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METHODS FOR TREATING INFLAMMATORY CHANGES IN PERIAPICAL TISSUES (LITERATURE REVIEW)

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Introduction: Calcium-containing preparations hold an important place in modern dentistry due to their unique properties, which enable successful treatment of both pulp tissues and periapical tissues. The action of these preparations is based on the formation of calcium hydroxide ($Ca(OH)_2$), which exhibits reparative and antibacterial properties. However, if inadvertently introduced into surrounding vital structures, it can cause severe harm, including thrombosis if it enters blood vessels, damage to connective tissues, and skin necrosis. Modern calcium-containing preparations include additional components such as silicon hydroxide, strontium ions, and phosphates, which enhance their biocompatibility and clinical efficacy. Long-acting formulations are also being developed, simplifying their use in dental practice. This article presents contemporary literature data describing the main mechanisms of action of temporary root canal filling agents and the most common methods for non-surgical treatment of periapical changes.

Purpose of the study. To review literature data on the influence of root canal filling preparations on the stimulation of reparative processes in the periapical tissue area.

Materials and methods. A review and analysis of literature sources were conducted using keywords in electronic databases including Scopus, Web of Science, MedLine, The Cochrane Library, and RSCI. Both foreign and domestic sources were used to write this review article.

Results. The use of calcium-containing paste (e.g., calcium hydroxide) helps preserve pulp vitality, preventing irreversible changes. Administering temporary root canal fillers facilitates the elimination of the infectious process, creating a barrier to bacterial spread, and stimulating reparative processes in the periapical tissues. Calcium hydroxide assists in forming a dense apical plug when treating immature roots. In the treatment of perforations and root resorptions, calcium preparations help seal defects and prevent tooth loss.

Conclusion. There are various approaches and methods for treating destructive forms of chronic periodontitis, and the results of traditionally used treatments are not always successful. Thus, this problem remains relevant and not entirely resolved in dentistry.

Keywords: chronic periodontitis, filling, root canal obturation.

It is known that inflammatory diseases of the pulp and apical periodontium are among the most common dental pathologies worldwide.. Prevalence rates in different regions range from 14% to 25% among all dental diseases. This underscores the need for epidemiological studies in Uzbekistan to assess their prevalence. Effective prevention and treatment strategies and improvements in dental care quality can be developed from such research. Despite global advances in medicine, the structure of major dental diseases remains relatively stable. This indicates the ongoing necessity for improving dental care approaches and implementing modern preventive and treatment methods.

Endodontic treatment is crucial for the preservation and functionality of teeth. The outcome of treatment depends on various factors, including anatomical features, the dentist's expertise, adherence to treatment protocols, and the use of modern materials and technologies.

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Key factors influencing endodontic treatment outcomes include:

1. **Complexity of the root canal system:** Varies depending on the tooth, with curved, bifurcated, or calcified canals posing significant treatment challenges. Modern diagnostic methods like 3D tomography (CBCT) allow for better identification of root canal system features and improve treatment prognosis.
2. **Accuracy at each treatment stage:** Errors at any stage, such as incomplete removal of infected tissues, insufficient canal sterilization, or improper sealing, can lead to apical periodontitis. Adhering to procedural sequences—mechanical preparation, medicinal antiseptics, and proper sealant application—is crucial.
3. **Modern endodontic instruments:** Tools like nickel-titanium files ensure safe and effective canal preparation. Innovations in materials—such as calcium-containing medications, bioceramic sealers, and pastes—aid disinfection and tissue regeneration. Subpar initial endodontic treatment can result in apical inflammation, necessitating retreatment or surgery explanation needed of the additional medicinal applications and extended use of materials, effectively closing the defect and restoring lost function.

When conservative treatment is ineffective, procedures like root resection removing granulomas or cysts are employed. Laser treatment can sterilize even hard-to-reach areas, and bioceramic materials improve sealant quality and prevention of re-infections.

Filling materials must meet diverse requirements based on biological, physical characteristics, and practical considerations. The dental market offers a wide range of endosealants: zinc oxide-eugenol (ZOE) based materials, glass ionomer cements, epoxy resin-based materials, and mineral trioxide aggregate (MTA).

Developed by Dr. Torabinejad in 1993, MTA uses Portland cement chemistry and water reactions.Next-generation dental materials, like MTA, are often termed "bioceramics" due to their use of water as a primary reagent in the curing process. The term bioceramics encompasses non-metallic inorganic materials, including zinc-phosphate, zinc oxide-eugenol, and glass ionomer cements (GICs). However, in dentistry, it is often associated more with prosthetic restorative materials than endodontics, highlighting the need for a new term reflecting MTA and modern endosealers' properties better.

A study discovered that only 26% (85) of practitioners prefer MTA materials for treating apical periodontitis, while just 5.81% (19) choose bioceramic sealers. The surveyed literature showed MTA usage reaching 49.4% (38). Our survey indicated a need for more active adoption of MTA and modern bioceramic endosealers.

These materials have shown improved endodontic treatment quality, especially in cases of resorbed root tips and apical constriction.

For a long time, MTA was the most well-known and effective hygroscopic dental material with positive clinical results. Despite this, the technology for studying and producing MTA-based root canal sealers continues to evolve with companies developing new generations of hygroscopic dental materials adjusting the composition.

Hygroscopic dental materials (bioceramics) are designed for professional use as obturating and restorative materials, such as endosealers, liners, and bases. They use inorganic hygroscopic compounds (e.g., calcium silicates, calcium aluminates, zinc sulfate, calcium sulfate) with water in curing reactions.

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Antibacterial effects are crucial advantages of ZOE-based materials. They inhibit microbial growth, making them effective in acute and chronic periodontitis treatment. Enhanced antimicrobial properties are achieved by adding antibacterial components like nano-silver particles or amoxicillin, improving endodontic therapy effectiveness. Bioceramic sealers also possess significant antimicrobial properties due to high pH, calcium ion release, and a porous structure with nanocrystals preventing bacterial adhesion. They outperform epoxy sealers against pathogens, including *Enterococcus faecalis, Escherichia coli, Streptococcus mutans,* and *Candida albicans*.

The antibacterial properties of bioceramic sealer are marked. High pH is essential for root canal sealers, as calcium ion release stimulates hard tissue deposition and shows antibacterial properties. S.S. Raghavendra et al. (2017) found that sealers' antibacterial effects result from precipitation at the site after setting, sequestering bacteria. Bioceramics form porous powders containing nanocrystals of 1-3 nm in diameter, preventing bacterial adhesion. Sometimes, apatite crystals include fluoride ions enhancing antibacterial properties. Comparing the antimicrobial activity of bioceramic and epoxy sealers, Z.S. Madani et al. (2014) concluded bioceramics' superior effectiveness against *Enterococcus faecalis, Escherichia coli, Streptococcus mutans, Candida albicans, Micrococcus luteus, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa,* and *Candida albicans*.

Therefore, applying modern technologies and materials in endodontics significantly increases successful outcomes. It is essential to adhere strictly to the principles:

- Accurate diagnosis using CBCT.
- Thorough removal of infected tissues.
- Creating a hermetic barrier against microorganisms.
- Using biocompatible materials that stimulate periapical tissue regeneration.

Conclusion: Endodontic treatment success directly depends on a comprehensive approach, high professionalism of the dentist, and the application of modern technologies. Regularly updating knowledge and integrating innovations into clinical practice allows for the effective

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