF-MPQ and BPI offer unique

insights in more complex or chronic pain cases, despite their limitations in routine clinical use.

Ultimately, no single pain assessment tool is universally applicable, and the choice should be guided by the clinical context, patient needs, and the nature of the study. Future research should focus on developing hybrid tools that combine the precision, multidimensionality, and practicality required for effective pain assessment. Such advancements could significantly improve pain management and enhance the comparability of findings in endodontic research and beyond.

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