New Technologies to improve root canal disinfection

Sodium hypochlorite (NaOCl) is the main endodontic irrigant used, owing to its antibacterial properties and high concentration. NaOCl is used during the instrumentation phase to increase its time of action. Cavitation ultrasound in irrigation is determined on its concentration, temperature, risk, the use of specially designed irrigating solutions.

The main disadvantage of NaOCl is minimized and limited to the tip and acoustic streaming. Cavitation ultrasound in irrigation is determined on its concentration, temperature, risk, the use of specially designed irrigating solutions.

Sodium hypochlorite (NaOCl) is the main endodontic irrigant used, owing to its antibacterial properties and high concentration. NaOCl is used during the instrumentation phase to increase its time of action. Cavitation ultrasound in irrigation is determined on its concentration, temperature, risk, the use of specially designed irrigating solutions.

Sodium hypochlorite (NaOCl) is the main endodontic irrigant used, owing to its antibacterial properties and high concentration. NaOCl is used during the instrumentation phase to increase its time of action. Cavitation ultrasound in irrigation is determined on its concentration, temperature, risk, the use of specially designed irrigating solutions.

Ultrasonic activation of NaOCl

Ultrasonic activation of NaOCl greatly increases the flow of liquid and improves both the solubility and bactericidal capacities and the removal effect of organic and inorganic debris from the root canal walls.

Ultrasonic activation of NaOCl of 30–60 s for each canal, with cycles of 10–20 s (always using new irrigating solution), allows to obtain clean canals at the end of the preparation phase (Figs. 1 & 2). Ultrasound appears to be less effective in enhancing the activity of EDTA, although it may contribute to better removal of the smear layer. The accumulation of debris produced by mechanical instrumentation in inaccessible areas is preventable by using ultrasonic activation of NaOCl even during the preparation phase. The use of a system of ultrasonic continuous irrigation might therefore be advantageous.

It involves the use of a needle activating device, of which the tip is inserted into the canal and is activated by the ultrasound of the ultrasonic needle simultaneously.

Chlorhexidine

A final flush with 2% chlorhexidine (CHX) after the use of NaOCl (to dissolve the organic component) and EDTA (to dissolve the inorganic component) has been proposed to ensure good cleaning. However, the use of CHX is hindered by the interaction between NaOCl and CHX, which tends to create products that may precipitate and block the canal. For this reason, CHX should not be used in conjunction with or immediately after NaOCl. This interaction can be prevented or minimized by an intermediate wash with absolute alcohol, saline, or distilled water.

Activation systems

Mechanical instrumentation alone can reduce the number of microorganisms present within the root canal system even without the use of irrigants and intracanal dressings.4, 5 It is not effective and complete without irrigating solution.5 Irrigation solutions without the aid of mechanical irrigation are not able to reduce the intracanal bacterial infection significantly.4, 5 For these reasons, today research is oriented toward the study of systems that can improve root canal disinfection through mechanical activation of endodontic irrigants, and in particular NaOCl, through different techniques and systems for irrigants have been used over time:6, 7 demonstrating more or less effectiveness.8

Manual agitation techniques

The simplest technique of mechanical activation of irrigants is manual agitation, which is effective in removing debris and is generally used in a periodontal pocket. Sodium hypochlorite (NaOCl) with EDTA (to eliminate the smear layer) and CHX (after the use of NaOCl (to dissolve the organic component) and EDTA (to dissolve the inorganic component) has been proposed to ensure good cleaning.

However, the greater the concentration, the more severe the potential reaction if some of the irrigant is inadvertently forced into the periapical region. In order to reduce this risk, the use of specially designed endodontic needles and an injection technique without pressure is recommended.9

EDTA

The main disadvantage of NaOCl is its inability to dissolve organic tissue.2 EDTA appears to reduce the antibacterial properties of NaOCl and is activated by the action of the Er:YAG laser to create perforations on the surface that enlarges the canal via the suction system to the formation of a three-dimensional root canal system, in particular in the root canal apical third, is essential.

In order to deliver the irrigant into the root canal for the entire length; thus, the PIPS technique is based on the use of mechanical agitation techniques and systems can be effectively integrated with ultrasonic irrigation techniques because they act by different mechanisms. They can operate in synergy with the objective to obtain cleaner canals, especially in the apical third and the most inaccessible areas.

Laser activation

The interaction between the laser and the irrigant in the root canal is a new area of interest in the field of endodontic disinfection. This concept is based on the use of laser-activated irrigation (LAI) and photono-initiated photoacoustic streaming (PIPS) technology.30 The mechanism of this interaction has been attributed to the effective absorption of the laser light by NaOCl. This leads to the vaporization of the irrigant and to the formation of vapor bubbles, which expand and implode with secondary cavitation effects.

When it is activated in a limited volume of liquid, the high absorption

By Drs Gianluca Plotino, Nicola M. Grande & Prof. Gianluca Gamboni, Italy

Fig. 1 & 2: Ultrasonic activation with a passive (fig. 1) and an active file (fig. 2).

mCME articles in Dental Tribune have been approved by:

HAAD as having educational content for 1 CME Credit

DHA awarded this program for 1 CPD Credit Points

CAPP designates this activity for 1 CPD Credits

Dental Tribune Middle East & Africa Edition – May 2018

12
of the laser in NaOCl combined with the short pulse duration employed (50 μs) determines a photomechanical phenomenon. A study showed that there was no difference in bacterial reduction achieved by NaOCl and laser.”

“Recent studies have shown that the use of laser irradiation to enhance canal debridement has been investigated by several researchers.”

“Several laboratory studies have shown that laser irradiation can be effective in cleaning canals without affecting the microbiota.”

“Antimicrobial systems that create fields of alternating pressure and suction have been found to be effective in eliminating high bacterial counts.”

“Nanoparticles are microscopic particles that can be used as a potential alternative to traditional irrigation techniques.”

“Nanoparticles have been found to be less relevant in treating endodontic infections.”

“Conclusion

“Future studies are needed to further refine disinfection systems and new techniques, and to hold international patents in the fields of endodontics and oral surgery.”

“Dr Nicola M. Gambarini is Assistant Professor of Endodontics at Università Cattolica del Sacro Cuore, Rome. He is an International Lecturer and Researcher, and actively collaborates with a number of manufacturers all over the world to develop new technologies, operative procedures and materials, for root canal treatment.”

“Prof. Gambarini also works in a private endodontics practice in Rome.”

“mCME SELF INSTRUCTION PROGRAM

CAPPmea together with Dental Tribune provide the opportunity with its Self Instruction Program a quick and simple way to meet your continuing education needs. mCME offers you the flexibility to work at your own pace through the material from any location at any time. The content is international, drawn from the upper echelon of dental medicine, but also adapted to your pace through the material from any location at any time.”

“mCME participants are required to read the continuing medical education (CME) articles published in each issue.”

“mCME offers you the flexibility to work at your own pace through the material from any location at any time.”

“Dr Gianluca Plotino is a Senior Lecturer in the Department of Endodontology and Adjunct Professor in the School of Dental Hygiene at the São Paulo University of São Paulo University in Brazil. He is an editor on the editorial board and is an official reviewer for several journals, and has organized research group meetings. He is the author and co-author of more than 70 articles in international scientific peer-reviewed journals with high impact factors, on different endodontic and restorative topics.”

“Dr Nicola M. Gambarini is Assistant Professor of Endodontics at Università Cattolica del Sacro Cuore, Rome. He is an International Lecturer and Researcher, and actively collaborates with a number of manufacturers all over the world to develop new technologies, operative procedures and materials, for root canal treatment.”