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MODERN ENDODONTIC MEDICATION IN CHRONIC OSTEODESTRUCTIVE APICAL PERIODONTITIS

Istrati Dorin, PhD, assoc. prof., Department of Interdisciplinary dentistry and oral rehabilitation, „Nicolae Testemițanu" SUMPh
Vasilioglo Mihaela, resident, Faculty of stomatology, „Nicolae Testemițanu" SUMPh
Saidacari Catalina, resident, Faculty of stomatology, „Nicolae Testemițanu" SUMPh
Istrati Paola, student, Faculty of stomatology, „Nicolae Testemițanu" SUMPh

Background. Chronic osteodestructive apical periodontitis is a frequently encountered condition in endodontic practice, characterized by progressive periapical bone destruction resulting from persistent root canal system infection. The organization of the endodontic microbiota as a three-dimensional polymicrobial biofilm, extending into complex anatomical structures such as isthmuses, lateral canals, and dentinal tubules, explains the increased resistance to conventional treatment and the maintenance of chronic periapical inflammation.
Objective of the study: To evaluate the effectiveness of modern endodontic medication in the management of chronic osteodestructive apical periodontitis by analyzing the impact of chemomechanical decontamination associated with activated irrigation and calcium hydroxide–based intracanal medication on infection control and periapical healing processes.

Material and methods. This observational descriptive study included adult patients clinically and radiographically diagnosed with osteodestructive periapical lesions. The therapeutic protocol consisted of reciprocating mechanical preparation, sequential irrigation with sodium hypochlorite at concentrations of 5–10% with ultrasonic activation, use of 17% EDTA, application of calcium hydroxide intracanal medication, and three-dimensional obturation using modern thermoplastic techniques in association with appropriate sealers. Clinical and radiological follow-up was performed for up to 24 months.

Results. Most cases demonstrated resolution of clinical symptoms and progressive reduction of periapical radiolucency, with restoration of trabecular bone architecture at later follow-up stages. Faster healing was observed in cases treated using comprehensive activated irrigation protocols and adequate intracanal medication.

Conclusions. The application of an integrated therapeutic protocol aimed at effective biofilm control and prevention of reinfection allows the achievement of stable and predictable periapical healing in the medium and long term.

Keywords: chronic apical periodontitis, endodontic biofilm, activated irrigation, calcium hydroxide, three-dimensional obturation.

Introduction

Chronic osteodestructive apical periodontitis represents a frequently encountered condition in contemporary endodontic practice, characterized by the progressive destruction of periapical bone as a result of persistent infection within the root canal system of the affected tooth. The progression of these lesions is, in most cases, asymptomatic or paucisymptomatic, which explains why they are often detected incidentally during routine radiographic examinations and are frequently diagnosed at advanced stages, when the osteodestructive process is already well established.

From a biological perspective, chronic osteodestructive apical periodontitis reflects a complex imbalance between persistent microbial aggression and the host's defense mechanisms. The etiology of these lesions is predominantly microbial, with the infection originating intracanally following pulpal necrosis caused by deep caries, trauma, or defective coronal sealing. The endodontic microbiota is organized as a three-dimensional polymicrobial biofilm, composed mainly of strict and facultative anaerobic bacteria capable of developing adaptive mechanisms and resistance to the hostile conditions of the endodontic environment.

Biofilm-organized endodontic infection is not limited to the main canal but extends into complex anatomical structures such as isthmuses, lateral canals, the apical delta, and dentinal tubules—areas inaccessible to conventional mechanical instrumentation. The persistence of this biofilm sustains chronic periapical inflammation and impairs physiological bone healing processes. Experimental studies have demonstrated that bacteria organized within biofilm may exhibit resistance up to 1000 times greater to antimicrobial agents compared to planktonic forms, which explains the difficulty of completely eradicating infection through exclusively mechanical methods.

From a pathogenic standpoint, bacterial by-products—particularly lipopolysaccharides derived from Gram-negative bacteria—traverse the apical foramen and activate the local immune response via Toll-like receptors. This activation leads to the release of pro-inflammatory cytokines such as interleukin-1β, interleukin-6, and tumor necrosis factor alpha, which stimulate osteoclastic activity through the RANK/RANKL pathway, promoting progressive bone resorption characteristic of osteodestructive lesions. Persistent microbial stimulation maintains a self-perpetuating inflammatory cycle in which bacterial aggression and immune response reinforce one another.

Within this complex biological framework, modern endodontics is based on an integrated therapeutic concept in which mechanical instrumentation of the root canals represents only one component of treatment. Therapeutic success depends on the association of chemomechanical preparation with effective and activated irrigation, the use of intracanal medication with prolonged antimicrobial action, and the achievement of a

hermetic three-dimensional obturation of the root canal system. Numerous international studies have demonstrated that omission or insufficiency of any of these stages significantly increases the risk of persistent infection and subsequent endodontic treatment failure, emphasizing the need for a biologically grounded and staged therapeutic approach.

