Review

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Cemental tears: theoretical basis, etiology, treatments and outcome

Lágrimas de cemento: fundamentação teórica, etiologia, tratamentos e desfechos

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ABSTRACT

Cemental tears are characterized by the partial or total detachment of cementum along the dentinocemental junction or incremental lines within the cementum, possibly involving the adjacent radicular dentin. Although this condition has been documented in some studies, its pathogenesis remains poorly understood. This integrative review aimed to analyze the etiology, treatments, and outcome of cemental tears based on studies published between 2019 and 2024. The findings indicate that, despite advancements in imaging techniques such as cone-beam computed tomography, early diagnosis of cemental tears remains challenging. Identification of this condition often occurs late when significant periodontal compromise is already present. Reviewed studies suggest that predisposing factors, such as the affected tooth type, history of

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trauma, and advanced age, may influence the onset of the pathology. However, the scarcity of research and the variability of therapeutic protocols hinder the standardization of clinical approaches. Treatment options range from conservative methods, such as cemental fragment removal and guided tissue regeneration, to invasive interventions, such as tooth extraction in cases of severe periodontal damage. The findings of this review highlight the urgent need for further clinical studies to enhance the understanding of cemental tears pathophysiology and establish more effective therapeutic guidelines.

Indexing terms: Dental cementum. Periodontics. Review.

RESUMO

As lágrimas de cemento são caracterizadas pelo descolamento parcial ou total do cemento ao longo da junção dentino-cementária ou de linhas incrementais dentro do corpo do cemento, podendo envolver também a dentina radicular adjacente. Embora essa condição tenha sido documentada em alguns estudos, sua patogênese ainda não está completamente esclarecida. Esta revisão integrativa teve como objetivo analisar a etiologia, os tratamentos e os desfechos das lágrimas de cemento com base em estudos publicados entre 2019 e 2024. Os resultados indicam que, apesar dos avanços em técnicas de imagem, como a tomografia computadorizada de feixe cônico, o diagnóstico precoce das lágrimas de cemento continua desafiador. A identificação dessa condição frequentemente ocorre tardiamente, quando já há comprometimento periodontal significativo. Os estudos revisados sugerem que fatores predisponentes, como tipo de dente acometido, histórico de trauma e idade avançada, podem influenciar o surgimento da patologia. No entanto, a escassez de pesquisas e a variabilidade dos protocolos terapêuticos dificultam a padronização das condutas clínicas. As abordagens terapêuticas incluem desde métodos conservadores, como remoção do fragmento cementário e regeneração tecidual guiada, até intervenções invasivas, como extração dentária nos casos de comprometimento periodontal severo. Os achados desta revisão reforçam a necessidade de estudos clínicos adicionais para aprimorar o entendimento da fisiopatologia das lágrimas de cemento e estabelecer diretrizes terapêuticas mais eficazes.

Termos de indexação: Cemento dentário. Periodontia. Revisão de literatura.

INTRODUCTION

Cemental Tears (CT) are characterized by partial or total detachment of the cementum along the Dentin-Cementum Junction (DCJ) or incremental lines within the body of the cementum, and may also involve the adjacent radicular dentin. Although this condition has been documented in some studies, its pathogenesis is still not fully understood [1]. CT is often associated with periodontal and periapical changes, leading to symptoms that may be confused with other endodontic and periodontal pathologies [2]. In some cases, CT can trigger rapid periodontal attachment loss, representing a significant risk factor for the progression of periodontal diseases [3].

Several factors have been suggested as predisposing to the development of CT, including tooth type, age, sex, history of dental trauma, occlusal trauma, excessive occlusal forces, and previous endodontic treatment [4]. Studies suggest that maxillary and lower incisors are the most affected teeth, with a higher prevalence in male patients over 60 years old [5]. However, the causal relationship between these factors and the development of cemental tears still lacks scientific confirmation [6]. The low reported prevalence of this condition may be related to diagnostic difficulties, as well as limitations in the studies published on the topic [4]. Cementum detachment can present as a rapidly progressing lesion, with clinical features that may include abscesses, infections in sinus tracts, and localized periodontal pockets [5].

CT can mimic other diseases, such as localized periodontitis, apical periodontitis, and vertical root fractures [7]. The presence of isolated periodontal pockets may be one of the few clinical signs for its identification [7]. Therefore, radiographic and imaging exams play a fundamental role in detecting these lesions, as CT often appears as thin, "spike-like" radiopaque masses along the affected root surface [8]. However, a retrospective review indicated that in approximately 46.03% of CT cases, the initial diagnosis was mistaken, being confused with apical periodontitis resulting from pulp necrosis or endodontic-periodontal lesions [9].

