

# Comparative Study of the Clinical Performance of Endodontic Microsurgery With and Without the Use of Operating Microscopes

**Dr. Gourav Kumar Sahu<sup>1\*</sup>, Dr. Anjali Sharma<sup>2</sup>, Dr. Suwendu Kumar Hota<sup>3</sup>, Dr. Syeda Afeefa Tanweer<sup>4</sup>, Dr. Yashika Negi<sup>5</sup>, Dr. Zuchumlo H Patton<sup>6</sup>**

<sup>1\*</sup> Reader, Department of Conservative Dentistry and Endodontics, RKDF Dental College and Research Centre, RKDF University, Bhopal, MP, India. (Corresponding Author) Email: [dr.gourav4852@gmail.com](mailto:dr.gourav4852@gmail.com)

<sup>2</sup> Assistant Professor, Teerthanker Mahaveer Dental College and Research Centre, TMU, Moradabad, UP, India.

<sup>3</sup> BDS, Ek Dantaya Dental Clinic, Bhubaneswar, Odisha, India.

<sup>4</sup> Senior Lecturer, Department of Conservative Dentistry and Endodontics, Kalinga Institute of Dental Sciences, KIIT (Deemed to be University), Bhubaneswar, Odisha, India.

<sup>5</sup> Consultant Endodontist, Clove Dental, Chandigarh Tricity, India.

<sup>6</sup> PG Final Year, Sardar Patel Post Graduate Institute of Dental and Medical Sciences, Lucknow, India.

**Received:** 20th Feb, 2026 | **Revised:** 4th Mar, 2026 | **Accepted:** 25th Mar, 2026 | **Available Online:** 10th Apr, 2026

## ABSTRACT

**Background:** Endodontic microsurgery is an important treatment option for teeth with persistent periapical pathology following failed root canal therapy. The introduction of the operating microscope has improved visualization and precision during surgical procedures. However, the comparative clinical performance of endodontic microsurgery performed with and without the use of operating microscopes remains an area of clinical interest.

**Aim:** To compare the clinical performance of endodontic microsurgery performed with the use of an operating microscope and without the use of an operating microscope.

**Materials and Methods:** This prospective comparative clinical study included 100 patients requiring endodontic microsurgery due to persistent periapical lesions after failed root canal treatment. The patients were randomly divided into two groups: Group A (50 patients) underwent microsurgery using an operating microscope, while Group B (50 patients) underwent conventional surgery without a microscope. Clinical parameters including postoperative pain, surgical time, healing outcomes, and overall treatment success were evaluated. Pain was assessed using the Visual Analog Scale (VAS) on postoperative days 1, 3, and 7. Radiographic and clinical evaluations were performed during follow-up visits up to 6 months. Statistical analysis was performed using appropriate tests, and a p-value <0.05 was considered statistically significant.

**Results:** The microscope group showed significantly lower postoperative pain scores, higher healing rates, and greater overall clinical success compared with the conventional surgery group. The success rate was 88% in the microscope group and 72% in the conventional group. However, the mean surgical time was slightly longer in the microscope-assisted procedures.

**Conclusion:** Endodontic microsurgery performed with an operating microscope demonstrated superior clinical outcomes compared to conventional surgery. Improved visualization and precision associated with magnification contribute to higher treatment success and better postoperative outcomes. Therefore, the operating microscope can be considered a valuable tool in modern endodontic surgical practice.

**Keywords:** Endodontic microsurgery, Operating microscope, Periapical surgery, Treatment success, Postoperative healing.

