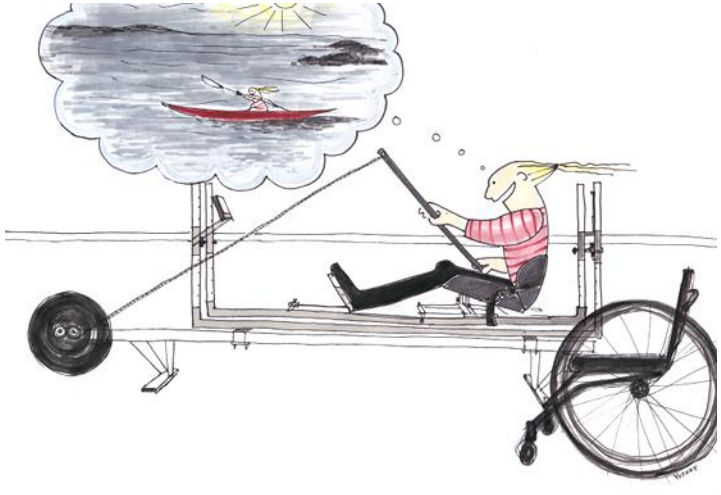
Positive Effects of Kayak and Kayak Ergometer Training by people with Paraplegia



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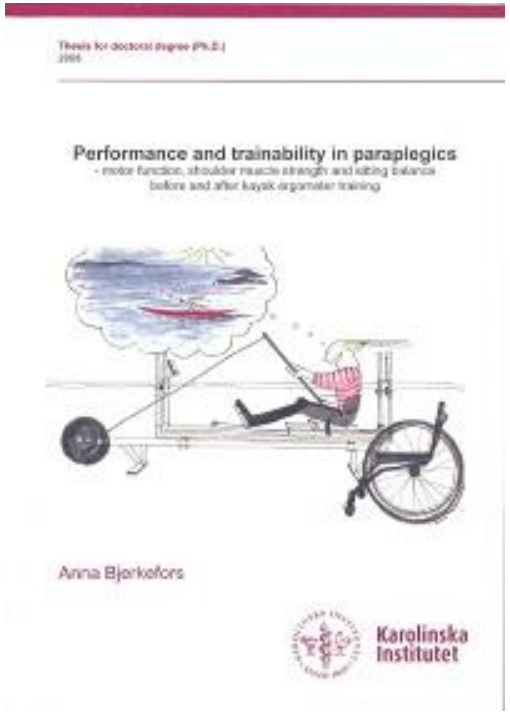


Rio2016 JOGOS PARALÍMPICOS

TOKYO 2020 PARALYMPIC GAMES

Subjective experience

- Sense of freedom
- Easy to get out in the nature
- Good complement to other training
- Social exchange
- Pain relief
- Effects on daily life activities – propelling uphill, easier to transfer into the car

Does kayaking also result in measurable effects?

How to measure?

Video: Hans Rosdahl och Johnny Nilsson

Why is trunk control important?

Impaired trunk control is related to

shoulder pain
(Sinnot et al. 2000)

decreased propulsion efficiency
(Dallmeijer et al. 1998, Schantz et al. 1999)

respiratory dysfunction
(Baydur et al. 2001)

development of pressure sore
(Karataş et al. 2008)