Despite advances in knowledge about CT, the literature still presents significant gaps regarding its etiopathogenesis, predisposing factors, and best therapeutic approaches [2]. Treatment can range from the removal of the cemental fragment with scaling and root planing to regenerative surgical procedures, such as Guided Tissue Regeneration (GTR) and bone grafts [10]. In some cases, extraction of the affected tooth may be indicated, especially when there is extensive periapical involvement [9].

The scarcity of more robust studies on the topic reinforces the need for further investigation of these lesions, contributing to a better understanding of their pathophysiology and to the improvement of diagnostic and treatment strategies [4]. In this context, this integrative review aims to gather and critically analyze the available evidence in the literature on CT, seeking to consolidate information on its etiology, prevalence, clinical manifestations, and proposed therapies, as well as to identify gaps in knowledge that may guide future research on the topic [7].

Objective

General Objective

Analyze the etiology, treatments, and outcomes related to cemental tears.

Specific Objectives

Conduct an analytical search of the scientific literature on cemental tears analyze the likely consequences and assess whether there is a treatment that is more suitable for cases of cemental tears and its outcomes.

METHODS

For the development of the present study, an integrative review was chosen, based on scientific articles available through digital databases. The bibliographic search was conducted in databases such as USA National Library of Medicine (PubMed), Google Scholar, Latin American and Caribbean Health Sciences Literature (LILACS), and the Virtual Health Library (BVL). To expand the investigation, the Consensus tool within the ChatGPT software was used, applying the same search criteria used in the databases to this tool.

The bibliographic search began on May 1st, 2024, and was conducted by a single independent reviewer. In cases of doubt regarding the inclusion or exclusion of articles in the sample, a second reviewer was consulted to assist in the decision-making process.

For English-language databases, the descriptors used were: Cemental Tears and Periodontics. For Portuguese-language databases, the descriptors were: *Lágrimas de Cemento* and *Periodontia*. In order to identify recent research and the most up-to-date and promising treatment protocols, only articles published between 2019 and 2024 were selected.

The inclusion criteria considered articles that were available online and free of charge, published in English or Portuguese, indexed within the last five years, and that addressed studies conducted on living human beings, including case reports and treatments. Articles that did not meet these criteria were excluded from the analysis.

The data from the articles included in the sample were synthesized into a table containing the following information: title, authors, year, country, type of study, sample size, sample gender, treatment method, and outcome. The outcome was considered favorable when the dental unit was maintained and unfavorable when extraction was necessary.

RESULTS

During the research process, 536 articles were initially identified in the databases. The initial selection was carried out based on the analysis of titles and abstracts, aiming to identify those that best fit the scope of the study. After a preliminary reading of titles and abstracts, 19 articles were selected for full reading. Of these, only 4 fully met all inclusion criteria. After selection, the information contained in these articles was analyzed in detail, organized, and gathered to identify the theoretical basis, etiology, treatments, and outcomes related to cemental tears.

No studies were found in the BVL database using the descriptors *Lágrimas de Cemento* and *Periodontia*. For this reason, this database was not included in the search flowchart (figure 1). Additionally, no scientific articles in Portuguese were found in any of the analyzed databases. The information obtained from the selected articles was synthesized and organized into a table (chart 1).

All included articles presented reports of one or more clinical cases, with two of these studies using retrospective secondary data. The follow-up period for the cases ranged from 3 to 36 months. The cases in which an attempt was made to maintain the dental unit through treatments such as endodontics, guided tissue regeneration, and conservative surgical curettage showed a longer follow-up period. The therapeutic approach varied according to the degree of damage to the periodontal tissues, tooth mobility, and the clinical criteria adopted by the operators.

Although the literature suggests that men tend to show a higher prevalence of CT lesions, no significant difference in the number of cases between male and female patients was detected in the articles analyzed in this study. However, the studies analyzed show a predominance of patients between middle and old age, corroborating what is suggested in the literature.

Types of teeth and root thirds most affected

The retrospective studies included in this research with the highest number of cases were Qari et al. [6] and Zhao et al. [9], presenting 21 and 61 cases, respectively. The most affected tooth type differed between the two studies: Qari et al. [6] reported a higher prevalence of lesions in maxillary incisors (47.6%), while Zhao et al. [9] reported that molars were the most affected (71.43%).