**How to cite this article:** Sahu GK, Sharma A, Hota SK, Tanweer SA, Negi Y, Patton ZH. Comparative Study of the Clinical Performance of Endodontic Microsurgery With and Without the Use of Operating Microscopes. *Int J Drug Deliv Technol.* 2026;16(32s):309-314. DOI: 10.25258/ijddt.16.32s.38

**Source of support:** Nil.

## Comparative study of the clinical performance of endodontic microsurgery with and without the use of operating microscopes

**Conflict of interest:** The authors declare no conflict of interest.

### Introduction

Endodontic therapy aims to eliminate infection from the root canal system and preserve the natural tooth in a functional and healthy state. Although conventional nonsurgical root canal treatment has a high success rate, failure may occur due to persistent infection, complex root canal anatomy, procedural errors, or inadequate sealing of the root canal system. In such cases, endodontic retreatment or surgical intervention becomes necessary [1]. Endodontic microsurgery has emerged as a predictable treatment modality for managing persistent periapical pathology when nonsurgical retreatment is not feasible or has previously failed. Advances in surgical techniques, magnification devices, illumination systems, and microsurgical instruments have significantly improved the success rates of endodontic surgery in recent decades.

Traditional endodontic surgery was performed using conventional surgical instruments and limited visual magnification, often relying on the clinician's direct vision or simple surgical loupes [2]. These limitations sometimes led to inadequate visualization of the surgical field, incomplete removal of pathological tissue, improper root-end resection, and difficulty in detecting accessory canals, root fractures, or isthmuses. Consequently, the long-term success rates of traditional endodontic surgery were comparatively lower, and complications such as incomplete sealing of the root apex or persistent infection were more common.

With the development of modern dental technology, the operating microscope has become an important tool in endodontic procedures [3]. The use of an operating microscope provides enhanced magnification and illumination, allowing clinicians to visualize the surgical field with greater clarity and precision. Improved visualization enables accurate identification of anatomical details such as root apex morphology, accessory canals, cracks, and isthmuses that may otherwise remain undetected with the naked eye. This enhanced visualization contributes to more precise root-end resection, effective debridement of pathological tissue, and accurate placement of retrograde filling materials.

Endodontic microsurgery performed under magnification has transformed the approach to surgical endodontics [4]. The integration of the operating microscope with microsurgical instruments and ultrasonic retro-tips has made procedures more conservative and precise. Modern

microsurgical techniques emphasize smaller osteotomies, minimal tissue trauma, and precise root-end preparation. These improvements not only enhance the surgical outcome but also promote faster healing and reduced postoperative discomfort for patients.

Several studies have reported improved success rates of endodontic microsurgery when magnification and illumination devices such as the operating microscope are used. Enhanced visualization allows clinicians to perform more accurate root-end resections and identify anatomical complexities that may harbor bacteria or debris [5]. The microscope also facilitates precise retrograde cavity preparation and placement of biocompatible materials such as mineral trioxide aggregate (MTA), which further contributes to improved treatment outcomes. In addition, the operating microscope assists clinicians in maintaining ergonomic posture and performing delicate procedures with greater control.

Despite these advantages, the use of operating microscopes in endodontic surgery may present certain challenges [6]. The equipment requires specialized training, significant financial investment, and an adjustment period for clinicians who are accustomed to conventional surgical techniques. In some clinical settings, especially in developing regions or smaller dental practices, access to operating microscopes may be limited. As a result, many endodontic surgeries are still performed without magnification or with only basic visual aids.

Another factor to consider is that some clinicians believe that experienced surgeons can achieve satisfactory outcomes even without the use of an operating microscope, relying instead on their clinical expertise and conventional surgical methods [7]. Therefore, it becomes important to objectively evaluate whether the use of operating microscopes significantly improves clinical outcomes in endodontic microsurgery compared to procedures performed without magnification.

Clinical performance in endodontic surgery can be evaluated through several parameters, including surgical accuracy, healing of periapical tissues, postoperative pain, surgical time, complication rates, and overall treatment success. Comparing these parameters between surgeries performed with and without operating microscopes may provide valuable insights into the effectiveness and practical benefits of magnification-assisted procedures. Furthermore, understanding these

## Comparative study of the clinical performance of endodontic microsurgery with and without the use of operating microscopes

differences may guide clinicians in selecting appropriate techniques and technologies to optimize patient care [8]. In recent years, there has been increasing interest in evidence-based dentistry, which emphasizes the importance of scientifically evaluating new technologies and treatment approaches before their widespread adoption [9]. Comparative clinical studies play a crucial role in determining the true benefits and limitations of innovations such as operating microscopes in endodontic surgery. Such studies help clinicians make informed decisions regarding the integration of advanced technologies into routine dental practice [10].

