

Fitness for wheelchair users in everyday life

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Topics

- **Introduction**
- Anatomy of Shoulders
- Strength training
- Endurance training
- Body weight and nutrition
- Conclusions

Level of Sports

- Therapy
 - Moving just for fun
 - Health
 - Fitness
 - Competitions
 - High Performance
- At the start
- History in sports
 - Abilities
 - Goal

Reasons for using a wheelchair



- Spinal Cord Injury / Disease SCI/D
- Cerebral Palsy (from birth or accident)
- Amputation (missing limbs)
- Diseases of muscles and nerves
 - Post Polio Syndrome
 - Multiple Sclerosis MS
 - Amyotrophic lateral sclerosis ALS
 -

Goals of Fitness Training

Balance to everyday life

Enhancement of quality of life
 through maintenance and improvement
 of mobility and independence

Goals of Fitness Training

- stable shoulder joints  Strength
- prevention of shoulder pain
- prevention of cardiovascular disease  Endurance
- prevention of overweight and diabetes
- prevention of degeneration of brain (BDNF)
- social reasons (meeting peers, being part of a group: basketball, rugby, dancing,
- inclusion (fitness center, cycling, table tennis and many more)

Cardiovascular Disease

Risc:

- general population: 5 – 10%
- with SCI/D: 30- 50 %
- with quadriplegia + 16 %

Tawashy, Amira. *CARDIOVASCULAR FITNESS IN INDIVIDUALS WITH CERVICAL SPINAL CORD INJURY*. Diss. UNIVERSITY OF BRITISH COLUMBIA (Vancouver, 2009)

Problems associated with CVD:

- Diabetes mellitus
- Thrombosis
- Overweight
- Reduced performance

A. Schmid, A. Berg: *Behindertensport und Sportmedizin: Internistische Aspekte; Handicapped sports and sports medicine: aspects of internal medicine: Abt. Rehabilitative und Präventive Sportmedizin, Medizinische Universitätsklinik Freiburg*

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Stress on shoulders

- wheeling
- transfers
- support at tables
- over head movements
- (depending on seating position)

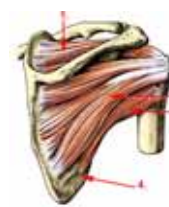
Anatomy of shoulder



- Target:
- scapular stabilizers
 - rotator cuff



- Goals:
- mobilize for improved coordination
 - strengthen the muscles



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Goals for strength training

- Easier moving in everyday life
 - wheeling, transfers (car, bed, bathtub,
- Better stabilization of joints to avoid injuries, overuse, pain
- Reduction of tension
- Improved bone density
- Better posture and figure
- Better flexibility



Places for strength training

Training at home

- easy to access
- easy to disturb
- limited variations
- limited knowledge about proper training

Fitness Center

- many options for training
- no accessibility
- uninformed instructor
- fear of entering a place

Strength training equipment



Functional strength training



Challenges

- avoid damage of passive structures
- pressure sores



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Challenges

- transfers onto benches and machines
- balance on narrow benches
- loss of balance due to spasm
- getting up without abdominals



Challenges

- handles are too high



Solutions



Challenges

- no use of fingers



Adaptive machines



Moves

Arm combinations

Aerobic moves for coordination

Moves



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Cardio training



Cardio training



Cardio training



Effects of Endurance Training

- Heart:
 - decreased demand of oxygen
 - decreased heart rate
 - better variation of heart rate
- Blood:
 - improved blood flow
 - decreased risk of thrombosis
- Metabolism:
 - improved ratio of lipoproteins
 - decreased levels of insulin and stress hormones
- Psyche:
 - better mood (solving problems)

Prevention
of CVD

Challenges for Endurance

Impairment due to SCI/D

- motoric: paralysis of parts of the body
- sensibility: touch, pain, hot-cold
- urologic;
- sympathetic system regulates:
 - cardiovascular system (heart rate)
 - endocrinous system (hormones)
 - body temperature

Impairment for quadriplegics

- reduced maximum heart rate (T1-T4 innervates heart)
- reduced increase in catecholamines (T5-T9 innervates adrenal medulla)
- blood pooling

Results in

- reduction of aerobic and anaerobic capacity
- inadequate blood pressure regulation
- limited heart rate variation

Schmid, A., et al. "Catecholamines response of high performance wheelchair athletes at rest and during exercise with autonomic dysreflexia." *International journal of sports medicine* 22.1 (2001): 2-7.