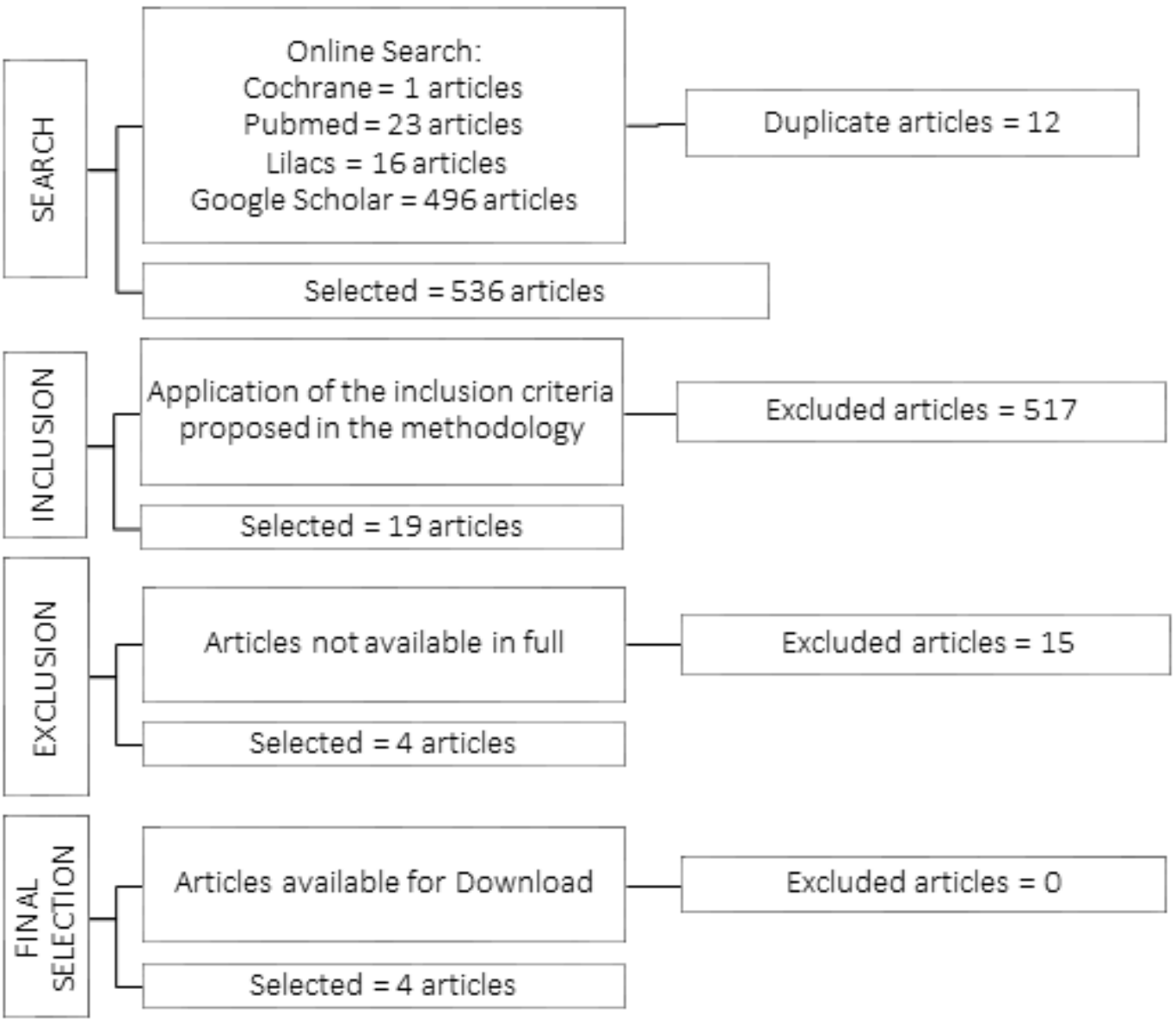

Figure 1. Search flowchart.
Source: Own authorship (2025).

Cementum fragments can be found in all three thirds of the root. However, the analyzed studies have shown a greater predominance in the apical third or throughout the entire root region. According to Qari et al. [6], CT affecting the entire dental root was more frequent, found in 47.6% of cases, whereas Zhao et al. [9], identified a higher frequency of CT limited solely to the apical third (57.14% of cases).

