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## The new antimicrobial medication for endodontic treatment based on calcium hydroxocuprate and cooper nanoparticles

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Alveolar bone regeneration may be achieved only in 53.6% - 70.8% of apical periodontitis cases. Zones of exposed root dentin, formed during root canal cleaning, may be considered as surgical wounds. Specificity of these wounds includes a large surface area – there are 20,000-80,000 dentine tubules' apertures on each 1 mm<sup>2</sup> – and a permanently persistent bacterial biofilm, which is found in dentine at the depth of 300 – 1000 microns. It's necessary to develop new methods of prolonged antimicrobial treatment to improve the alveolar bone healing.

The aim of this study was to investigate a new nanomedicine based on calcium hydroxocuprate and copper nanoparticles and to show the dynamics of passive impregnation of the root dentin with this mixture.

**Results:** The formation of nanoparticle compositions was established by electron microscopy. Cooper nanoparticles, due to their small size (0.5-3 nm) and high surface energy, penetrate into calcium hydroxocuprate crystals having an average size of 287±23.4 nm. Large particles accumulate the energy of smaller cooper particles and become capable of getting into the dentin along the concentration gradient by the osmotic pressure in the capillary system of the dentine tubes. This fact is confirmed by the clinical research.

In the slices of the roots of the teeth treated with water paste of calcium hydroxocuprate cooper particles were detected in the dentine at a depth of just 10 microns. The

distribution of copper in the dentin fragment treated by calcium hydroxocuprate electrophoresis was different- copper was detected after 200 microns from the root canal wall. The calcium hydroxocuprate and cooper hydrosol mixture made it possible to achieve impregnation of the dentin to a depth of 300 to 500 microns without any electric exposure.

Antibacterial potential of this medicine is being investigated in the laboratories of Tver State Medical University using real-time PCR analysis.

### Recent publications

1. Blinova AV. Nanotechnology: Finding new solutions for preventive dentistry. Bulletin of Avicenna [Avicenna Bulletin]. 2021;23(1):78-84.
2. Rummyantsev VA, Frolov GA, Blinova AV, Karasenkov YaN, Bituyukova EV. Electron microscopic properties of a new antimicrobial nanodrug based on copper-calcium hydroxide compound. Vestnik Avitsenny [Avicenna Bulletin]. 2021;23(4):532-41

### Speaker Biography

A Blinova is a post-graduate student of Tver State Medical University, Russia. She graduated from Tver State Medical University in 2020 with a degree in dentistry. She has over 40 publications and 5 patents that have been cited over 30 times (the publication H-index is 3). Her research interests include modern conceptions of endodontic treatment, the control of oral biofilms and using nanotechnologies in dentistry.

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