

Walking without a Limp: Applying Gait Laboratory Outcomes for Optimizing Gait Pattern with Orthotics

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Background: Complex orthopedic and neurological injuries are common outcomes of combat situations. Rehabilitation includes physiotherapy aimed at restoring movement and strength, and returning the patient to full function. A functional biomechanical assessment is necessary during rehabilitation in order to plan treatment and tailor orthopedic devices such as braces, shoes, and insoles to improve walking ability.

Objective: To present two cases of patients who exhibited a combined and complex pattern of orthopedic and neurological injuries, requiring decisions regarding assistive device recommendations. Traditionally, gait patterns are clinically assessed in rehabilitation departments due to the limited availability of advanced gait laboratories.

This presentation aims to evaluate the contribution of advanced gait laboratory analyses in guiding treatment and determining optimal assistive devices, particularly

in cases where clinical evaluations alone may not fully diagnose gait patterns. Gait laboratory results could provide more precise gait pattern diagnoses and optimize device recommendations for improved walking.

Method: Two cases involved patients with complex gunshot injuries undergoing rehabilitation to improve range of motion, muscle strength, and mobility. During rehabilitation, the need for assistive devices to enhance gait patterns was identified. A gait analysis was conducted in a laboratory using a 3D motion analysis system (Vicon®, Oxford Metrics, UK) and force plates (AMTI). Kinematic and kinetic gait data were measured across three planes. The patients were assessed under two conditions: barefoot and with assistive devices fitted according to gait analysis results.

Participants:

- Case 1: A patient with a gunshot wound to the left pelvis at L5 level, spinal canal shrapnel and an S1 fracture. The patient exhibited a drop foot gait pattern during the swing phase and associated compensations. Additionally, muscle weakness during the stance phase was noted, characterized by lack of muscular control around the knee and hyperextension of the knee throughout the stance phase.
- Case 2: A patient with a gunshot injury involving orthopedic and soft tissue damage in the lower limbs. The main manifestations were limited range of motion and muscular weakness around the ankles, bilaterally.

Results:

- Case 1: Braces that supported dorsiflexion during the swing phase without anterior support failed to correct the gait pattern during the stance phase. A Blue Rocker (Allard©) brace provided adequate support for the swing phase, reducing compensations due to clearance insufficiency and prevented knee

hyperextension during the stance phase.

- Case 2: Laboratory results indicated that due to limited ankle joint range of motion and partial muscle weakness, the required gait correction - which improved spatiotemporal parameters and normalized knee and hip extension during the terminal stance phase - was achieved by using heel lifts without the need for braces.

Conclusions: Gait analysis enables more accurate recommendations regarding appropriate assistive devices and enables optimal walking quality. By utilizing laboratory analyses and interpreting kinematic and kinetic results, it is possible to identify the source of gait deviations and determine the optimal device needed to improve gait patterns.

Key words: gait analysis laboratory, rehabilitation, splints, gait assistive devices, gait analysis, war injuries