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Upper limb strength asymmetry on a ballistic ergometer between seated paralympic athletes and able-bodied athletes

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## INTRODUCTION:

Upper limb asymmetry could increase the risk of injuries in able-body athletes [1] as in manual wheelchair users [2] on strength asymmetry particularly. Paralympic sitting athletes overused their upper limbs in daily life and physical activities, so they could develop more strength asymmetries than able-bodied people. In this study, we hypothesize that Para-athletes are more asymmetric in strength than able-bodied athletes.

## METHODS:

Paralympic athletes (PA) were composed of wheelchair tennis, basketball, rugby, and cycling athletes (n = 54, 17 women and 37 men) divided into two groups (with abdominal capacities (PAAC), n = 31 (10 women and 21 men), and without abdominal capacities (PANAC), n = 23 (7 women and 16 men). Able-bodied athletes (AB) were judokas and sports court athletes (n = 42, 13 women and 29 men). was performed seated on a frictionless sledge and consisted of measuring the force during ballistics push-ups at 4 load levels. The force of the right and left upper limbs was measured using two Kistler force plates. The Instantaneous Symmetry Index (ISI) was calculated, according to the method proposed by Chénier et al. (2017) [3] and applied to the push phase for all loads. T-test was used to compare ISI between groups.

## RESULTS:

The mean strength asymmetry from all loads, calculated with ISI value was significantly higher in men PA compared to AB (respectively  $0.057 \pm 0.038$  and  $0.033 \pm 0.013$ ;  $p = 0.001$ ) but also in both paralympic groups (PAAC ( $p = 0.003$ ) and between AB and PANAC ( $p = 0.045$ ). However, there is no significant difference between PAAC and PANAC (respectively  $0.056 \pm 0.031$  and  $0.058 \pm 0.046$ ,  $p = 0.884$ ). No significant differences were found between all women populations (PAAC  $0.054 \pm 0.026$  or PANAC  $0.050 \pm 0.014$ , and AB  $0.048 \pm 0.043$ ,  $p > 0.05$ ). Finally, there is no significant difference between PA and AB males and females (respectively  $p = 0.703$  and  $0.231$ ).

## CONCLUSION:

With a graded load push-up exercise, this study aimed to compare the strength symmetry with ISI between the upper limbs of paralympic and able-bodied athletes. Our main results show that in the men's group, PA present greater asymmetry than AB, which is not observed in the women's group which tends to be more asymmetrical than men. But this result may be due to a smaller woman population in all subgroups. The abdominal capacities do not seem to be the reason for a lesser asymmetry given the non-significant differences between PAAC and PANAC. From push-up exercise, ISI applied to the force is relatively low compared to results on wheelchair propulsion from Chénier et al. 2017 (ISI =  $0.2 \pm 0.09$ ), but we observe for PA an ISI greater than 0.05 regardless of gender. This value could be an interesting indication threshold of the asymmetry with this index on this test to pay attention to para-sports practice.

## REFERENCES:

- [1] Fohanno V. et al., Sports Biomechanics (2015).
- [2] Hurd WJ. et al., Archives of Physical Medicine and Rehabilitation (2008).
- [3] Chénier F. et al., Journal of Biomechanics (2017).

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