HIP RECONSTRUCTION WITH AN ALLOGRAFT/ENDOPROSTHETIC COMPOSITE IN DOGS: LONG TERM RESULTS

Introduction: Large bone defects commonly occur after multiple hip revisions and tumor resection. The use of allograft/endoprosthetic composites (APC) is one method of reconstructing the proximal femur following massive bone loss.1,2 Impaired limb function may result from inadequate or failed abductor muscle attachment to the APC with this reconstruction technique. The goal of this study was to compare APC incorporation using three methods of gluteal muscle attachment during total hip arthroplasty in dogs.

Methods: A total hip replacement using a cemented APC to replace the proximal 25% of the femur was performed in 48 dogs with FACC consent. The gluteal muscles were attached to the allograft by one of three methods: 1) tendon – host tendon sutured to allograft tendon, 2) grip - host greater trochanter to allograft using a cable grip system, and 3) wrap - host shell of cortical host bone with intact gluteal muscle attachments was wrapped around the allograft and secured with cerclage wires. Each method was performed on 16 dogs: 8 dogs followed for 9 months and 8 dogs followed for 18 months. Radiographs taken every 2 months were graded for host bone-allograft fusion, bone resorption, fracture, and graft shortening. Dual energy x-ray absorptiometry (DXA) of the hips was performed every 2 months to measure bone mineral density (BMD) in seven regions of interest described by Gruen.3 Specimens were harvested after euthanasia at 9 and 18 months and mechanically tested in tension to evaluate structural stiffness and maximum load to failure. Radiographic scores, BMD, peak VGRF, and mechanical properties were compared among the three groups using one-way analysis of variance followed by a post-hoc t-test when differences were significant (p ≤ 0.05).

Results: Radiology: Overall, the wrap group had significantly greater fusion scores and less graft shortening than the grip group and less graft resorption than the tendon and grip groups. In zone 7 (calcar), the tendon and grip groups reached 100% fusion by 6 months, while the wrap group reached 100% fusion by 8 months. The wrap group had significantly greater bone mineral density (BMD) in zone 7 (calcar) over time. By 18 months, the wrap group was significantly stiffer than the grip and tendon groups and stronger than the grip group. The tendon and wrap groups were significantly stiffer and stronger than the grip group. There were no significant differences in stiffness or strength between the tendon and grip groups at 18 months.

Discussion: Based on radiographic and DXA parameters, the APC constructed using the wrap method was incorporated better with less graft resorption, fracture, and shortening than the other groups. The wrap group dogs regained normal limb function more quickly and completely than the grip and tendon groups after 18 months. In zone 6, the BMD of the wrap group was significantly greater than the tendon group by 12 months after surgery. In zones 1 (greater trochanter) and 7 (calcar), the wrap group had significantly greater BMD than the other two groups overall and at most time intervals. By 18 months, the wrap group was significantly stronger than the grip and tendon groups and stronger than the grip group. No other significant differences were observed between the groups in stiffness or strength. By 18 months, the wrap group was significantly stiffer than the grip and tendon groups and stronger than the grip group.

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References:

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