



## THERAPY OF VITAL PULP OF PERMANENT TEETH WITH REVERSIBLE OR IRREVERSIBLE PULPITIS

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**Abstract:** Vital pulp therapy (VAC) has recently been proposed as an alternative approach even in mature permanent teeth with symptoms and deep caries in order to preserve the viability of the pulp over time and/or avoid non-surgical root canal treatment (NCRT). However, to date, the diagnosis of reversible or irreversible pulpitis is based only on the clinical amount and quality of pain, without accurately reflecting the state of inflammation of the pulp. VAC can be successfully used not only in mature permanent teeth with a diagnosis of reversible pulpitis, but also in permanent dental elements with signs and symptoms of irreversible pulpitis.

**Keywords:** hydraulic cements; irreversible pulpitis; pain; reversible pulpitis; vital pulp therapy

**Introduction.** Vital pulp therapy consists of various treatment strategies to maintain the integrity and health of the teeth and preserve the viability of the pulp in case of deep caries damage, approximation/involvement of the pulp or in case of exposure of pulp tissues due to injury or mechanical causes. VAC mainly includes direct and indirect pulp coating and pulpotomy procedures such as partial and complete pulpotomy; it is successfully performed in the daily treatment of baby teeth and immature teeth with permanent elements that ensure apexogenesis. Recent results have suggested VAC for a broader focus and as an alternative approach even in symptomatic mature permanent teeth with deep caries lesions in order to preserve pulp viability over time and/or avoid non-surgical root canal treatment. However, the results and success of VAC are strictly related to the severity of pulp inflammation and histological involvement of pulp tissue. Moreover, it has been demonstrated that there is no exact correlation. Between the clinical symptoms and the histopathological status of the pulp, mainly with irreversible pulpitis, which can lead to an erroneous diagnosis. Unfortunately, to date, the diagnosis of reversible or irreversible pulpitis is based on anamnesis, subjective clinical pain parameters and pulp sensitivity testing without reflecting the actual pulp inflammation status. Thus, the purpose of this study was to provide an overview based on modern scientific literature to:

- improve the diagnosis of pulp health;
- demonstrate the clinical efficacy of VAC on mature permanent teeth;
- Support the use of hydraulic cement during the VAC;
- evaluate pain as a potential diagnostic criterion.

Diagnosis of reversible/irreversible pulpitis Two different nerve pathways are responsible for pain in the tooth pulp. A-delta myelin fibers (A $\delta$  fibers) are involved in the rapid conduction of pain,

causing a rapid, acute and localized pain response. In the case of applying a cold stimulus to the crown of the tooth, a rapid pain reaction occurs, followed by an almost immediate cessation of pain. Unmyelinated C fibers are responsible for the slow conduction of pain, which is difficult to localize and which is mainly caused by a thermal stimulus.

The pain response is quick and brief; stopping after a short time, more intense pain occurs with greater frequency. Toothache caused by A-delta fibers is most often eliminated by diagnostic viability tests, whereas pain caused by C-fibers is usually associated with pathological inflammation of the pulp tissue. In the absence of external triggers, pain associated with inflamed or damaged tissues may occur spontaneously. Currently, the severity of pulp inflammation can be clinically assessed only by soft and hard tissue examination with a subjective interindividual test for the sensitivity of the patient's pulp. Answers and radiological examination. The degree of inflammation of the pulp is often determined after the application of a cold irritant, which can cause an exaggerated and "prolonged" response due to sensitization of C fibers and hypersensitivity caused by inflammation. Despite the fact that pain is one of the main symptoms of infection/inflammation, its presence or intensity does not correlate exactly with the degree of damage to pulp tissues and the severity of histopathological status. Indeed, it should be emphasized that pulpitis can often be asymptomatic. Irreversible pulpitis associated with caries is often histologically characterized by necrotic tissue colonized by bacteria, and sometimes microabscesses and inability to heal are formed. On the other hand, an immune defense response develops in the surrounding pulp tissue to prevent the spread of infection and is largely free from inflammation or necrosis. Accordingly, if it were possible to isolate and remove the infected pulp (before the spread of necrosis), a healthy uninfected part of the pulp tissue would remain healthy. Conversely, when the pulp becomes inflamed only reversibly, it has the potential to heal and repair tissues. Despite the fact that reversible and irreversible pulpitis can be histologically differentiated, the restoration of pulp tissue cannot be objectively clinically evaluated.

Coronal pulpotomy has proven effective in the treatment of permanent teeth affected by caries. Irreversible pulpitis with clinical and radiological success rates of 97.4% and 95.4%, respectively, after 12 months of follow-up. With repeated visits after 36 months, the clinical and radiological success rates decreased to 93.97% and 88.39%, respectively, which suggests comparable success over time. Thus, the authors concluded that coronal pulpotomy of permanent teeth with symptoms may be a potential alternative to NSRT and should not be considered only as an emergency anesthesia procedure before traditional endodontic therapy.

### Conclusions

Within the framework of this article, it can be concluded that:

- VAC can be successfully used in mature permanent teeth with reversible pulpitis disease or even signs and symptoms of irreversible pulpitis;
- Adequate diagnosis of pulp inflammation and the selection of appropriate materials, such as bioactive cements, are key factors in increasing the success of VAC;
- Pain can be considered as a preoperative diagnostic criterion, as well as a method of treatment, a success parameter. However, further research is needed to assess its role in the progression of pulp diseases and the potential benefits derived from the use of hydraulic materials.

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