UNIVERSIDADE FERNANDO PESSOA

ANALYTICAL CONSIDERATIONS OF THE ENDODONTIC TREATMENTS WITH PERIODONTAL IMPAIRMENTS: AN INTEGRATIVE REVIEW

[Considerações analíticas sobre os tratamentos endodônticos em pacientes com comprometimento periodontal: uma revisão integrativa]

Dissertação de Mestrado

[Mestrado Integrado em Medicina Dentária]

Jonathan Yehouda Dray

Orientador:
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REGARDS

At the end of this project, it is essential for me to express my profound gratitude to all those who, in one way or another, contributed to my journey.

This thesis marks the culmination of several years of effort, sacrifice, but also of remarkable encounters, shared experiences, and unforgettable moments.

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ABSTRACT

Introduction: There is a strong interrelationship between pulpal necrosis and infection on the root canal system with the periodontium, establishing a disease process. Endoperiodontal lesions represent a complex pathological condition arising from the anatomical, microbiological, and inflammatory interrelationship between the dental pulp and periodontal tissues. Natural and acquired communication pathways allow the spread of microorganisms and inflammatory mediators, making diagnosis and treatment challenging and directly affecting prognosis. This integrative review aimed to critically analyze the available scientific evidence on therapeutic approaches and clinical outcomes in the management of endoperiodontal lesions, with particular emphasis on the role of endodontic treatment and its interaction with periodontal therapy. **Methodology**: An integrative literature review was conducted using the PubMed, Scopus, and Web of Science databases, including studies published up to November 2025. The research question was structured according to the PIOS criteria. Randomized clinical trials, prospective and retrospective studies, longitudinal studies, and case series with a minimum follow-up of six months were included, involving adult patients diagnosed with endodontic–periodontal lesions. Study selection followed PRISMA guidelines, resulting in the inclusion of thirteen studies for qualitative synthesis. **Results:** The analyzed studies consistently demonstrated that non-surgical endodontic treatment constitutes the biological cornerstone in the management of EPLs and is decisive for periapical healing, regardless of baseline periodontal severity. High periapical healing rates (>80–90%) were reported when adequate (endodontical) chemomechanical debridement and three-dimensional root canal obturation were achieved. Periodontal healing outcomes were more variable and strongly influenced by probing depth, clinical attachment loss, and (periapical) lesion classification. In true combined endodontic–periodontal lesions, particularly in patients with periodontitis, adjunctive periodontal regenerative therapies were associated with improved clinical outcomes. Supportive therapies, such as diode laser application, showed additional benefits in periodontal parameters but did not demonstrate a consistent impact (in the outcome). **Conclusion:** Current evidence indicates that the quality of endodontic treatment is the primary prognostic determinant in the management of endodontic–periodontal lesions, exerting a decisive influence on periapical healing and significantly conditioning periodontal outcomes. A conservative, sequential, and classification-based therapeutic approach—prioritizing high-quality endodontic treatment followed by periodontal reassessment—is essential to optimize clinical outcomes and preserve long-term tooth survival.

Keywords: "Endoperiodontal lesions"; "Root canal treatment"; "Periapical healing"; "Periodontal therapy"

RESUMO

Introdução: Existe uma forte inter-relação entre a necrose pulpar e a infeção no sistema de canais radiculares com o periodonto, estabelecendo-se assim um processo patológico. As lesões endo-periodontais constituem uma entidade patológica complexa resultante da inter-relação anatómica, microbiológica e inflamatória entre a polpa dentária e os tecidos periodontais. A presença de vias de comunicação naturais ou adquiridas permite a disseminação de microrganismos e mediadores inflamatórios, dificultando o diagnóstico diferencial e comprometendo o prognóstico. Este estudo teve como objetivo analisar criticamente a evidência científica disponível sobre as modalidades terapêuticas e os desfechos clínicos associados ao tratamento das lesões endo-periodontais, com enfoque na relevância do tratamento endodôntico e na sua interação com a terapêutica periodontal. **Metodologia:** Foi realizada uma revisão integrativa da literatura com base nas bases de dados PubMed, Scopus e Web of Science, considerando estudos publicados até novembro de 2025. A questão de investigação foi estruturada segundo os critérios PIOS. Foram incluídos ensaios clínicos randomizados, estudos prospetivos e retrospetivos, estudos longitudinais e séries de casos com seguimento mínimo de seis meses, envolvendo pacientes adultos com lesões endodôntico-periodontais. Após aplicação dos critérios de inclusão e exclusão e de acordo com as diretrizes PRISMA, treze estudos foram incluídos na análise qualitativa. **Resultados:** Os estudos analisados demonstraram que o tratamento endodôntico não cirúrgico constitui o pilar biológico fundamental no manejo das LEP, sendo determinante para a cicatrização periapical, independentemente da gravidade periodontal inicial. Taxas elevadas de cicatrização periapical (>80–90%) foram consistentemente reportadas quando a desinfeção e a obturação tridimensional do sistema de canais radiculares foram adequadamente realizadas. A resposta periodontal mostrou maior variabilidade, estando fortemente dependente da profundidade de sondagem, do nível de perda de inserção clínica e da classificação da lesão. Em lesões combinadas verdadeiras, sobretudo em pacientes com periodontite, a associação de terapias periodontais regenerativas demonstrou melhores resultados clínicos. O uso de terapias adjuvantes, como laser de díodo, apresentou benefícios adicionais nos parâmetros periodontais, sem impacto consistente (no desfecho clínico esperado). **Conclusão:** A evidência científica indica que a qualidade do tratamento endodôntico é o principal fator prognóstico na abordagem das lesões endodôntico-periodontais, condicionando de forma decisiva a cicatrização periapical e influenciando os desfechos periodontais. Uma abordagem conservadora, sequencial e baseada na classificação da lesão, com prioridade ao tratamento endodôntico seguido de reavaliação periodontal, mostra-se essencial para otimizar os resultados clínicos e preservar a longevidade dentária.

Palavras-chave: Lesões endo-periodontais; Tratamento endodôntico; Cicatrização periapical; Terapia periodontal.

