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NEW IRRIGATION TECHNOLOGIES IN CLEANING AND DISINFECTION OF ROOT CANALS

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Abstract

In endodontic treatment, effective cleaning and disinfection of root canals play a crucial role in preventing disease recurrence. In recent years, significant innovations have emerged in irrigation technologies. This article analyzes the effectiveness of ultrasonic activation, laser technologies, passive hydrodynamic systems, and novel chemical irrigants. Studies indicate that innovative technologies enable better penetration into the complex anatomy of the root canal system and more effective elimination of microorganisms, while significantly improving therapeutic outcomes compared to conventional techniques. These approaches reduce the risk of recurrent endodontic infections and optimize the treatment process.

Keywords

endodontics, root canal, irrigation, disinfection, ultrasonic activation, laser, sodium hypochlorite, biofilm

Introduction.Cleaning and disinfection of root canals are fundamental components of endodontic treatment. When pathogenic agents, organic debris, and necrotic tissues remain within the root canal system, chronic infections and periodontitis may develop. Conventional irrigation techniques, including static use of sodium hypochlorite (NaOCl) and EDTA solutions, are sometimes insufficient to completely clean root canals with complex anatomy. Therefore, in recent years, new technologies have been developed to enhance irrigation efficiency, including ultrasonic activation, laser-assisted disinfection, passive hydrodynamic systems, and combined chemical irrigants.

Relevance of the study:Recurrence of endodontic infections is observed at a high rate in clinical practice. Therefore, effective and safe irrigation technologies play an important role in preventing disease recurrence, reducing treatment duration, and improving patient comfort.

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Aim of the study:To investigate modern irrigation technologies used in the cleaning and disinfection of root canals, analyze their effectiveness, and recommend their application in clinical practice.

Main Part (Results and Discussion)1. Conventional irrigation technologies

Conventional irrigation is performed using NaOCl, EDTA, and water. NaOCl possesses strong bactericidal and proteolytic properties, dissolving organic debris, while EDTA removes inorganic residues from canal walls. Static irrigation methods may fail to completely eliminate biofilm in root canals with complex anatomy, thereby increasing the risk of reinfection. Studies indicate that canal cleanliness achieved using conventional technologies averages 60–70%.

2. Ultrasonic Activation

Ultrasonic irrigation, also known as passive ultrasonic irrigation (PUI), induces movement of irrigants within the canal through microvibrations. This technology:

Enhances penetration of irrigants into canal ramifications

Effectively removes biofilm and necrotic tissues

Achieves up to 90% elimination of microorganisms

According to Haapasalo and Shen (2015), ultrasonic technology increases canal cleanliness by 25–40% compared to classical static irrigation, while causing minimal mechanical damage to canal walls.

3. Laser-assisted Irrigation

Laser technologies, particularly diode and Er:YAG lasers, eliminate bacterial biofilm through high-energy radiation. The advantages of laser irrigation include:

Selective elimination of microorganisms

Minimal thermal damage to canal walls

Reduced risk of infection recurrence

According to Mohammadi and Shalavi (2018), the incidence of chronic infections in root canals treated with laser technology is reduced by 15–20%. In addition, laser-assisted irrigation decreases patient pain symptoms and shortens treatment duration.

4. Passive and Activated Hydrodynamic Systems (Negative Pressure Systems)

EndoVac, Self-Adjusting File (SAF), and other passive hydrodynamic systems deliver irrigants into the canal using passive flow. These technologies:

Reach all canal ramifications

Effectively eliminate biofilm through dynamic fluid circulation

Ensure cleaning without damaging canal walls

According to Boutsioukis et al. (2014), passive hydrodynamic systems demonstrate high effectiveness even in root canals with complex anatomy.

5. Chemical Irrigants and Combined Approaches

Modern approaches involve combining NaOCl and EDTA with ultrasonic or laser activation. Such approaches:

Simultaneously remove organic and inorganic debris

Maximally reduce intracanal biofilm

Minimize the risk of recurrent endodontic infections

According to Zehnder (2006), microbial contamination in canals cleaned using combined technologies is reduced to 95–98%.

6. Results and analysis

Modern irrigation technologies are significantly more effective than conventional methods in cleaning root canals.

Ultrasonic and laser technologies are the most effective in eliminating biofilm.

Passive hydrodynamic systems provide high efficiency in cleaning canals with complex anatomy.

Combined chemical and physical approaches ensure maximal canal cleanliness.

Clinical observations indicate that patients treated with modern technologies show a significantly lower risk of post-treatment infection recurrence, reduced treatment time, and decreased pain symptoms compared to conventional methods.

Conclusion.New irrigation technologies in root canal cleaning and disinfection ensure high effectiveness in endodontic treatment. Ultrasonic activation, laser technologies, passive hydrodynamic systems, and combined chemical approaches:

Reach the complex anatomy of the root canal system

Effectively eliminate microorganisms

Reduce the risk of infection recurrence

Shorten treatment duration and improve patient comfort

Therefore, the widespread implementation of these technologies in clinical practice is recommended. Future studies should focus on evaluating the long-term effectiveness of these technologies and developing new combined approaches.

REFERENCES:

Peters, O.A., et al. Cleaning and shaping of the root canal system. Endodontic Topics, 2016; 34: 21–36.

Haapasalo, M., Shen, Y. Ultrasonics in endodontics: current status and future perspectives. Int Endod J, 2015; 48: 779–795.

Mohammadi, Z., Shalavi, S. Laser-assisted endodontic disinfection. J Lasers Med Sci, 2018; 9(1): 1–7.

Boutsioukis, C., et al. Irrigation dynamics in root canal treatment. Int Endod J, 2014; 47: 980–997.

Zehnder, M. Root canal irrigants. J Endod, 2006; 32: 389–398.