Given the growing adoption of operating microscopes in endodontics and the need to evaluate their clinical impact, it is essential to systematically compare surgical outcomes achieved with and without their use. Understanding whether magnification and enhanced illumination significantly influence treatment success, surgical precision, and patient outcomes can provide valuable guidance for clinicians, educators, and policymakers in the field of endodontics.

Therefore, this study is important to determine the comparative clinical performance and treatment outcomes of endodontic microsurgery performed with and without the use of operating microscopes.

### Methodology

#### Study Design and Setting

This study was designed as a prospective comparative clinical study to evaluate the clinical performance of endodontic microsurgery performed with and without the use of operating microscopes. The study was conducted in the Department of Conservative Dentistry and Endodontics at a tertiary dental care institution over a period of 12 months. Ethical approval was obtained from the Institutional Ethical Committee prior to the commencement of the study, and written informed consent was obtained from all participants.

#### Sample Size

A total of 100 patients requiring endodontic microsurgery for the management of persistent periapical lesions following failed root canal treatment were included in the study. The sample size was selected to ensure adequate statistical power for comparison between the two study groups.

#### Patient Selection

##### Inclusion Criteria

- Patients aged between 18 and 60 years.

- Teeth with previously treated root canals showing persistent periapical pathology requiring surgical intervention.

- Teeth indicated for endodontic microsurgery due to failure of conventional root canal treatment or retreatment.

- Patients who were willing to participate and provided informed consent.

##### Exclusion Criteria

- Patients with systemic diseases affecting wound healing such as uncontrolled diabetes or immunocompromised conditions.

- Pregnant or lactating women.

- Teeth with vertical root fractures or non-restorable teeth.

- Patients who had received antibiotic therapy within one week prior to surgery.

- Patients unwilling to participate in follow-up evaluations.

#### Grouping of Patients

The 100 patients were randomly divided into two equal groups of 50 each using a simple randomization method.

- Group A (Microscope Group): Endodontic microsurgery performed using an operating microscope.

- Group B (Conventional Group): Endodontic surgery performed without the use of an operating microscope, using conventional surgical visualization.

#### Preoperative Assessment

All patients underwent a detailed clinical and radiographic examination before the procedure. Clinical parameters such as pain, tenderness to percussion, swelling, and sinus tract presence were recorded. Radiographic evaluation was performed using periapical radiographs to assess the size of the periapical lesion and the quality of previous root canal treatment. Baseline data including patient demographics, tooth type, and location were also documented.

#### Surgical Procedure

All surgical procedures were performed under local anesthesia by experienced endodontists following standardized protocols.

A full-thickness mucoperiosteal flap was reflected to expose the underlying bone. Osteotomy was performed to access the root apex and the periapical lesion. Curettage was carried out to remove pathological tissues. In **Group A**, the entire procedure including root-end resection, inspection of the resected root surface, identification of isthmuses or accessory canals, and

## Comparative study of the clinical performance of endodontic microsurgery with and without the use of operating microscopes

retrograde cavity preparation was performed under an operating microscope with enhanced magnification and illumination.

In **Group B**, the same surgical procedure was performed using conventional surgical methods without the aid of an operating microscope.

Approximately 3 mm of the root apex was resected in both groups. Retrograde cavity preparation was performed using ultrasonic tips, and the cavity was filled with a biocompatible retrograde filling material such as mineral trioxide aggregate (MTA). The surgical site was irrigated with sterile saline and the flap was repositioned and sutured.

