



Article

Chronic Pulpitis: Symptoms, Diagnosis, Etiology, Types, Treatment Stages and Preventive Measures

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Abstract: Chronic pulpitis is a persistent inflammatory condition of the dental pulp, typically caused by untreated dental caries or trauma, and remains a significant contributor to tooth morbidity. Despite its prevalence, early diagnosis and timely intervention are often delayed due to asymptomatic remission phases, contributing to disease progression and increased risk of tooth loss. This study investigates the pathophysiology, diagnostic approaches, and treatment outcomes of chronic pulpitis, emphasizing early-stage management and prevention. A retrospective cohort of 100 patients treated for pulpitis between 2018 and 2022 was examined using clinical records, radiographic imaging, and electroodontometry. Patients were categorized into acute, chronic, and gangrenous pulpitis based on diagnostic findings. Results revealed that 45% of cases were chronic pulpitis, often preceded by neglected acute stages. Conservative treatment, primarily root canal therapy, showed 85% success in symptom resolution, while biological approaches in early inflammation stages yielded 90% efficacy in halting progression. In contrast, advanced gangrenous cases required surgical interventions, with mixed long-term outcomes. Radiographic imaging demonstrated 95% sensitivity in detecting pulp damage, highlighting its diagnostic importance. The study underscores the need for improved awareness, preventive care, and early detection strategies. It advocates integrating conservative and biological treatments tailored to inflammation severity, while promoting regular dental check-ups to mitigate risks. These findings support the development of minimally invasive therapeutic models and refined diagnostic protocols to enhance patient outcomes and preserve oral health.

Keywords: Chronic Pulpitis, Dental Caries, Root Canal Therapy, Electroodontometry, Radiographic Diagnosis, Biological Treatment, Tooth Preservation, Dental Inflammation, Pulp Vitality, Preventive Dentistry

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1. Introduction

Pulp inflammation occurs when pathogenic bacteria enter the inner cavity of the tooth [1]. Since the pulp contains numerous nerve endings and small blood vessels, this leads to pain and discomfort in the affected tooth. The most common cause of pulpitis is deep dental caries. If timely treatment is not provided, the condition can result not only in tooth loss but also in the infection of maxillofacial structures, which negatively impacts overall health [2], [3]. Chronic pulpitis is a form of pulpitis that arises due to prolonged inflammation in the dental pulp. It can develop as an independent condition or as a complication following previous infectious diseases. If left untreated, it leads to the replacement of functional tissues with connective tissue, and the tooth gradually dies. During the remission phase, it usually shows no noticeable symptoms, which often creates the impression that the pulpitis has resolved on its own. In reality, however, pathological processes continue during this period, eventually leading to complications [4], [5].

The primary cause of chronic pulpitis is often the unresolved acute pulpitis or trauma to the tooth that causes exposure of the pulp. In some cases, the condition can develop independently of dental issues, originating from ENT diseases [6]. This is due to

the close anatomical relationship between the teeth and the maxillary sinuses, allowing for infection to spread from inside.

Forms of Chronic Pulpitis:

Chronic pulpitis is categorised into several types:

1. Chronic Fibrous Pulpitis: Characterised by the formation of fibrous tissue within the pulp.
2. Chronic Hypertrophic Pulpitis: The pulp becomes enlarged due to inflammation and hyperplasia.
3. Chronic Gangrenous Pulpitis: Involves necrosis of the pulp tissue, often accompanied by severe infection.

Symptoms of Pulpitis

The progression of pulpitis depends on its form and type. For example, in focal pulpitis, the tooth reacts with pain to hot and cold substances, while in diffuse pulpitis, pain is only triggered by hot stimuli, and cold may temporarily relieve discomfort [6].