Intervention Study 1 - Open-sea kayaking

12 individuals with SCI

8-week-period

2 – 3 times/week

Sub- and maximal oxygen consumption

Bjerkefors, Rosdahl et al. 2005

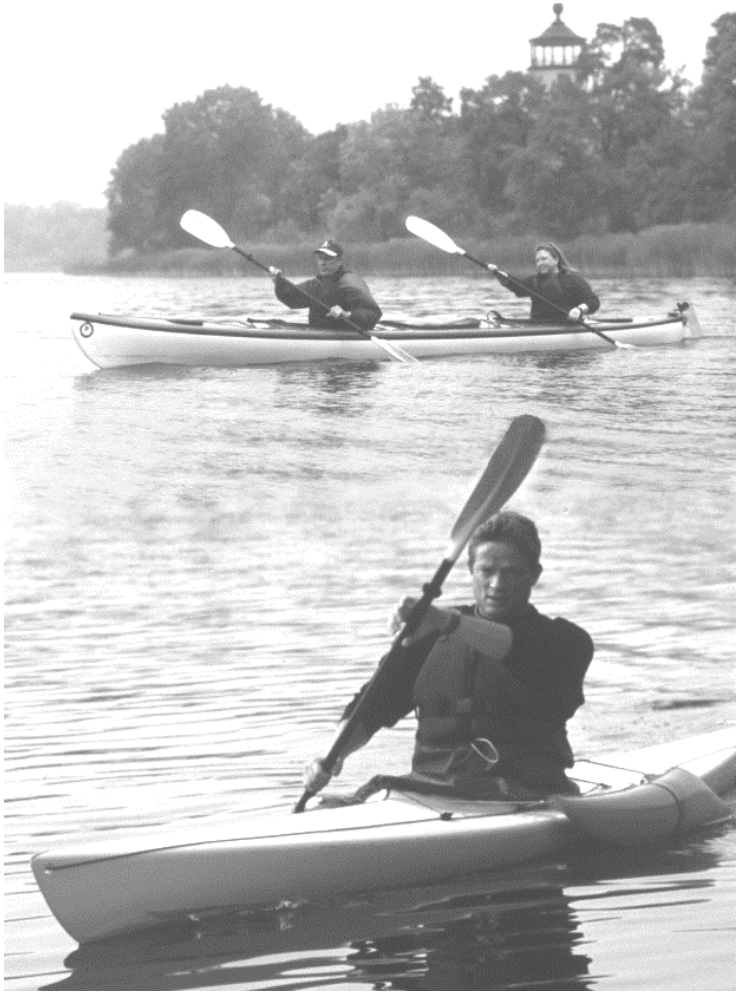
Fig. 1. The experimental set-up for balance testing. The subject is sitting in a special chair which is also used in the kayak. The chair is firmly attached to a force plate. The subject's feet are resting on a support connected to the chair via steel rods.

Grigorenko et al., 2004

Table IV. *Subjective experiences of direct effects of the kayak training as stated in a questionnaire presented to the individuals with spinal cord injury 1 year after the training period*

	General well being	Sitting balance in wheelchair	Shoulder strength	Upper body stability	Spasticity
No improvements	1	3	4	4	5
Small improvements	1	3		5	3
Moderate improvements	4	3	6		1
Large improvements	6	3	2	3	1
Don't know					2