Radiographic characteristics and diagnosis

Cemental tears often appear as radiopaque masses with shapes resembling a “D,” “J,” wedge, or thin/thick vertical lines along the root surface [6,9,11,12]. The study conducted by Qari et al. [6] identified a higher number of lesions with a “D” shape. These masses appear surrounded by radiolucency generated

Chart 1. Data on title, authors, year, country, type of study, sample number, sample gender, treatment method and outcome present in the articles added to the sample.

Articles	The pararadicular radiolucency with vital pulp: Clinicopathologic features of 21 cemental tears	Cemental tear: An overlooked finding associated with rapid periodontal destruction. A case series	Cemental tear on the first maxillary premolar in the patient with facial palsy: an uncommon type of root fracture	Clinical, radiographic features and prognosis of cemental tear: A retrospective study of 63 teeth
Authors	Qari et al. [6]	Pedercini et al. [11]	Podugu et al. [12]	Zhao et al. [9]
Year	2019	2021	2023	2024
Country	USA	USA	India	China
Type of Study	Retrospective Case Review	Case Series Study	Case Report	Retrospective Case Review
Number of Samples	21	3	1	61
Gender	12 Men; 9 Women	2 Women; 01 Man	1 Woman	33 Men; 28 Women
Treatment Methods	Tooth extraction with or without prior endodontic treatment, 17 cases. Conservative surgical curettage, 4 cases.	Removal of cementum tear associated with Guided Tissue Regeneration (GTR).	Tooth extraction followed by tissue biopsy.	Treatment varied depending on the case. Some teeth underwent apical surgery, non-surgical periodontal treatment, or surgical periodontal treatment.
Outcome	In 17 cases, the outcome was unfavorable, while in the other four cases, the teeth were preserved. For lesions close to the bone crest, more aggressive scaling and root planing appear to be more appropriate. For more apical lesions, conservative curettage, with or without grafting, has shown promising results.	Only one case had an unfavorable outcome. The diagnosis of cemental tears was confirmed in all three patients after histopathological evaluation. The LGE protocol was successful in two cases, allowing the maintenance of the teeth with cemental tears.	Unfavorable outcome. After extraction of the unit and biopsy, it was observed that the cementum present in the fragment was mainly acellular with a large number of inflammatory cells.	In 26 cases, the outcome was unfavorable. In 35 cases, the teeth were preserved with or without discomfort after treatment. Twenty-six teeth were extracted due to excessive mobility and uncontrollable bone loss. Other teeth were preserved with or without discomfort (23), but the teeth most affected by mobility and greater probing depth were at higher risk of extraction. Advanced age was also associated with a worse outcome.
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Source: Own authorship (2025).

by areas of periodontal destruction, possibly involving the periapical region. When located near the apical area, they may produce images similar to apical periodontitis induced by pulp necrosis. When involving the entire root region, CT lesions may create images suggestive of localized periodontitis or endo-periodontal lesions [6,9].

Cone-Beam Computed Tomography (CBCT) has demonstrated greater accuracy in the differential diagnosis of CT compared to root fractures and other periodontal diseases. Therefore, this exam should be requested when CT is suspected, as it is fundamental for the differential diagnosis, provides a better assessment of periodontal destruction, and offers information that supports treatment planning and outcome expectations.

Treatments used in the studies

Conservative curettage, with or without GTR and Guided Bone Regeneration (GBR), was effective in preserving dental units in cases where the root and periodontium were not extensively compromised. In cases with grade 3 mobility, associated furcation lesions, and probing depths greater than 9 mm, extraction was the most recommended treatment. The size, thickness, and location are complicating factors for these cases; the larger and more apical the CT, the more invasive the surgical interventions, the greater the risk to pulp vitality, and the worse the outcomes.

Zhao et al. [9] reported that, of the 63 teeth analyzed, 26 were extracted due to excessive mobility and uncontrollable bone loss, while 35 were preserved, with 23 presenting some degree of post-treatment discomfort. In the same study, it was shown that in some cases, no treatment was performed, generally when probing depths were less than or equal to 5 mm and mobility was grade 0 or 1.

