Spasticitet, hvad er det egentlig?

VITSI Workshop (Odense)
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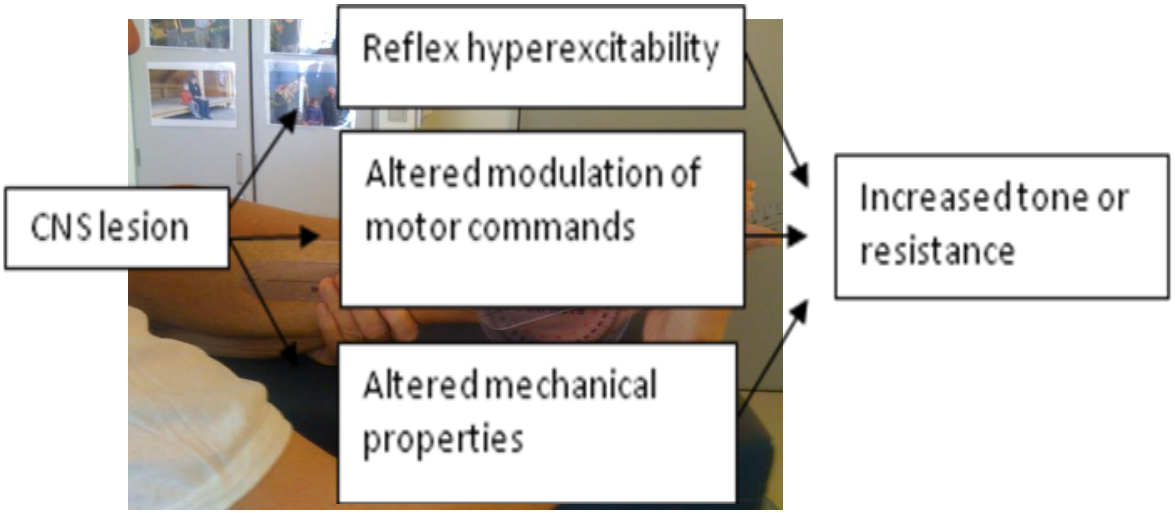
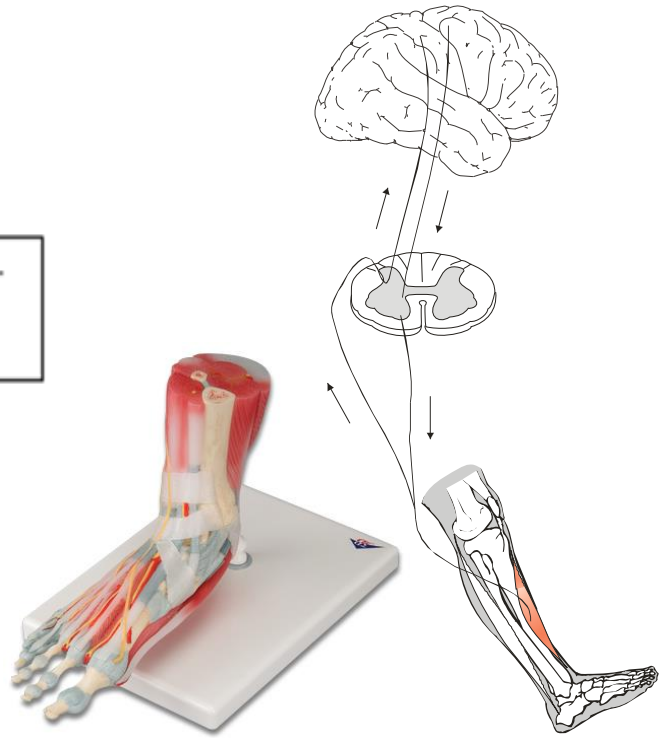
Muskel tonus

”the sensation of resistance felt as one manipulation of a joint through a range of motion, with the subject attempting to relax” Lance and McLoud 1981





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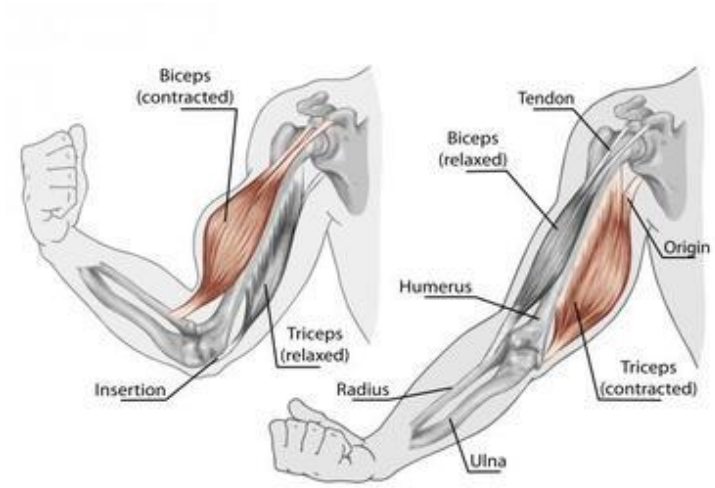
Måling af tonus

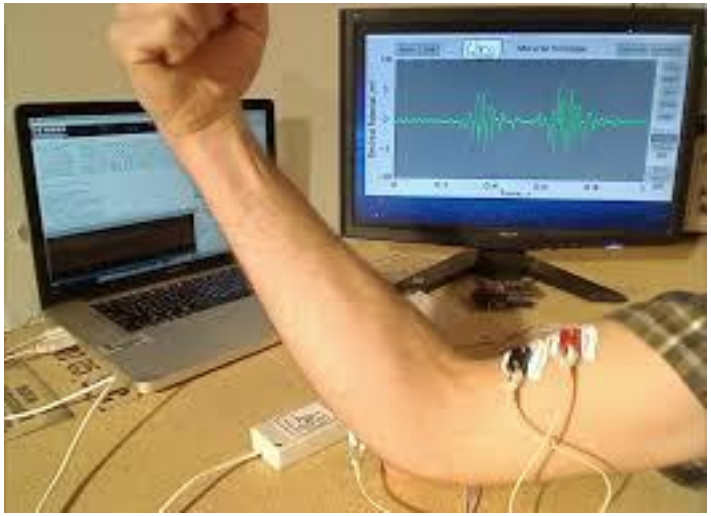
Man kan observere patienterne!

