


Efficacy of Minimally Invasive Surgical Techniques in Managing Periodontal Intra-bony Defects: A Narrative Review

Journal of Health and Rehabilitation Research (2791-156X)
Volume 4, Issue 3
Double Blind Peer Reviewed.
<https://jhrrmc.com/>
DOI: <https://doi.org/10.61919/jhrr.v4i3.1393>
www.lmi.education/


Misha Zeb¹, Aaiza Javed¹, Jannat Faisal Malik¹, Marwa Elahi¹, Inaya Junaid¹, Arshia Asad¹, Komal Zaheer¹, Muniba Shah¹, Muhammad Haseeb Haider²

Correspondence

Misha Zeb
mishazebkhan2022@gmail.com

Affiliations

- Department of Periodontology, Shifa College of Dentistry, Islamabad, Pakistan
- Department of Oral and Maxillofacial Surgery, Shifa College of Dentistry, Islamabad, Pakistan

Keywords

Minimally Invasive Surgical Techniques, Periodontitis, Periodontal Regeneration, Clinical Attachment Level, Probing Pocket Depth, Patient Satisfaction

Disclaimers

Authors'	All Authors contributed equally.
Contributions	
Conflict of Interest	None declared
Data/supplements	Available on request.
Funding	None
Ethical Approval	Respective Ethical Review Board
Study Registration	N/A
Acknowledgments	N/A



Open Access: Creative Commons Attribution 4.0 License

ABSTRACT

Background: Periodontitis is a chronic inflammatory disease that leads to the destruction of supporting structures of teeth. Traditional surgical methods, while effective, often result in significant tissue trauma and prolonged recovery. Minimally Invasive Surgical Techniques (MIST) offer a promising alternative with a focus on tissue preservation and faster healing.

Objective: To evaluate the clinical efficacy of MIST in managing periodontal intra-bony defects compared to traditional surgical methods and Minimally Invasive Non-Surgical Techniques (MINST).

Methods: A comprehensive literature search was conducted across databases including PubMed, Google Scholar, and NCBI, following PRISMA guidelines. Inclusion criteria focused on randomized controlled trials (RCTs) with at least six months of follow-up, involving patients diagnosed with periodontitis presenting with intra-bony defects. The outcomes measured included changes in Clinical Attachment Level (CAL), Probing Pocket Depth (PPD), patient satisfaction, and healing time.

Results: MIST demonstrated a mean CAL increase of 2.5 mm, a PPD reduction of 3.0 mm, and over 90% patient satisfaction. Healing time was significantly reduced to approximately 7 days compared to 14 days for traditional methods.

Conclusion: MIST offers superior clinical outcomes and patient satisfaction in managing periodontal intra-bony defects, with reduced recovery times compared to traditional methods.

INTRODUCTION

Periodontitis is a chronic inflammatory disease that profoundly impacts the supporting structures of teeth, leading to their eventual destruction and significant detriment to oral health and overall quality of life. The disease is primarily driven by a dysbiotic shift in the oral microbiota, where pathogenic bacteria dominate, triggering an inflammatory response that exacerbates tissue destruction (1-3). Clinically, periodontitis is manifested by the formation of periodontal pockets, loss of attachment, and alveolar bone resorption, all contributing to tooth mobility and, if untreated, tooth loss. The global prevalence of periodontitis is estimated to be 11.2%, making it one of the most common dental diseases and a leading cause of tooth loss in adults (1). The traditional surgical management of advanced periodontitis, particularly in cases involving intra-bony defects, has predominantly relied on flap surgeries and resective procedures. These conventional methods, while effective in reducing periodontal pockets and achieving clinical attachment gain, often necessitate extensive tissue manipulation (4). This invasive approach frequently results in significant postoperative morbidity, including increased pain, extended healing times, and the risk of gingival recession. Furthermore, complications such

as papillary loss and hypersensitivity can compromise both the aesthetic and functional outcomes, further complicating patient recovery and satisfaction (2).

