

Outcomes associated with the use of microprocessor-controlled prosthetic knees among individuals with unilateral transfemoral limb loss: A systematic review

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This article presents a systematic review of outcomes associated with the use of microprocessor-controlled prosthetic knees (MPKs) compared with non-microprocessor-controlled prosthetic knees (NMPKs) among individuals with unilateral transfemoral limb loss (TFLL). A comprehensive review of 27 publications revealed that MPKs may be indicated in cases where improved ambulatory safety and the ability to negotiate uneven terrain, hills, and stairs are required. Their use may also increase patient preference and satisfaction while reducing the perceived effort required for ambulation. These benefits appear to be accomplished at an equivalent total cost compared with NMPK alternatives. Additional research is required to confirm and build upon the currently available evidence for the prescription and use of MPKs.
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Review of electrical stimulation, botulinum toxin, and their combination for spastic drop foot

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This article reviews the available data on treatment options for spastic drop foot and makes recommendations for future research. Spastic drop foot is when a patient is unable to dorsiflex (flex upward) his or her ankle because of combined weakness of the ankle dorsiflexor muscles and spasticity of the ankle plantar flexor muscles. It is caused by neurological conditions such as stroke, traumatic brain injury, multiple sclerosis, and spinal cord injury. Although we do not know the exact number of veterans with spasticity or spastic drop foot, the conditions causing spastic drop foot are common among veterans. Given the high prevalence of these conditions

and the potential for serious falls and injuries, drop foot is a significant issue for the veteran population.
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Needs and concerns of combat Veterans with mild traumatic brain injury

Virginia S. Daggett, PhD, RN, et al.

Traumatic brain injury (TBI) has emerged as a major cause of morbidity among U.S. servicemembers who have served in Iraq and Afghanistan. The community reintegration of Veterans with TBI is challenging. To determine the needs and concerns of Veterans with mild TBI (mTBI), a qualitative inquiry was conducted. Findings provide preliminary support for a new, context-specific conceptual model that has the potential to identify areas for interventions to enhance community reintegration of Veterans with mTBI.

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Effect of service dogs on manual wheelchair users with spinal cord injury: A pilot study

Geoffroy Hubert, MSc, et al.

Using traction provided by service dogs has physical benefits for wheelchair users. The objective of this study was to document the effect of a service dog on wheelchair mobility and user shoulder pain, social participation, and quality of life. Eleven wheelchair users with spinal cord injury were assessed before and after training with a service dog and 7 months later. Results showed that the service dogs seem to be an effective way to improve wheelchair skills, social participation, and quality of life. More extensive research is needed to identify the effect of service dogs on the long-term management of wheelchair use.

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Sex, shoulder pain, and range of motion in manual wheelchair users

Karla K. Wessels, MS, ATC, et al.

With more veterans returning from war, the number of manual wheelchair users (MCUs) has increased. It has been shown that an upwards of 70% of MCUs experience shoulder pain with a variety of causes. One possible cause is limited range of motion (ROM). We found that females with shoulder pain had less shoulder extension than females without pain and all males. Females also had greater ROM than males. It is unclear why there was a sex discrepancy and if there is a causal relationship between shoulder pain and ROM. It is important to find the cause of shoulder pain because any chronic shoulder pain may greatly hinder the MCU's quality of life.

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Bimanual gliding control for indoor power wheelchair driving

Yang-Hua Lin, PhD, et al.

This study describes a wheelchair control interface designed with a bimanual gliding (BG) mechanism and compares the indoor driving performance by BG with that by a conventional joystick (CJ) control. We examined 11 experienced and 11 novice manual wheelchair users. Experienced wheelchair users using the BG control needed less time to practice and complete the task. They also focused on the elbow extensors instead of the wrist muscles while using the BG control. Novice wheelchair users involved less of their wrist muscles when using the BG control compared with the wrist muscle activated when using the CJ control.

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Investigation of robotic-assisted tilt-table therapy for early-stage spinal cord injury rehabilitation

Colm T. D. Craven, MEngSc, et al.