INDEX

INDEX OF FIGURES

INDEX OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

[$Ca(OH)_2$]	Calcium hydroxide
CBCT	Cone-beam computed tomography
CSV	Comma-Separated Values
EDTA	Ethylenediaminetetraacetic acid
EPL	Endoperiodontal lesions
GFK	Gabriel Fukunaga Kato
IL-1β	Interleukin-1-beta
I	Intervention
JYD	Jonathan Yehouda Dray
n	Number
O	Outcome
P	Population
RCT	Root canal treatment
S	Study design
TNF-α	Tumor necrosis factor-alpha
USA	United States of America

I. INTRODUCTION

There is a strong interrelationship between pulpal necrosis and infection on the root canal system with the periodontium, establishing a disease process. The endodontic-periodontal lesion (EPL) is a condition characterized by a resorption activity on the periodontium and periapex region, with presence of local infection, high probing depth, and possible occurrence of fistula/sinus tract. The periodontal diseases could be cautious to the endodontic treatment outcome, but a pulpal necrosis can occur in a "periodontal patient" without become an EPL. Still, in EPLs management, endodontic treatment is mandatory and prior to periodontal approach.

Endoperiodontal lesions (EPLs) represent a multifaceted pathological entity which therapeutics involve endodontics and periodontal approaches. The definition of EPLs is a pathological communication between the pulpal and periodontal tissues at a given tooth (Papapanou et al., 2018), establishing an exchange of inflammatory mediators, toxins, and microorganisms between the root canal system and periodontium (Al-Sibassi et al., 2025; Chen et al., 2024; Sălceanu et al., 2025). As instance, according to the 2017 Classification of Periodontal and Peri-Implant Diseases and Conditions, EPLs could occur in time as acute or chronic conditions (Papapanou el al., 2018).

Generally, an EPL related to a recent traumatic or iatrogenic event (e.g. root fracture or perforation) would be related to a manifestation of an abscess accompanied by pain. In turn, patients with periodontitis usually present slow and chronic progression without evident symptoms (Herrera et al., 2018).

EPLs can arise primarily from the pulpal or the periodontal tissue independently or evolving to a complex bidirectional process (Papapanou et al., 2018).

The current consensus for EPL establishes a classification that distinguishes that entity as related to root damage (root fracture or cracking; root canal or pulp chamber perforation; external root resorption) and without root damage. As well, EPL without root damage is discern from lesion related to periodontitis patients and non-periodontitis patients. Moreover, graduation system is established according to the extension of periodontal pocket: grade 1 for narrow deep periodontal pocket in 1 tooth surface; grade 2 for wide deep periodontal pocket in 1 tooth surface; grade 3 for deep periodontal pocket in more than 1 tooth surface (Chen et al., 2024; Papapanou et al., 2018).

Historically, Simon, Glick, and Frank developed the foundational classification that remains a cornerstone for understanding EPLs (Simon et al., 1972). They categorized the lesions into five types: primary endodontic, primary periodontal, primary endodontic with secondary periodontal involvement, primary periodontal with secondary endodontic involvement, and true combined lesions (Chen et al., 2024; Simon et al., 1972). Primary endodontic lesions are confined to the pulp and periapical tissues, and disease is remised after a root canal therapy (RCT). Primary periodontal lesions, on the other hand, are caused by plaque-induced inflammation that progresses apically along the root surface, affecting pulp vitality due to periodontal pathogens and their byproducts. The mixed forms – endodontic lesions with secondary periodontal involvement or vice versa – demand sequential or combined interventions (Al-Fouzan, 2014).

To correctly identify the etiology of EPLs, clinicians must integrate findings from pulp vitality tests, probing depths, and radiographic or tomographic imaging. Also, cone-beam computed tomography (CBCT) provides three-dimensional visualization of root anatomy, bone defects, and lesion extent, permitting the identification of small bone resorptions or root damages that could be remain undetected on conventional periapical radiographs (Al-Sibassi et al., 2025).

The prognosis of EPLs depends on root integrity, periodontal support, and patient compliance with maintenance protocols (Guo et al., 2022). Concerning to the EPLs, the 2017 classification identifies three prognostic categories for EPLs – favorable, poor, and hopeless – based on the extent of structural damage and periodontal destruction (Herrera et al., 2018; Papapanou et al., 2018). Therefore, teeth with intact roots and moderate attachment loss could respond properly to combined therapy, whereas those with vertical fractures or advanced bone loss would present a worse prognostic (Alquthami et al., 2018).

Concerning the periodontal approach, long-term success relies on coordinated follow-up. Supportive periodontal therapy every three to six months is recommended to monitor healing, control plaque, and detect any recurrence. Re-evaluation using periapical radiographs or CBCT enables assessment of periradicular healing and detection of residual or recurrent infection. The application of microbiological monitoring and host modulation therapy – through probiotics or anti-inflammatory agents, as examples – could fuel a promising future direction for the management of EPL as an approach for a personalized medicine (Guo et al., 2022).

The microbial overlap between root canal and periodontal pockets underscores the necessity of controlling infection comprehensively. A persistent infection in either compartment may act as a reservoir for reinfection in the other. Moreover, the proximity of posterior maxillary roots to the sinus floor facilitates the extension of infection to the maxillary sinus, contributing to chronic maxillary sinusitis (Sălceanu et al., 2025).

Recent molecular studies have illuminated the shared microbial ecology of the pulp and periodontium. The bacterial communities involved in both infections consist primarily of anaerobic Gram-negative species such as *Porphyromonas, Prevotella, Fusobacterium* and *Treponema* (Buonavoglia et al., 2021). These organisms participate in biofilm formation and exhibit synergistic pathogenicity. Advances in molecular microbiology have expanded our understanding of these ecosystems, revealing not only bacterial diversity but also the role of fungi, archaea, and viruses in disease persistence. Metagenomic sequencing has identified common species shared between endodontic and periodontal infections, suggesting a symbiotic relationship within the biofilm that allows adaptation to hypoxic environments and resistance to antimicrobial agents (Nair et al., 2019). The overlapping presence of *Fusobacterium nucleatum*, *Porphyromonas gingivalis*, *Prevotella intermedia*, and *Tannerella forsythia* in both infection sites underscores the interdependence of these microbial communities. The “red” and “orange” microbial complexes, traditionally associated with periodontitis, have also been isolated from infected root canals. Moreover, their virulence mechanisms include proteolytic enzyme secretion, immune evasion, and the stimulation of pro-inflammatory cytokines, such as interleukin-1-beta (IL-1β) and tumor necrosis factor-alpha (TNF-α) as instance (Sălceanu et al., 2025).

