Relationship between perceived shoulder pain and kinematic analysis of wheelchair propulsion in sedentary and active wheelchair users

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Introduction

- High prevalence of shoulder injuries in manual wheelchair users (MWU) (Curtis, 1999)
- The overuse of the anterior muscles of the joint respect to posterior muscles, generates muscle imbalance (Burnham, 1993)
- Physical activity and MWU (Fernhall , 2008; Nash, 2005): recreational and therapeutic exercise.
- Circuit resistance exercise training on muscle strength, endurance, anaerobic power (Nash, 2007)
- Alternative ways of trainning for MWU (Hettinga, 2008)
- Intensive exercise programme on a seated double-poling ergometer (Norrbrink, 2012)

Introduction

- Promotion of active exercise for wheelchair users is encouraged to decrease shoulder pain (Fullerton, 2003)
- Involvement in athletics neither increases nor decreases the risk of shoulder pain in the MWU (Finley, 2004)

VS

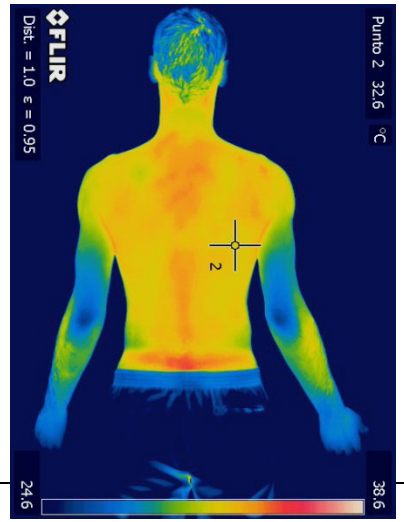
High performance exercise… will increase or decrease the imbalance?

Purpose

To analyse the relationship between upper limb kinematics in wheelchair propulsion and shoulder pathology, comparing sedentary and athlete wheelchair users.

Test battery

- Thermography
- WUSPI / PA questionnaires for people with PI (PASIPD and PADS).
- Accelerometry
- Flexibility of the internal and external rotators of the shoulder joint
- Dynamometer: Peak force at two speeds of isokinetic contraction of internal and external rotators of the shoulder
- Test of wheelchair propulsion



Methods

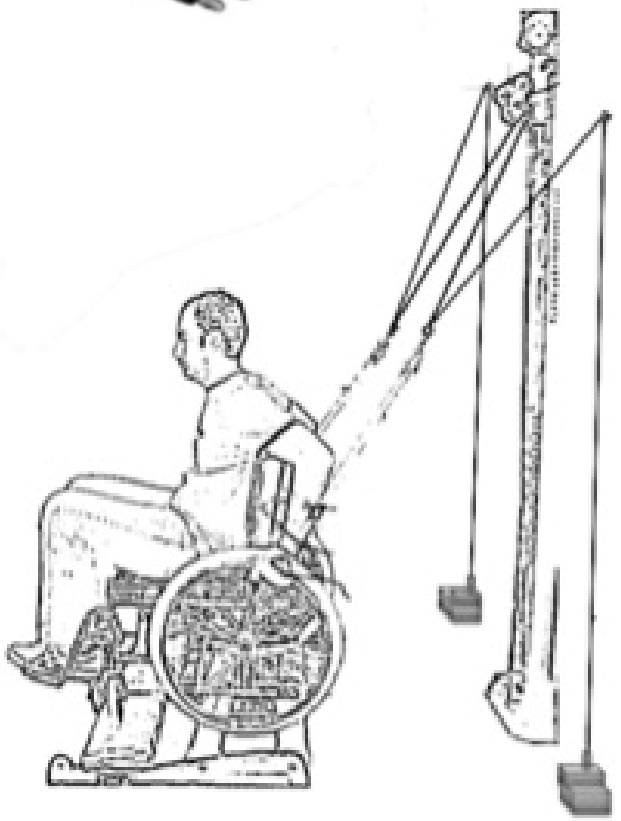
Participants

- 37 manual wheelchair users
  - 14 sedentary
  - 23 wheelchair basketball players:
    - ✓ 11 high performance (WBa)
    - ✓ 12 non-professional (WBb)

Methods

Equipment

- Test-CIDIF
  - Frictionless roller system
  - Individual daily wheelchair
  - 2 position linear transducers
  - Pulley: load + kinematic variables
- WUSPI questionnaire (Curtis, 1995):
  - Performance Corrected Wheelchair User's Shoulder Pain Index (PC-WUSPI)



Methods

Resistance to overcome in the wheelchair propulsion test depending on the weight of the participant:

Participants' weight (kg)	Resistance (kg)
<55	2
56-65	6
66-75	10
76-85	14
86-95	18

- Data were analyzed using a one-way analysis of variance (ANOVA).
- For ANOVA analyses, the factor was group (sedentary, WBa and WBb).

Results

Comparison of variables obtained in the test of wheelchair propulsion according to the group.

Variable	Sedentary (n=14)	WBa (n=11)	WBb (n=12)
Number of propulsions	49.1±12.9	54.7±5.5	45.9±20.1
Average peak power	61.6±41.8	166.9±76.9**	209.0±106.1***
Average power	33.6±21.8	73.7±26.9**	80.6±30.9***
Maximum speed	3.38±1.50	6.50±1.44***	6.63±1.42***
Average maximum speed	2.78±1.30	5.02±1.00***	5.30±1.46***
Total work	534.9±347.3	1146.7±407.2**	1183.8±502.0***

** and ***difference with repect to sedentary with $p<0.01$ y $p<0.001$, respectively.

Results

- ANOVA test:
  - ✓ No significant differences depending on the *group* variable regarding the number of propulsions ($p=0.338$; $\eta 2=0.062$)

- WUSPI questionnaire:
  - There was no differences between WBa and WBb.
  - Sedentary wheelchair users have a higher score than trained wheelchair user:
    - WUSPI: (16.4 ± 14.4 respecto a 5.8 ± 6.7, $p<0.05$).
    - PC-WUSPI: (18.8 ± 17.2 respecto a 5.9 ± 6.8, $p<0.05$)

Discussion

1. The loss of functionality, as a result of shoulder pain, is higher in sedentary MWU than in trained MWU. Therefore, the systematic practice of physical exercise entails lower risk of losing functionality on the shoulder joint compared to the sedentary lifestyle.
2. No differences were observed in any variable among athletes who use wheelchairs only for sports respect to athletes who use wheelchairs in their daily life.
3. In the absence of differences between WBa and WBb, the comparisons have been made regarding sedentary and athletes.

Conclusion

- The athletes had higher kinematic variables than sedentary MWU in the test-CIDIF. The greater the loss of function caused by the shoulder pain, the lower the speed at which a MWU is able to propel in the designed test.
- The maximum wheelchair propulsion test designed and developed by the Research Center of Physical Impairments (CIDIF) could be performed easily on all the participants, it detected differences between athletes and sedentary MWU and it was sensitive to MWU with different levels of functionality on the shoulder joint.

Limitations

- Own wheelchair: daily wh, not sport wh.

Participants, CIDIF and INEF…

Thank you!

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