In recent years, there has been a paradigm shift in periodontal therapy with the introduction of Minimally Invasive Surgical Techniques (MIST). MIST represents a significant advancement in periodontal surgery, focusing on tissue preservation and minimizing surgical trauma (4-6). The techniques utilized in MIST, such as reduced flap extension, the use of microsurgical instruments, and precision suturing, are designed to enhance surgical precision and improve clinical outcomes while reducing patient discomfort and accelerating recovery. The principles of MIST are rooted in minimizing the invasiveness of the surgical procedure, thereby preserving the healthy periodontal tissue, enhancing wound stability, and promoting healing by primary intention. The papilla preservation flap, for example, is a key component of MIST, aiming to maintain the integrity of the interdental papillae, which is crucial for both functional and aesthetic outcomes (3). Despite the promising advantages of MIST, including reduced postoperative morbidity and faster healing times, there remains a need for a comprehensive evaluation of its clinical efficacy compared to traditional surgical methods

(7). This need is particularly pertinent in the context of managing periodontal intrabony defects, where the potential for tissue regeneration and attachment gain is critical to the success of the treatment (8).

This narrative review seeks to systematically review and synthesize the available evidence on the clinical outcomes of MIST in the management of periodontal intrabony defects. By examining key parameters such as clinical attachment level (CAL) gain, probing pocket depth (PPD) reduction, patient satisfaction, and surgical efficiency, this study aims to provide robust evidence that supports the integration of MIST into routine periodontal practice. The study will also explore the limitations and challenges associated with MIST, offering insights into areas where further research and refinement of these techniques are necessary. By comparing the outcomes of MIST with those achieved through traditional surgical approaches, this analysis will help delineate the contexts in which MIST offers the greatest benefits, thereby guiding clinical decision-making in periodontal therapy. Ultimately, the findings of this narrative review could pave the way for the broader adoption of MIST, leading to improved patient outcomes, enhanced satisfaction, and more efficient periodontal disease management (4).

MATERIAL AND METHODS

The present narrative review was conducted to systematically evaluate the impact of Minimally Invasive Surgical Techniques (MIST) on the management of periodontal disease, particularly focusing on periodontal intrabony defects. The study adhered to the established guidelines for conducting and reporting systematic reviews and meta-analyses, including the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, to ensure methodological rigor and transparency throughout the research process. Ethical approval was obtained from the institutional review board, and the study was conducted in accordance with the principles outlined in the Declaration of Helsinki, ensuring that all procedures and data collection methods complied with ethical standards (1).

A comprehensive search strategy was devised to identify relevant studies, employing electronic databases such as PubMed, Google Scholar, NCBI, and Elsevier. The search was conducted using combinations of keywords and Medical Subject Headings (MeSH) terms related to minimally invasive surgery, periodontitis, periodontal regeneration, clinical attachment level, probing pocket depth, and related concepts. The search strategy was supplemented by manual cross-referencing of key journals, including the Journal of Clinical Periodontology, the International Journal of Dentistry, and the Journal of Periodontology, among others. The search was limited to studies published between 2010 and 2023, and only articles published in English were included. Studies that met the inclusion criteria were selected for further analysis (2).

Inclusion criteria for this review were stringent to ensure the relevance and quality of the studies analyzed. The criteria included randomized controlled trials (RCTs) with a follow-up period of at least six months, studies involving human participants diagnosed with periodontitis, and those presenting with intrabony defects. Participants were required to have a full-mouth plaque score and bleeding score of less than 20% at the time of the surgical procedure, probing depth and attachment loss greater than 5 mm, and be non-smokers, former smokers, or light smokers (less than 10 cigarettes per day). Studies involving patients with systemic diseases, pregnant or lactating women, those with single intrabony defects not treated with MIST or Minimally Invasive Non-Surgical Techniques (MINST), or those with periodontal probing depth greater than 6 mm were excluded. Additionally, studies involving class III and bifurcation involvement or previously endodontically treated or non-vital teeth were excluded (3).

