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# Antibacterial Effect of the New Intracanal Medication Based on Copper-Calcium Hydroxide and Silver Nanoparticles: Real-Time PCR Study

**Alisa Vladimirovna Blinova**
Tver State Medical University, Russia

Alveolar bone regeneration may be achieved only in 53.6% - 70.8% of apical periodontitis cases. The root canal system has an irregular shape, which is difficult to clean with endodontic instruments. Besides, zones of exposed root dentin, formed during root canal cleaning, include a large surface area – there are 20,000-80,000 dentine tubules' apertures on each 1 mm2. Persistent bacterial biofilm is found in dentine at the depth of 300 – 1000 microns. So, it's necessary to develop new ways of antimicrobial treatment. The aim of the study was to evaluate the antibacterial properties of a new intracanal paste based on calcium hydroxocuprate (CHC, CaCu(OH)4) and silver nanoparticles hydrosol for root dentine impregnation. The study included 55 teeth with 69 root canals of 29 patients with chronic apical periodontitis. The study did not include patients with decompensated chronic somatic disorders and acute infectious diseases, as well as patients with obliterated root canals or allergic reactions to copper and silver medicines. Informed consent was obtained. First, the tooth was isolated with a rubber dam. After cavity preparation, the root canals were minimally expanded. The first biological sample was taken with a paper absorber. The canals were mechanically treated and irrigated with a 3% solution of sodium hypochlorite. Then the canals were filled with antimicrobial paste. The main group, including 44 root canals, was filled with a new paste based on CHC and silver nanoparticles for 7 days. CHC paste and a colloidal solution of silver nanoparticles (3 mg/l, particle size is 0,5-3nm) were mixed in a ratio of 1:1. Silver hydrosol was obtained by condensation of low-temperature plasma in a spark discharge. In the control group, 25 root canals were sealed with an aqueous paste of calcium hydroxide for 14 days. During the second visit, the paste was washed out of the root canals with a sterile isotonic solution and the second biological sample was taken. The presence of the endodontic microorganisms in each sample was evaluated by real-time PCR. Statistical analysis was performed using SPSS software. Significance levels were set at the 5% level using the Student t-test or Mann-Whitney test. 95% confidence intervals (CI) were calculated. At the first step, the comparability of the groups was checked. No significant differences in the bacteria species were found between the groups before treatment. Further analysis showed that the amount of the DNA, common for P. gingivalis, T. forsythia and T. denticola, after treatment was less in the main group, where the new paste was applied. These results were significant at the p = 0.05 level (p=0,005, p = 0,006, p=0,003 according to each mentioned bacterial species). No significant differences were found between the groups in the number of genome equivalents specific for P. intermedia and F. nucleatum (p=0,543, p=0,554), although the amount of DNA of these bacteria in the main group was less than in the control group. These findings suggest that the new method of root dentine impregnation with the CHC and silver nanoparticles paste may be useful for the treatment of chronical apical periodontitis. The new medication turned out to be more effective than calcium hydroxide against the most pathogenic microorganisms.

## Biography

Alisa Vladimirovna Blinova, PhD, a post-graduate student of Tver State Medical University (Russia). She graduated from Tver State Medical University in 2020 with a degree in Dentistry. Her research interests include modern conceptions of endodontic treatment, the control of oral biofilms and using nanotechnologies in dentistry. The method of passive nano-impregnation developed by her has a high therapeutic and commercial potential. It can improve the quality of conservative treatment of apical periodontitis without increasing the patient's treatment costs. The new method considers the tooth as a nanostructured organ and corresponds to the modern concept of microbial biofilms.