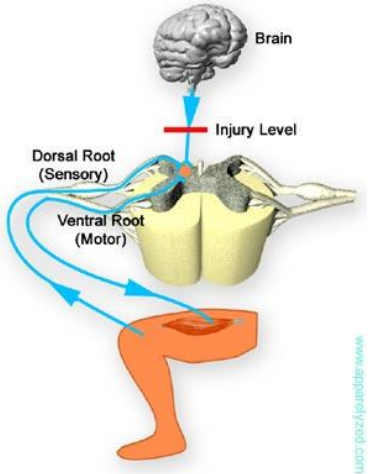
	Spasticity	**Dystonia**	**Contracture**
Summary	Velocity-dependent resistance	Sustained or intermittent muscle contractions	Independent of velocity
Effect of increasing speed of passive movement on resistance	Increases	No effect	No effect
Presence of a fixed posture	Only in severe cases	Yes	Yes
Effect of voluntary activity on pattern of activated muscles	Minimal	Yes	No effect
Effect of behavioural task and emotional state on pattern of activated muscles	Minimal	Yes	No effect

Table 2 Comparison chart of principal differentiation diagnostic features (modified from Sanger, 2003)

Man kan måle om der er muskelaktivitet (EMG)

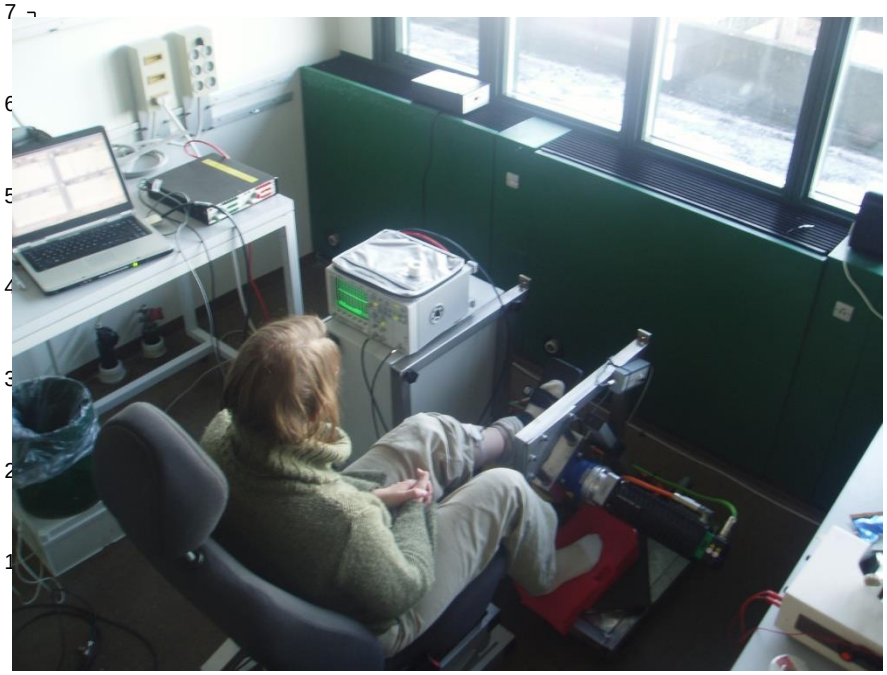






Objektiv biomekanisk metode

Klinisk metode



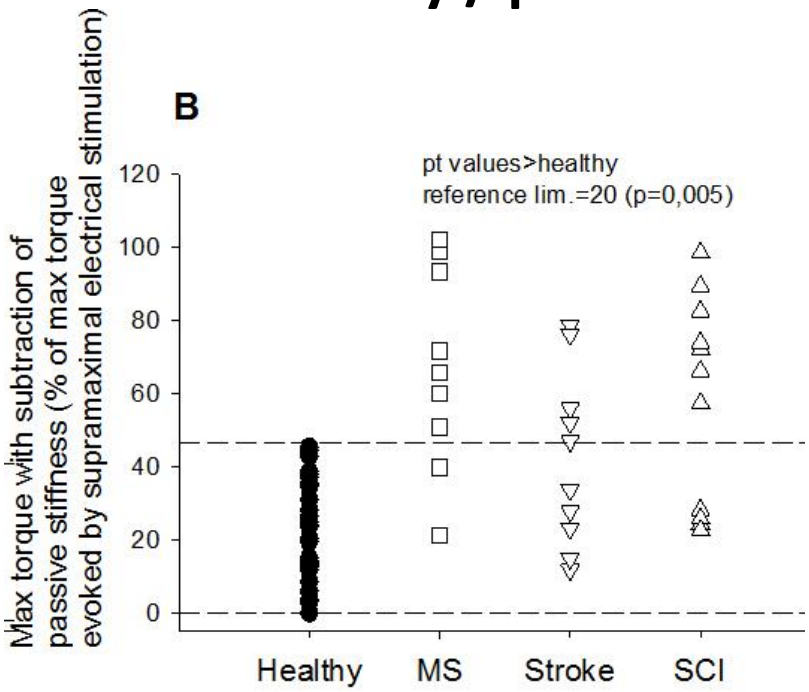
Kan skelne mellem refleksstivhed og kontraktur