Impairment for quadriplegics

VO_{2max} (VO_{2peak}), heart rate, performance, catecholamines

	VO ₂ [ml*min ⁻¹]	Hf [l*min ⁻¹]	P [Watt]	NA [ng/ml]	A [ng/ml]
TETRA Ruhe	281,5	67,7		0,28	0,06
TETRA max.	1027,7	110,2	33	0,34	0,08
H PARA Ruhe	327,0	73,4		0,36	0,09
H PARA max.	1818,0	172,1	67	0,91	0,14
M PARA Ruhe	350,5	79,1		0,66	0,15
M PARA max.	2177,9	181,7	79	2,08	0,25
L PARA Ruhe	349,6	76,3		0,54	0,17
L PARA max.	2248,0	176,2	72	1,52	0,30
AB Ruhe	409,2	71,4		0,37	0,11
AB max.	2131,8	168,9	63	0,83	0,26

Schmid, A., et al. "Kardiozirkulatorische, metabolische und hormonelle Adaptation von querschnittsgelähmten Sportlern unterschiedlicher Läsionshöhe in Ruhe und unter Belastung."

Impairment for quadriplegics

Free fatty acid, glucose, insulin

		FFS [mmol*l ⁻¹]	Glukose [mg*dl ⁻¹]	Insulin [uE*ml ⁻¹]
TETRA Ruhe		0,82 ± 0,40 ^{1,4}	99,6 ± 10,3 ^{1,4}	18,2 ± 24,6 ^{1,4}
TETRA max.		0,86 ± 0,43 ⁴	85,2 ± 12,1 ^{1,4}	11,3 ± 5,8
H PARA Ruhe		0,67 ± 0,34 ⁴	99,7 ± 15,7 ¹	9,1 ± 2,9 ¹
H PARA max.		0,94 ± 0,28 ⁴	106,5 ± 20,4 ¹	13,5 ± 7,3
M PARA Ruhe		0,60 ± 0,28 ¹	95,2 ± 11,4	10,9 ± 5,4 ¹
M PARA max.		0,99 ± 0,33	116,7 ± 30,1 ¹	15,5 ± 10,1
AB Ruhe		0,42 ± 0,24 ^{1,2}	90,3 ± 7,1 ¹	8,4 ± 5,0 ¹
AB max.		0,52 ± 0,27 ^{1,2}	98,7 ± 10,4 ¹	16,8 ± 20,3

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Body Weight

- Overweight:
- cardiovascular disease
 - decreased mobility
- Energy consumption:
- Para 300 - 500 kcal/h
 - Tetra / Quad 150 - 250 kcal/h
 - AB: Running 11 km/h 900 kcal/h
Soccer 700 kcal/h
- 1 kg fat: 9300 kcal!

Energy consumption kcal/h

Wheelchair Sports:	
Tennis:	259,0±71,3
Rugby:	185,0±66,4
Basketball:	312,0±119,1
Handcycling:	327,0±102,7
Wheelchair racing:	284,2±82,5
Overall:	275,4±101,6

Abel, Thomas. Energetische und leistungsphysiologische Untersuchungen im Rollstuhlsport: Unter besonderer Berücksichtigung präventivmedizinischer Aspekte. diplom. de, 2002

Nutrition

Carbohydrates make you eat more than you need!

Carbs → Blood Sugar ↑ → Insulin ↑

→ Blood Sugar ↓ → Carbs to fat

→ hungry again

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Overuse

“No sports, since shoulders are overused through daily activities.”

Body is not a machine.
Use it or loose it!

Better:
Do the right training.
Find a coach!

Start today

First of all:
Start any sport on regular basis
Have your health checked

And then:
Move.
Again.
And again.



Thank you for your attention



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