Effects of a noble metal alloy coating on fibroblast-mediated tissue repair

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OBJECTIVES

- Implant-associated infections are serious complications in orthopedic surgery, with potential severe consequences for peri-implant tissue healing and osseointegration
- A noble metal alloy coating of orthopedic implants has been developed (Bactiguard®, Sweden)
- This coating has been shown to reduce device-related infections by preventing microbial adhesion to the surface
- The objectives of this study were to assess the in vitro effects of Bactiguard-coating on fibroblast proliferation, migration, and collagen production.

METHODS

- Human fibroblasts (fHDF/TERT166) were cultured with 1.) Bactiguard-coated titanium coins, 2.) non-coated titanium coins and 3.) without any coins as controls.
- Cell proliferation was studied by counting the number of cells at different timepoints after seeding in the presence of Bactiguard-coated and non-coated titanium coins.
- A cell scratch assay was applied to mimic tissue injury. Cell migration was determined by the rate of scratch recovery in Bactiguard-coated, non-coated titanium coins and control cultures.
- Western blot analysis was used to study Collagen I and III expression in protein lysates extracted from cultures with Bactiguard-coated, non-coated titanium coins and normal controls.
- All statistical analyses were performed using SPSS software (IBM SPSS, v26.0). Between group comparisons were made by the Student's t-test or one-way analysis of variance followed by LSD. $p<0.05$ was considered significant.

RESULTS

- Cell proliferation experiments at 24 or 36 hours detected no significant differences between the number of cells in cultures with BG-coated and NC titanium coins.
- Significantly higher migration rate was observed in both the Bactiguard-coated (54%, $p = 0.003$) and non-coated coin (46%, $p = 0.013$) cultures compared to the normal control (Fig 1).
- Western blot analysis revealed no significant differences among Bactiguard-coated, non-coated coins or control cultures in the amount of Collagen I and Collagen III expression (Fig 2A, B)

CONCLUSIONS

- The study results of this in vitro model on fibroblast-mediated tissue repair suggest that the Bactiguard-coating does not exert any adverse effects on tissue repair.
- The higher migration ratio and slightly higher Collagen III/Collagen I ratio on the coin cultures (i.e., Bactiguard coated and non-coated) compared to normal control, indicates inflammatory healing response from placing a coin on a fibroblast cell culture.
- Coated implants can help reduce infections but may increase the risk of toxicological effects. Thus, non-toxic, infection-prevention coatings that do not disrupt the normal cell repair mechanisms are preferable.

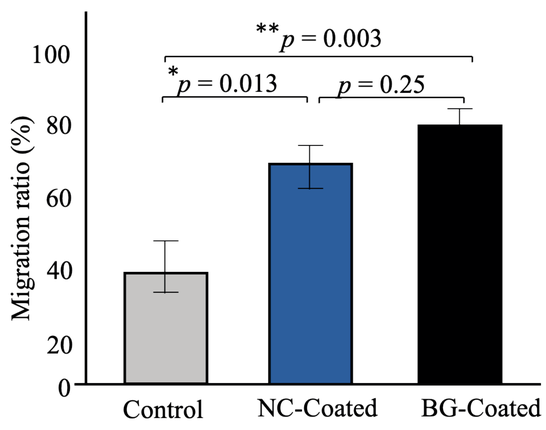

Fig 1.
Semi-quantitative analysis of cell migration ratio in control, Non-Coated (NC) and Bactiguard (BG)-coated cultures at 24 hrs. Data reported as mean ± SEM with n = 3 replicates. *p<0.05, **p<0.005.

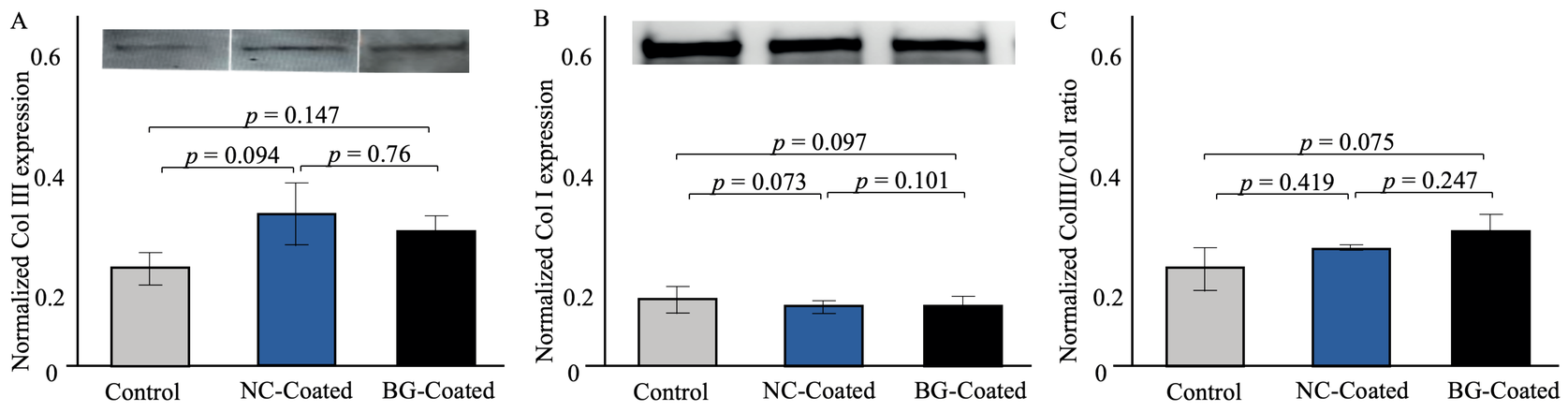

Fig 2.
The representative western blot images and semi-quantitative analysis of A) Col III, B) Col I, and C) Col III/I ratio from protein lysates generated by control, Non-Coated (NC) and Bactiguard (BG)-coated cultures at 36 hrs. Signal intensity was used for analysis and the intensity of the house-keeping gene (beta-actin) used for normalization. Data reported as mean ± SEM with n = 3 replicates.

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