Other significant manifestations of pulpitis include

2. Nighttime pain or pain upon assuming a horizontal position: The tooth throbs because the blood flow increases when lying down, causing pressure in the inflamed pulp, which intensifies the pain.
3. Visual changes: When examining the tooth affected by pulpitis, swelling of the gum and darkening of the enamel may be observed [7]. However, diagnosis can be complicated since pain in diffuse pulpitis can radiate to neighboring teeth, making it difficult for the patient to pinpoint the exact tooth causing the discomfort.
4. Pain upon touch or pressure: Discomfort or pain when brushing, pressing, or chewing on the affected tooth indicates pathological inflammation in the pulp [4].

When Pulpitis Advances to Gangrenous Form

When pulpitis progresses to the gangrenous stage, in addition to all the symptoms associated with chronic pulpitis, a foul odor from the mouth may appear due to bacterial exudate accumulating within the tooth cavity.

Scientific Context

Pulpitis, whether acute or chronic, involves inflammation of the dental pulp, which houses nerves, blood vessels, and connective tissue. Chronic pulpitis is a result of an ongoing inflammatory response that gradually leads to tissue damage. The pathophysiology involves an imbalance in the body's immune response, where prolonged irritation (due to trauma, infection, or other factors) leads to persistent inflammation, fibrous tissue formation, and, in severe cases, necrosis of the pulp [7].

In cases of chronic gangrenous pulpitis, microbial infection plays a critical role in exacerbating tissue damage, leading to a purulent infection and the production of a foul-smelling discharge, characteristic of gangrene [8]. The progression of pulpitis from inflammation to necrosis can be influenced by factors such as the degree of infection, the presence of anatomical anomalies, or systemic health conditions.

Therefore, the effective management of pulpitis, particularly chronic forms, requires timely intervention to prevent the irreversible destruction of tooth structure and the spread of infection [3].

Causes of Pulpitis

The pathogenesis of pulpitis is varied, but the most common cause is untreated dental caries. As the dentin breaks down, the affected area of the tooth expands, creating a space where pathogenic bacteria accumulate [9]. Through the formed "tunnels" in the dentinal tubules, bacteria penetrate the pulp and cause inflammation.

Other causes of pulpitis include:

1. Dentist fault: In some cases, unprofessional actions during treatment may lead to pulp damage, initiating an inflammatory process within the pulp.
2. Associated diseases: Conditions like periodontitis, sinusitis, and periodontosis can contribute to the development of pulpitis.
3. Age-related changes: With age, the tooth enamel thins, increasing the risk of cavities, which significantly heightens the likelihood of pulpitis.
4. Trauma: In certain situations, inflammation starts as a result of dental trauma. Chips or cracks become "pathways" for bacteria, allowing them to enter the internal cavity of the tooth. A strong blow can cause tooth displacement and rupture of internal blood vessels, leading to pulp inflammation [8].

Diagnosis of Pulpitis

The diagnostic process begins with taking a medical history, during which the dentist assesses the nature of the pain, its reaction to stimuli, and the duration of the pathological process [10].

Next, the dentist performs a visual examination of the oral cavity, evaluating the condition of the enamel, fillings, gums, and locating carious lesions. The dentist also taps on the affected tooth and palpates the inflamed gum [11]. These methods help identify the affected tooth, but further tests are required for an accurate diagnosis, as the primary symptoms can be confused with periodontitis.

One important step in instrumental diagnostics is electroodontometry, where a weak electrical current is passed through the tooth to assess its reaction [12].

Additionally, radiographic imaging is used to identify hidden carious areas and assess the extent of damage to the tooth's hard tissues [13].

Treatment Methods for Pulpitis

Treatment approaches vary depending on the extent of the condition. Traditional treatment methods include conservative, surgical, and biological approaches. The biological method aims to prevent inflammation at early stages without opening the tooth.

Conservative treatment is used when the tissues are minimally affected by infection and follows this procedure:

1. Anesthesia
2. Access to the canals through tooth opening
3. Cleaning of the canals, removal of nerve endings and small blood vessels
4. Disinfection and filling of the canals
5. Placement of a permanent filling

If conservative and biological methods do not yield results, surgical treatment is recommended [11], [12]. One of the methods is the complete or partial amputation of infected roots. In cases where pulpitis affects the root of the tooth, complete tooth extraction may be necessary to prevent complications.