Grigorenko et al., 2004

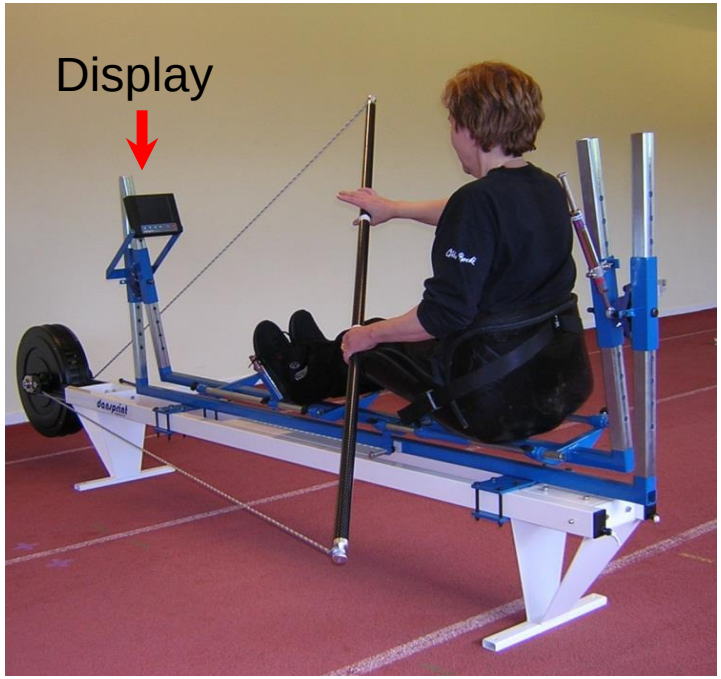


Aerobic capacity

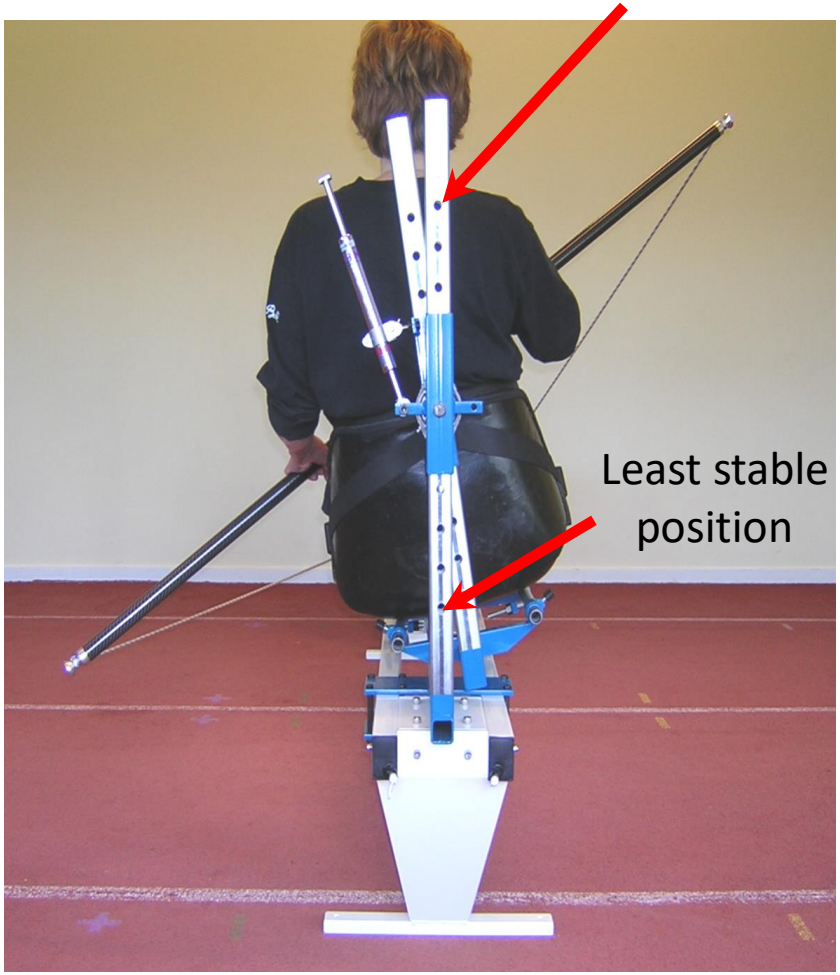
Quality of life

Subjective experiences; e.g. sitting balance & shoulder strength

Intervention Study 2 – Kayak ergometer



weather-independent
adjustable balance module



Subjects

- 10 persons with SCI (7 M, 3 F)
- T3 – T12
- 23 – 60 year
- year post injury: 2 - 26

Training

3 times/week (total: 30)

10-week-period

60 min

the intensity and the balance

demand successively increased

Balance demand, intensity and distance

	Balance demand		Intensity (W)		Distance (m)	
Subjects	first	last	first	last	first	last
1	6	8	19	40	2678	4387
2	7	9	15	32	2736	4400
3	5	8	15	39	2389	4335
4	5	8	20	44	2807	3919
5	8	9	36	75	3289	4540
6	6	9	22	34	3200	4408
7	5	9	15	34	2626	4393
8	7	9	33	58	3046	6237
9	7	9	15	31	2385	4099
10	7	9	14	27	2870	3500
mean	6	**9**	20	**41**	2803	**4422**
SD	1	1	8	15	308	709

Shoulder muscle strength

- **Improved**
- Flexion – extension
- Abduction – adduction
- Internal – external rotation

