

**IMPROVED EFFICIENCY AND MOBILITY FOR PERSONS WITH MOTOR DISABILITIES**

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Many disabled individuals use a wheelchair because they can walk only with great effort, if at all, with voluntary control or stimulation. We have built devices that allow individuals to propel a wheelchair with their legs by voluntary activity or functional electrical stimulation (FES). The foot rests of a conventional wheelchair have been replaced by a device that allows movement of the legs about the knee centre. Movement is then coupled to one wheel of the chair during knee flexion and extension. Gears have also been added to allow faster movements on level ground or more power for climbing hills.

Three groups have been studied: control subjects (13), subjects with complete spinal cord injury (SCI) (8) and those with a variety of other motor disorders (13) who still retain some voluntary control of the legs. We included a variety of conditions in the third group to determine which types of disabilities might benefit most. The physiological cost index (PCI) was studied in all subjects as the change in heart rate during exercise (in beats/min.) divided by the velocity (in m/min.). Oxygen consumption (VO<sub>2</sub>) was also measured for some subjects with a similar protocol.

Arm wheeling took significantly more effort (mean PCI = 0.52) than walking (0.32) and walking significantly more effort than leg wheeling (0.23). For SCI subjects arm wheeling also required significantly more effort (0.36) than leg wheeling with FES (0.20). This group could not walk. The group with other disabilities were able to walk, but with substantial effort (1.81), compared to arm wheeling (0.76) or leg wheeling (0.64). The results for oxygen consumption were similar to those for PCI. These results suggest that better efficiency and increased mobility can be obtained for many disabled individuals, while building up the leg muscles voluntarily or with FES.

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