Lorentzen et al 2010

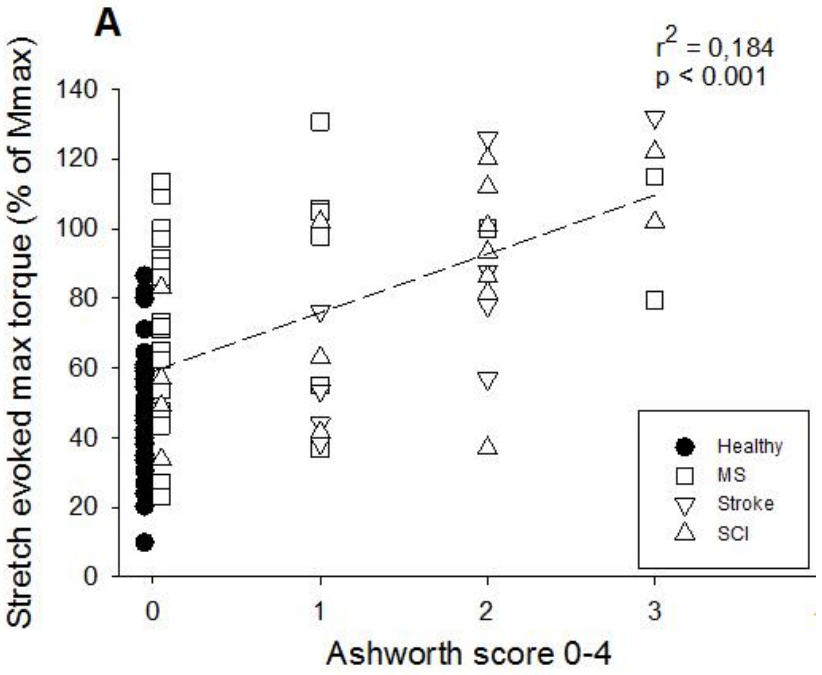
Bohannon and Smith 1987

Hvor gode er vi til at bestemme refleksstivhed – spasticitet?

Refleks healthy / patients



Refleks / Ashworth



Lorentzen et al 2010

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Hvad kan vi gøre?

Forbedre den kliniske diagnostik – ved brug af alternative metoder?

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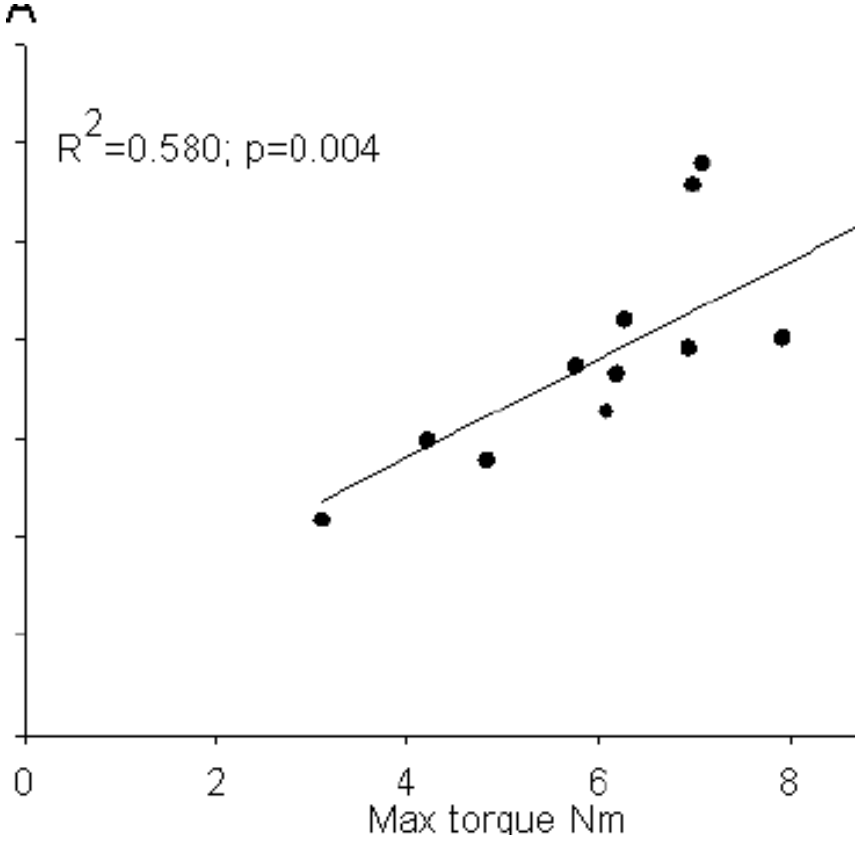
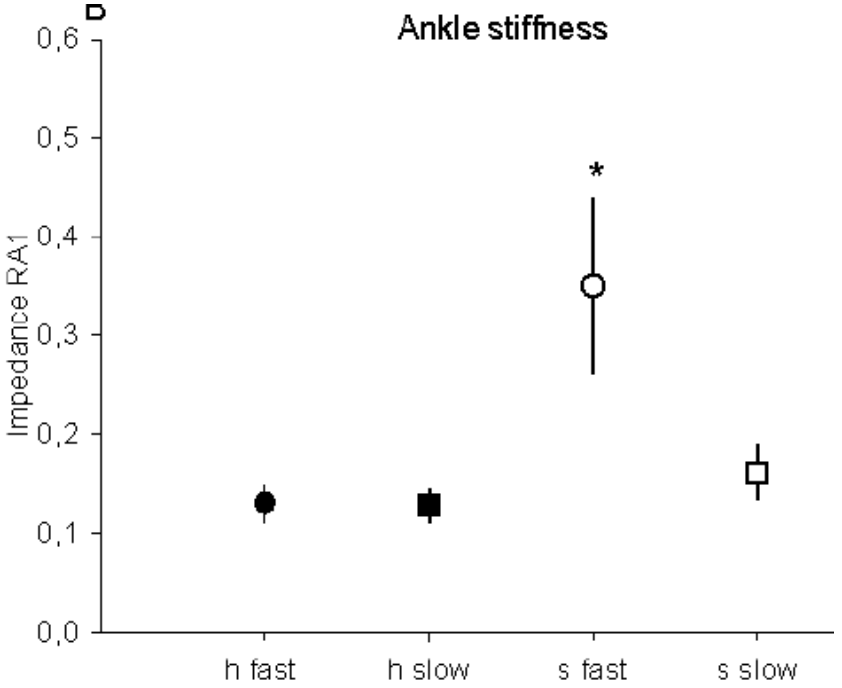
Hånd-holdt dynamometer resultater

