The effect of nanocomposite, impregnated with ornidazole, on biofilm formation by opportunistic microorganisms

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The arise and spread of antibiotic resistant strains of opportunistic bacteria became a global issue. While designing novel approaches to overcome the resistance it is vital to consider that the main and less susceptible to antimicrobials form of microbial existence is a biofilm – a group of surface-associated bacterial cells enclosed in the extracellular polymeric matrix. Aiming to prevent or block the biofilm formation novel agents targeting the integrity of biofilms should be designed, among them special attention is drawn to nanocomposite impregnated with antimicrobials due to their antibiofilm and antiadhesive properties.

In the study nanocomposite synthesized on the basis of disperse pyrogenic silica with 1-chloro-3-(2-methyl-5-nitro-1-H-imidazol-1-yl)- propan-2-ol (ornidazole) was applied. To determine the effectiveness of nanocomposite's antibiofilm action the standardized 0,5 McFarland units suspensions of *Staphylococcus aureus* ATCC25923, *Escherichia coli* ATCC25922 and *Pseudomonas aeruginosa* ATCC27853 cells were used. To study the antimicrobial effect of nanocomposite on the irreversible adhesion and maturation stages of biofilm formation the microtiter dish biofilm formation assay with the application of crystal violet staining was carried out. Bacterial adhesion was quantified due to Brillis method using human red blood cells.

According to the results, the exposure of bacteria to nanocomposites prior the irreversible attachment led to the decrease in the cells adhesivity and thereby biofilm formation. The reduction of adhesion was observed in all tested bacterial strains, independently of the blood type of human erythrocytes. Moreover, the percentage of *E. coli* and *P. aeruginosa* cells capable of biofilm formation decreased to only 38 % comparing to control. However, only a slight reduction in biofilm-forming S. aureus cells was observed. In comparison, when the bacteria were exposed to the nanocomposite after the irreversible adhesion stage of biofilm formation, the decrease of biofilm-forming cells number was no longer observed.

In essence, nanocomposites with ornidazole are effective antibiofilm and antiadhesive agents, however, due to the higher resistance of bacterial biofilms, the time of the uptake and the concentration of active compound should be considered to reach the maximal effectivity of the treatment.