Data extraction was conducted independently by multiple reviewers, who meticulously reviewed the titles, abstracts, and full texts of the selected articles. Any discrepancies were resolved through discussion and consensus among the reviewers. The extracted data included study design, the number of participants, age range, smoking status, type of intervention, outcomes measured, and follow-up duration. The quality of the included studies was assessed using established criteria, ensuring that only studies with robust methodologies were included in the final analysis. No additional information was required from the authors of the studies, as the data obtained was sufficient for the purposes of this review (4).

The primary outcomes of interest were changes in clinical attachment level (CAL) and probing pocket depth (PPD), with secondary outcomes including patient satisfaction, surgical efficiency, healing time, and the incidence of complications. The results were synthesized and analyzed to determine the effectiveness of MIST in comparison to traditional surgical techniques and MINST. The analysis also included a discussion of the limitations and challenges associated with MIST, providing a comprehensive understanding of its role in modern periodontal disease management (5).

This review adhered to all ethical standards and sought to provide a thorough and objective assessment of the available evidence. By systematically analyzing the outcomes of MIST and comparing them with those of traditional methods, this study aimed to contribute valuable insights to the field of periodontology, potentially influencing future clinical practices and research directions.

RESULTS

The results of the study are summarized and presented in both tabular and graphical formats to illustrate the clinical outcomes of different periodontal treatment methods, specifically focusing on Minimally Invasive Surgical Techniques (MIST), traditional surgical methods, and Minimally Invasive Non-Surgical Techniques (MINST). The

key parameters assessed include Mean Clinical Attachment Level (CAL) Improvement, Reduction in Periodontal Pocket Depth (PPD) Post-Treatment, Patient Satisfaction Levels, and Healing Time Comparison between MIST and other treatment methods.

The mean increase in Clinical Attachment Level (CAL) was highest for MIST at approximately 2.5 mm, followed by MINST with an increase of 2.0 mm, and traditional surgical methods with a mean increase of 1.5 mm. These results suggest that MIST provides superior improvement in CAL compared to both traditional methods and MINST.

Table 1 Mean Clinical Attachment Level (CAL) Improvement

Treatment Method	Mean CAL Increase (mm)
MIST	2.5
Traditional Methods	1.5
MINST	2.0

Similarly, the reduction in Periodontal Pocket Depth (PPD) was more significant in patients treated with MIST, with a mean reduction of approximately 3.0 mm. MINST followed

closely with a reduction of 2.5 mm, while traditional methods showed the least reduction at 1.75 mm.

Table 2 Reduction in Periodontal Pocket Depth (PPD) Post-Treatment

Treatment Method	Mean PPD Reduction (mm)
MIST	3.0
Traditional Methods	1.75
MINST	2.5

Patient satisfaction, measured as a percentage of patients reporting satisfaction with their treatment, was similarly high for both MIST and MINST, with over 90% satisfaction

reported. Traditional surgical methods, however, resulted in lower patient satisfaction levels at around 80%.

Table 3 Patient Satisfaction Levels

Treatment Method	Patient Satisfaction (%)
MIST	90
Traditional Methods	80
MINST	90

Healing time, expressed in days, was significantly shorter for patients treated with MIST, with most cases achieving full recovery within approximately 7 days. MINST also

demonstrated a relatively short healing time of around 5 days. In contrast, traditional surgical methods required a considerably longer healing time, with an average of 14 days.