Hånd holdt/ stationært dynamometer



Raske / spastiske



Lorentzen et al 2010

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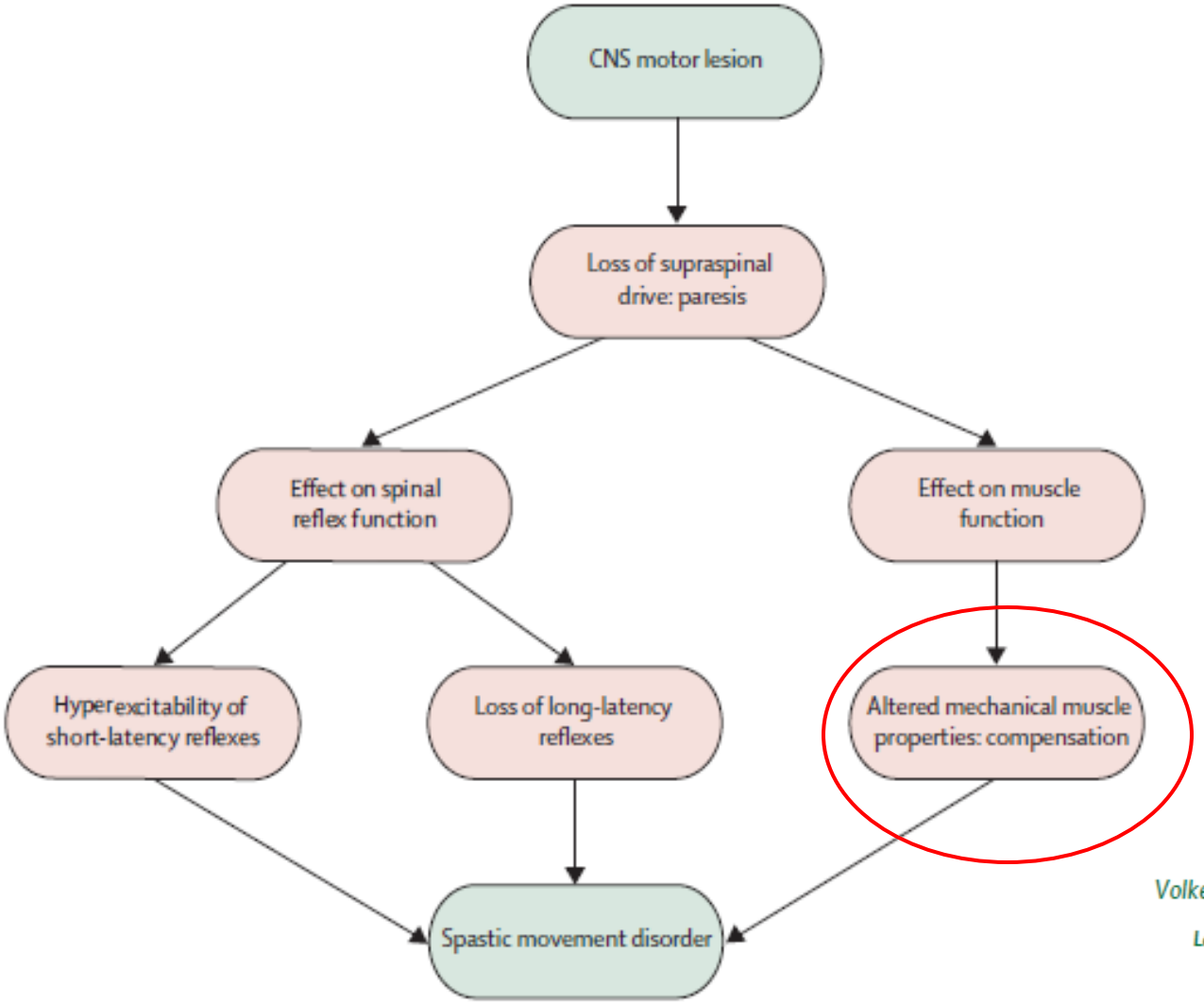
Behandling / Træning



Volker Dietz, Thomas Sinkjaer

Lancet Neurol 2007; 6: 725–33

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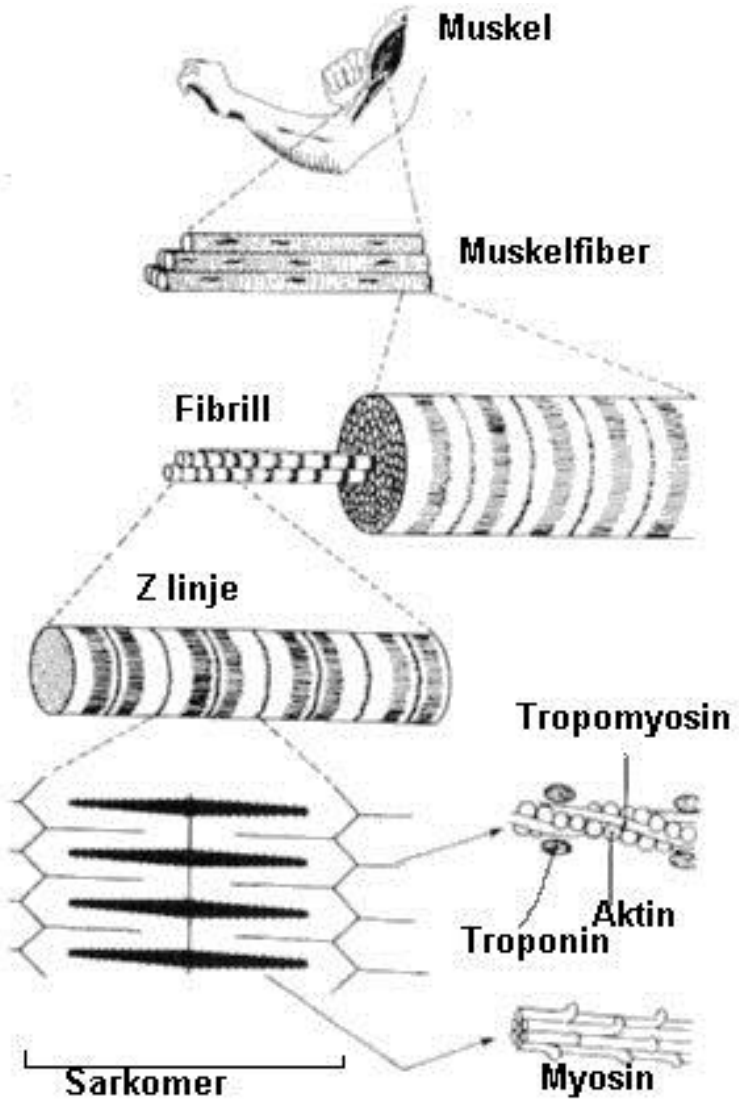
Hvordan trækker musklen sig sammen?
Hvordan forlænger musklen sig?