Effective management of EPLs is grounded in an interdisciplinary approach that integrates endodontic and periodontal expertise. Understanding the lesion’s primary origin remains critical because it guides treatment sequencing and determines prognosis (Al-Sibassi et al., 2025). The clinician’s ability to interpret the continuum of pulpal and periodontal pathology determines the success of treatment. Modern diagnostic tools, including CBCT, digital periapical radiography, and advanced microbial assays, provide unprecedented precision for assessing lesion etiology. Simultaneously, minimally invasive endodontic techniques, ultrasonic irrigation activation, and regenerative periodontal materials have expanded the therapeutic possibilities (Al-Sibassi et al., 2025; Chen et al., 2024).

The primary objective is to eliminate infection, promote healing, and preserve the structural integrity of the tooth. When the primary source of infection is uncertain, clinicians generally initiate RCT first, since successful disinfection of the root canal system can reduce periodontal inflammation (Al-Sibassi et al., 2025). The RCT procedure should include proper access preparation, cleaning and shaping with modern nickel-titanium instruments, copious irrigation using sodium hypochlorite and EDTA, and three-dimensional obturation to prevent reinfection. Intracanal medicaments such as calcium hydroxide [$Ca(OH)_2$] are widely used for their bactericidal and anti-inflammatory effects (Dong et al., 2023).

Periodontal therapy follows in cases where significant attachment loss remains after successful RCT. The modern approach, as defined by the European Federation of Periodontology, follows three key stages: (1) control of risk factors such as smoking cessation and glycemic regulation; (2) nonsurgical scaling and root planning to remove subgingival biofilm and calculus; and (3) surgical intervention when deep pockets persist. Periodontal surgery may include open flap debridement, osseous recontouring, or regenerative procedures using bone grafts and membranes. For teeth with limited root damage, regenerative therapies have shown promising outcomes by restoring attachment and maintaining tooth function (Al-Sibassi et al., 2025; Chen et al., 2024; Dong et al., 2023).

The ability to establish an accurate plan of treatment both in Endodontics and Periodontics scopes is mandatory to achieve an acceptable success rate in the management of non-vital teeth with periodontal impairments, mainly, in cases of endo-periodontal lesions. The objective of the proposed dissertation was to establish a rationale review in an integrative perspective around the treatment modalities of non-surgical-endodontic treatments and their protocols; the treatment modalities around the affected periodontium; the opportunity and indication of complementary surgical approaches into the periapex and periodontium.

II. DEVOLOPMENT

1.Methodology

1.1. Sources of information and research

For the elaboration of this integrative review, the PIOS criteria (Population, Intervention, Outcome, and Study design) were considered (table 1), according to the scope of endodontic–periodontal lesions (EPL).

Table 1:

PIOS criteria

Population (P)	Adult patients diagnosed with combined endodontic–periodontal lesions (EPL) in non-vital teeth
Intervention (I)	Non-surgical endodontic treatment and/or periodontal therapy (mechanical debridement, regenerative procedures)
Outcome (O)	Periapical and periodontal healing, including resolution of probing depth, bone repair, and absence of infection
Study Design (S)	Clinical studies: randomized, non-randomized, longitudinal, case series, prospective, or retrospective studies

1.2. Search question and methods

The main question applied to conduct this work was: “What are the treatment modalities and clinical outcomes in the management of endodontic–periodontal lesions?”. The search strategy aimed to identify clinical studies that examine pulpal necrosis–associated infection affecting the periodontium and the therapeutic approaches available, mainly EPL, regarding to studies that evaluate non-surgical endodontic protocols, periodontal treatment modalities, and possible surgical complementary procedures involving the periapex and/or the periodontium.

For the elaboration of this work was conducted in November 2025, a wide structured bibliographic search strategy was carried out in Pubmed (National Library of Medicine, Bathesda, USA), Scopus (Elsevier B.V, New York, USA) and Web of Science (Clarivate,

Boston, USA), using the keywords/uniterms in multiple combinations, using the Boolean operator "AND/OR". In the query search, it was established to not include review articles, and it was run to be selected only available abstracts.

Pubmed: ((((((ENDO-PERIO) OR (ENDO-PERIODONTAL) OR (ENDODONTIC-PERIODONTAL)) AND ((ROOT CANAL*) AND ((POCKET) OR (PERIO*)) NOT (REVIEW)

Scopus: (TITLE-ABS-KEY (endo perio lesion) OR TITLE-ABS-KEY (endo periodontal lesion) AND TITLE-ABS-KEY (root canal treatment) AND NOT TITLE-ABS-KEY (review))

Web of Science: ((((((ALL=(ENDO PERIO LESION)) OR ALL=(ENDO PERIODONTAL LESION)) OR ALL=(ENDODONTIC-PERIODONTAL)) AND ALL=(ROOT CANAL*)) AND ALL=(POCKET)) AND ALL=(PERIO*)) NOT ALL=(REVIEW)

A Microsoft Excel (Microsoft Corporation, USA) file was created in .CSV format after data extraction from the database. The abstract was retrieved manually and read from custom browser. Annotations related to selection and exclusion were pointed out in the .CSV file.

As well, the abstracts were read to retrieve evidence related to the uniterms, such as: *"Endo-Perio Lesion", "endo-perio treatment", "endodontic-periodontal treatment", "Periapical Healing", "Periapical Repair", "Periodontal Healing", "Periodontal Repair".*

1.3. Eligibility Criteria

Inclusion and exclusion criteria were applied to the choice of articles.

Studies will be included if they meet the following:

(1) Population: adult patients presenting non-vital teeth with diagnosed endodontic–periodontal lesions.

(2) Intervention: endodontic and/or periodontal treatment applied to EPL.

(3) Outcome: evaluation of periodontal and periapical healing.

(4) Follow-up: minimum 6 months after therapy.

(5) Study Design: randomized clinical trials, non-randomized clinical studies, longitudinal studies (prospective or retrospective), case series with clinical follow-up.

(6) Language: language restrictions were not established

(7) Access: studies with available abstract and full text.

The following studies will be excluded:

(1) Investigations including fractured or perforated roots or inflammatory root resorption.

(2) In vitro or animal studies.

(3) Duplicated publications.

(4) Studies not aligned with the therapeutic management of EPL.

(5) Follow-up shorter than 6 months.

1.4. Study selection and Flow Diagram

Records were first screened by title, followed by abstract assessment, and finally full-text evaluation. Only studies meeting all inclusion criteria were selected for qualitative synthesis.

All abstracts were retrieved in English. One article was retrieved in full text completely in Serbian, and the DeepL Translate tool (DeepL, Cologne, Germany, https://deepl.com) was applied in free license.