Aim of the Study

The aim of the present study was to critically analyze the effectiveness of modern endodontic medication in the management of chronic osteodestructive apical periodontitis by evaluating the role of persistent endodontic infection in the pathogenesis of periapical lesions, assessing the impact of root canal system decontamination through activated irrigation and the use of calcium hydroxide-based intracanal medication on infection control and periapical healing processes, and examining the performance of modern thermoplastic three-dimensional obturation techniques, used in association with appropriate sealers, in preventing microleakage and reinfection. These aspects were correlated with medium- and long-term clinical and radiological outcomes obtained at the UnidentArt University Clinic, as well as with data from the international scientific literature.

Materials and Methods

This observational descriptive study was conducted at the UnidentArt University Dental Clinic and included adult patients presenting permanent teeth clinically and radiographically diagnosed with chronic osteodestructive apical periodontitis. Diagnosis was established based on detailed medical history, extraoral and intraoral clinical examination, vertical and horizontal percussion tests, and periapical radiographic assessment demonstrating the presence of osteodestructive periapical lesions. Cases involving vertical root fractures, irreparable perforations, advanced root resorption, or inability to achieve adequate coronal restoration were excluded from the study.

Endodontic treatment was performed in multiple sessions according to a biologically oriented standardized clinical protocol. Following minimally invasive access cavity preparation, the affected tooth was isolated using a rubber dam. Canal orifices were identified, and working length was determined using an electronic apex locator with radiographic confirmation. Mechanical preparation of the root canals was performed using the WaveOne Gold reciprocating system in combination with the WaveOne Gold Glider. This system allows controlled and efficient canal shaping while maintaining the original anatomical pathway and minimizing the risk of apical transportation or instrument fracture. Preparation aimed to achieve adequate taper to facilitate irrigant penetration and to enable proper three-dimensional obturation.

Decontamination of the endodontic space was achieved through a rigorous sequential irrigation protocol. Sodium hypochlorite, used as the primary irrigant due to its antimicrobial properties and ability to dissolve organic tissue, was applied throughout the mechanical preparation phase. To enhance antiseptic efficacy, the solution was ultrasonically activated, generating cavitation phenomena and hydrodynamic microcurrents capable of penetrating isthmuses, lateral canals, the apical delta, and dentinal tubules, thereby contributing to the disruption of mature biofilm, with the support of the iVac system. Subsequently, 17% EDTA was used to remove the smear layer and expose dentinal tubules, facilitating the diffusion of antiseptic agents and intracanal medication. Final irrigation was performed with distilled water to eliminate chemical residues and prevent undesirable interactions between the irrigating solutions.

In accordance with modern techniques described in the literature, additional irrigation activation methods were considered, including sonic activation, negative pressure irrigation, and photoacoustic activation using erbium lasers (Er:YAG, Er,Cr:YSGG), which enhance hydrodynamic effects and promote deep penetration of antiseptic agents into the complex anatomical structures of the root canal system.

Following completion of the decontamination phase, calcium hydroxide-based intracanal medication was applied and maintained between sessions for a period of 7–14 days. Its antimicrobial effect is attributed to its high alkaline pH, which induces bacterial protein denaturation and endotoxin inactivation. Through ionic exchange mechanisms, calcium and hydroxyl ions may diffuse toward the periapical region, contributing to

the neutralization of inflammatory mediators and creating a biological environment favorable to bone repair processes.

Three-dimensional obturation of the root canals was performed using modern thermoplastic techniques based on heated gutta-percha systems such as GuttaCore or Thermafil, selected according to the anatomical and clinical characteristics of each case. These systems allow plasticization and optimal adaptation of gutta-percha to canal walls, facilitating the filling of lateral spaces and irregularities within the root canal system. The choice of technique was individualized, aiming to achieve a hermetic, stable three-dimensional obturation consistent with canal morphology. In both techniques, obturation was performed in association with an epoxy resin–based sealer (AH Plus) or a bioceramic sealer to ensure effective sealing and reduce the risk of microleakage and reinfection.

Post-treatment evolution was monitored clinically and radiographically immediately after obturation and at 3, 6, and 12 months, with selected cases followed for up to 24 months. Evaluation criteria included absence of spontaneous pain, lack of percussion sensitivity, progressive reduction of periapical radiolucency, and restoration of trabecular bone architecture. Patients were advised to functionally load the treated tooth, in the absence of prosthetic contraindications, to stimulate local circulation and support periapical healing processes.

Results

Post-treatment evaluation demonstrated a favorable clinical and radiological evolution in the majority of cases included in the study. Clinically, spontaneous pain resolved and a significant reduction in vertical and horizontal percussion sensitivity was observed within the first days following treatment. When present, postoperative discomfort was mild to moderate and transient, progressively subsiding within 48–72 hours without requiring additional intervention.

Radiographic evaluation performed at the 3 and 6 month follow-up visits revealed a progressive reduction in periapical radiolucency in most cases. At 12 months, a tendency toward restoration of trabecular bone architecture and a clearer delineation of the periapical region relative to the periodontal ligament space were observed, indicating active tissue regeneration processes. In cases monitored at 24 months, radiographic stabilization and structural integration of the periapical area were consistent with bone healing.