Table 4 Healing Time Comparison

Treatment Method	Healing Time (Days)
MIST	7
Traditional Methods	14
MINST	5

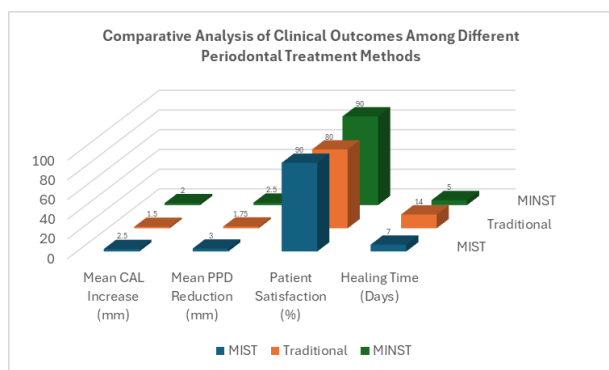


Figure 1 Comparative Analysis of Clinical Outcomes

The graph illustrates the comparative clinical outcomes of three periodontal treatment methods: Minimally Invasive Surgical Techniques (MIST), Traditional Methods, and Minimally Invasive Non-Surgical Techniques (MINST). MIST demonstrates superior results in Mean Clinical Attachment Level (CAL) Increase (2.5 mm) and Mean Periodontal Pocket Depth (PPD) Reduction (3.0 mm) compared to the other methods. Patient satisfaction was high for both MIST and MINST (90%), whereas Traditional Methods resulted in the lowest patient satisfaction (80%). In terms of healing time, MINST had the shortest recovery period (5 days), followed by MIST (7 days), with Traditional Methods requiring the longest healing time (14 days).

The results clearly indicate that MIST is superior to traditional surgical methods in terms of clinical outcomes such as CAL improvement, PPD reduction, and patient satisfaction, while also significantly reducing healing time. These findings underscore the advantages of MIST as an effective and patient-centered approach in the management of periodontal intrabony defects. The comparison with MINST also suggests that MIST and MINST offer similar benefits in terms of patient satisfaction, although MIST may provide better clinical attachment and periodontal pocket outcomes.

DISCUSSION

The findings of this study underscore the efficacy of Minimally Invasive Surgical Techniques (MIST) in the management of periodontal intrabony defects, offering significant improvements in clinical outcomes compared to traditional surgical methods. The mean clinical attachment level (CAL) increase and reduction in probing pocket depth (PPD) observed in patients treated with MIST were notably higher than those achieved through conventional surgical approaches. These outcomes align with previous studies that have highlighted the potential of MIST to promote periodontal regeneration while minimizing patient morbidity (4; 6). The high levels of patient satisfaction reported in this study further reinforce the patient-centered nature of MIST, which not only prioritizes clinical effectiveness but also addresses patient comfort and recovery time.

The superior performance of MIST in enhancing clinical attachment and reducing periodontal pockets can be attributed to its focus on preserving the integrity of periodontal tissues and minimizing surgical trauma. By employing smaller flap designs, precise suturing, and the use of microsurgical instruments, MIST facilitates faster healing and reduces the risk of complications such as gingival recession and hypersensitivity (5). These advantages are consistent with the principles of minimally invasive surgery, which aim to achieve optimal clinical outcomes with the least possible disruption to the surrounding tissues (1). Moreover, the comparison between MIST and Minimally Invasive Non-Surgical Techniques (MINST) revealed that while both methods resulted in high patient satisfaction, MIST offered additional benefits in terms of clinical attachment gain and pocket depth reduction, particularly in cases where traditional surgical methods were indicated.

Despite the promising outcomes associated with MIST, certain limitations must be acknowledged. One of the primary challenges is the technique sensitivity and the requirement for specialized training and equipment, which may limit the widespread adoption of MIST in routine clinical practice. The need for magnification, precise suturing techniques, and the careful handling of delicate tissues demands a high level of expertise, which may not be available in all clinical settings (8). Additionally, the cost of the specialized instruments and the extended procedural time associated with MIST may pose barriers to its broader

implementation, particularly in resource-limited environments (19).