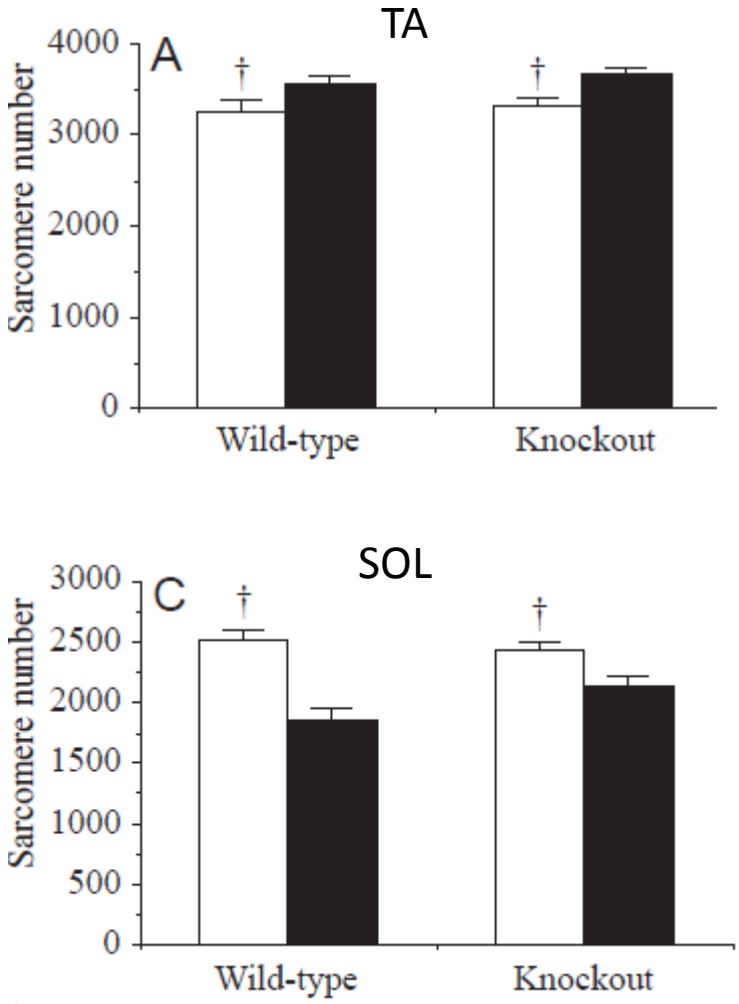


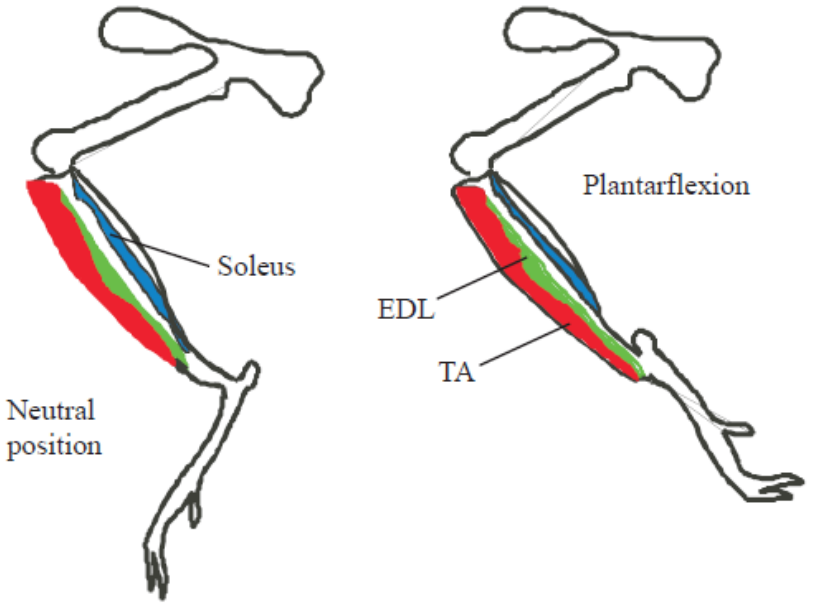
Kontrakturer

Arthrogenic changes	*Myogenic changes*
intra-articular adhesion formation	loss of sarcomeres in series
adaptive shortening of peri-articular dense connective tissue	↑ intramuscular collagen (endomysium & perimysium)
↓ lubrication between collagen fibres (producing micro-adhesions)	disuse atrophy: ↑ protein breakdown & ↓ synthesis
↑ synthesis and ↑ rate of collagen degradation=>↑ immature collagen	transformation of ST to FT muscle fibres
	degenerative changes at myotendinous junction
	actin-myosin cross-bridge linkages (possible ↓ rate of detachment during stretch)

Ref: Singer B et al. Reflex and non-reflex elemanet of hypertonia in triceps surae muscles following acquired brain injury: implications for rehabilitation. Disabil Rehab, 2001; vol.23 no.17, 749-757.

Ændring i antallet af sacromer





Ref: Shah SB et al. Sacromere number regulation maintained After immobilization in desmin-null mouse skeletal muscle. The Journal of experimental biology 204, 1703-1710 (2001).

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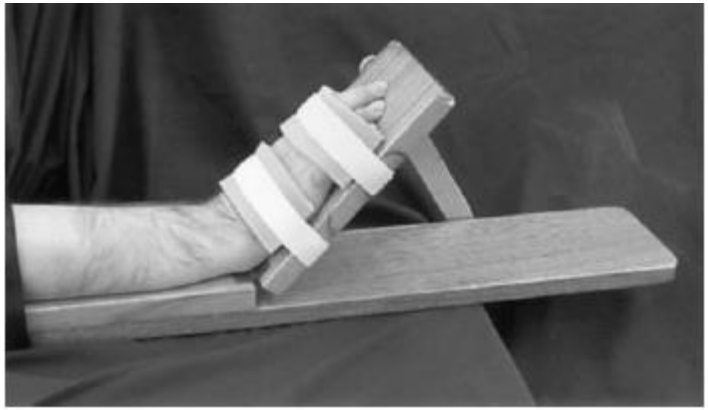
Behandling

- Evidens for øget ROM
- Ingen ændring i spasticitet
- Ikke øget funktionsniveau

Ref: Mortenson PA, Janice JE. The use of casts in the management of joint mobility And hypertonia following brain injury in Adults: a systematic review. Physical Therapy Vol 83 number 7, July 2003.

