The Use of Three-Dimensional Quantitative Gait Analysis to Assess a Bilateral Transfemoral Amputee Following Initial Prosthetic Fitting

Derek P. Watson, MD; Arash Bigdoli, DO; Peter Gemelli, MD; Blaise Williams PhD PT; Thurman Whitted, MD
Pitt County Memorial Hospital/East Carolina University Brody School of Medicine, Greenville, NC

Abstract: Selecting an advanced biometric technology for our prosthetic patient was a critical decision that directly impacts their patient's quality of life. In this case a young 23 year old male diagnosed with acute myelocytic leukemia in August 2005, following induction therapy he suffered a sepsis failure and several months later he required readmission for sepsis. He was critically hypotensive requiring a prolonged ICU stay and multiple doses of multiple vasopressors. At admission to the IRF he was non-ambulatory. He underwent a comprehensive rehabilitation program including inpatient rehabilitation, outpatient physical therapy, occupational therapy, and speech therapy. He underwent a comprehensive rehabilitation program including inpatient rehabilitation, outpatient physical therapy, occupational therapy, and speech therapy. He underwent a comprehensive rehabilitation program including inpatient rehabilitation, outpatient physical therapy, occupational therapy, and speech therapy. Ankle: Throughout the gait cycle the prosthesis bilaterally remained in a greater degree of dorsiflexion than normal (fig 1). This correlates with the prosthesis only allowing for passive dorsiflexion and limited active plantarflexion (due to dynamic response foot). If the limitations of cost, timeliness, and necessary expertise can be overcome and additional research is conducted then quantitative gait analysis may offer our patients benefits that physicians have yet to fully realize. This information was used to instruct the patient and his therapists on appropriate strengthening and physical therapy goals. Our evaluation benefited from the use of 3D gait analysis which is a common adjunct to visual gait analysis in the day to day care of lower extremity amputees, however this technology is difficult to translate to the clinical setting for most amputees. The cost of a gait lab setup is prohibitive in the private world clinical setting.

Methods: Equipment and Procedures:
The patient was taken to the gait lab after discharge from the rehabilitation center where gait analysis was first performed. Visual analysis has always been and remains a critical tool in the physical therapist’s armament to provide care and monitor functional improvement in lower limb amputees. Adequate understanding of the gait cycle and amputee gait deviations will always be crucial to the day to day care of amputee patients, as selected walking speed (>0.9 m/s) is the newest technology in motion capture techniques and measurement of ground reaction forces three dimensional quantitative gait analysis is a valuable tool in gait analysis as it offers the ability to identify and quantify issues that cannot be easily identified visually. We also discussed our findings with the physician who constructed the prosthesis that they could make appropriate modifications. In addition, our evaluation benefited from the use of 3D gait analysis which is a common adjunct to visual gait analysis in the day to day care of lower extremity amputees. This technology is difficult to translate to the clinical setting for most amputees. The cost of a gait lab setup is prohibitive in the private world clinical setting.

Results: Patient was noted to have slowed gait with decreased cadence, decreased time in double support, decreased step length, and circumduction during swing phase on the left.

Quantitative Biomechanical Analysis: See Figures 1, 13, 2, 9.