Classification of athletes with coördination impairment in Wheelchair Rugby

Impact Coordination Impairment on sport specific activities

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Matching Performance Potential

Athletes with Coördination Impairment

Athletes with:

- *Hypertonia*: 86%, Motor cortex damage, muscles appear stiff/tight.
- *Athetosis*: 6%, Basal ganglia damage, continue unvoluntary movements.
- *Ataxia*: 6%, Cerebellum damage, characterized by shaky movements.

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Relation Research and Classification

This study: Evidence based practice*

Integration of:

→ (1) clinical expertise/expert opinion with

→ (2) the best available external evidence

→ (3) athletes preference.

Breukelen, K. van (2017). Impact of Trunk Impairment; On sport specific activities that determine performance in WR.
* Sackett, D. (1997). Evidence-Based Medicine. *W.B. Saunders Company*.

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Background study

- Current problem IWRF-classification:
  - No specific assessment protocol,
  - No specific tests for coordination yet (in Manual),
  - While more and more athletes with coördination impairment on the WR court (Team NL: 4 athletes)

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- Lack of standardized assessment till now leads to:

1. Different approaches between classifiers
2. Lack of reliability between classification panels
3. Increased possibility of different outcomes

= unwished practice which undermine the faith in classification.

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Purpose study

- Presenting a theoretical/practical *frame of reference*,
  (this presentation)
- Generating practical *instruments* for the classification of athletes with coördination impairment.

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Methods study

- Assessment of 30 athletes with coördination impairment coming from the sports WR, WB, PCH and HC (period 2016-2018).

- (a) Repetitive Movement Tests,
- (b) ASAS testing,
- (c) Filmed during national and international competition.

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Results study (1)

- *Physical Assessment*: ROM limitations, accuracy limitations, reduced speed of movements, ‘catches’ found in ASAS scoring: summarised to 2 main concepts of coördination impairment:

- Concepts (A) ***‘Co-contraction’*** and (B) ***‘Dissociation inability’*** were found useful in analysing the movement pattern of athletes with coördination impairment, and…

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Results study (2)

- Concepts ***'Co-contraction'*** and ***'Dissociation inability'*** were transformed into an assessment protocol / practical tool for the classification of these athletes:

  1. An (additional) *assessment form* when classifying athletes with coördination impairment.
  2. A *document/article* explaining the classification protocol

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Definition Coördination Impairment

- (A) The inability to: contract the agonist and at the same time relax the antagonist, to make a smooth, well directed, repetitive movement at maximum voluntary velocity and adequate ROM in *one body segment*. The opposite happens: ***Co-contraction***

- (B) The inability to: combine opposite movements of *several body segments* at the same time (extension in one segment and flexion in the other segment): ***Dissociation inability***.

- (Altmann & Groeneweg, 2016; van Breukelen et al., 2015; Sanger et al., 2003).

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Co-contraction

one body segment:
Arm

+

Dissociation inability

two body segments:
Arm-Trunk

Dissociation
(Arm-Hand)

Dissociation inability
(Arm-Hand)

Concept of ‘Maximal Effort’

Eligibility testing / Physical Assessment

RMT, Repetitive Movement testing in:

- shoulders, elbows, forearm, wrist and fingers.
- location + severity: amplitude/accuracy + movement speed

Research Altmann (2018): forearm pro-supination score < 66 in 20 sec and/or wrist flexion/extension score < 68 in 20 sec = coordination impairment which do give the, maximum, 3.0 handscore.

(3.5 is a normal arm/hand)

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Mirror movements

- “Mirror movement refers to simultaneous contralateral, involuntary, identical movements that accompany voluntary movements”.

- Proves that the coordination impairment is reflected in hands and arms.

Nadkami, N., & Deshmukh, S. (2012). Mirror movements. *Annals of Indian Academy of Neurology*

Kuhtz-Buschbeck, J., Krumlind Sundholm, L., Eliasson, A., & Forssberg, H. (2000). Quantitative assessment of mirror movements in children and adolescents with hemiplegic cerebral palsy. *Developmental Medicine & Child Neurology*.

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Impact

Classification: the association between:

(1) Measure of impairments and

(2) Determinants of sport performance

- The *impact* of the impairment on the sportspecific activities in WR:
- (1) Pushing
- (2) Ballhandling

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Impact
Co-contraction/Dissociation inability

on

Wheelchair Pushing:

1. Pushing forward: (a) -frequence, (b) -volume
2. Pushing reverse
3. Braking/Turning

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Impact Co-contraction

- **Arm pushing frequence**
  - **Normal:** frequency of, at least, 2 strokes each second.
  - **Decreased:** 1,5 strokes each second can be seen already as a ‘decreased’ pushing frequency.
  - **Limited:** 1 stroke each second, is (very) limited.