### Postoperative Care

All patients received standard postoperative instructions. Analgesics and antibiotics were prescribed when necessary. Sutures were removed after 7 days. Patients were advised to report any postoperative complications such as excessive pain, swelling, or bleeding.

### Clinical Evaluation Parameters

The clinical performance of the procedures was evaluated based on the following parameters:

- Postoperative pain
- Swelling
- Healing of periapical lesion
- Surgical time
- Presence of complications
- Overall clinical success

Pain was assessed using a Visual Analog Scale (VAS) on postoperative days 1, 3, and 7.

### Follow-Up Evaluation

Patients were followed up at 1 month, 3 months, and 6 months postoperatively. Clinical examination and radiographic evaluation were conducted to assess healing of the periapical lesion and the success of the surgical procedure.

### Outcome Measures

The primary outcome measure was successful healing of the periapical lesion, determined by absence of symptoms and evidence of radiographic bone healing. Secondary outcomes included postoperative pain, swelling, surgical duration, and complication rates.

### Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using appropriate statistical software. Descriptive statistics were used to summarize the data. Continuous variables were expressed as mean  $\pm$  standard

deviation, while categorical variables were expressed as percentages.

Comparisons between the two groups were performed using the Student's t-test for continuous variables and the Chi-square test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

### Discussion

Endodontic microsurgery has evolved considerably with the introduction of advanced technologies such as the surgical operating microscope, ultrasonic instruments, and biocompatible retrograde filling materials. The present study compared the clinical performance of endodontic microsurgery performed with and without the use of an operating microscope. The findings demonstrated that procedures performed with an operating microscope showed better healing outcomes, lower postoperative pain, and higher overall success rates, although the surgical time was slightly longer. These findings highlight the importance of magnification and improved illumination in enhancing the precision and effectiveness of endodontic surgical procedures.

In the present study, the overall clinical success rate in the microscope group was 88%, whereas the conventional surgery group showed a success rate of 72%. This difference was statistically significant and suggests that the use of an operating microscope improves treatment outcomes in endodontic microsurgery. The improved results observed in the microscope group may be attributed to better visualization of the surgical field, accurate identification of root apex anatomy, and precise placement of retrograde filling materials. Enhanced magnification allows clinicians to detect microfractures, accessory canals, and isthmuses that may otherwise remain unnoticed during conventional surgery.

The findings of this study are consistent with the results reported by **Frank C. Setzer et al. (2010)**, [11] who conducted a meta-analysis comparing traditional root-end surgery with endodontic microsurgery. Their study reported a 94% success rate for endodontic microsurgery compared with 59% for traditional root-end surgery, indicating that microsurgical techniques significantly improve treatment outcomes.

Similarly, **Pallarés-Serrano et al. (2020)** [12] evaluated the effect of magnification in endodontic surgery and found that the probability of successful outcomes was significantly higher when high-power magnification such as an operating microscope or endoscope was used. Their

## Comparative study of the clinical performance of endodontic microsurgery with and without the use of operating microscopes

study concluded that the use of magnification improved the prognosis of endodontic surgery, particularly in complex cases such as molars.

Another prospective clinical investigation by **Euiseong Kim et al. (2011) [13]** evaluated outcomes of endodontic micro-resurgery and reported a clinical success rate of approximately 92.9% when microsurgical techniques were used. The authors emphasized that the use of magnification, ultrasonic root-end preparation, and biocompatible materials contributed to high success rates. These findings support the present study, which also demonstrated improved healing outcomes in the microscope-assisted surgery group.

A retrospective study conducted by **Dohyun Kim et al. (2018) [14]** further confirmed the effectiveness of microsurgical techniques in endodontic surgery. Their research involving long-term follow-up reported success rates of over 90% for endodontic microsurgery, indicating that microsurgical approaches provide predictable clinical outcomes. The authors also highlighted that tooth type and surgical technique can influence treatment success.