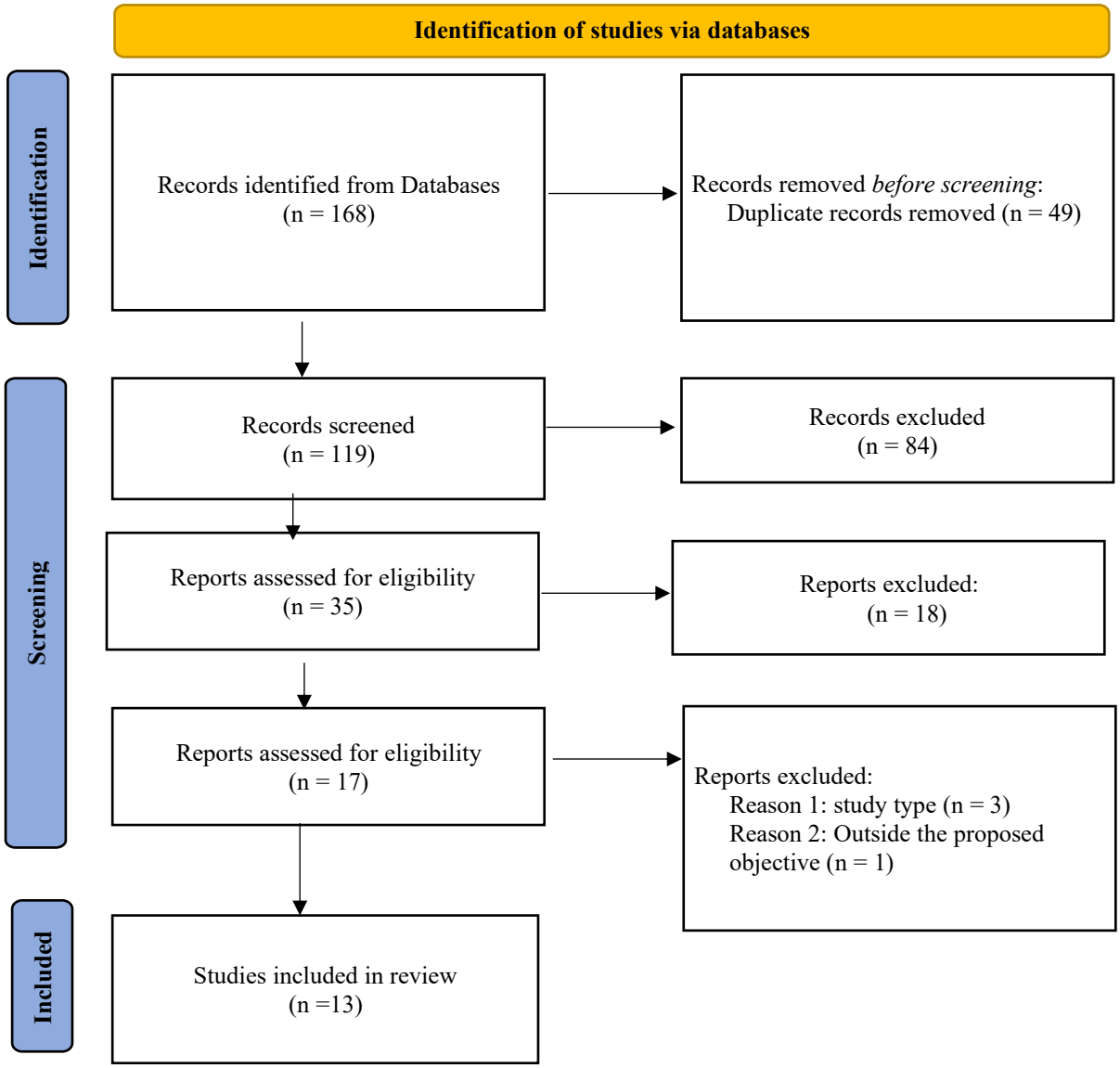
The methodological process, from identification of studies to inclusion, was summarized in the PRISMA flowchart (Figure 1)

During the study selection process, a total of 168 articles were initially identified and screened. Of these, 49 duplicate abstracts were removed and individually recorded. The remaining studies proceeded to a paired-review stage, in which 35 abstracts were jointly evaluated by two readers (JYD, GFK); this step resulted in 12 agreements and 23 disagreements, the latter requiring additional discussion to reach a final decision. Following this screening phase, 17 full-text articles were selected for detailed assessment. After the initial reading, 4 studies were excluded, one review article, two clinical case

reports, and one study determined to be outside the scope of the research question, yielding a final total of 13 articles included in the qualitative synthesis.

Figure 1:

PRISMA flow diagram for new systematic reviews which included searches of databases



2. Results

2.1.Characteristics of the studies included

The characteristics of the thirteen studies included in this integrative review are summarized in Table 2, while detailed information regarding endodontic protocols, periodontal interventions, adjunctive therapies, and healing outcomes is presented in Table 3.

The included studies were published between 2008 and 2025 and comprised thirteen clinical investigations addressing the diagnosis, treatment strategies, and outcomes of endodontic–periodontal lesions. The methodological designs were heterogeneous and included case series (Lin et al., 2008), prospective clinical studies (Nešković & Živković, 2009), randomized clinical trials (AlJasser et al., 2021; Bansal et al., 2018; Dembowska et al., 2022 Ustaoğlu et al., 2020;), retrospective cohort studies (Fan et al., 2020; Parihar et al., 2025), prospective cohort studies (Duraisamy et al., 2024), and observational analytical studies (Bagde et al., 2025; Sălceanu et al., 2025).

The studies were conducted across multiple geographic regions, including Asia, Europe, and the Middle East, contributing to a diverse clinical representation. Sample sizes ranged from 11 to 187 patients, with several investigations reporting outcomes per tooth rather than per patient (Fan et al., 2020; Sălceanu et al., 2025). Follow-up periods varied substantially, from six weeks in microbiological studies (Bagde et al., 2025) to ten years in long-term outcome analyses (Parihar et al., 2025).

According to the 2017 World Workshop classification (Papapanou et al., 2018), the studies encompassed lesions with necrotic pulp, lesions with vital pulp, and true combined endodontic–periodontal lesions, both in patients with and without periodontitis.

Lesions classified as endodontic–periodontal lesions with necrotic pulp and without root damage were predominantly managed with non-surgical root canal treatment. Studies by Lin et al. (2008), Nešković and Živković (2009), Bansal et al. (2018), and Duraisamy et al. (2024) demonstrated that adequate chemomechanical debridement, intracanal medication when indicated, and hermetic obturation resulted in high rates of periapical healing and secondary periodontal improvement. These findings support the concept that periodontal breakdown in such lesions is often a secondary consequence of endodontic infection.