Use of biomodulators and regenerative materials

Pedercini et al. [11] highlighted the use of tissue biomodulators, such as enamel matrix derivatives and Ethylenediaminetetraacetic Acid (EDTA), to optimize tissue regeneration after conservative surgical curettage. Freeze-dried allograft bone mixed with calcium sulfate was used to stabilize the treated area, covered with a resorbable collagen membrane. The use of GTR and GBR can reduce clinical attachment loss post-surgery and improve the outcomes of the case.

Endodontic treatment

Endodontic treatment was often necessary, especially in cases with associated periapical damage. Pulp sensitivity testing was the most emphasized parameter in the studies for determining pulp vitality. None of the analyzed studies reported the use of bioceramic cements to seal possible communications between the root canal and the periodontium.

Outcomes

The follow-up period ranged from 3 to 36 months. Cases treated with GTR, GBR, and conservative approaches showed a longer duration of tooth preservation and required long-term follow-up. Outcomes were less favorable in elderly patients and in cases of extensive lesions, especially when the apical third of the root was involved (tables 1 and 2).

Table 1. Distribution of cementum tears in the analyzed studies.

Authors	Year	Number of samples	Most affected type of tooth	Most prevalent location of Cemental Tears
Qari et al. [6]	2019	21	Maxillary Incisors	Full Root
Zhao et al. [9]	2024	63	Molars	Apical Third
Pedercini et al. [11]	2021	3	Maxillary Incisors	Apical Third
Podugu et al. [12]	2023	1	Maxillary First Premolar	Middle Third

Source: Own authorship (2025).

Table 2. Treatment methods and their outcomes.

Authors	Treatment methods	Number of samples	Success* (%)	Failure** (%)	Observations
Qari et al. [6]	Extraction	17	0	100.0	Teeth extracted with or without prior endodontic treatment
	Conservative surgical curettage	4	100.0	0	None of these cases had apical radiolucency
Zhao et al. [9]	Apical surgery	10	90.0	10.0	Extraction in 1 case
	Non-surgical periodontal treatment	14	71.4	28.6	Extraction in 4 case
	Surgical periodontal treatment	3	100.0	0	The teeth were retained and presented no discomfort
	No treatment performed	15	100.0	0	The teeth were retained and presented no discomfort
	Extraction	11	0	100.0	Due to periodontal and/or endodontic involvement, it was the first-choice treatment
Pedercini et al. [11]	Cementum tear removal + guided tissue regeneration	3	67.0	33.0	Two cases were successful with guided tissue regeneration
Podugu et al. [12]	Extraction + biopsy	1	0	100.0	Histopathological confirmation of cementum tear

Note: Success* = maintenance of the dental unit; Failure** = extraction of the dental unit.
Source: Own authorship (2025).

DISCUSSION

Cemental tears remain an underdiagnosed and poorly documented condition in the dental literature. The low prevalence of this pathology directly reflects the scarcity of clinical studies, making it difficult to establish treatment protocols based on high levels of scientific evidence. Most of the available studies are case reports or case series, which limits the generalization of the findings and complicates the standardization of therapeutic approaches. Furthermore, the differential diagnosis of cemental tears can be challenging, as the condition presents clinical manifestations similar to localized periodontitis and vertical root fractures. Therefore, the use of complementary exams, such as CBCT, is essential for the accurate identification of the problem. Proper differentiation between cemental tears and other periodontal and endodontic conditions is crucial, as late or incorrect diagnosis can lead to disease progression and, in many cases, result in the loss of the dental unit.

The findings of this review are consistent with the results of Lee [13], who emphasize the difficulty in diagnosing this condition and the lack of well-designed studies on its etiology and treatment. Although the predisposing factors for the development of cemental tears are not yet fully understood, the literature reviewed suggests that advanced age, history of dental trauma, and occlusal trauma are important risk factors. Regarding the distribution of lesions, some studies indicate a higher incidence in maxillary incisors, while others point to molars as the most frequently affected teeth. These differences may be explained by the lack of epidemiological data and the underreporting of the condition.

The study by Lin et al. [1] demonstrated that the likelihood of maintaining the affected dental unit varies according to the affected site. Lesions involving the middle and cervical thirds showed maintenance rates of 66.7% and 60.0%, respectively, whereas lesions related to the apical third had a maintenance rate of 11.1%. These results align with the observations made in this review.

The studies evaluated observed isolated periodontal pockets associated with dental units affected by CT in some cases. This finding was also identified by Ishikawa et al. [7], whose authors state that CT contributes to the progression of periodontitis, as the presence of the cementum fragment increases bacterial accumulation in the pocket and, consequently, exacerbates periodontal inflammation, especially in cases where CT is located in the cervical third of the root.

