

# Effects of Antiseptic Irrigation Solutions on Osseointegration in a Cementless Tibial Implantation Mouse Model

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**INTRODUCTION:** Despite the success of standard antiseptic irrigation solutions in reducing periprosthetic joint infection (PJI) rates, there is still a need for more effective solutions. Synergistic use of povidone-iodine (PI) and hydrogen peroxide ( $H_2O_2$ ) has shown promising results; however, the optimal solution concentration balancing bactericidal activity and osseointegration remains unknown. This study aims to evaluate the impact of these antiseptic irrigation solutions on osseointegration and the bone-implant interface strength *in vivo*. We hypothesized no impact of these antiseptic irrigation solutions on trabecular bone microarchitecture and biomechanical pull-out properties in our established mouse model for cementless tibial implantation.

**METHODS:** Forty C57BL/6 mice underwent bilateral tibial implantation surgery and were randomly allocated into three groups receiving dilute 0.3% PI, 10% PI mixed with 3%  $H_2O_2$ , or saline (control) as irrigation solutions intraoperatively. Assessments were performed on postoperative days 1 and 28, including plain radiographs, micro-CT evaluation, histological analysis, immunohistochemistry, and biomechanical pull-out testing. Differences in micro-CT and pull-out testing were analyzed with ANOVA followed by Tukey's post hoc test. Differences in immunohistochemistry data were analyzed with repeated ANOVA followed by Tukey's post hoc test with Bonferroni correction. Results are expressed as mean differences and 95% confidence intervals (CIs). All tests were two-sided.

**RESULTS:** No wound complications were observed. MicroCT scans revealed no differences in peri-implant trabecular bone parameters. Biomechanical pull-out testing showed no differences in the bone-implant interface strength across groups. Histological analysis indicated no differences in bone and bone marrow percentage areas among treatment groups. Immunohistochemical analysis demonstrated no differences among groups in peri-implant osteocalcin, osterix, or endomucin-positive cells.

## DISCUSSION AND CONCLUSION:

This study demonstrated that dilute povidone-iodine and a combination of 10% povidone-iodine mixed with hydrogen peroxide do not negatively impact osseointegration or the bone-implant interface strength in a cementless tibial implantation mouse model. These findings suggest that these antiseptic solutions can be safely used during primary and revision total joint arthroplasty without compromising implant stability or causing wound complications. The results align with existing knowledge on the bactericidal efficacy of these solutions while providing new insights into their safety concerning bone healing and integration. Future studies should investigate the long-term effects and clinical outcomes to further validate the use of these solutions in surgical practice.

