

Rehabilitative Knee Brace

Using Electrical Stimulation and Biofeedback

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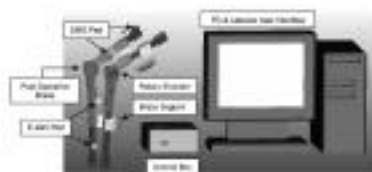
ELE 482

4/3/06

The rehabilitative knee brace is a proposed solution to many post-knee surgery problems. By combining electrical stimulation and biofeedback (two preferred methods of treatment by physical therapists), this brace will help to increase the range of motion in the knee, reduce pain, swelling, and increase recovery time.

Electrical stimulation (e-stim) is a rehabilitation treatment that stimulates nerves by sending an electrical current through the skin, activating the muscles around the knee.

Biofeedback monitors the muscle activity around the knee through electromyography (EMG). Electrodes are placed over the muscle to be monitored. When muscle tension is detected, a signal is given (sound, light, etc.) and the patient is able to focus on what muscle tension feels like, which overtime will help to reeducate the muscles. The biofeedback data helps therapists to better understand how the patient is responding to treatment.



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The rehabilitative knee brace is a combination of electrical stimulation, biofeedback, and the rotary encoder. The prototype that is currently being tested uses a DonJoy TROM (total range of motion) knee brace as a frame. The electrodes are attached to the brace in proper locations and

the rotary encoder is attached at the hinge so that the shaft rotates with the lower leg. The wires from the electrodes and the encoder are attached to a control box which holds the biofeedback unit, the e-stim unit, and 2 solid state relays (increase operating speed). The control box is then hooked up to a computer where it compares all the data in a graphical interface program called LabView. If the computer detects a bio-signal being sent from the brain to the leg and there is no motion in the brace, the e-stim is activated, assisting the patient in moving the joint. In the LabView program, physical therapists are able to adjust the settings appropriately so that the knee brace may be used throughout the patient's entire rehabilitation process.

The brace is still in its testing stages, however, collaborations with large companies to test the product's efficiency on humans have been arranged. If the brace is successful it is believed that it will open new doors for rehabilitation.

Resources:

1. "Smart Portable Rehabilitation Devices". Journal of NeuroEngineering and Rehabilitation. Vol. 2 (2005)
2. Rotary Encoders. 24 Feb. 2006. Micro Basics. <<http://www.ubasics.com/adam/electronics/doc/rotrvenc.shtml>>
3. Knee Guru. General Knee Information. http://www.kneeguru.co.uk/html/knee/knee_anatomy/bones_front01.html
4. Rehab TROM Knee Brace. <http://www.kneesupport.com/donjoy/rehab-trom.htm>
5. Biofeedback Infocenter. Holistic-Online. <<http://www.holistic-online.com/Biofeedback-EMG.htm>>