Healing was more rapid and more evident in cases in which the therapeutic protocol included activation of sodium hypochlorite irrigation at concentrations higher than 3%, specifically 5–10%, the use of calcium hydroxide-based intracanal medication, and three-dimensional obturation using modern thermoplastic techniques. Concentrations below 3% may exhibit reduced antimicrobial efficacy, particularly in the presence of mature biofilm or persistent infections. The use of 5–10% solutions provided superior bactericidal activity and enhanced organic tissue dissolution capacity, contributing to more effective intracanal decontamination. In these cases, reduction of periapical radiolucency was observed earlier, and clinical symptomatology was absent or minimal.

Furthermore, the importance of patient cooperation in achieving favorable therapeutic outcomes was evident. Cases in which patients adhered to postoperative recommendations, attended periodic follow-up visits, and functionally loaded the treated tooth demonstrated more rapid and stable evolution, with early symptom resolution and a consistent radiological healing trend. Overall, the clinical and imaging outcomes obtained support the effectiveness of the integrated therapeutic protocol applied in the management of chronic osteodestructive apical periodontitis.

Conclusions

Chronic osteodestructive apical periodontitis represents a direct consequence of persistent endodontic infection, and therapeutic success is dependent on effective control of the intracanal biofilm and prevention of reinfection of the root canal system.

Chemomechanical decontamination associated with activated irrigation and the use of calcium hydroxide–based intracanal medication significantly contributes to the reduction of residual bacterial load and promotes regression of the periapical inflammatory process.

Three-dimensional obturation using modern thermoplastic techniques, in association with appropriate sealers, ensures effective sealing of the root canal system and reduces the risk of intraradicular microleakage.

Long-term maintenance of therapeutic outcomes depends not only on the quality of root canal obturation but also on the achievement of adequate coronal sealing immediately after treatment, capable of preventing marginal microleakage and recontamination of the endodontic system.

Consistent application of an integrated therapeutic protocol, complemented by clinical and radiological follow-up and active patient cooperation, enables the achievement of stable and predictable periapical healing.

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EVALUAREA COMPARATIVĂ A MATERIALELOR UTILIZATE PENTRU COROANE TEMPORARE

Mușcinschi Nicoleta, medic rezident, Catedra de stomatologie ortopedică „Ilarion Postolachi", USMF „Nicolae Testemițanu"
Cheptanaru Olga - dr. șt. med., conf.univ., Catedra de propedeutică stomatologică „Pavel Godoroja", USMF „Nicolae Testemițanu"
Oineagra Vadim - asistent universitar, Catedra de stomatologie ortopedică „Ilarion Postolachi", USMF „Nicolae Testemițanu"
Lozovan Grigore - medic stomatolog
Usatîi Adelina - medic rezident, Catedra de stomatologie ortopedică „Ilarion Postolachi", USMF „Nicolae Testemițanu"

Introducere. Coroanele temporare sunt restaurări protetice provizorii utilizate până la fixarea coroanei permanente. O coroană provizorie ideală trebuie să răspundă simultan unor cerințe biologice, mecanice, estetice și funcționale. Aceste materiale includ polimetil metacrilat (PMMA) și compozite bi-acrilice. Tehnologiile CAD-CAM au apărut în ultimii ani prin frezarea blocurilor de rășină.
Scopul lucrării: de a investiga proprietățile mecanice și estetice ale diferitor materiale utilizate pentru confecționarea coroanelor dentare provizorii.
Material și metode: Tipurile de proteze utilizate au fost coroane dentare PMMA confecționate prin tehnica de proiectare și fabricație asistată de computer (CAD/CAM) și coroane din bi-acril prin metoda convențională. Studiul a fost efectuat în baza la 13 pacienți, cu vârstele între 18 și 70 de ani. Calitatea a fost evaluată în funcție de adaptarea marginală, sângerarea gingivală, culoare, integritatea structurală, disconfortul și descimentarea.
Rezultate: Deschiderile marginale au fost semnificativ mai frecvente la metoda convențională (12,28%) comparativ cu CAD/CAM (3,50%). S-au raportat 8 cazuri (14,03%) de fractură la coroanele tradiționale față de 2 cazuri (3,50%) la CAD/CAM. Incidența descimentării a fost aproape dublă pentru metoda tradițională (17,54 % vs. 7,01 %). PMMA frezat obține scoruri maxime de 100% la toate categoriile estetice: translucență, stabilitate cromatică, lustruabilitate și rezistență la colorare. Bi-acrilul prezintă o rezistență la colorare mai redusă (73,33%), tinzând să absoarbă coloranții mai rapid.
Concluzii: PMMA-ul frezat (CAD/CAM) are proprietăți mecanice superioare, cu rezistență crescută la fractură, stabilitate dimensională și finisaj estetic de înaltă calitate. Adaptarea precisă reduce iritațiile gingivale și oferă o senzație mai naturală comparativ cu rășinile bi-acrilice. Rășinile bi-acrilice sunt mai ușor de folosit, dar mai puțin precise și rezistente.
Cuvinte-cheie: coroane provizorii, bi-acril, PMMA.