Behandling - udspænding



Ikke evidens for effekt.

- ”Four weeks of daily stretch has little or no effect on wrist contracture after stroke: a randomised controlled trial

Ref: Horsley SA et al. Four weeks of dayily stretch has little or no effect on wrist contracture after stroke: a randomised controlled trial. 2007 Australian Journal of physiotherapy 53: 239-245.

Anbefaling – langvarigt stræk > 20 min – 12 timer pr dag

Ref: Harvey LA, Herbert RD. Muscle stretching for treatment and prevention of contracture in people with spinal cord injury. Spinal Cord. 2002 Jan; 40(1):1-9.

Effectiveness of Stretch for the Treatment and Prevention of Contractures in People With Neurological Conditions: A Systematic Review

Owen M. Katalinic, Lisa A. Harvey, Robert D. Herbert

Background. Contractures are a disabling complication of neurological conditions that are commonly managed with stretch.

Objective. The purpose of this systematic review was to determine the effectiveness of stretch for the treatment and prevention of contractures. The review is part of a more-detailed Cochrane review. Only the results of the studies including patients with neurological conditions are reported here.

Data Sources. Electronic searches were conducted in June 2010 in the following computerized databases: Cochrane CENTRAL Register of Controlled Trials, Database of Abstracts of Reviews of Effects (DARE), Health Technology Assessment Database (HTA), MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), EMBASE, SCI-EXPANDED, and Physiotherapy Evidence Database (PEDro).

Study Eligibility Criteria. The review included randomized controlled trials and controlled clinical trials of stretch applied for the purposes of treating or preventing contractures in people with neurological conditions.

Study Appraisal and Synthesis Methods. Two reviewers independently selected studies, extracted data, and assessed risk of bias. The primary outcome measures were joint mobility (range of motion) and quality of life. Secondary outcome measures were pain, spasticity, activity limitation, and participation restriction. Meta-analyses were conducted using random-effects models.

Results. Twenty-five studies met the inclusion criteria. These studies provide moderate-quality evidence that stretch has a small immediate effect on joint mobility (mean difference=3°, 95% confidence interval [CI]=0° to 5°) and high-quality evidence that stretch has little or no short-term or long-term effects on joint mobility (mean difference=1° and 0°, respectively, 95% CI=0° to 3° and −2° to 2°, respectively). There is little or no effect of stretch on pain, spasticity, and activity limitation.

Limitations. No studies were retrieved that investigated the effects of stretch for longer than 6 months.

Conclusion. Regular stretch does not produce clinically important changes in joint mobility, pain, spasticity, or activity limitation in people with neurological conditions.

O.M. Katalinic, BAppSc(Physiotherapy), is Physiotherapist, Rehabilitation Studies Unit, Northern Clinical School, Sydney Medical School, University of Sydney, Sydney, New South Wales, Australia. This systematic review was done in partial fulfillment of the requirements for Mr Katalinic's Master of Philosophy (MPhil) degree, Sydney Medical School, University of Sydney.

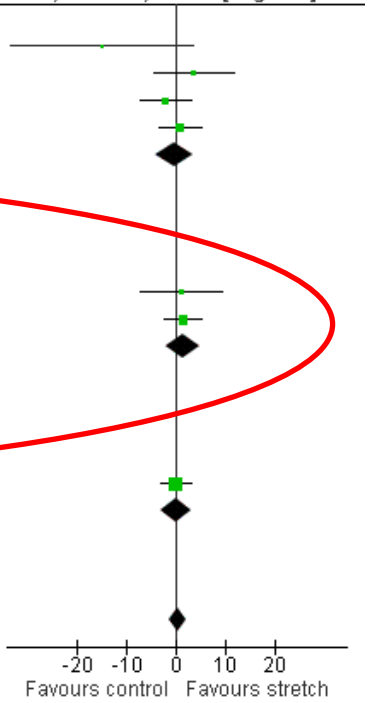
L.A. Harvey, BAppSc(Physiotherapy), GradDipAppSc(ExSpSc), MAppSc(Physiotherapy), PhD, is Associate Professor, Rehabilitation Studies Unit, Northern Clinical School, Sydney Medical School, University of Sydney, PO Box 6 Ryde, New South Wales, 2112, Australia. Address all correspondence to Dr Harvey at: l.harvey@usyd.edu.au.

R.D. Herbert, BAppSc(Physiotherapy), MAppSc(ExSpSc), PhD, is Associate Professor, Musculoskeletal Division, The George Institute for Global Health, Sydney, New South Wales, Australia.

[Katalinic OM, Harvey LA, Herbert RD. Effectiveness of stretch for the treatment and prevention of contractures in people with neurological conditions: a systematic review. *Phys Ther.* 2011;91:11–24.]

Ledmobilitet - langtidseffekt

Study or Subgroup	Stretch Mean [degrees]	Stretch SD [degrees]	Stretch Total	Control Mean [degrees]	Control SD [degrees]	Control Total	Weight	Mean Difference IV, Random, 95% CI [degrees]
3.1.1 Stroke								
Gustafsson 2006	33.8	24.1	16	48.9	27.1	14	1.0%	-15.10 [-33.57, 3.37]
Horsley 2007	3.5	12.47481	18	0	12.81665	19	5.0%	3.50 [-4.65, 11.65]
Lannin 2003	0	7.504182	16	2	6.222139	11	12.2%	-2.00 [-7.20, 3.20]
Lannin 2007	0.8	6.857155	20	0	6.857155	20	18.3%	0.80 [-3.45, 5.05]
Subtotal (95% CI)			**70**			**64**	**36.4%**	**-0.32 [-4.09, 3.44]**
Heterogeneity: Tau² = 3.70; Chi² = 3.87, df = 3 (P = 0.27); I² = 24%								
Test for overall effect: Z = 0.17 (P = 0.87)								
3.1.2 Cerebral palsy								
Ackman 2005	10	7	12	9	11	9	4.9%	1.00 [-7.21, 9.21]
McNee 2007	-1	4.071821	9	-2.45	4.071821	9	23.3%	1.45 [-2.31, 5.21]
Subtotal (95% CI)			**21**			**18**	**28.2%**	**1.37 [-2.05, 4.79]**
Heterogeneity: Tau² = 0.00; Chi² = 0.01, df = 1 (P = 0.92); I² = 0%								
Test for overall effect: Z = 0.79 (P = 0.43)								
3.1.3 Spinal cord injury								
Harvey 2000	0	4.117218	14	0	4.117218	14	35.4%	0.00 [-3.05, 3.05]
Subtotal (95% CI)			**14**			**14**	**35.4%**	**0.00 [-3.05, 3.05]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.00 (P = 1.00)								
Total (95% CI)			**105**			**96**	**100.0%**	**0.32 [-1.50, 2.13]**
Heterogeneity: Tau² = 0.00; Chi² = 4.49, df = 6 (P = 0.61); I² = 0%								
Test for overall effect: Z = 0.34 (P = 0.73)								