Vanlandewijck, Y., Theisen, D., & Daly, D. (2001). Wheelchair Propulsion Biomechanics; Implications for Wheelchair Sports. *Sports Med*, 339-367

Lenton, J., Woude, L., Fowler, N., & Goosey-Tolfrey, V. (2009). Effects of arm frequency during synchronous and asynchronous wheelchair propulsion on efficiency. *International Journal of Sports Medicine*, 233-239.

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Kees van Breukelen, MSc
Eline Lammens, BSc student

Impact Co-contraction

Arm Pushing Volume:

- ***Co-contraction*** of the elbow (biceps/triceps) impacts the angle between contact point hand on the wheel and release hand of the wheel

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Impact Co-contraction

Arm pushing Volume

- the hands will go back to the rear earlier, after one push.
- **Result:** the amount of power will be less and the end speed will be decreased.
  - Power = Force * Velocity = Force * Displacement/Time

Energielevering bij inspanning. (2011). In J. Morree, M. Jongert, & G. Poel, *Inspanningsfysiologie, oefentherapie en training* (pp. 19-21). Houten: Bohn Stafleu van Loghum.

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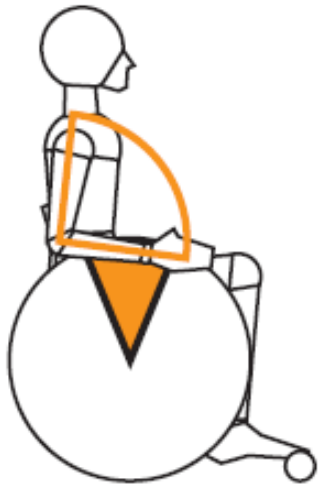
Arm-pushing volume

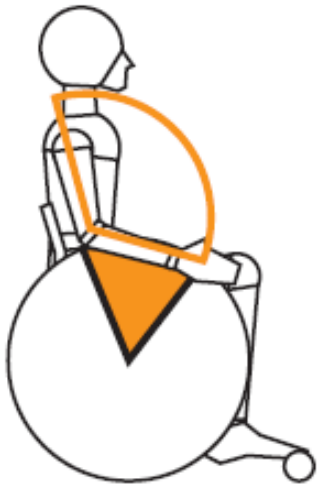
Pushing Profiles CP-athletes in WR

0.5



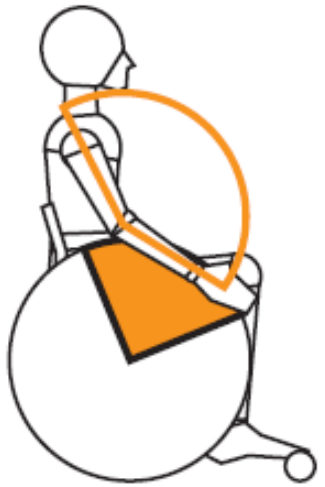
elbow: 90°
wheelcontact: ≤ 45°

1.0



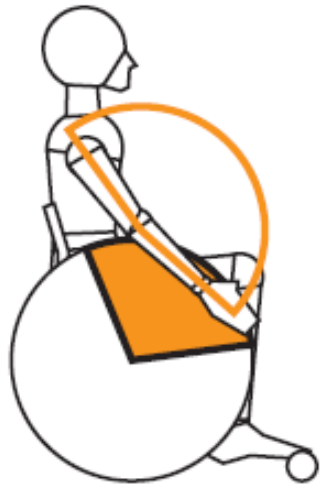
elbow: 120°
wheelcontact: 45°- 60°

1.5



elbow: 150°
wheelcontact: 60°- 90°

2.0



elbow: 170°
wheelcontact: ≥ 90°

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IWRF

Impact Dissociation Inability

2 Body segments unable to execute opposite movement patterns:

(1) Arm extension leads to wrist/fingers extension
(2) Arm extension leads to Trunk extension

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Dissociation inability: overflow extension left wrist/fingers