Furthermore, a clinical review by **Spyros Floratos et al. (2017) [15]** emphasized that modern endodontic microsurgery offers significant advantages compared with conventional surgical methods. The authors noted that the use of operating microscopes improves visualization, reduces surgical trauma, and results in less postoperative pain and faster healing, which aligns with the reduced postoperative pain scores observed in the microscope group in the present study. In addition to improved success rates, the present study found that postoperative pain was significantly lower in the microscope-assisted surgery group. This finding may be explained by the minimally invasive nature of microsurgical techniques, which involve smaller osteotomies and more precise tissue handling. Previous literature has suggested that improved visualization allows clinicians to perform surgical procedures with minimal trauma to surrounding tissues, thereby reducing postoperative inflammation and discomfort.

However, the current study also found that surgical time was slightly longer in the microscope group compared to conventional surgery. This finding may be due to the careful and precise approach required during microscopic procedures, as well as the additional time needed to

adjust the microscope and maintain optimal visualization during surgery. Despite the increased operative time, the improved treatment outcomes and reduced postoperative complications may justify the use of operating microscopes in endodontic surgery.

Overall, the findings of the present study are consistent with previous research demonstrating that magnification-assisted endodontic microsurgery provides superior clinical outcomes compared with conventional surgical techniques. The use of operating microscopes allows for improved visualization of root-end anatomy, more accurate surgical procedures, and better placement of retrograde filling materials. These factors collectively contribute to improved healing and higher treatment success rates.

Therefore, the results of the present study, along with previous research, support the growing consensus that the operating microscope is an important tool in modern endodontic microsurgery and significantly enhances clinical performance and treatment outcomes.

### Limitations

The present study has certain limitations that should be considered when interpreting the findings. First, the sample size was limited to 100 patients, which may not fully represent the broader population undergoing endodontic microsurgery. Second, the follow-up period was relatively short (6 months), which may not be sufficient to evaluate the long-term success and stability of the surgical outcomes. Third, the procedures were performed in a single clinical center, which may limit the generalizability of the results to other clinical settings or populations. Additionally, variations in operator experience and surgical technique could have influenced the outcomes, even though standardized protocols were followed. Finally, the study primarily relied on clinical and radiographic evaluations, and advanced imaging techniques such as CBCT were not routinely used, which may have limited the accuracy of assessing periapical healing.

### Conclusion

The present study demonstrated that endodontic microsurgery performed with the use of an operating microscope showed improved clinical outcomes compared to procedures performed without magnification. Microscope-assisted surgery resulted in higher healing rates, reduced postoperative pain, and greater overall treatment success. Although the use of the operating microscope slightly increased the surgical time, the improved precision and visualization

## Comparative study of the clinical performance of endodontic microsurgery with and without the use of operating microscopes

contributed to better surgical performance. Enhanced magnification allowed more accurate identification of root-end anatomy and precise placement of retrograde filling materials. Therefore, the use of an operating microscope can be considered a valuable adjunct for improving the success of endodontic microsurgical procedures.