Katalinic 2010, Cochrane review

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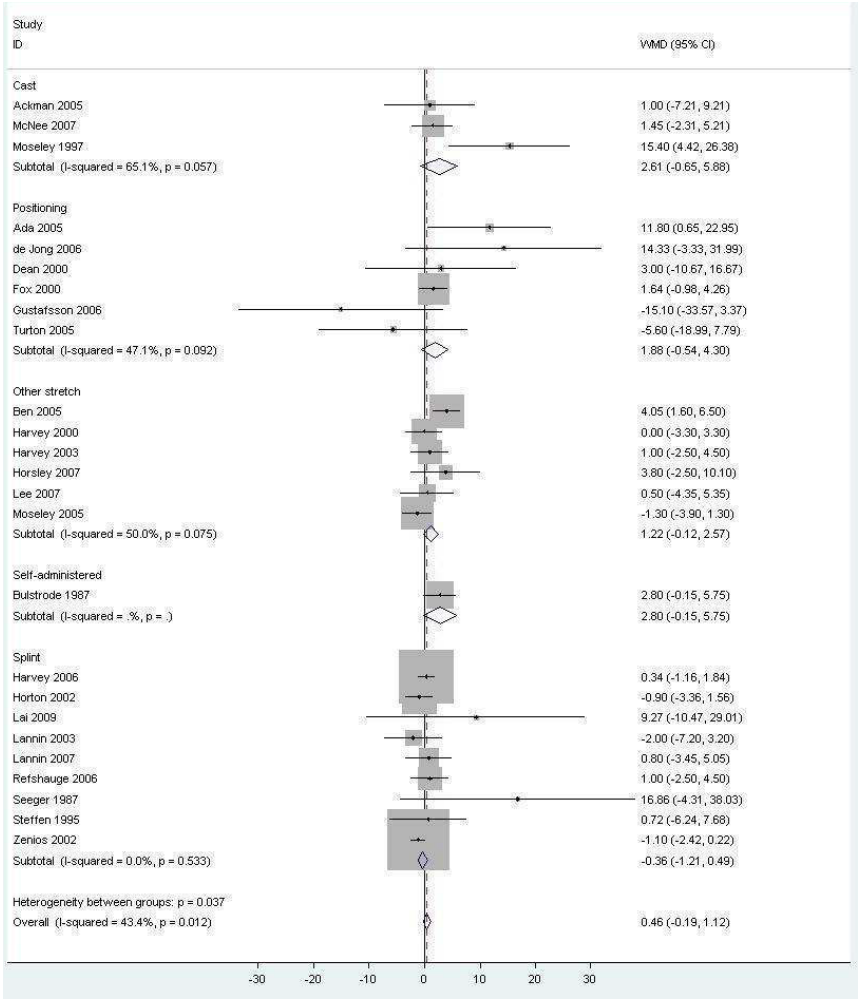
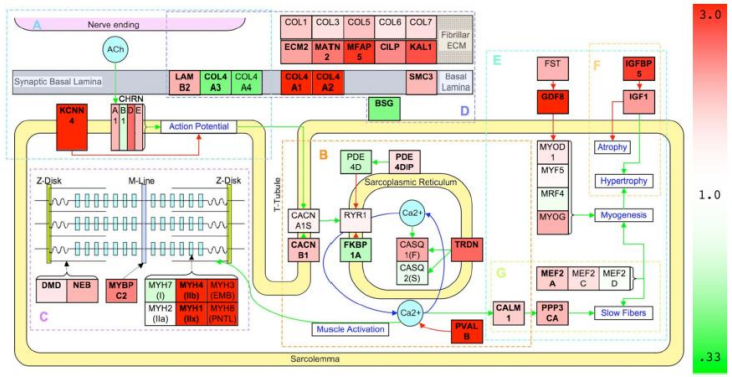
Ledmobilitet – forskellige interventioner



