EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 5
Issue: 7
192-193
Year: 2018

CALCIUM HYDROXIDE IN ENDODONTIC TREATMENT: A SHORT REVIEW

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Article Received on 01/05/2018 **Article Revised on 21/05/2018** **Article Accepted on 11/06/2018**

ABSTRACT
Calcium Hydroxide is the versatile agent used in various endodontic treatments. Its unique properties like bactericidal effect, mineralization induction are important to understand. Present article is focusing on properties, rationale of Calcium hydroxide use, and application in various endodontic treatments.

KEYWORDS: Calcium Hydroxide, Endodontic treatment, intracannal medicaments, weeping canal.

INTRODUCTION

Teeth are bio-composites that require controlled mineral deposition during their self assembly to form tissues with unique mechanical properties.[1] On the other hand biominerals such as calcium synthetically produced or obtained from natural sources. As the main constitute of biominerals calcium can be therapeutically used for preventing demineralization of hard tissues of the tooth along with the preservation and maintenance of the health of the pulp.[2] Nowadays calcium hydroxide is used as therapeutic agent for various endodontic and conservative treatments.

Calcium hydroxide was originally introduced to the field of endodontics by Herman in 1920 as a pulp-capping agent.[3] It is a white odorless powder with low solubility in water. Calcium hydroxide has a slow, controlled release of both calcium and hydroxyl ions. It has a high pH, is insoluble in alcohol, and is chemically classified as a strong base. The ionic dissociation leads to the formation of Ca^{++} and OH^- ions. Ca^{++} induces hard tissue deposition and OH^-having antibacterial action.[4]

Mechanism of action

Calcium hydroxide as dissociate produce the Hydroxyl ions. Hydroxyl ions are highly oxidant free radicals that show extreme reactivity with several biomolecules. This reactivity is high so this free radical usually not able to diffuses away from sites of generation. The hydroxyl ions damage to the bacterial cytoplasm membrane, denaturant protein, damages to the DNA, thus it shows bactericidal effect.[5]

Mineralization activity is seen as a pulp-capping agent and in apexification cases, a calcified barrier induced by calcium hydroxide. Because of the high pH of pure calcium hydroxide, a superficial layer of necrosis occurs in the pulp up to certain extend, Beyond this layer, only a mild inflammatory response is seen and, provided the operating field is kept free from bacteria when the material was placed, hard tissue may be formed.[5]

Applications of Calcium Hydroxide in Endodontics

Intracannal Medicaments

Endodontic treatment requires the intracannal medicament for elimination of bacteria, prevention of bacterial growth, stop bacterial ingress and to cut off their nutrient supply to the bacteria in the canal. Calcium hydroxide is most commonly used as an intracanal medicament for disinfection of the root canal system.[6] Application of calcium hydroxide paste at intervals of at least 7 days is able to eliminate and/or reduce the total number of bacteria surviving even after biomechanical preparation.[7]

Calcium hydroxide has a little or no effect on the intensity or severity of postoperative pain following endodontic treatment.[8] The Effect of calcium hydroxide on pro-Inflammatory cytokines was studied and concluded that it leads to denaturation of these pro-inflammatory mediators such as interleukin-1α (IL-1α), tumor necrosis factorα (TNFα) and calcitonin gene-related peptide (CGRP) that is a potential mechanism by which calcium hydroxide contributes to the resolution of periradicular periodontitis.[9]

Root Canal Sealer

The main objective of root canal obturation is to achieve a tight seal of the root canal system. Such sealing enhance the healing process of periapical and apical regions after endodontic therapy.[19] Some forms of cement are required when filling the root canals to fill the minor spaces between the core material and the dentinal walls of the canal to prevent leakage.

Calcium based sealers help in the formation of root-end hard tissue, antibacterial activity. Calcium hydroxide-based sealers having limitations like limited antibacterial activity, poor cohesive strength, greater solubility and marginal leakage.[10]

In Weeping Canal

Weeping canal is a canal from which constant clear or reddish exudation is appeared. The tooth is difficult to treat. Many times during treatment exudate stops but it reappears in next appointment. For such teeth, application of calcium hydroxide in the canal after drying with sterile absorbent paper points is helpful. This is because of its high alkalinity, which changes the acidic pH of periapical tissues to a more basic environment.[6,11] Two other mechanisms have also been proposed: 1) build up bone in the lesion due to the calcifying potential of calcium hydroxide and 2) the residual chronically inflamed tissue is cauterized by the caustic action of calcium hydroxide.[5]

Pulp Capping Agent[6]

Calcium hydroxide is generally accepted as the material of choice for pulp capping. Histologically there is a complete dentinal bridging with healthy radicular pulp under calcium hydroxide dressings.

As already mentioned when calcium hydroxide is applied directly to pulp tissue there is necrosis of adjacent pulp tissue and an inflammation of contiguous tissue. Dentinal bridge formation occurs at the junction of necrotic tissue and vital inflamed tissue. Beneath the region of necrosis cells of underlying pulp tissue differentiate into odontoblasts and elaborate dentin matrix.

Apexification[6]

In apexification technique canal is cleaned and disinfected, when tooth is free of signs and symptoms of infection, the canal is dried and filled with stiff mix of calcium hydroxide. Histologically there is formation of osteodentin after placement of calcium hydroxide paste. There appears to be a differentiation of adjacent connective tissue cells; there is also deposition of calcified tissue adjacent to the filling material.

Pulpotomy[6]

It is the most recommended pulpotomy medicament for pulpally involved vital young permanent tooth with incomplete apices. It is acceptable because it promoted reparative dentin bridge formation and thus pulp vitality is maintained.

CONCLUSION

Calcium hydroxide has been used for different purpose in endodontics and available in different forms. It is having wide range of antimicrobial activity. Even if some limitations are there to the calcium hydroxide. Hence further studies are recommended to evaluate the effectiveness of calcium hydroxide and its applications in the field of endodontics.

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