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Mini Review

Decontamination of the Endodontic System, in Terms of Minimally Invasive Approach

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Abstract

The main purpose of endodontic therapy is decontamination of the entire endodontic system, which means removal of the infected content of the root canal, dentinal debris and the intracanalar microbiota. For the maintaining of the biostructure and physical properties of dentin, the concept of minimally invasive approach has to be implemented, and the special role of the adjunctive irrigation method is emphasized. The varied root configurations and anatomical complexity represent a permanent challenge for modeling and chemical debridement of the endodontic space.

Keywords: Endodontic System; Decontamination; Irrigants; Minimal Invasive Preparation

Introduction

Root canal cleaning and preparation techniques involve the use of instruments and chemical solutions with the role of removing and dissolving vital or necrotic pulp tissue, disinfecting and removing bacteria and the smear layer from the root canal system. The most used chemical solutions are sodium hypochlorite (NaOCl) in a concentration of up to 5% and ethylenediaminetetraacetic acid (EDTA) in a concentration of 17%. A large number of studies have been undertaken to determine the effectiveness, safety and predictability of lavage protocols in endodontic treatment [1,2].

In order to improve the quality of disinfection of the endodontic system, since inaccessible areas of the dentinal surface are difficult to reach especially in the apical third of the root canal, proper irrigation methods have to be used, in the context of minimally invasive preparation [1-4]. The challenge for clinicians, regarding the decontamination of the endodontic system, has to be improved, decreasing the size of the preparation [5,6].

The geometry of the access cavity [7] and the preparation must be redefined, by means of modern access cavity design, minimally

instrumentation and improved irrigation procedures, to enhance the structural integrity of the tooth [8,9].

Minimal invasive approach regarding disinfection of the endodontic system

The implementation of modern technology, new materials and investigation methods, like micro-CT, CBCT, the use of operative microscopes made it feasible to apply the concept of minimally invasive preparation in clinical practice [6,10].

First of all, in order to preserve tooth structure, a conservative access cavity has to be prepared, to avoid dentinal fissures and cracks, and later, the vertical corono-radicular fracture. The use of heat treated super elastic alloy instruments with smaller taper offers, in this respect, a sufficient access to the apical segment of the root canal, even if the paracervical area is more susceptible to the vulnerability of the dentinal structure [11-13].

For a proper irrigation method, the sonic and laser activation of the NaOCl solution must be used. The efficiency of the irrigation depends on chemical and mechanical effect, the irrigation method, with activation of the solution, but in the same time the interaction with the content of the endodontic system, irritants, biofilms, endotoxins, dentin debris [9,11]. Mechanical instrumentation and decontamination of the endodontic system is very important for the outcome of the endodontic treatment, eliminating the residual microbiota and smear- layer. Endodontic pathology status has to be determined [8], as well as general health condition of the patient. The clinician has to appreciate the potential virulence of the microbiota of the infected root canal space, as well as some of the endodontic pathology, like radicular resorption, furcal and lateral lesions and diffuse radiolucency's, that can complicate the long term prognosis [9]. Minimally invasive instrumentation must permit a proper instrumentation and debridement of the apical segment of the root canal and the adjunctive irrigation system facilitates degradation and detachment of biofilms and smear -layer.

Recent superior cleaning of complex apical anatomy

The use of delivery systems (alternating pressure), agitation techniques, sonic and ultrasonic activation of irrigation solutions that improved the performance of chemical debridement [3,4].

In the minimally invasive preparation technique, it is essential that the irrigant solutions are ultrasonically or laser activated. Multisonic activation is considered one of the most recent techniques used in chemical debridement. Gentle Wave (Sonendo, Laguna Hills, CA) is the device that uses this technology [5].

The Gentle Wave System consists of a console and a sterile single-use procedure instrument (PI). A flow of treatment solution including EDTA, NaOCl and distilled water is delivered from the tip of the handpiece into the pulp chamber. Excess fluid is simultaneously removed by the built-in suction through handpiece ventilation [4]. Vapor blocking is prevented by degassing the washing solutions in the console and then diluting the procedure fluids to the desired concentrations (3% NaOCl and 8% EDTA). The high-pressure fluid jet (approximately 50 mL fluid per minute) flows through the procedure instrument, the fluid jet interacts with the stationary fluid in the pulp chamber to generate a shear force that produces a cavitation cloud. The cavitation cloud consists of thousands of microbubbles that implode to create broad spectrum acoustic energy that penetrates the root canal system.

Gentle Wave (Sonendo, Laguna Hills, CA) required minimal (#15-20/.04) root canal shaping [5,6]. The continuous supply of fresh liquid in the root canal system is accelerated chemical exchange. The extrusion of the solutions is minimized by the negative pressure created at the top of the root canals by the vortex flow generated by the fluid jet [7,8].

Further clinical research is needed to establish the superiority of this method of irrigation, in contrast with other special techniques.

Of course, curved root canals and calcified pulp chambers and canals are challenging.

In order to avoid recontamination of the endodontic system, after proper minimally invasive treatment, endocrown restaurations are suggested, using adhesive technology [10].

Concluding Remarks

Proper case selection, nowadays minimally invasive preparations have to be considered, also by means of decontamination of the endodontic system.

In order to obtain a proper disinfect ion of the endodontic system, in terms of the minimal invasive approach, a new geometry of the access cavity has to be imagined, a conservative mechanical preparation must be realised, respecting the concept of preserving more dentine, to avoid weakening of the tooth.

It is, at last, the clinician s decision, if the tooth that has to be treated is suitable to the minimally invasive procedures.

Endodontic research, as well as advanced technology regarding proper irrigations methods are required for future evaluation of the long term condition of the teeth, treated in a minimally invasive approach.

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