Lesions classified as endodontic–periodontal lesions with vital pulp, typically associated with primary periodontal disease, were less frequently addressed directly. However, evidence from Nešković and Živković (2009) showed that biopulpectomy combined with periodontal monitoring was sufficient to promote healing when pulpal involvement became irreversible.

For combined endodontic–periodontal lesions, especially those occurring in patients with periodontitis as defined by the 2017 classification, periodontal therapy played a decisive role in determining clinical outcomes.

Across all studies, non-surgical endodontic treatment was the foundational therapeutic intervention. Despite variability in instrumentation systems, irrigants, intracanal medicaments, and obturation techniques, the primary objective was effective chemomechanical debridement and three-dimensional obturation of the root canal system (Bansal et al., 2018; Lin et al., 2008; Nešković & Živković, 2009).

The most frequently analyzed clinical and radiographic parameters included periodontal probing depth, clinical attachment level, bleeding on probing, tooth mobility, and periapical healing, assessed by conventional radiography or cone-beam computed tomography (AlJasser et al., 2021; Dembowska et al., 2022; Fan et al., 2020). Additional outcomes such as microbiological reduction, immunological markers, and tooth survival were evaluated in selected studies (Bagde et al., 2025; Blashkova et al., 2021; Parihar et al., 2025).

Regarding treatment outcomes, periapical healing was consistently reported following technically adequate endodontic therapy, with healing rates exceeding 80–90% in several studies (AlJasser et al., 2021; Lin et al., 2008; Nešković & Živković, 2009). In contrast, periodontal healing demonstrated greater variability and was strongly influenced by baseline periodontal parameters, lesion classification, and the type of periodontal intervention employed (Fan et al., 2020; Sălceanu et al., 2025; Ustaoğlu et al., 2020)

Adjunctive therapies, including diode laser application (Blashkova et al., 2021; Dembowska et al., 2022), lesion sterilization and tissue repair therapy (Saleh et al., 2014), and regenerative periodontal procedures (AlJasser et al., 2021; Ustaoğlu et al., 2020), were associated with improved periodontal parameters, although their influence on long-term tooth survival was inconsistently reported.

Long-term data provided by Parihar et al. (2025) indicated that both surgical and non-surgical approaches achieved comparable tooth retention rates over a ten-year period. While surgical therapy resulted in superior periodontal parameters, it did not significantly improve long-term tooth survival, reinforcing the importance of individualized treatment planning based on lesion classification and patient-related risk factors.

Table 2:

Characteristics of the included studies

Author (Year)	Study design	Country	Follow-up	Sample size (Patients / Teeth)	Objective	Assessment performed	Main results	Main conclusions
Lin et al. (2008)	Case series	Israel	≥12 months	11 / 11	To evaluate a conservative endodontic approach for endo-periodontal lesions involving furcation areas	Probing depth, furcation involvement, radiographic healing	Complete periodontal and periapical healing in 100% of cases	Conservative approach resulted in excellent periodontal and periapical repair
Nešković & Živković (2009)	Prospective clinical study	Serbia	3, 6 and 12 months	30 / 42	To assess the effectiveness of endodontic therapy in endo-periodontal and perio-endodontic lesions	Clinical and radiographic evaluation	Periapical healing achieved in 88.9% of vital teeth and 91.7% of non-vital teeth	Endodontic treatment was the primary determinant of lesion healing
Saleh et al. (2014)	Clinical trial	Saudi Arabia / Egypt	3, 6, 9 and 12 months	26 / 26	To evaluate lesion sterilization and tissue repair as an adjunct to conventional root canal treatment	Clinical evaluation and prognosis	Overall prognosis 98% (test) vs 90% (control)	Lesion sterilization and tissue repair therapy significantly improved prognosis
Bansal et al. (2018)	Randomized clinical trial	India	1, 3 and 6 months	75 / 75	To compare the effect of different intracanal medicaments on periodontal healing	Probing depth, clinical attachment level, bleeding on probing and periapical index	PD reduction ≈2.1 mm; CAL gain ≈2.4 mm; $p < 0.001$.	Type of intracanal medication did not influence healing
Ustaoğlu et al. (2020)	Randomized controlled clinical trial	Turkey	9 months	45 / 45	Comparing regenerative periodontal approaches following endodontic treatment	Probing depth, clinical attachment level and radiographic assessment	PD reduction 4.2 ± 0.8 mm; $p < 0.05$	Titanium-prepared platelet-rich fibrin showed results comparable to guided tissue regeneration
Fan et al. (2020)	Retrospective case-control study	China	≥6 months	- / 140	To identify prognostic factors affecting outcomes of non-surgical treatment of	Probing depth, clinical attachment level and periapical index	probing depth and clinical attachment loss were significant	Smoking, deep periodontal defects and multirooted teeth

					grade 2–3 endo-periodontal lesions		negative prognostic factors ($p < 0.05$)	were associated with poorer prognosis
Blashkova et al. (2021)	Prospective clinical trial	Russia	Short-term post-treatment	110 / -	To evaluate clinical and immunological effects of diode laser therapy	Periodontal indices and immunological markers	Significant periodontal improvement with laser.	Diode laser enhanced clinical and immunological response
AlJasser et al. (2021)	Randomized clinical trial	Saudi Arabia	3, 6 and 12 months	120 / -	Comparing obturation materials and regenerative periodontal therapy in true endo-periodontal lesions	Probing depth, clinical attachment level and cone-beam computed tomography	Up to 90% periapical healing; $p < 0.05$.	Combination of mineral trioxide aggregate and bone graft showed best outcomes
Dembowska et al. (2022)	Randomized clinical trial	Poland	6 months	12 / -	To evaluate adjunctive diode laser therapy in endo-periodontal lesion treatment	Probing depth, tooth mobility and tomography	Greater reduction with laser; $p < 0.05$.	Diode laser improved periodontal and periapical healing
Duraisamy et al. (2024)	Prospective cohort study	India	6 and 12 months	45 / -	To assess the influence of periodontal severity on periapical healing	Clinical and periapical index evaluation	Healing 47–80%; $p = 0.150$.	Periodontal severity did not influence periapical healing
Bagde et al. (2025)	Observational clinical study	India	6 weeks	30 / -	To evaluate microbiological changes after combined endodontic–periodontal therapy	Microbiological analysis and clinical parameters	Significant microbial reduction; $p < 0.05$.	Combined therapy significantly reduced pathogenic microbial load
Parihar et al. (2025)	Retrospective cohort study	India	Up to 10 years	187 / -	To compare surgical and non-surgical treatment outcomes of EPLs in diabetic patients	Tooth retention, probing depth, clinical attachment level and pain	Retention similar; better periodontal outcomes surgically.	Surgical treatment improved periodontal parameters but not tooth retention
Sălceanu et al. (2025)	Retrospective analytical study	Romania	≥6 months	90 / 126	To identify independent risk factors for endo-periodontal lesions	Probing depth, clinical attachment loss and periapical index	PD ≥4 mm strongest predictor; $p < 0.001$.	Probing depth was the strongest predictor of endodontic–periodontal lesions

