

SHORT REPORT

A Controlled Clinical Trial of Pushrim Activated Power Assisted Wheelchairs

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Pushrim Activated Power Assisted Wheels (PAPAWs) incorporate motors within the wheels which are activated by utilising the Pushrims during manual propulsion. These wheels are detachable and can be retro-fitted to most wheelchair frames (folding and fixed). Even though PAPAWs were found, in laboratory conditions, to reduce effort and energy consumption compared to standard manual wheelchairs, the benefits have not previously been tested in clinical conditions and criteria for prescription are nonexistent for the National Health Service (NHS). This study attempted to address these issues.

Thirty three consenting randomly selected adult self-propelling wheelchair users (17 male, 16 Female, Mean age 47 ± 14.7 , range 20-77, 11 SCI, 7 Amputees, 5 CP, 3 MS and 7 Others) underwent four trials each on an outdoor track consisting of a level and gradient component altogether measuring 50 metres. Each of the four trials consisted of participants propelling one of their own MWC, the wheels changed to PAPAWs with the power on and off or a dummy pair. The trials were carried out in a randomised order, with the participants being blinded to the type of wheels. Participants rested for 20 minutes between trials during which they answered a satisfaction questionnaire. Metabolic cost and time for each trial was recorded using the Cosmed K4b2 system. Arm strength was also measured using a spring balance. In this study the Alber M12 Emotion wheels were used.

Energy cost savings for the PAPAWs vs the participant's own chair was seen for all diagnosis except amputees, this would possibly be due to the stability of the chair. Significant benefits were found for energy consumption ($P < 0.001$), PAPAW-Off consumed significant more energy than the participant's Own chair ($P = 0.002$). Significant differences were found for time ($P = 0.002$), less time was required to complete the course in their own chair compared to the other wheel types. Questionnaire scores for the wheel types showed that the PAPAW-On mode scored higher than the other types of chairs. Users' comments described particular benefits and problems encountered with the PAPAWs-on mode. They perceived the PAPAW helped them climb slopes easily. The majority of participants felt they required more time to get used to the PAPAW, and felt it was too heavy to maintain an independent lifestyle, some users of light weight wheelchairs felt it would not be of benefit.

This study does not confirm previous studies' data regarding energy savings with PAPAW but there is a minimal energy saving in these test conditions. Users perceive the PAPAWs could be of benefit by increasing range, and reducing pain in shoulders. For others, weight appears to be an issue which needs to be addressed and some training maybe required for the marginal users.

From this study it can be recommended that practical training and tests are completed to assess a potential user's ability to use PAPAWs. Bi-manual dexterity and cognitive ability appear to be important factors for effective propulsion.

Further Information

The team would like to thank the Posture & Mobility Group and the West Midlands Wheelchair Service Managers Group for supporting this work. The findings of this study have been submitted for publication to an international peer-reviewed journal. If you would like further details you may contact Mr Joyjit Sarkar (joyjit.sarkar@nhs.net).