INTRODUCTION
Forces experienced when walking on different terrains has an influence on the kinetics and kinematics of gait (Gates et al., 2012). Healthy individuals have the ability to adapt and adjust to these terrains by utilizing the incredible complexity and design of the human body (Damavandi et al., 2010). In an amputee, these forces are not as easily adjusted for, and as a result can be difficult to accommodate or correct (Gates et al., 2012).

A number of studies have examined clinical alignment and its effect on the forces and moments that exist within a prosthesis (Boone et al., 2013; Kobayashi et al., 2012). Although it is important to gain understanding of how regularly encountered terrains also influence these forces and moments in an amputee’s gait (Gates et al., 2012), little has been done to examine these outside research laboratories. Kinetic and kinematic data could provide important insight into what an amputee experiences while walking on different surfaces and the resulting effects on their gait.

Recent developments in technology have made the measurement of the forces experienced by amputees in non-clinical settings possible. The iPecs (Intelligent Prosthetic Endo-Skeletal Component System), a portable, six degree-of-freedom measurement device, allows kinetic and kinematic data to be gathered outside of a laboratory setting in real-world environments. By integrating this device into the prosthesis, it is possible to examine the kinetics and kinematics of amputee gait in real time over multiple commonly-encountered surfaces.

The purpose of this case study is to investigate the forces involved in a transtibial amputee’s gait over multiple surfaces.

METHOD
Subject: The study utilizes a healthy, active, unilateral, transtibial amputee. The subject is an experienced ambulator, accustomed to walking on their prosthesis for extended periods of time, and can walk comfortably without the use of an ambulatory aid.

Apparatus: All gait data is collected by the iPecs (Intelligent Prosthetic Endo-Skeletal Component System) which is positioned at the proximal end of their pylon. The subject walks at their own self-selected speed for five conditions over level surfaces. These surfaces include tiled floor, once between parallel bars and once in a hallway, carpeted hallway, concrete sidewalk, and grass.

Procedures: In this case study, the iPecs is integrated into the prosthesis of a unilateral transtibial patient. The prosthesis is statically and dynamically aligned by a certified prosthetist prior to walking trials. Kinetic data is collected while the patient ambulates at a self-selected pace for a predetermined distance, consistent through the five conditions. Subject is given rest between each trial and communicates their perceived stability and comfort levels after each trial is complete.

RESULTS
The results of the force data that was collected using the iPecs as well as the perceived comfort and stability experienced by the subject for each condition will be presented.

CLINICAL APPLICATIONS
This is a single subject case study designed to measure and report the forces experienced by a transtibial amputee over different real-world terrains. This research is designed to be a pilot study exploring an area with new technology that has not been previously documented. Understanding forces that a transtibial amputee experiences outside the clinic can help prosthetists address the unique alignment and fitting needs of each individual patient based on the activities and terrains they may encounter. Not only does the understanding of these forces help with individual patient care, it acts...
to facilitate further research concerned with the biomechanical characteristics and lack of adaptability of current prosthetic component designs (Bateni & Olney, 2002).

REFERENCES


Biographical Sketch
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Brian and Christine are second year graduate students in Eastern Michigan University’s Orthotics and Prosthetics master’s program.