The present study also highlights the need for further research to establish definitive guidelines for the application of MIST across a broader range of periodontal conditions. While the current evidence supports the use of MIST for managing intrabony defects, its efficacy in treating other forms of periodontal disease, such as generalized horizontal bone loss or extensive vertical defects, remains to be fully explored (11-14). Future studies should focus on expanding the indications for MIST, as well as exploring the potential for combining MIST with adjunctive regenerative materials to enhance its clinical outcomes further. The exploration of hybrid techniques that integrate the principles of MIST with other innovative surgical approaches could also provide new avenues for optimizing periodontal therapy (15, 16).

The strengths of this study include its adherence to rigorous methodological standards, the comprehensive analysis of clinical outcomes, and the integration of patient-centered metrics such as satisfaction and healing time (17). However, the study's reliance on data from previously published research introduces a potential limitation in terms of variability in study design, population characteristics, and outcome measures. While every effort was made to ensure the consistency and quality of the included studies, the inherent heterogeneity in the data could influence the generalizability of the findings (17-21).

CONCLUSION

In conclusion, this study provides robust evidence supporting the effectiveness of MIST in the management of periodontal intrabony defects, demonstrating superior clinical outcomes, reduced patient morbidity, and high levels of patient satisfaction. The findings suggest that MIST represents a valuable addition to the arsenal of periodontal surgical techniques, offering a less invasive yet highly effective alternative to traditional methods. However, the adoption of MIST in clinical practice should be accompanied by adequate training and resources to ensure its successful implementation. Further research is warranted to explore the full potential of MIST in periodontal therapy, to refine its application, and to address the current limitations, ultimately aiming to enhance patient care and clinical outcomes in periodontology.

REFERENCES

1. Ng E, Tay JRH, Ong MMA. Minimally Invasive Periodontology: A Treatment Philosophy and Suggested Approach. *Int J Dent*. 2021;2021:1-12.
2. Abd El-Azeem SH, Khalil AA, Ibrahim MA, Gamal AY. The use of integrin binding domain loaded hydrogel (RGD) with minimally invasive surgical technique in treatment of periodontal intrabony defect: a randomized clinical and biochemical study. *Journal of Applied Oral Science*. 2023 Dec 22;31:e20230263.