Regarding therapeutic approaches, the analyzed studies demonstrated great variability in the treatments employed. Conservative surgical curettage, surgical and non-surgical periodontal treatments, guided tissue regeneration, and guided bone regeneration were reported as viable alternatives for maintaining the dental unit, especially in cases where there was no severe mobility, furcation involvement, or extensive bone loss. The use of tissue biomodulators, such as enamel matrix derivatives and EDTA, was also described as a promising strategy to optimize tissue regeneration after lesion removal. However, in cases where periodontal destruction was irreversible, tooth extraction followed by GBR and prosthetic rehabilitation was the most indicated approach.

Another relevant aspect is the need for a multidisciplinary approach in the management of cemental tears. In many cases, involvement of the root canal system requires endodontic intervention in conjunction with periodontal treatment. Nevertheless, the studies included in this review did not mention the use of bioceramic cements to seal communications between the main and/or lateral canals and the periodontium, which could represent an opportunity for future research.

Given the heterogeneity of treatments found in the literature and the absence of a standardized clinical protocol, a possible approach to guide clinical decision-making would be the use of a decision tree. Considering the evidence presented in this article, the authors suggest the decision tree illustrated in figure 2. Furthermore, there is an urgent need for comparative studies evaluating the efficacy of different therapeutic approaches, enabling the establishment of evidence-based guidelines for managing this condition.

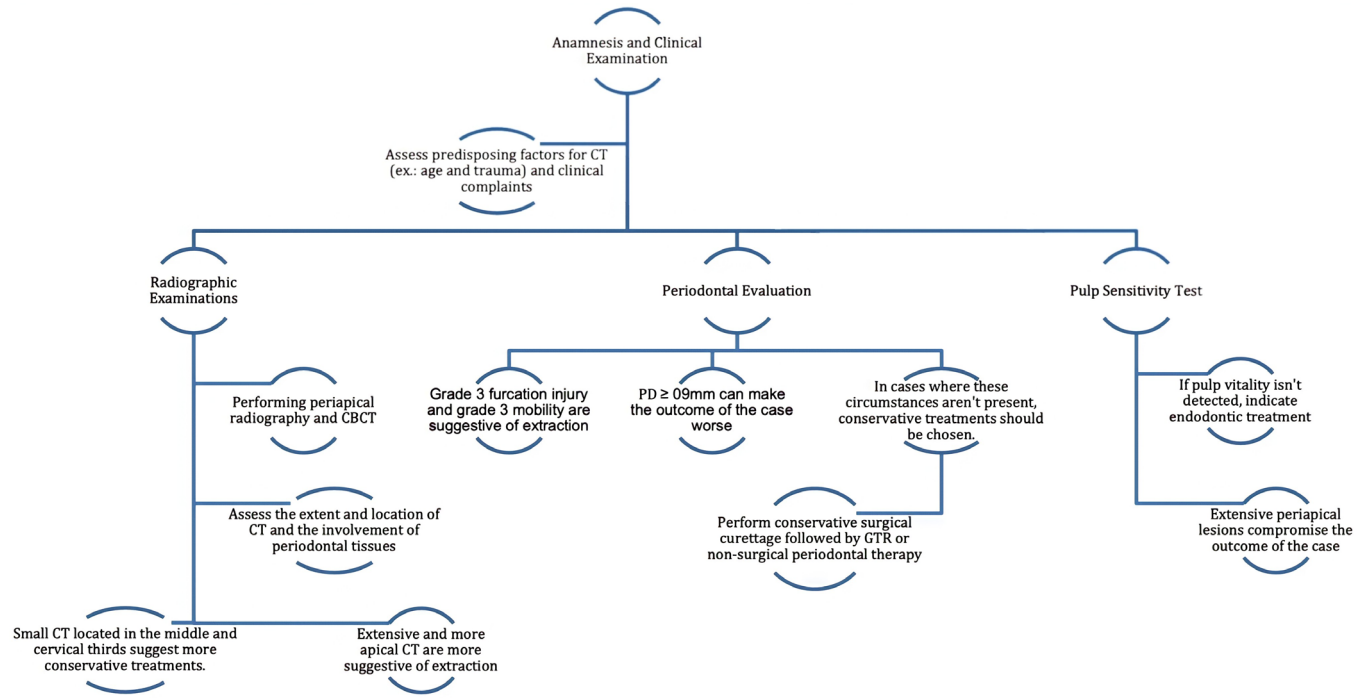

Figure 2. Decision Tree.
Source: Own authorship (2025).