Table 3:

Characteristics of Endodontic and periodontal treatment of the included studies

Author (Year)	Endodontic treatment	Obturation Technique and Material	Sealer / Intracanal Medication	Periodontal treatment	Laser parameters	Periodontal healing	Periapical healing
Lin et al. (2008)	Root canal treatment initiated at first appointment; intracanal dressing with calcium hydroxide plus iodine–potassium iodide maintained for 90 days (two-stage approach).	Obturation with gutta-percha and cement at second stage; Dentin bonding used to seal furcation floor to prevent bacterial ingress	Not reported	Furcation dentin sealing without periodontal surgery	Not applicable	Probing depth reduced from >6 mm to 2–4 mm in 100% of cases	Periapical radiographic examination showed complete healing of periradicular lesions in all patients (100%).
Nešković & Živković (2009)	Access cavity, removal of pulpal content; mechanical preparation with hand K and K-flex files using crown-down technique; copious irrigation with 1% sodium hypochlorite. For necrotic cases, inter-appointment calcium hydroxide (aqueous suspension prepared from calcium oxide powder and distilled water) placed with lentulo spiral and left 4 weeks (re-applied in 3 cases for an additional 4 weeks)	Final obturation by lateral compaction of gutta-percha.	Apexit paste sealer (Apexit®).	Adjunctive periodontal treatment provided only when clinical signs persisted (extent-dependent)	Not applicable	Clinical periodontal regeneration in majority of cases; pocket resolution in >85%	Periapical healing healing in 88.9% (vital) and 91.7% (non-vital teeth).
Saleh et al. (2014)	Conventional root canal treatment with or without lesion sterilization and tissue repair therapy	Root canal treatment performed with conventional sealer in control; in test group, sealer was mixed with	Not reported	Open flap periodontal surgery	Not applicable	Mean probing depth reduction >3 mm; periodontal improvement in 98% (test) vs. 90% (control)	Periapical healing in 98% of test group vs. 90% of control group

		lesion sterilization and tissue repair antibiotic mixture in equal proportions					
Bansal et al. (2018)	Standardized non-surgical root canal treatment. Canals enlarged three sizes beyond initial binding file using step-back technique. Irrigation with 10 mL of 1% sodium hypochlorite using 30-gauge NaviTip; smear layer removal with 17% EDTA for 1 minute followed by sodium hypochlorite and distilled water. Intracanal medicaments applied for 10 days: Group I calcium hydroxide paste; Group II calcium hydroxide mixed with 2% chlorhexidine; Control group received no medicament.	Lateral compaction of gutta-percha after removal of intracanal medicament at 10 days.	calcium hydroxide-based medicaments	Supragingival scaling at baseline; subgingival scaling and root planning performed 1 month after completion of root canal treatment in all groups	Not applicable	Probing depth reduced by approximately 2.06–2.21 mm at 6 months; clinical attachment gain 2.17–2.56 mm; bleeding on probing reduced by 40–43% (all intragroup $p < 0.001$). No significant intergroup differences ($p > 0.05$)	Periapical index score reduced by 0.79‑0.90 at 6 months in all groups ($p \leq 0.002$), with no intergroup difference
Ustaoğlu et al. (2020)	Rubber dam isolation; working length determined 1 millimeter short of apical foramen using apex locator; glide path with 15/20 K-files; rotary preparation with ProTaper Universal up to F1–F4 as needed. Irrigation: 2 milliliters of 5.25% sodium hypochlorite after each filing; final irrigation with 2 milliliters of 17% EDTA to remove inorganic debris and open	Single cone obturation using ProTaper Universal F4 gutta-percha; composite resin restoration	Dentsply DeTrey sealer	Full-mouth supragingival and subgingival scaling and root planing; reassessment at 6 weeks; then surgery: open flap debridement alone vs open flap debridement + titanium-prepared platelet-rich fibrin vs open flap debridement + guided tissue regeneration (allograft + collagen membrane).	Not applicable	Significant probing depth reduction and clinical attachment gain in titanium-prepared platelet-rich fibrin and guided tissue regeneration groups vs open flap debridement at 9 months ($p < 0.05$); Radiographic intrabony defect depth showed significant	Periapical status remained stable in 100% of cases

	dentinal tubules; canals dried with paper points					intergroup difference	
Fan et al. (2020)	Two-visit non-surgical root canal treatment under rubber dam isolation. Crown-down preparation with rotary nickel–titanium instruments. Working length determined with electronic apex locator and confirmed radiographically. Irrigation with 3% sodium hypochlorite and 17% EDTA. Intracanal medication with calcium hydroxide paste for approximately 7 days.	Vertical compaction of gutta-percha	Zinc oxide–eugenol–based sealer	Full-mouth supragingival scaling followed by subgingival scaling and root planing 1–2 months after root canal treatment	Not applicable	Probing depth, clinical attachment level, sulcus bleeding index, and tooth mobility significantly improved at 6 months ($p < 0.01$).	Periapical index significantly reduced after root canal therapy ($p = 0.002$) and further after periodontal therapy ($p = 0.042$).
Blashkova et al. (2021)	Root canal instrumentation using Reciproc and Mtwo rotary systems up to ISO size 30–40. Irrigation with 3% sodium hypochlorite and 17% EDTA with passive ultrasonication	Obturation with gutta-percha	Epoxy resin–based sealer	Professional oral hygiene, endodontic treatment, and periodontal curettage	Diode laser 980 nm; endodontic irradiation 1.25 W (average), pulsed mode; periodontal pocket curettage at 0.75 W, pulsed mode	Russell periodontal index reduced from median 3.38 to 1.3 in laser group vs 3.95 to 2.0 in control ($p < 0.001$). Oral hygiene index reduced from 2.9 to 1.0 (laser) vs 1.6 (control).	Indirect reduction of periapical inflammation
AlJasser et al. (2021)	Root canal treatment with gutta-percha or mineral trioxide aggregate	Obturation with gutta-percha or MTA	Mineral trioxide aggregate (as obturation material) versus conventional obturation	Periodontal regenerative therapy with bone grafting	Not applicable	Probing depth reduction up to 5.1 ± 1.2 mm in grafted groups	up to 90% complete healing (cone-beam computed tomography periapical index 0) in mineral trioxide aggregate + graft group at 12 months.
Dembowska et al. (2022)	Microscope-assisted root canal treatment. Glide path with stainless steel hand files (#20), rotary preparation with Endostar E3 Basic system using	Lateral condensation of gutta-percha	AH Plus epoxy resin–based sealer; Interappointment calcium hydroxide paste	Mechanical non-surgical periodontal treatment (root surface debridement/planning) as part of protocol; one group	Diode laser 940 nm; pulsed mode; average power 0.8 W; fiber 200–300 µm; applied to	Periodontal: significant reduction in periodontal pocket depth and tooth mobility in	cone-beam computed tomography showed significant reduction in lesion volume and bone