Dissociation inability: overflow extension right wrist/fingers


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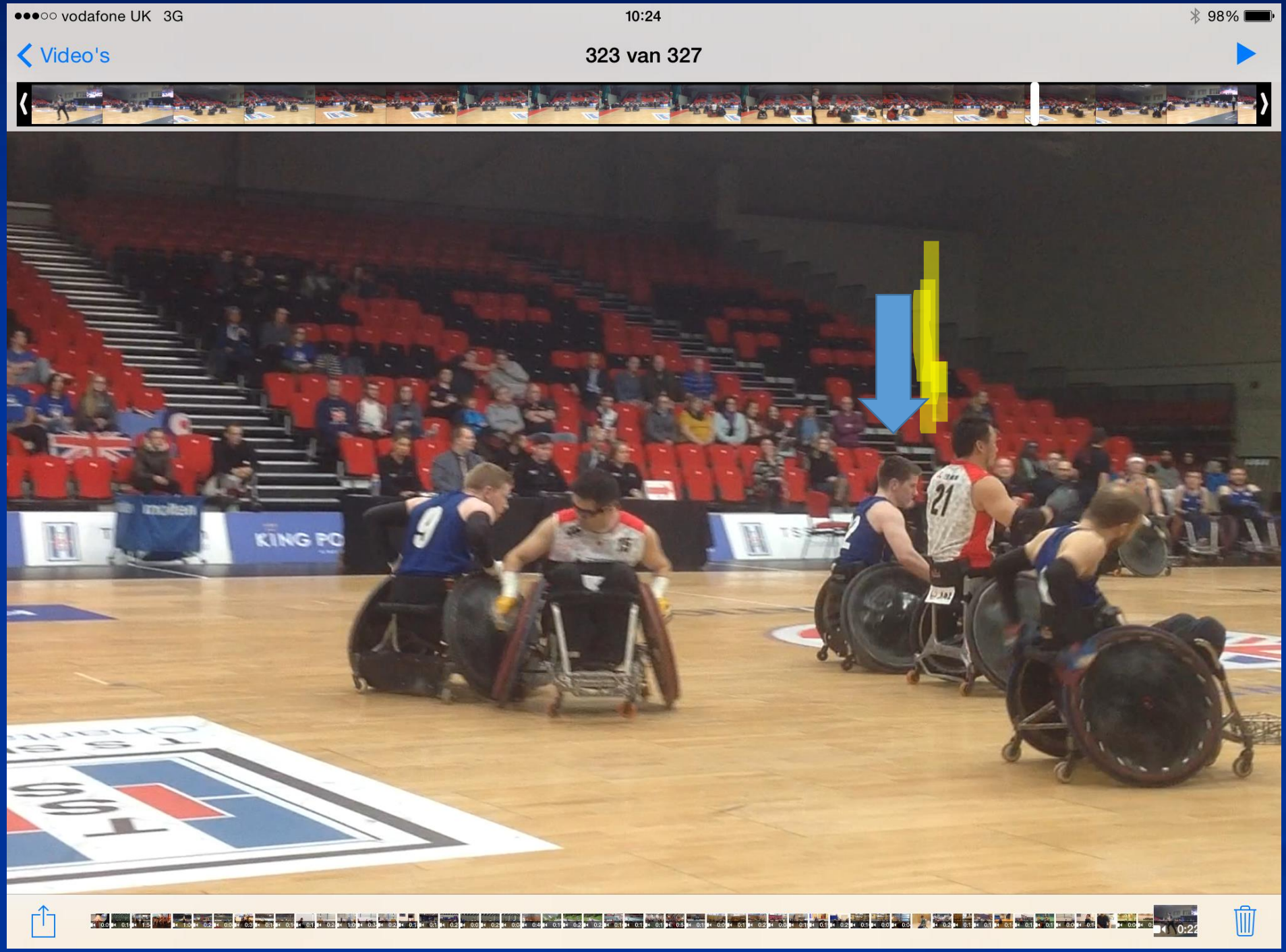
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Reverse Arm-pushing

- **Observation in Technical/Observational Assessment:**

  Can the athlete combine opposite movement patterns in the reverse pushing:

  - execution of only the *pulling* (flexion) movement or
  - also the *pushing* (extension) movement?

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Impact
Co-contraction/Dissociation inability
on
Ballhandling

One-handed: throwing/catching, dribbling, pick-up ball, fingertip test
Two-handed: chestpass, pop-up

Matching Performance Potential

Co-contraction
(one body segment: Arm)
+
Dissociation inability
(two body segments: Arm-Trunk)

Dissociation inability: prefered twohanded dribbling

Dissociation inability: prefered twohanded receiving

Dissociation inability: prefered use other hand

Final Class Determination

Classification Formula WR: **UE + Tr = final class**

(UE = Upper Extremity, TR = Trunk)

UE = Pp (pushing profile) + Bp (ball handling profile)

Central question: how is the arm/hand acting during Pushing & Ballhandling.

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Impact
Co-contraction/Dissociation inability
on
Trunk movements

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Trunk Rotation

Physical assessment:
may pass test 4, rotation

On court however….
co-contraction can prevent rotational movement.

→ Rotation to one side can only be done with relaxation of the other side at the same time.

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Trunk Lateral Flexion

Physical assessment:
may pass trunk test 5, lateral flexion

On court however….
co-contraction can prevent effective use lateral flexion.

→ Lateral flexion to one side needs relaxation other side at same time

Class Danny?

Coordination impaired athletes

- Lack of standardized assessment till now leads to:

1. Different approaches between classifiers
2. Lack of reliability between panels
3. Increased possibility of different outcomes

Example:
Danny's national class: 3.0 (UE 2.5 + Tp 0.5)
Danny's international class: NE (UE 3.0 + Tp 1.0)

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Take home message

- Classifiers have to work with óne protocol, óne standardised assessment when evaluating athletes with coördination impairment,
- To prevent a variety of classification outcomes.

- Hopefully this work can be helpful to accomplish this.

Thank you