

IMPACTS OF A THROWING SPORTS WHEELCHAIR SPECIFIC PATENT MATERIAL ON DISORDERS: PRELIMINARY RESULTS

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Introduction

In literature, many studies have linked the handrim wheelchair propulsion with a prevalence of upper limb musculoskeletal disorders [Boninger, 1999, Boninger, 2004, Mulroy, 2004, Veeger, 1998, Veeger, 2002]. In this study, the purpose is to focus on disorders due to the practice of throwing sports that could be avoided by adding a specific wheel kit to the classical wheelchair. In this study, we compare upper limb kinematics during throwing of a bowling ball.

Methods

For this preliminary study, the upper limb kinematics data of one subject (1.75m, 80kg, 30 years old) have been recorded. The aim of the task was to throw ten times a bowling ball seat in a classical wheelchair and ten times with the same chair equipped with a specific wheel kit. This kit is registered at the European patent office under number: EP12368023.3. It is composed of a small 10" wheel that can be placed under the seat and control via a reduction mechanism with a second external handrim. It allows removing the lateral wheel on the throwing side, thus should avoid the numerous injuries due to the impact between the hand and the wheel or the handrim. With the two handrims on one side it also allows to keep the control on the wheelchair speed and direction during the ball throwing that is not the case with a classical chair. The upper limb joints parameters are calculated according ISB Rules [Senk, 2006, Wu, 2005]. Explored parameters are shoulder flexion-extension, abduction-adduction and axial rotation, elbow flexion-extension, wrist flexion-extension, radioulnar deviation and forearm pronation angles (in degrees).

Results

In this single subject preliminary study we can observe that with the classical wheelchair an impact between the hand or ball add occurred three times on the ten ball throwing whereas with the kit no impact was observed. Only shoulder abduction and wrist ulnar deviation seem to be affected by the wheelchair modification. In average we can observe that

with the classical wheelchair shoulder abduction is 35.89 ± 2.36 degrees and wrist ulnar deviation is 16.91 ± 2.16 degrees, whereas with the seat equipped with the kit for throwing sports, shoulder abduction is 18.83 ± 3.92 degrees and wrist ulnar deviation is 5.29 ± 2.31 degrees.

Discussion

According to literature information, this wheel kit could help avoiding some musculoskeletal disorders. Indeed, wrist ulnar deviation up to 10 degrees [Faessen, 1989] and shoulder abduction up to 30 degrees [Kuorinka, 1995] are considered as factors of musculoskeletal disorders and we can observe that with a classical wheelchair both are exceeded, that is not the case with the wheelchair equipped with the specific wheel kit for throwing activities. Of course this result should be verified. Thus, the next step is to realize a complete study with a great number of subjects to allow a great statistical power. Moreover, in addition to kinematic parameters, we will investigate EMG data for the main upper limb muscles and will analyse the effects on throwing precision and social acceptance.

References

- M. L. Boninger *et al*, Arch Phys Med Rehabil, 80: 910-5, 1999.
- M. L. Boninger *et al*, Arch Phys Med Rehabil, 85: 1141-5, 2004.
- H. G. M. Faessen *et al*, Journal, 1989.
- I. A. Kuorinka *et al*, Journal, 512, 1995.
- S. J. Mulroy *et al*, Arch Phys Med Rehabil, 85: 925-934, 2004.
- H. E. Veeger *et al*, J Rehabil Res Dev, 35: 305-313, 1998.
- H. E. Veeger *et al*, Clin Biomech, 17: 211-8, 2002.
- M. Senk *et al*, Clin Biomech, 21 Suppl 1: S3-8, 2006.
- G. Wu *et al*, J Biomech, 38: 981-992, 2005.