Transcutaneous Endoprosthetic Reconstruction of Devastating Lower Limb Military and Terrorist Blast Injuries

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Background/Purpose: Military-type blast injuries from improvised explosive devices (IEDs), unfortunately, all too often result in truly devastating lower extremity injuries, and in many instances it is not possible to reconstruct biologically. The associated gross destruction of the extremities frequently results in lower limb amputations, with soft tissues and bone obliterated by the force of the explosion. Moreover, these injuries are often bilateral, and are notoriously difficult to fit with prostheses because of a short skeletal residuum, dense adherent scars, and heterotopic bone. Osseointegration provides a revolutionary strategy for management of these amputees, using a transcutaneous porous-coated titanium endoprosthetic device. The primary objective here was to describe our experience using osseointegration as the definitive reconstruction strategy following amputations resulting from military-type blast injuries, including preliminary assessment of the safety and efficacy of the procedure in this challenging cohort of patients.

Methods: This is a case series of 10 patients who had sustained military or terrorist blast injuries resulting in lower extremity amputations. The study groups comprised 10 males and 0 females, aged 23-67 years (mean 37). Principal outcome measures included: Questionnaire for persons with a Trans-Femoral Amputation (Q-TFA), Short Form Health Survey 36 (SF-36), Six Minute Walk Test (6MWT), Timed Up and Go (TUG), and K-levels. Adverse events were recorded including infection, revision surgery, fractures, and implant failures.

Results: Clinical outcomes were obtained pre- and postoperatively from 10 to 30 months, with a mean follow-up of 16 months. Compared to the mean preoperative values with socket prostheses, the mean postoperative values for all five validated outcome measures were improved. The postoperative Q-TFA global score (40.69 ± 6.46 to 78.13 ± 4.44, P = 0.0003) and the SF-36 physical component summary (42.16 ± 2.83 to 47.90 ± 3.34, P = 0.2) were both superior to the preoperative values, although for the SF-36 this did not achieve significance because of the limited sample size. K-levels improved in 9 patients, and remained unchanged in 1 patient; no patient had a reduction in their K-level (X^2 = 14.624, df = 2, P = 0.0007). The 6MWT (102 ± 56.17 to 437 ± 60.61, P = 0.0017) and the TUG (14.34 ± 3.33 to 8.74 ± 1.46, P = 0.11) were also dramatically improved; for the 6MWT this is a 330% increase, and the TUG was decreased 39%. This difference was significant for the 6MWT, but not the TUG, again most likely because of the small sample size. These patients were often completely disabled, with 4 participants wheelchair bound preoperatively, and could not perform the TUG and 6MWT; however, all 4 were able to do so after osseointegrated reconstruction, and their postoperative values were comparable to those of the prosthetic users who were ambulatory preoperatively. A total of 6 participants were adverse event-

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free, There were episodes of minor infection in 3 patients, and all of these responded to oral antibiotics. Refashioning of the soft-tissue residuum was performed on 1 patient electively; 1 periprosthetic fracture occurred due to increased activity, and was successfully stabilized without the need to revise the implant.

Conclusion: Our experience in this small series suggests osseointegration may be considered a highly effective strategy for the definitive reconstruction of amputees resulting from military-type blast injuries. Despite having tremendous difficulties using a socket-mounted prosthetic limb, their functional levels were much improved after osseointegrated reconstruction. These findings have very important implications for the definitive reconstruction and rehabilitation of those veterans who have undergone an amputation as a result of military combat blast injuries.