

Osseointegrated Implants for Lower Limb Amputees: Evaluation of Bone Mineral Density

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Purpose: The use of dual-energy x-ray absorptiometry (DXA) is a standard clinical procedure for the evaluation of bone mineral density (BMD). Amputee patients are known to have decreased BMD and an increased risk of osteoporosis in the affected proximal femur and hip region. The major cause of these issues in these patients is the absence of adequate loading leading to bone resorption in accordance to Wolff's law. We present a prospective study reporting changes in BMD among amputees who received osseointegrated implants to determine if the loading through the osseointegrated implant can overcome the bone resorption issues.

Methods: This is a prospective study of 33 patients, consisting of 24 males and 9 females, aged 22-77 (mean = 51.0 ± 2.0) years with 1 and 2-year follow-up. Selection criteria included age over 18 years, unilateral amputees with socket-related problems. All patients received osseointegrated implants press-fitted into the amputated limb. BMD was assessed using DXA in the femoral neck (operative and contralateral) and lumbar spine (L2-L4) regions, and corresponding Z-scores were generated. DXA scans were taken preoperatively as well as 1 year and 2 years following osseointegration surgery.

Results: Mean BMD and Z-scores of spine, and operative and contralateral sides, were generated for all patients. Dependent t tests were used to test for significant differences ($P < 0.05$) preoperative, 1 year, and 2 years for mean changes in BMD and Z-scores following surgery. Analysis of the BMD and Z-scores indicated that patients showed improvements at 1 year post surgery.

Conclusion: These results suggest that osseointegrated implants are effective at encouraging bone growth and restoring BMD levels for amputees within a short period of time post surgery. Osseointegrated implants therefore have the potential to address stress distribution issues associated with socket prostheses and restore the normal bone-loading regime in lower limb amputees.