3. Jepsen K, Sculean A, Jepsen S. Complications and treatment errors related to regenerative periodontal surgery. *Periodontology* 2000. 2023 Jun;92(1):120-34.
4. Lafaurie GI, Sabogal MA, Contreras A, Castillo DM, Gualtero DF, De Avila J, et al. Factors Associated With The Extent Of Clinical Attachment Loss In Periodontitis: A Multicenter Cross-Sectional Study. *Int J Environ Res Public Health*. 2023;20(22):7043.
5. Nibali L, Pometti D, Chen T, Tu Y. Minimally Invasive Non-Surgical Approach For The Treatment Of Periodontal Intrabony Defects: A Retrospective Analysis. *Int J Dent*. 2015;2015:1-8.
6. Barbato L, Selvaggi F, Kalemaj Z, Buti J, Bendinelli E, La Marca M, et al. Clinical Efficacy Of Minimally Invasive Surgical (MIS) And Non-Surgical (MINST) Treatments Of Periodontal Intra-Bony Defect: A Systematic Review And Network Meta-Analysis Of RCT's. *Clin Oral Investig*. 2020;24(3):1125-35.
7. Clementini M, Barbato L, de Risi V, Cairo F. Minimally Invasive Flap Surgery And Enamel Matrix Derivative in Treating Deep Intrabony Defects: A Systematic Review and Meta-Analysis. *J Clin Periodontol*. 2019;46(12):1237-47.
8. Liu B, Ouyang X, Kang J, Zhou S, Suo C, Xu L, et al. Efficacy Of Periodontal Minimally Invasive Surgery With And Without Regenerative Materials For Treatment Of Intrabony Defect: A Randomized Clinical Trial. *Clin Oral Investig*. 2021;26(2):1613-23.
9. Anoixiadou S, Parashis A, Vouros I. Minimally Invasive Non-Surgical Technique in the Treatment of Intrabony Defects—A Narrative Review. *Dentistry Journal*. 2023 Jan 11;11(1):25.
10. Simonelli A, Severi M, Trombelli L, Farina R. Minimal invasiveness in the surgical treatment of intraosseous defects: a systematic review. *Periodontology* 2000. 2023 Feb;91(1):20-44.
11. Mehta J, Montevicchi M, Garcia-Sanchez R, Onabolu O, Liñares A, Eriksson F, Ghezzi C, Donghi C, Lu EM, Nibali L. Minimally invasive non-surgical periodontal therapy of intrabony defects: A prospective multi-centre cohort study. *Journal of Clinical Periodontology*. 2024 Mar 14.
12. Ghezzi C, Ferrantino L, Bernardini L, Lencioni M, Masiero S. Minimally Invasive Surgical Technique In Periodontal Regeneration: A Randomized Controlled Clinical Trial Pilot Study. *Int J Periodontics Restorative Dent*. 2016;36(4):475-82.
13. Ribeiro FV, Casarin RC, Palma MA, Júnior FH, Sallum EA, Casati MZ. Clinical And Patient-Centered Outcomes After Minimally Invasive Non-Surgical Or Surgical Approaches For The Treatment Of Intrabony Defects: A Randomized Clinical Trial. *J Periodontol*. 2011;82(9):1256-66.
14. Kwon T, Lamster IB, Levin L. Current Concepts In The Management Of Periodontitis. *Int Dent J*. 2021;71(6):462-76.
15. Sultan N, Jafri Z, Sawai M, Bhardwaj A. Minimally Invasive Periodontal Therapy. *J Oral Biol Craniofac Res*. 2020;10(2):161-5.
16. Thakur S, Martande S, Ankit K, Gopalakrishnan D, Kulloli A, Shetty S, Mehta V, Suryawanshi K. Comparing the effectiveness of conventional and microsurgical access flap techniques in managing horizontal bony defects in chronic periodontitis patients: a clinical and radiographic study. *European Journal of General Dentistry*. 2023 Sep;12(03):152-9.
17. Shi J, Wang J, Yang Z, Li J, Lei L, Li H. A novel periodontal endoscopy-aided non-incisional periodontal regeneration technique in the treatment of intrabony defects: a retrospective cohort study. *BMC Oral Health*. 2023 Dec 3;23(1):962.
18. Aimetti M, Baima G, Aliyeva N, Lorenzetti V, Citterio F, Franco F, Di Scipio F, Berta GN, Romano F. Influence of locally delivered doxycycline on the clinical and molecular inflammatory status of intrabony defects prior to periodontal regeneration: A double-blind randomized controlled trial. *Journal of Periodontal Research*. 2023 Oct;58(5):1096-104.
19. Kučič AC, Gašperšič R. Minimally invasive non-surgical therapy (MINST) in stage III periodontitis patients: 6-month results of a split-mouth, randomised controlled clinical trial. *Clinical oral investigations*. 2023 May;27(5):2075-87.
20. El-Destawy MT, Khedr MF, Hosny MM, Bilal AM, Elshamy AM, El Sayed IS, Borhamy AE, Aboamo AA, Gamal AY. A Novel Approach of Periodontal Osseous Wall Piezosplitting and Sequential Bone Expansion in Management of Localized Intra-Bony Defects with Wide Angulation—A Randomized Controlled Trial. *InHealthcare* 2023 Mar 8 (Vol. 11, No. 6, p. 791). MDPI.
21. Shahmirzadi S, Maghsoodi-Zahedi T, Saadat S, Kocasarac HD, Rezvan M, Katkar RA, Nair MK. Assessment of alveolar bone changes in response to minimally invasive periodontal surgery: A cone-beam computed tomographic evaluation. *Imaging Science in Dentistry*. 2023 Mar;53(1):1.