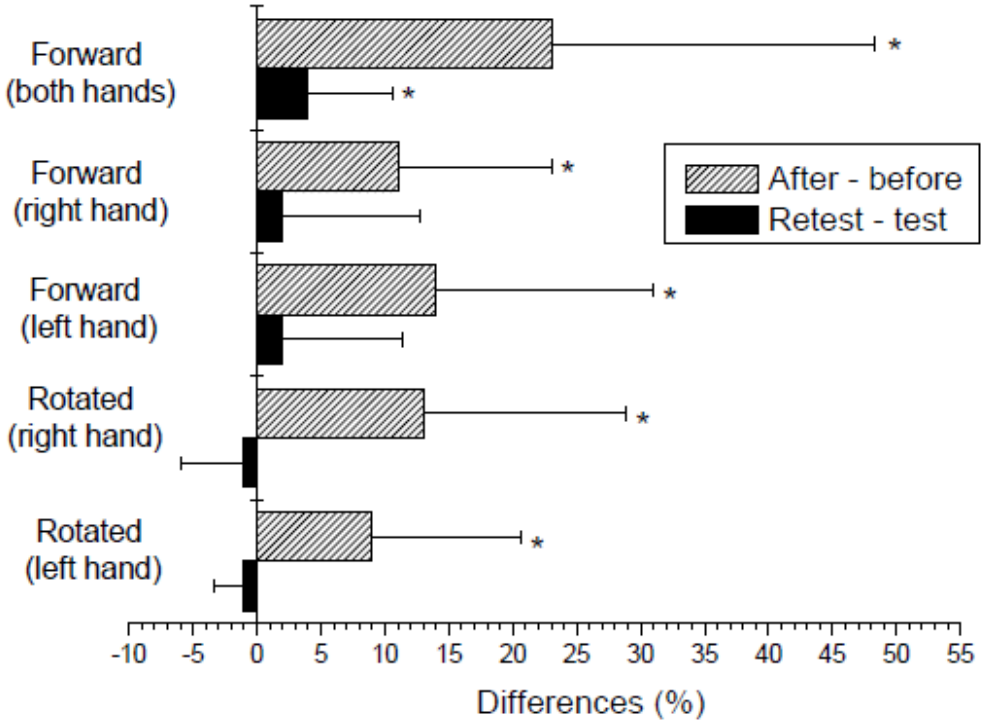
Sit-and-reach-tests

forward, bilateral

forward, unilateral

45°rotated, unilateral

Sit-and-reach test



Transfer and wheelchair tests

Transfer to a plank bed*

(height, cm)

5 m on the rear wheels

(time, s)

Mounting a platform*

(height, cm)

* Significantly improved

Transfer and wheelchair tests

5 laps in a figure-8 (time, s)

Propelling 15 m on a level surface (time, s)*

Propelling 50 m up a 3° incline (time, s)*

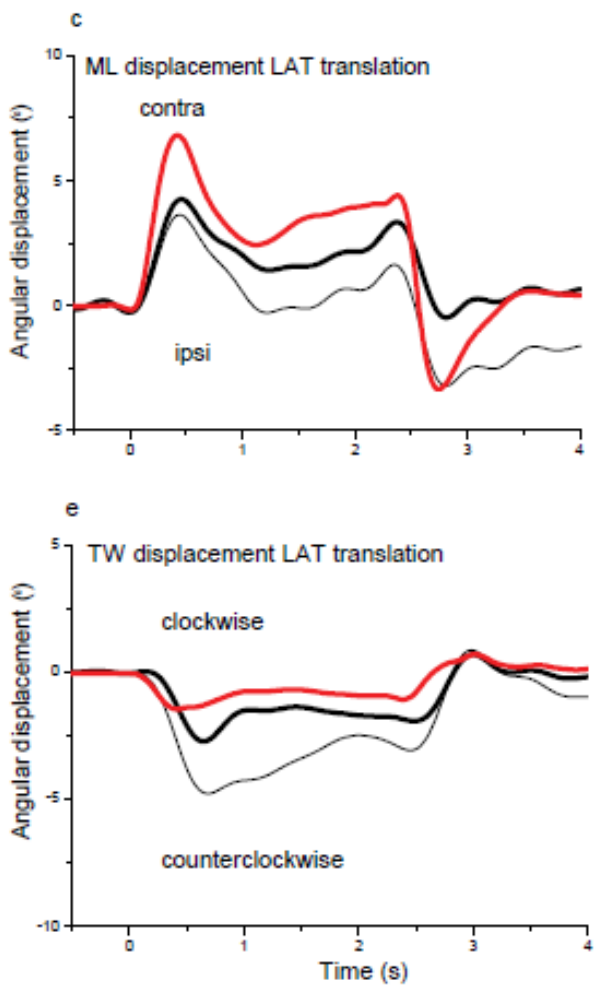
* Significantly improved

Kinematic responses to unexpected pertubations

Medio-lateral direction

Anterio-posterior direction

Unexpected perturbations in lateral direction



Subjective experiences

	General well-being	Cardio-vascular fitness	Upper body stability	Shoulder strength	Reach an object	Propel uphill	Transfer into a car	Propel over a curb
"Unchanged"		1	1	1	2	1	**3**	2
"Small improvement"	1	2	1	2	2	3	2	**5**
"Moderate improvement"	3	1	2	**3**	2	**4**	**3**	1
"Large improvement"	**5**	**4**	**4**	**3**	2			1
"Very large improvement"	1	2	1	1	2	2	1	1
"Don't know"			1				1	

Conclusion

kayak ergometer training improved

- shoulder muscle strength
- functional performance
- postural stability

→ suitable activity in post-rehabilitation and recreation

→ did not cause any shoulder pain

Thank you for your attention!

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