Hockey Prosthetic Skate
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INTRODUCTION
Technological advancements in the field of orthotics and prosthetics have allowed many amputees to return to sports and lifestyle activities that they were not able to enjoy just a few years ago. Even with these advancements, however, there is still improvement to be made to replace the diversely complicated motions of the human body. Thus far, there has not been a clear dedication to develop a lower extremity prosthesis that can effectively allow amputees to compete in one of the world’s most popular athletics, ice hockey. The sport is continuing to grow in the United States, with its governing body, USA Hockey seeing a 143% expansion in membership from 1990-2010 (Peters, 2011).

Although several hockey skate devices have been produced, observational analysis indicates that none have functioned within the biomechanics of a hockey stride, and most do not permit the amputee to skate athletically. Upper extremity amputees can utilize several different terminal devices, such as the “power play” and “slap shot” of TRS, which function to hold a hockey stick, but no lower extremity prostheses have been mass-produced (TRS product catalogue). Additionally, none of the lower extremity devices have been formally evaluated and described in peer-reviewed literature. The purpose of this study is to develop, fabricate, and test a prosthesis that addresses a biomechanical function that is lacking in existing devices.

METHODS
There is extensive literature regarding the proper technique and biomechanics of an ice hockey stride. The kinematics involved with keeping a flat skate blade maintain its contact with the ice, across the range of motion and through toe-off are complex, but attainable. However, this is the main element lacking from current prosthetics available to the amputee. Current devices do not give amputees the ability to impart a driving force to create plantar flexion at toe-off, which accounts for a great deal of force in a stride (Harvey). Additionally, motion at the ankle joint has been shown to range from 3 degrees of dorsiflexion to 10 degrees of plantar flexion, with the greatest mean angular velocity peaking at the ankle joint, upon toe-off (Upjohn, Turcotte, Pearsall & Loh, 2008). Current prosthetic devices merely adjust for shock and do not provide amputees with this vital force.

The end goal of this project will be a functional prosthetic skate which can be utilized by amputees that gives rise to effective plantar flexion forces. This project aims to create both alpha and beta models, with subsequent testing of functionality. Initial testing will be done on the first model using specially created jigs from a previous project which will allow the non-amputee author to test the prosthesis as if he were a transtibial amputee. Development of the beta prototype will proceed based on data collected during alpha testing. An active amputee will then be recruited to functionally test the beta-level prototype prosthesis. If this proves beneficial, the result will be the basis for continued research and development.

RESULTS
A functional basis for future designs, allowing for continued research, development, and production with distribution to amputees worldwide.

DISCUSSION
The implications for increasing the quality of life for amputees following this project are significant. Upon successful conclusion of this project, amputees will have the potential to be more efficient on the ice; and more competitive against each other, and non-amputees. Currently, there are no effective products which amputees can utilize for ice hockey. This project has the capability of improving life for amputees on a physical, emotional, and psychological level.

REFERENCES