CONCLUSION

This integrative review highlighted that cemental tears represent a rare and underdiagnosed pathology with significant clinical impact, as late or incorrect diagnosis can lead to progressive periodontal destruction and tooth loss. Although the available data, extracted from a few studies with predominantly low-evidence methodologies, suggest that factors such as tooth type, history of trauma, and age play a crucial role in etiology, the management of the condition varied considerably in the literature, as there is no clinically established treatment protocol.

Conservative therapeutic approaches may preserve the dental unit in less severe cases and should be the first choice in these situations, as there is a greater chance of maintaining the affected unit. On the other hand, less conservative interventions are indicated when there is advanced mobility, severe furcation involvement, and extensive bone loss. Considering this evidence, it becomes imperative that future research focuses on standardizing diagnostic and therapeutic protocols to optimize outcomes for patients affected by this condition.

Conflicts of interest: The authors declare that there are no conflicts of interest.

Data availability: O The research data are available in the body of the document.

Collaborators

AA Santos, data curation, formal analysis, research, methodology, development, Writing – original draft. CS Santana-Neto, conceptualization, data curation, data analysis, methodology, project administration, software, supervision, validation, writing – original draft, writing – review & editing.

REFERENCES

1. Lin HJ, Chang MC, Chang SH, Wu CT, Tsai YL, Huang CC, et al. Treatment outcome of the teeth with cemental tears. J Endod. 2014;40(9):1315-20.
2. Nagata M, Kanie T, Shima K. Cemental tear in an autotransplanted tooth that had been functioning for 15 years. Clin Adv Periodontics. 2016;6(3):111-7.
3. Watanabe C, Watanabe Y, Miyauchi M, Fujita M, Watanabe Y. Multiple cemental tears. Oral Surg Oral Med Oral Pathol Oral Radiol. 2012;114(3):365-72.
4. Stewart ML, McClanahan SB. Cemental tear: a case report. Int Endod J. 2006;39(1):81-6.
5. Tulkki MJ, Baisden MK, McClanahan SB. Cemental tear: a case report of a rare root fracture. J Endod. 2006;32(10):1005-7.
6. Qari H, Dorn SO, Blum GN, Bouquot JE. The pararadicular radiolucency with vital pulp: clinicopathologic features of 21 cemental tears. Oral Surg Oral Med Oral Pathol Oral Radiol. 2019;128(6):680-9. http://doi.org/10.1016/j.oooo.2019.07.012
7. Ishikawa I, Oda S, Hayashi J, Arakawa S. Cervical cemental tears in older patients with adult periodontitis: case reports. J Periodontol. 1996;67(1):15-20.
8. Haney JM, Leknes KN, Lie T, Selvig KA, Wikesjö UME. Cementai tear related to rapid periodontal breakdown: a case report. J Periodontol. 1992;63(3):220-4.
9. Zhao S, Yuan Z, Zhou X, Yang X. Clinical, radiographic features and prognosis of cemental tear: a retrospective study of 63 teeth. Heliyon. 2024;10(10):e30999. https://doi.org/10.1016/j.heliyon.2024.e30999.
10. Chou J, Rawal YB, O'Neil JR, Tatakis DN. Cementodentinal tear: a case report with 7-year follow-up. J Periodontol. 2004;75(12):1708-13.
11. Pedercini A, Weitz D, Heyse J, Pedercini C, Kormas I, Koutlas I, et al. Cemental tear: An overlooked finding associated with rapid periodontal destruction: a case series. Aust Dent J. 2021;66 Suppl 1:S82-S87. https://doi.org/10.1111/adj.12844
12. Podugu UK, Balne T, Srivastav A, Ramana Reddy KV, Ali MM, Swathi A. Cemental tear on the first maxillary premolar in the patient with facial palsy: an uncommon type of root fracture. Int J Dental Materials. 2023;5(1):22-5. http://dx.doi.org/10.37983/IJDM.2023.5105
13. Lee AHC, Neelakantan P, Dummer PMH, Zhang C. Cemental tear: Literature review, proposed classification and recommendations for treatment. Int Endod J. 2021;54(11):2044-73. https://doi.org/10.1111/iej.13611

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