This study investigates the use of a robotic-assisted tilt-table to determine whether it may be of benefit to people during the early stages of spinal cord injury rehabilitation. This tilt-table may be used for exercise in order to help maintain fitness and to reduce the likelihood of developing cardiovascular health complications later in life. We found that there may be such a fitness benefit if this device is used regularly as part of a training program. It may be of most benefit if the person can participate and actively step with the robotic assistance.

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Estimating the patient's contribution during robot-assisted therapy

Marco Guidali, PhD, et al.

Robots have been introduced that assist patients with neurological problems during therapy. Active participation of the patient is one of the keys to successful rehabilitation. Since the assistance is often automatically adjusted by the robot, it is difficult for the patient and therapist to judge to what extent the patient contributes to the execution of a movement. Therefore, methods to quantify patient contribution comprehensively are of key importance. We developed and evaluated a metric to quantify the patient's contribution during therapy. This metric can provide valuable feedback for the patient and the therapist over the course of therapy.

<http://dx.doi.org/10.1682/JRRD.2011.09.0172>

Selection of muscle and nerve-cuff electrodes for neuroprostheses using customizable musculoskeletal model

Dimitra Blana, PhD, et al.

Functional electrical stimulation (FES) systems aim to return movement to people with neurological problems, such as spinal cord injury, by electrically stimulating paralyzed muscles. Which muscles to stimulate in order to restore the most function depends on the FES users' characteristics and needs and on hardware limitations, such as the number of electrodes available in the FES system. We successfully used a computer model that considers all these factors to identify the best set of muscles to stimulate without the need for human experimentation.

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Design and development of ankle-foot prosthesis with delayed release of plantarflexion

Michael Mitchell, MSc, et al.

A mechanism was built to hold the energy stored in an artificial foot and delay its return until later in the stride. The mechanism was tested with two volunteers, who reported that they could feel a difference in the delays. Some delays felt more comfortable than others, but the subjects were not consistent in their choices. The increased mass of the device made the general kinematics more similar to the nondisabled population. The mechanism not only delayed the release but also slowed the release of the energy, creating a longer, slower push, which was felt by the subjects.

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Experimental characterization of axillary/underarm interface pressure in swing-through crutch walking

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Supporting weight on the upper support of a crutch is not recommended. However, for individuals with particularly weak upper limbs, doing so may be the only option for upright ambulation as opposed to wheelchair use. This study investigated changes in the underarm forces caused by the use of two different types of axillary supports, the traditional one on axillary crutches and a horizontal one on the Easy Strutter Functional Orthotic System. The eight subjects in this study exhibited reduced underarm forces and perceived greater comfort and stability when using the Easy Strutter Functional Orthosis System while supporting weight through the underarm. A horizontal axillary support may be beneficial to individuals who find crutch walking, with proper technique, to be too tiring.

<http://dx.doi.org/10.1682/JRRD.2012.01.0013>

Temporal adaptations in generic and population-specific quality of life and falls efficacy in men with recent lower-limb amputations

Cleveland T. Barnett, PhD, et al.

We studied how quality of life and falls efficacy changed in people with lower-limb amputations during the 6 mo after being discharged from rehabilitation. Participants completed the 36-Item Short Form Health Survey, Prosthesis Evaluation Questionnaire, and Modified Falls Efficacy Scale 1, 3, and 6 mo after being discharged from rehabilitation. Quality of life

improved and mental health tended to score higher than physical health. Falls efficacy was not greater when participants were performing indoor activities versus outdoor activities but was strongly related to quality of life. These results provide insight into how quality of life and falls efficacy develop in people with lower-limb amputations after rehabilitation.

<http://dx.doi.org/10.1682/JRRD.2011.10.0205>

Heart rate variability and phantom pain in male amputees: Application of linear and nonlinear methods

Elena Sarabia Cachadiña, PhD, et al.

This research has demonstrated that people with amputation may develop heart complications. This can occur because, while a healthy heart beats with variability, in those with amputation it beats with a very small variability. It seems that having one amputation is reason enough for losing this variability. The variability of the heartbeat is a marker of health. This study has also found that there is not a relationship between phantom-limb pain and the autonomic nervous system (ANS). The medication for curing this pain must be focused on something other than the ANS.

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