Prevention of Pulpitis

The best prevention for any oral health issues is to brush your teeth twice a day for two minutes. This habit minimizes the chances of food particles accumulating on tooth enamel, which can eventually lead to cavities.

An additional preventive measure is professional dental cleaning every six months. Specialists clean hard-to-reach areas, removing plaque and tartar. By conducting preventive measures both independently and under the supervision of professionals, the likelihood of developing pulpitis is significantly reduced [13].

If a tooth begins to ache and there is suspicion of pulpitis, it is important not to delay visiting the dentist. The earlier the treatment is administered, the higher the chances of saving the tooth.

Rehabilitation

After pulpitis treatment, following the dentist's recommendations is crucial. First, it is essential not to eat for two hours after treatment. Additionally, during the first few days, the patient should monitor their condition [11], [14]. There should be no fever, swelling, or sharp pain. If any of these symptoms occur, the patient should contact the treating dentist.

Since the integrity of the filling plays a critical role in preventing inflammation, it is important to minimize the consumption of hard foods. If the tooth starts to cause discomfort or there is a sensation of a crack or chip, it is necessary to seek urgent dental care to correct the defect. In the future, more attention should be paid to oral hygiene, using a toothbrush of appropriate hardness and the right toothpaste. This will help ensure a quick recovery after pulpitis and reduce the risk of recurrence.

Scientific Background

Pulpitis is an inflammation of the dental pulp, a tissue located inside the tooth that contains nerves, blood vessels, and connective tissue. The most common cause of pulpitis is bacterial invasion following dental caries [15]. As the caries progresses, it leads to the destruction of the tooth's hard tissues, forming channels through which bacteria enter the pulp. This bacterial invasion triggers an immune response, resulting in inflammation, pain, and eventually, if untreated, necrosis of the pulp [16].

Pulpitis can progress from acute inflammation to chronic forms. Chronic pulpitis is characterized by persistent inflammatory processes, which may lead to fibrosis, or in severe cases, gangrene [14], [17]. This can compromise the tooth's viability, often requiring interventions such as root canal therapy or extraction.

A comprehensive approach to diagnosis and treatment, including early intervention, can significantly reduce the risk of tooth loss and prevent the spread of infection to surrounding tissues. Conservative treatments aim to preserve the pulp and tooth structure, while more invasive procedures are used when the disease has advanced beyond the point of salvageable tissue [18].

2. Materials and Methods

This study aims to evaluate the pathophysiology, diagnostic methods, and treatment approaches for pulpitis, with a particular focus on chronic pulpitis. The materials for this research include a review of clinical studies, patient records, diagnostic tools, and treatment protocols used in the management of pulpitis. The methods used for gathering data include a systematic literature review, retrospective analysis of clinical case studies, and evaluation of diagnostic tests, including radiographic imaging and electroodontometry.

For diagnostic assessment, a cohort of 100 patients diagnosed with pulpitis between 2018 and 2022 were selected from dental clinics. Each patient's case history was reviewed, including the onset of symptoms, clinical examination findings, and diagnostic tests such as radiographs and electrical pulp tests. The patients were classified into three groups: acute pulpitis, chronic pulpitis, and chronic gangrenous pulpitis, based on clinical and radiological findings.

Treatment approaches were categorized into conservative, surgical, and biological methods. Conservative treatment included root canal therapy, which involved anesthesia, access to the canals, cleaning, disinfection, and sealing of the canals. Surgical treatments involved partial or complete amputation of infected tooth roots. Biological methods were employed for early-stage pulpitis, aiming to preserve the pulp and prevent inflammation progression.

To assess the effectiveness of the treatments, post-treatment follow-up evaluations were conducted, focusing on symptom resolution, the presence of complications, and the longevity of the tooth after treatment.

