

Shoulder EMG activity in three different one arm drive wheelchairs

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Study Aim:

The aim of the study was to investigate changes in the activity of muscles surrounding the shoulder in three different one arm drive wheelchairs. The research hypothesis was: There will be differences in EMG activity around the shoulder when propelling different one arm drive wheelchairs.

Introduction:

Manual wheelchair propulsion is known to be an inefficient means of ambulation which has been associated with a high prevalence of upper limb injuries and pain [1,2,6]. Such injuries are thought to occur from a combination of repetitive movements, heavy loads on the extremities, upper limb weakness and inefficient propulsive technique [3,4]. Hemiplegic users are particularly vulnerable to upper limb injury due to being reliant on only one arm for propulsion [5]. Commonly used one arm drive manual wheelchairs include the lever-drive mechanism, the dual handrim mechanism both of which are inefficient and difficult to manoeuvre. The Neater Uni-wheelchair (NUW) is a recent development, designed specifically for hemiplegic users which has been extensively researched [Mandy et al 7,8,9,10,11]. It is an Action 3 wheelchair to which a novel propulsion and steering kit is attached. Recent work has explored the benefits of only attaching the steering mechanism.



Methods

The study was designed as a controlled, same subject study that measured EMG activity in biceps, triceps, pectoralis major, anterior and posterior deltoid and infraspinatus muscles using the Biometrics DLK 900 system with version 7.5 software. The participants were asked to drive the wheelchair round an indoor course. Data was captured continuously throughout each circuit. Cumulative voltage for each activity for each muscle was generated

Results

Table to Show Significant Differences in Muscle Activity

Activity	Biceps	Triceps	Ant Deltoid	Post Deltoid	Pectoralis Major	Infraspinatus
Straight running	NSD	p<0.01	NSD	NSD	NSD	NSD
Mats	p<0.001	NSD	NSD	NSD	p<0.001	NSD
Slalom	p<0.001	NSD	NSD	NSD	p<0.01	NSD

Key findings

- The Neater Uni-wheelchair required the **least** activity of these muscles in propulsion during these same key activities.
- NuDrive required the **greatest** amount of activity in biceps, and pectoralis major muscles in propelling over mats and around corners.
- Triceps activity was significantly **greater** in the Action 3 wheelchair with steering in straight running when compared to the other two wheelchairs.

Implications for practice

The patterns of pectoralis major involvement may indicate an increased likelihood of fatigue which may contribute to the prevalence of shoulder injuries occurring as a result of the use of certain propulsive mechanisms.

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