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PROOF OF CONCEPT TESTING OF INTELLIGENT FEMORAL HIP STEM

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Periprosthetic infections in hip arthroplasty are a feared complication with poor mortality and morbidity outcomes. Patients often present after the onset of clinical signs, by which time periprosthetic infection is extensive and biofilm formation has occurred. The aim of this study is to enhance earlier recognition of periprosthetic infection so antibiotic therapy is more likely to be effective. A femoral stem with surface pH and temperature sensors with the ability for wireless powering and data transfer was manufactured using micro-electro mechanical circuits and additive manufacturing methods. This stem was tested pre-clinically for proof-of-concept. The Author implanted this stem in cadaveric sheep leg. The sheep leg was warmed to physiological temperature and tissue pH and temperature was altered within biologically relevant ranges (pH 6.0-8.0, temperature 36-45°C) at 0.2 numerical intervals. The sensors reported pH recording with accuracy of 0.001pH and temperature recording accuracy of 0.2°C. The implant was tested in three sheep legs. Between the three trials, there was no statistical difference in pH or temperature recordings (pH, CI-2.44 to 5.11, P = 0.788. Temp, CI-4.23 to 2.90, P=0.233). Safety factors such as electric current leakage and technical uncertainties such as long-term powering reliability are unknown. In this study, the author proves the concept of the first reported dual pH and temperature sensing hip prosthesis.