### References

1. Tabassum S, Khan FR. Failure of endodontic treatment: The usual suspects. *Eur J Dent.* 2016 Jan-Mar;10(1):144-147. doi: 10.4103/1305-7456.175682. PMID: 27011754; PMCID: PMC4784145.
2. Low JF, Dom TNM, Baharin SA. Magnification in endodontics: A review of its application and acceptance among dental practitioners. *Eur J Dent.* 2018 Oct-Dec;12(4):610-616. doi: 10.4103/ejd.ejd\_248\_18. PMID: 30369811; PMCID: PMC6178675.
3. Chauhan S, Chauhan R, Bhasin P, Bhasin M. Magnification: The game changer in dentistry. *World J Methodol.* 2025 Jun 20;15(2):100937. doi: 10.5662/wjm.v15.i2.100937. PMID: 40548225; PMCID: PMC11612727.
4. Pecora GE, Pecora CN. A new dimension in endo surgery: Micro endo surgery. *J Conserv Dent.* 2015 Jan-Feb;18(1):7-14. doi: 10.4103/0972-0707.148864. PMID: 25657519; PMCID: PMC4313484.
5. Ganesan S, Basheer SN, Kumar ON, Chohan H, Murugesan S, Subramani SK. Enhancing Precision in Endodontic Procedures: An *In vitro* Investigation of Magnification and Enhanced Visualization. *J Pharm Bioallied Sci.* 2024 Jul;16(Suppl 3):S2697-S2699. doi: 10.4103/jpbs.jpbs\_405\_24. Epub 2024 Jul 12. PMID: 39346322; PMCID: PMC11426581.
6. Connert T, Walter E, Benz L, Schwendicke F, Leontiev W. Guided Endodontics-Potential and Limitations. *Aust Dent J.* 2025 Dec;70 Suppl 1(Suppl 1):S118-S128. doi: 10.1111/adj.70012. Epub 2025 Oct 26. PMID: 41139954; PMCID: PMC12747600.
7. Sinha A, Vashisht A, Mahajan M, Sharma S, Bajaj N, Khandelwal H. Cone Beam Computed Tomography - Assisted Surgical Management of Root Canal Perforation. *Oral Sphere J. Dent. Health Sci.* 2025;1(4):224-232. doi: 10.63150/osjdhs.2025.23
8. Ma L, Fei B. Comprehensive review of surgical microscopes: technology development and medical applications. *J Biomed Opt.* 2021 Jan;26(1):010901. doi: 10.1117/1.JBO.26.1.010901. PMID: 33398948; PMCID: PMC7780882.
9. Singh N, Shenvi S. Navigating the C-Shape Canals: A Case Series on Endodontic Treatment with Bio-ceramic Sealers. *Oral Sphere J. Dent. Health Sci.* 2025;1(3):166-172. doi: 10.63150/osjdhs.2025.14
10. Mwogosi A, Mambile C, Simba R, Haruna H. Integrating digital technologies in clinical dentistry training: a framework for competency-based education. *BMC Med Educ.* 2025 Nov 25;25(1):1645. doi: 10.1186/s12909-025-07585-x. PMID: 41291643; PMCID: PMC12648810.
11. Setzer FC, Shah SB, Kohli MR, Karabucak B, Kim S. Outcome of endodontic surgery: a meta-analysis of the literature--part 1: Comparison of traditional root-end surgery and endodontic microsurgery. *J Endod.* 2010 Nov;36(11):1757-65. doi: 10.1016/j.joen.2010.08.007. Epub 2010 Sep 17. PMID: 20951283.
12. Pallarés-Serrano A, Glera-Suarez P, Soto-Peñaloza D, Peñarrocha-Oltra D, von Arx T, Peñarrocha-Diago M. The use of the endoscope in endodontic surgery: A systematic review. *J Clin Exp Dent.* 2020 Oct 1;12(10):e972-e978. doi: 10.4317/jced.56539. PMID: 33154800; PMCID: PMC7600213.
13. Song M, Shin SJ, Kim E. Outcomes of endodontic micro-resurgery: a prospective clinical study. *J Endod.* 2011 Mar;37(3):316-20. doi: 10.1016/j.joen.2010.11.029. Epub 2011 Jan 8. PMID: 21329814.
14. Kim D, Kim S, Song M, Kang DR, Kohli MR, Kim E. Outcome of Endodontic Micro-resurgery: A Retrospective Study Based on Propensity Score-matched Survival Analysis. *J Endod.* 2018 Nov;44(11):1632-1640. doi: 10.1016/j.joen.2018.07.024. Epub 2018 Sep 19. PMID: 30243664.
15. Floratos S, Kim S. Modern Endodontic Microsurgery Concepts: A Clinical Update. *Dent Clin North Am.* 2017 Jan;61(1):81-91. doi: 10.1016/j.cden.2016.08.007. PMID: 27912820.