Common Complications of Endodontic Treatment and Successful Management Approaches: A Systematic Review

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Abstract
Background: Endodontic treatment is a cornerstone of modern dental practice with high reported success rates; however, procedural and postoperative complications remain clinically relevant.

Objective: To systematically review common complications of endodontic treatment and evaluate successful management approaches.

Methods: A systematic search of PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar (2000–2025) was conducted following PRISMA 2020.

Results: Instrument separation, canal transportation, ledge formation, perforations, postoperative pain, and flare-ups were the most frequent complications. Magnification, CBCT imaging, ultrasonic techniques, and bioceramic materials improved management outcomes.

Conclusion: Evidence-based management significantly enhances prognosis and treatment success.

Introduction

Endodontic therapy, commonly referred to as root canal treatment, is an essential component of contemporary dental practice.

Advances in imaging, nickel–titanium instrumentation, irrigation protocols, obturation materials, and magnification technologies have significantly improved success rates.

Despite these advancements, endodontic procedures remain technique-sensitive and prone to complications.

Understanding the etiology, risk factors, and management of endodontic complications is essential for dental practitioners.

Methods

This systematic review was conducted according to PRISMA 2020 guidelines. Databases searched included PubMed/MEDLINE, Scopus, Web of Science, and Google Scholar.

Results

Table 1. Common endodontic complications

Complication	Stage	Prevalence	Clinical impact
Instrument separation	Instrumentation	1–5%	Reduced disinfection
Ledge formation	Instrumentation	3–10%	Loss of working length
Canal transportation	Instrumentation	2–8%	Poor apical seal
Root perforation	Access	0.5–3%	Risk of failure
Postoperative pain	Post-treatment	10–30%	Patient discomfort

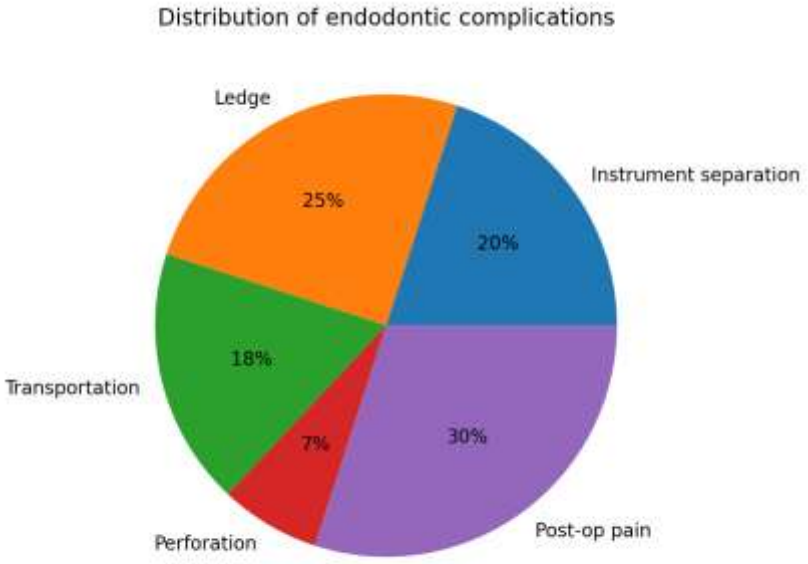
Table 2. Successful management strategies

Complication	Management	Technique/material	Outcome
Instrument separation	Ultrasonic retrieval	Microscope + ultrasonics	High success
Perforation	Immediate sealing	MTA/bioceramic	Improved prognosis
Transportation	Canal reshaping	Flexible NiTi files	Moderate success
Postoperative pain	Medication	NSAIDs	Symptom relief

Table 3. Risk factors associated with endodontic complications

Risk factor	Category	Associated complications	Evidence strength
Complex anatomy	Anatomical	Ledge, transportation	Strong
Operator inexperience	Operator	Instrument separation	Strong
Rigid instruments	Instrument	Transportation	Moderate
Inadequate irrigation	Biological	Postoperative pain	Moderate

Figure 1. Distribution of endodontic complications



Discussion

Endodontic complications remain prevalent despite advances in materials and techniques. Operator experience and anatomical complexity are major determinants.

Conclusion

Evidence-based management strategies and continuous professional training are essential.

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