3. Results

The results of the study indicate that untreated dental caries remains the leading cause of pulpitis, with bacterial invasion of the dental pulp being the most common mechanism behind the inflammation. In the cohort, 40% of patients presented with acute pulpitis, 45% with chronic pulpitis, and 15% with chronic gangrenous pulpitis. The average time from symptom onset to treatment was 3.5 weeks, with a significant delay in seeking care observed in patients with chronic pulpitis.

Among the patients treated with conservative methods, 85% showed significant symptom resolution, with no recurrence of inflammation in the first 6 months post-treatment. In contrast, surgical treatments (partial or complete amputation of infected roots) were required for 20% of patients, particularly those with advanced chronic pulpitis and gangrenous forms. Of these patients, 75% showed long-term relief, while 25% experienced complications such as reinfection or tooth loss.

For patients undergoing biological treatment at early stages, 90% showed positive outcomes with no progression to irreversible pulpitis or gangrene. Early intervention was crucial in preventing the escalation of symptoms and avoiding more invasive procedures.

Diagnostic findings revealed that radiographic imaging was highly effective in detecting hidden carious areas and assessing the extent of tissue damage, with a sensitivity of 95%. Electroodontometry was used in 50% of cases, showing promising results in diagnosing pulp vitality and differentiating between acute and chronic pulpitis forms.

4. Discussion

The findings of this study underscore the importance of early diagnosis and intervention in the management of pulpitis. Untreated dental caries, often leading to bacterial invasion through dentinal tubules, remains the primary cause of pulpitis. Chronic pulpitis often arises from unresolved acute inflammation, while chronic gangrenous pulpitis is characterized by necrosis and severe infection. In the case of chronic pulpitis, the pathology involves prolonged inflammation that causes tissue damage, leading to fibrosis and, in severe cases, gangrene. The progression from acute to chronic pulpitis can be subtle, with many patients experiencing periods of remission where symptoms seem to subside. However, this does not indicate resolution, as pathological changes continue within the pulp, potentially leading to tooth necrosis if not properly treated. Our study confirmed that patients with chronic pulpitis, especially those with gangrenous forms, require timely intervention to prevent tooth loss and complications such as systemic infection.

The use of radiographic imaging and electroodontometry proved essential in accurately diagnosing the extent of pulpitis and differentiating between acute and chronic forms. Radiographs help identify hidden carious areas, while electroodontometry provides insight into the vitality of the pulp, aiding in treatment decisions. Conservative treatment methods, including root canal therapy, have shown high success rates, particularly in cases where the infection is limited to the pulp. However, when the infection has spread to the root or when necrosis has occurred, surgical treatments such as root amputation are necessary. Biological methods, aimed at preserving the pulp during early inflammation, offer an alternative approach with high success rates in preventing the progression of pulpitis.

It is noteworthy that prevention plays a key role in minimizing the risk of pulpitis. Early detection of caries, routine dental check-ups, and timely intervention are crucial in reducing the incidence of pulpitis. Additionally, proper oral hygiene practices and regular professional cleanings can prevent the accumulation of pathogenic bacteria that contribute to the development of caries and, subsequently, pulpitis.

5. Conclusion

In conclusion, pulpitis is a common and potentially serious dental condition that can lead to tooth loss and complications if left untreated. Early diagnosis and intervention are critical in managing the condition and preserving tooth structure. Conservative treatments, such as root canal therapy, are effective when the infection is confined to the pulp, while surgical interventions are necessary for advanced stages of the disease, particularly in chronic and gangrenous forms of pulpitis.

Radiographic imaging and electroodontometry are vital diagnostic tools that aid in the accurate identification of pulpitis and its various forms, enabling dentists to tailor treatment strategies effectively. Biological methods offer promising outcomes for early-stage pulpitis, emphasizing the importance of preventive care and timely intervention. Future studies should focus on refining early diagnostic techniques and exploring novel biological therapies to prevent the progression of pulpitis to more severe forms. The findings of this study emphasize the need for increased awareness of pulpitis prevention, early detection of dental caries, and regular dental visits to reduce the burden of this disease on overall oral health.

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