

3-DIMENSIONAL GAIT ANALYSIS

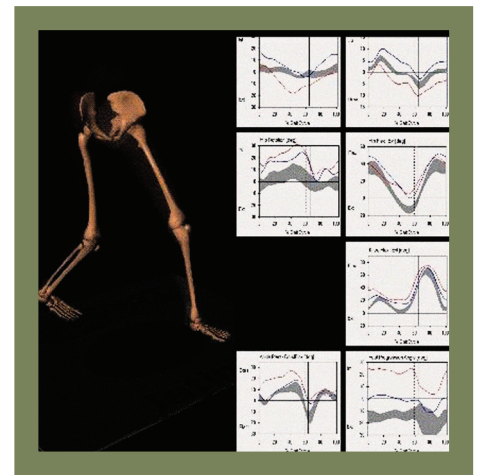
FOR PATIENTS WITH LOWER-LIMB AMPUTATIONS

EFFICIENT REHABILITATION OF SOLDIERS WHO HAVE SUFFERED LOWER-LIMB AMPUTATIONS REQUIRES A COMPREHENSIVE TEAM APPROACH TO CARE. TYPICALLY, A PROSTHETIST, PHYSICAL THERAPIST AND PHYSICIAN WORK CLOSELY TOGETHER WITH THE SOLDIER TO ANALYZE HIS OR HER GAIT OR WALKING PATTERN USING VISUAL OBSERVATION. SOMETIMES, HOWEVER, DESPITE ADJUSTMENTS THAT ARE MADE BASED ON THESE OBSERVATIONS, GAIT DEVIATIONS MAY STILL EXIST. AT THIS POINT, A SOLDIER WITH UNRESOLVED GAIT DIFFICULTIES MAY BE REFERRED FOR A COMPUTERIZED 3-DIMENSIONAL (3-D) GAIT ANALYSIS.

Because computerized 3-D gait analysis can be time-consuming, it may not be recommended for everyone with a lower-limb amputation. Instead, it may be reserved for the more difficult cases, such as people with two lower-limb amputations, those with one limb amputated above the knee, or those who have persistent difficulty with the fit or alignment of their prosthesis. The information collected from the 3-D gait evaluation is compared with "normal" walking to identify deviations.

Computerized 3-D gait analysis allows the members of the amputee center team to quantify the way the patient is walking to identify how to help him or her walk better and more efficiently. The data that may be collected during a gait analysis includes joint angles, forces affecting the joints, muscle activity and timing, and energy used while walking. To accomplish these tasks, several cameras are mounted on the wall to record the patient and calculate his or her joint angles, a forceplate is embedded in the floor to calculate the joint force information, surface electrodes are applied to the skin over selected muscles to monitor the patient's activity while walking, and a metabolic analysis system with a mask measures oxygen use and heart rate to calculate energy expenditure.

When patients are referred to the gait lab for evaluation, they are asked to change into shorts and a tank top to allow access to the joints and muscles to be studied. The gait lab physical therapist conducts a brief evaluation of their strength and the range of motion of their available joints, and a videotape is made to document their walking pattern from the front, the back and both sides.



If information about specific muscle activity is indicated, the skin is prepped with alcohol and shaved (if necessary), and then surface electrodes are applied. Reflective markers are applied to predetermined bony landmarks on the person's body to be seen by the cameras and used to calculate joint angles. The person being evaluated is asked to walk about 25 feet back and forth down the center of the lab so that sufficient data can be gathered. A stick figure representing the patient can be seen on the computer screen as the data is collected. After the information is collected, the markers and electrodes are removed, and the data collection portion of the evaluation is complete. The gait lab team works together to analyze the data, interpret the findings, and prepare a report to be reviewed with the patient's rehabilitation team. The team then discusses the report along with the videotape and arrives at final recommendations.

Report recommendations may include physical therapy interventions such as specific muscle strengthening, prosthetic interventions such as alignment or component changes, or medical referral to address medication or surgical options. Subjects may be re-evaluated after a particular treatment plan has been executed for a trial period to see if or how the intervention has affected their gait pattern. The overall goal of amputee rehabilitation is to return soldiers to their highest level of function and safety. Computerized 3-D gait analysis can be one tool to facilitate this.

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