	crown-down technique. Irrigation with 2% sodium hypochlorite, EDTA, and distilled water.			received adjunctive laser therapy	root canals and periodontal pockets twice monthly for 3 months	laser group vs control ($p < 0.05$).	defect size in laser group at 6 months ($p < 0.05$).
Duraisamy et al. (2024)	Non-surgical endodontic treatment in two visits; intracanal medicament used was 2% chlorhexidine	Obturation with gutta-percha	Chlorhexidine intracanal medication	Scaling and root planning as needed	Not applicable	No statistically significant differences between periodontal stages ($p > 0.05$)	Periapical healing at 12 months: 80% (periodontally healthy), 47% (periodontitis stage I–II), 50% (periodontitis stage III); no significant difference ($p = 0.150$).
Bagde et al. (2025)	Root canal therapy combined with periodontal debridement and systemic antibiotics; microbial sampling pre-treatment and after 6 weeks; microbial identification via culture and polymerase chain reaction (PCR)	Not reported	Not reported	Full-mouth scaling and root planning; systemic antibiotics (amoxicillin 500 mg + metronidazole 400 mg for 5 days).	Not applicable	Microbial reduction: Porphyromonas gingivalis 85%→ 30% ($p = 0.001$); Fusobacterium nucleatum 75%→ 25% ($p = 0.002$); Enterococcus faecalis 60%→15% ($p = 0.005$). Periodontal parameters significantly improved ($p < 0.05$).	Indirect reduction of periapical inflammation
Parihar et al. (2025)	Non-surgical group: root canal treatment with or without scaling and root planing; surgical group: apicoectomy with or without guided tissue regeneration.	Not reported	Not reported	Non-surgical periodontal therapy (scaling and root planning) versus apicoectomy and guided tissue regeneration as indicated.	Not applicable	Surgery yielded greater probing depth reduction and clinical attachment gain ($p < 0.01$).	Similar periapical healing between groups
Sălceanu et al. (2025)	Previously completed non-surgical root canal treatment	Not applicable	Not applicable	Initial periodontal therapy in all cases	Not applicable	Increased probing depth associated with higher lesion risk (odds ratio up to 13.83; $p < 0.001$)	Higher periapical index associated with endodontic failure

3. Discussion

The present integrative review attempted to summarize main qualitative aspects related to evidence from thirteen clinical studies to clarify therapeutic strategies for endodontic–periodontal lesions, with particular emphasis on the role of endodontic treatment quality, periodontal interventions, and adjunctive therapies. The analysis of the updated tables demonstrates that, irrespective of lesion classification or periodontal severity, effective endodontic infection control represents the biological cornerstone of successful management, governing periapical healing and strongly influencing subsequent periodontal outcomes.

Across all included studies, non-surgical endodontic treatment was consistently performed as the initial therapeutic step, reflecting both etiopathogenic principles and contemporary clinical guidelines (Bansal et al., 2018; Duraisamy et al., 2024; Lin et al., 2008; Nešković & Živković, 2009). This sequencing is biologically justified, as intraradicular microbial biofilms constitute the primary source of inflammatory mediators affecting periapical tissues and may secondarily contribute to periodontal breakdown through anatomical communication pathways.

Evidence from multiple studies indicates that high-quality endodontic treatment alone can induce both periapical and secondary periodontal healing, particularly in lesions where periodontal destruction is predominantly of endodontic origin. Lin et al. (2008) reported complete periapical and periodontal healing of furcation-associated lesions following a conservative two-stage endodontic protocol with prolonged calcium hydroxide medication, without the need for periodontal surgery. Similarly, Nešković and Živković (2009) observed periapical healing rates exceeding 88% in combined lesions, reinforcing the concept that periodontal changes adjacent to endodontic infection may be reversible once intraradicular infection is eliminated.

From a technical perspective, Table 3 highlights that studies reporting favourable outcomes consistently emphasized adequate chemomechanical debridement, effective irrigation protocols, and three-dimensional obturation of the root canal system. Sodium hypochlorite was the most used irrigant, reflecting its tissue-dissolving and antimicrobial properties, while intracanal medicaments, predominantly calcium hydroxide, were frequently employed in lesions with extensive periodontal communication (Lin et al., 2008; Fan et al., 2020; Dembowska et al., 2022).

However, the findings also suggest that endodontic protocol quality outweighs material selection in determining clinical outcomes. Bansal et al. (2018) demonstrated significant periodontal and periapical improvement across all treatment groups, with no statistically significant differences related to the type of intracanal medicament used. This underscores that meticulous canal debridement, working length control, and obturation quality are more decisive prognostic factors than the specific materials employed.

The importance of obturation quality is further supported by analytical evidence. Sălceanu et al. (2025) identified inadequate obturation length, density, or taper as significant predictors of persistent endodontic–periodontal lesions, indicating that deficient apical or lateral sealing may perpetuate inflammatory communication between the root canal system and the periodontium. Conversely, AlJasser et al. (2021) reported superior periapical healing when mineral trioxide aggregate–based obturation was used, particularly when combined with periodontal regenerative therapy, highlighting the relevance of sealing ability in complex lesions.

