Preservation of Osteochondral Autografts for Delayed Reimplantation in a Novel Preclinical Canine Model

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Purpose: In patients with open fractures, bone fragments devoid of soft-tissue attachments are felt to become a nidus for future infection and are therefore discarded during surgical management. When these fragments represent large portions of a joint, discarding the fragments will likely result in profound disability. We have developed a novel canine model of open periarticular elbow fractures, in which extruded joint segments are cleansed and preserved in a chondrocyte-protective solution for up to 14 days, demonstrating good success with fragment decontamination and maintaining chondrocyte viability.

Methods: Skeletally mature purpose-bred research hounds were humanely euthanized for purposes unrelated to the present study. A captive bolt pistol was used to create open fractures of the dog elbows with extruded osteoarticular fragments, which were retrieved and cleansed either with normal saline (negative control), 10% povidone-iodine and saline, or 0.002% chlorhexidine and saline. They were then placed into the Missouri Osteochondral Preservation Solution (MOPS) and maintained at room temperature for up to 14 days. We assessed bacterial cultures and chondrocyte viability at time zero, 7 days, and 14 days.

Results: At 7 days, mean colony-forming units (CFU) were 19.8 for controls, 0.2 for povidone-iodine, and 0.4 for chlorhexidine ($P<0.001$). At 14 days, mean CFU were 20.1 for controls, 3.3 for povidone-iodine, and 7.9 for chlorhexidine ($P = 0.003$). The bulk of CFU were considered nonpathogenic in the povidone-iodine and chlorhexidine groups. At 7 days, percent mean viable chondrocyte density (VCD) compared to day 0 was 59.3% for controls, 30.8% for betadine, and 75.7% for chlorhexidine ($P<0.001$). At 14 days, values were 15.3% for controls, 9.6% for betadine, and 70.1% for chlorhexidine ($P<0.001$).

Conclusion: Povidone-iodine and dilute chlorhexidine solutions successfully reduced bacterial contamination in extruded osteoarticular fragments from open elbow fractures in this canine model. Chondrocyte viability was better at 7 and 14 days for those fragments cleansed with dilute chlorhexidine. This model demonstrates that decontamination is successful and viability of extruded osteoarticular fragments after open fracture may be preserved through use of chlorhexidine cleansing of fragments followed by storage at room temperature in MOPS.