

An Overview of Lower-Limb Prosthetic Components and Their Effect on Gait

Steven Gard, PhD and Rebecca Stine, MS

Northwestern University Prosthetics-Orthotics Center (NUPOC)

Purpose—The purpose of this tutorial is to describe the features and functions of different commercially-available lower-limb prosthetic components with particular emphasis on how they affect gait biomechanics.

Intended Audience—Therapists, engineers, physicians and other individuals with little or no knowledge of lower-limb prosthetic components.

Prerequisite Knowledge—Fundamental knowledge of able-bodied gait kinematics and kinetics.

Abstract—A prosthetic limb, or “prosthesis,” is an external device that is worn on the body for the purpose of replacing a missing or absent limb or extremity, with the intent of restoring aesthetics or function. The complexity and functionality of prosthetic components have advanced significantly as technology has improved and knowledge about human movement has increased, but a state-of-the-art artificial limb is still a relatively poor substitute for an anatomical one. Lower-limb prostheses are generally prescribed with the intent of restoring ambulatory ability. Some of the functions of walking that the prosthesis should address include stability in stance phase, the ability to shorten in swing phase to achieve adequate foot clearance, and shock absorption. Prostheses typically consist of passive components, although over the past decade several new developments in prosthetic components have occurred that incorporate

microprocessors and motors in order to improve swing phase characteristics, provide greater stability during stance phase, and even serve to help propel the user forward during gait. This tutorial will review conventional prosthetic components, describe the latest and most exciting innovations, and discuss the impact of prosthetic technologies on gait biomechanics.

Outline of Course Content—

- I. Incidence of amputation/prosthesis use in U.S.
- II. Brief overview of the functions of gait
- III. Prosthetic feet and ankles—Forward progression and propulsion
- IV. Prosthetic knees—Stability in stance, limb shortening in swing
- V. Shock-absorbing components—Decreasing impact forces
- VI. Prosthetic sockets—Interfacing the prosthesis with the body
- VII. Prosthetic suspension—Keeping the prosthesis secured on the residual limb
- VIII. Prosthetic alignment—Stabilizing the limb during stance phase
- IX. Summary

Contact Information:

Steven Gard

sgard@northwestern.edu

(312) 503-5718

NUPOC

680 North Lake Shore Drive

Suite 1100

Chicago, IL 60611

Rebecca Stine

rstine@northwestern.edu

(312) 503-5726

NUPOC

680 North Lake Shore Drive

Suite 1100

Chicago, IL 60611