One of the most clinically relevant findings emerging from this review concerns the relationship between periodontal disease severity and periapical healing. Duraisamy et al. (2024) demonstrated that periodontal stage did not significantly influence periapical healing outcomes following technically adequate endodontic treatment, even in patients with advanced periodontitis. This challenges the traditional perception that combined endodontic–periodontal lesions inherently carry a poor endodontic prognosis and reinforces the concept that periapical tissues retain substantial regenerative capacity once the intraradicular source of infection is eliminated.

In contrast, periodontal healing outcomes were shown to be far more dependent on baseline periodontal parameters. Fan et al. (2020) and Sălceanu et al. (2025) consistently identified probing depth and clinical attachment loss as the strongest predictors of unfavourable periodontal outcomes. Probing depths of four millimetres or greater were significantly associated with persistent pathology, suggesting that while endodontic treatment governs periapical resolution, it cannot fully compensate for advanced periodontal destruction.

The importance of treatment sequencing was consistently emphasized across the included studies. Endodontic therapy was invariably performed before periodontal intervention, allowing clinicians to reassess periodontal defects after endodontic stabilization and avoid unnecessary surgical procedures (Bansal et al., 2018; Fan et al., 2020). This staged

approach facilitates differentiation between periodontal defects that are resolved spontaneously following endodontic healing and those that require active periodontal or regenerative intervention.

In true combined endodontic–periodontal lesions, particularly those associated with established periodontitis, endodontic treatment alone was often insufficient to achieve complete periodontal regeneration. In such cases, periodontal regenerative procedures demonstrate superior outcomes. Ustaoğlu et al. (2020) reported significantly greater probing depth reduction and clinical attachment gain following guided tissue regeneration and titanium-prepared platelet-rich fibrin compared with open flap debridement alone. Similarly, AlJasser et al. (2021) observed enhanced periodontal and periapical outcomes when periodontal bone grafting was combined with high-quality endodontic obturation, suggesting a synergistic interaction between optimal endodontic sealing and periodontal regeneration.

Adjunctive therapies, including diode laser application, were associated with improved periodontal parameters and reduced inflammatory markers (Blashkova et al., 2021; Dembowska et al., 2022). However, the evidence indicates that these benefits were consistently observed only when conventional endodontic treatment was properly executed. Consequently, laser therapy should be regarded as a supportive adjunct rather than a substitute for effective endodontic disinfection and obturation.

The role of periapical surgery appeared limited. Long-term outcomes reported by Parihar et al. (2025) revealed comparable tooth survival rates between surgically and non-surgically treated cases over a ten-year follow-up, indicating that surgical intervention should be reserved for persistent lesions associated with confirmed endodontic failure or anatomical limitations.

Overall, the evidence supports a conservative, endodontically driven treatment paradigm for endodontic–periodontal lesions. High-quality non-surgical root canal treatment constitutes the biological foundation of care, while periodontal and surgical interventions should be selectively indicated based on lesion classification, periodontal severity, and biological response to initial endodontic therapy.

The collective findings strongly support the clinical utility of the 2017 World Workshop classification (Papapanou et al., 2018). Lesions with necrotic pulp and minimal periodontal involvement demonstrated favorable outcomes with non-surgical endodontic

treatment alone (Lin et al., 2008; Nešković & Živković, 2009). Conversely, combined lesions in patients with periodontitis required a multidisciplinary approach integrating endodontic, periodontal, and selectively surgical therapies to achieve predictable outcomes (Fan et al., 2020; Sălceanu et al., 2025; Ustaoğlu et al., 2020).

Despite the valuable insights provided, the predominance of retrospective studies and short-term evaluations limits the strength of causal inferences, particularly regarding surgical and adjunctive interventions (Blashkova et al., 2021; Parihar et al., 2025). Future research should prioritize randomized clinical trials stratified according to the 2017 classification to establish evidence-based protocols tailored to lesion subtype and severity.

The endodontic treatment comes first in the management of EPL. Microbial contamination was revealed as an issue and a concern during the root canal treatment, whereas microbiological outcomes were assessed and systemic antibiotics were indicated (Badge et al., 2025). As attempts to manage the microbial features, optimization of irrigation protocols (Bansal et al., 2018; Blashkova et al., 2021; Nešković & Živković, 2009; Ustaoğlu et al., 2020), usage of rubber dam (Fan et al., 2020; Ustaoğlu et al., 2020) usage of calcium hydroxide based-intracanal medicaments (Bansal et al., 2018; Fan et al., 2020; Lin et al., 2008) and usage of triple paste antibiotics with sealer during final obturation (Saleh et al., 2014) were retrieved concerning to endodontic treatment.

In alignment with the objective of this dissertation, the available evidence supports an integrative, conservative, and classification-driven therapeutic rationale for endodontic–periodontal lesions. Non-surgical endodontic treatment remains the cornerstone of therapy, periodontal interventions should be tailored to lesion severity, and surgical approaches should be selectively indicated based on biological response and risk assessment.

III. CONCLUSION

Based on the evidence which was assessed during this this integrative review, it can be concluded that the quality of endodontic treatment is the primary prognostic determinant in the management of endodontic–periodontal lesions, exerting a decisive influence on periapical healing and significantly conditioning periodontal outcomes.

Across the included studies, non-surgical endodontic treatment consistently represented the biological foundation of therapy, regardless of lesion classification or periodontal disease severity. High rates of periapical healing were observed when effective chemomechanical debridement, appropriate irrigation, and adequate three-dimensional obturation of the root canal system were achieved, even in teeth affected by advanced periodontal involvement. These findings reinforce the concept that periapical tissues retain substantial regenerative potential once intraradicular infection is eliminated.

The reviewed evidence further indicates that endodontic protocol quality outweighs material selection in determining clinical outcomes. Although various instrumentation systems, intracanal medicaments, obturation techniques, and sealers were employed, successful healing was primarily associated with technical adequacy rather than specific materials. Inadequate obturation quality, conversely, was consistently linked to persistent endodontic–periodontal pathology.

While endodontic treatment governs periapical healing, periodontal outcomes were shown to be strongly dependent on baseline periodontal parameters, particularly probing depth and clinical attachment loss. Non-surgical periodontal therapy was effective in early-stage lesions following endodontic stabilization; however, advanced combined lesions frequently required surgical or regenerative periodontal interventions to achieve satisfactory periodontal healing.

Collectively, the findings support a conservative, endodontically driven, and classification-based treatment approach for endodontic–periodontal lesions. Clinicians should prioritize high-quality non-surgical root canal treatment as the initial therapeutic step, reassess periodontal status following endodontic stabilization, and selectively apply periodontal, regenerative, or surgical interventions based on lesion severity and biological response.

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