

Role of Calcium Hydroxide in Traumatized Teeth for Pulp Protection

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Commentary

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DESCRIPTION

Calcium hydroxide has been a cornerstone material in endodontics and dentistry, particularly for its pivotal role in pulp protection in traumatized teeth. Its unique chemical and biological properties make it an effective agent for promoting pulp healing, preventing bacterial invasion, and aiding in hard tissue formation. This article explores the significance of calcium hydroxide in managing dental trauma, emphasizing its mechanisms of action, applications, and limitations.

Traumatic injuries to teeth, such as fractures, luxation, or avulsion, can compromise the pulp, the vital tissue inside the tooth. These injuries often lead to pulp exposure or inflammation, making it vulnerable to bacterial contamination and necrosis. Preserving pulp vitality is essential for maintaining the tooth's long-term function and preventing the need for more invasive procedures like root canal therapy. Calcium hydroxide is frequently employed as a pulp capping or lining material in such scenarios because of its exceptional ability to support these processes.

Calcium hydroxide exerts its beneficial effects on the pulp through several mechanisms. Its high pH (approximately 12.5) creates an alkaline environment that is unfavorable for bacterial survival, effectively preventing infection in exposed or inflamed pulp tissue. It also stimulates odontoblast-like cells to deposit a reparative dentin barrier, which serves as a natural seal, protecting the pulp from further damage or bacterial invasion. Additionally, it neutralizes inflammatory byproducts, reducing pulp inflammation and promoting healing, while the release of calcium ions aids the mineralization process, encouraging dentin bridge formation.

In clinical practice, calcium hydroxide is used for direct pulp capping in cases of small pulp exposures caused by trauma, where it can encourage healing and dentin bridge formation while maintaining pulp vitality. In apexogenesis, it supports continued root development in immature teeth with open apices, strengthening the tooth structure and ensuring a favorable long-term prognosis. Calcium hydroxide is also utilized as a temporary root canal filling material in cases of severe pulp inflammation or necrosis, leveraging its antimicrobial and tissue-healing properties. Furthermore, it is effective in arresting root resorption, a common complication of dental trauma, by neutralizing the acidic environment and promoting repair.

Despite its advantages, calcium hydroxide has certain limitations. It is soluble in oral fluids, necessitating frequent replacements when used as a temporary filling material. Additionally, it lacks sufficient mechanical strength, requiring additional restorative materials to provide structural support. While it stimulates dentin bridge formation, the resulting barrier may occasionally be porous, potentially allowing bacterial penetration. These drawbacks have led to the exploration of alternative materials such as Mineral Trioxide Aggregate (MTA). Nevertheless, calcium hydroxide remains a preferred choice in many clinical scenarios due to its affordability, ease of use and proven efficacy.

Calcium hydroxide continues to play a vital role in the management of traumatized teeth, offering a reliable and effective solution for pulp protection and healing. Its antimicrobial properties, ability to promote hard tissue formation, and biocompatibility make it indispensable in trauma-related dental procedures. While it has certain limitations, its advantages outweigh its drawbacks in many situations. As research progresses, the integration of calcium hydroxide with other materials may further enhance its performance, ensuring optimal outcomes for patients with dental trauma.