Katalinic 2010, Cochrane review

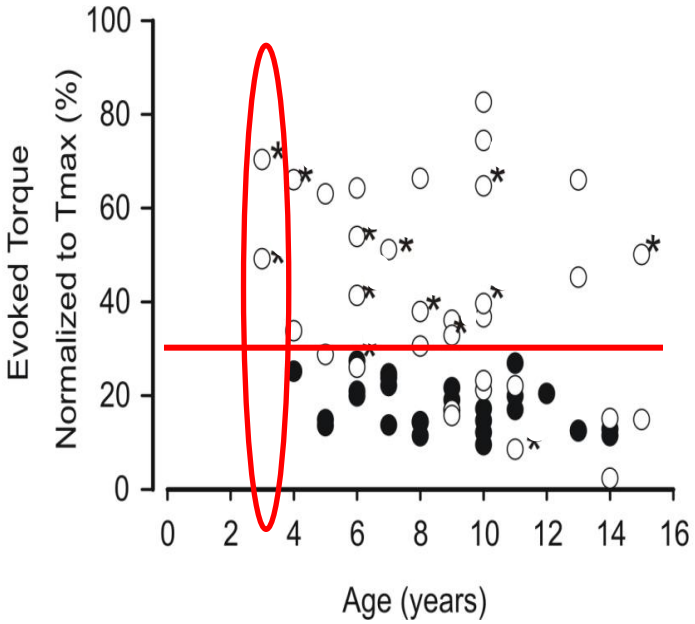
Kontrakturer udvikler sig over uger

Forøget dannelse af bindevæv efter få dage

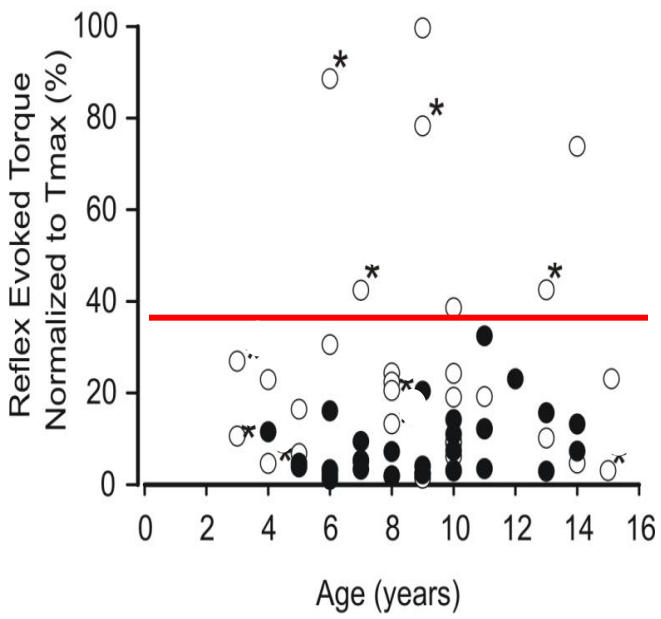


Passive stiffness increased already at 3 years of age

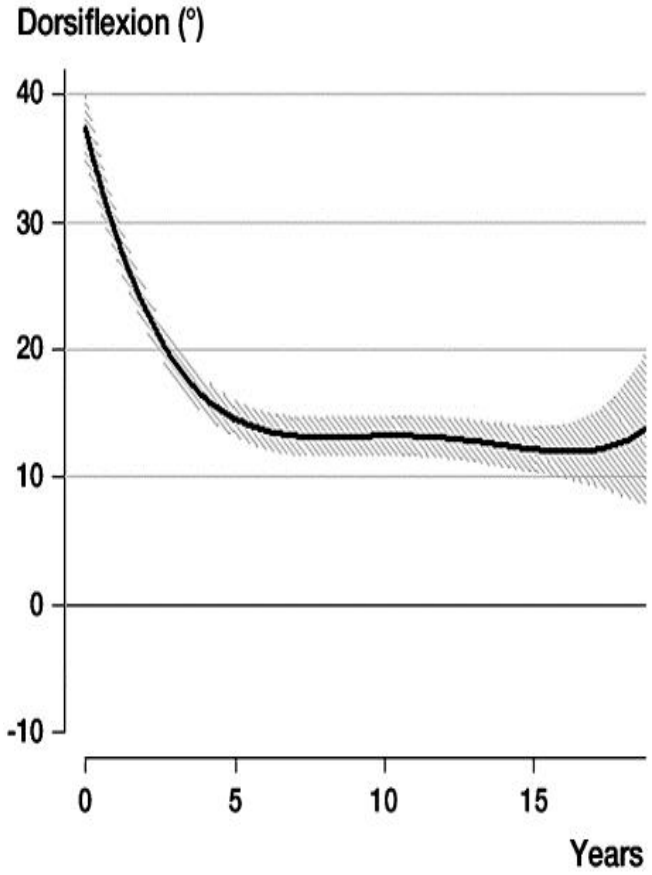
Passive Stiffness vs Age



Reflex Stiffness vs Age



Reduced ankle range of movement within first 3-4 years



Hagglund et al. 2011

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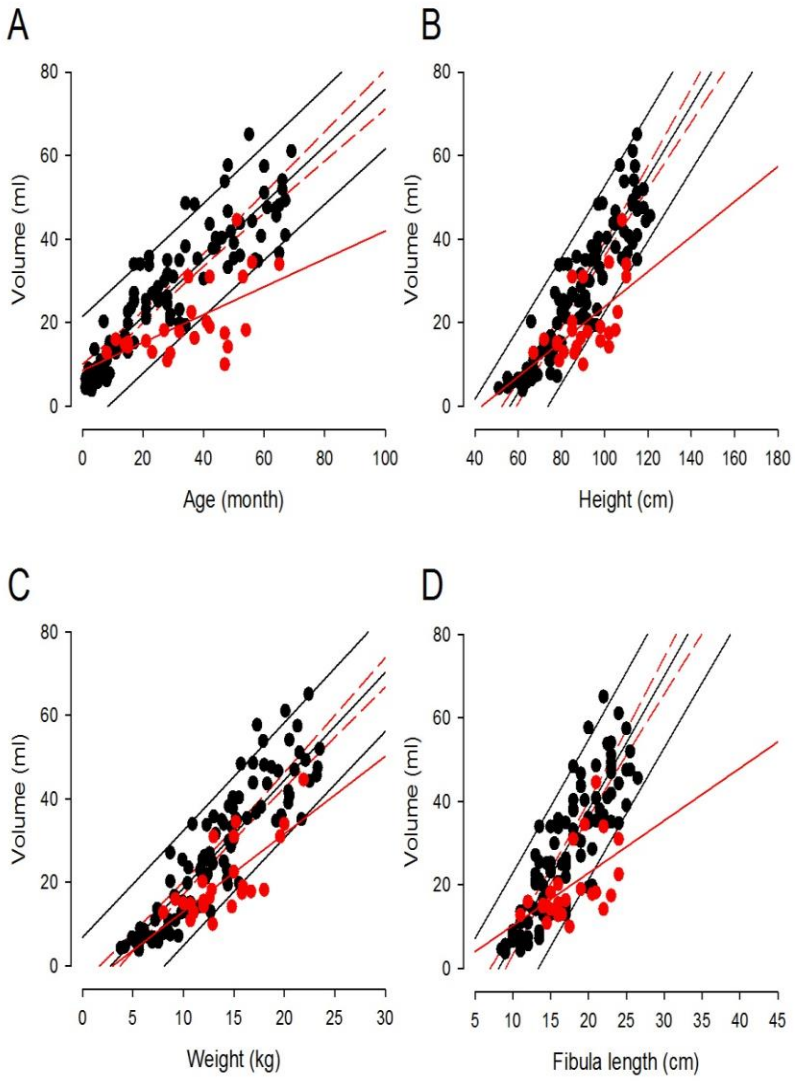
Muscle volume does not grow to same extent in children with CP as compared to typically developing children

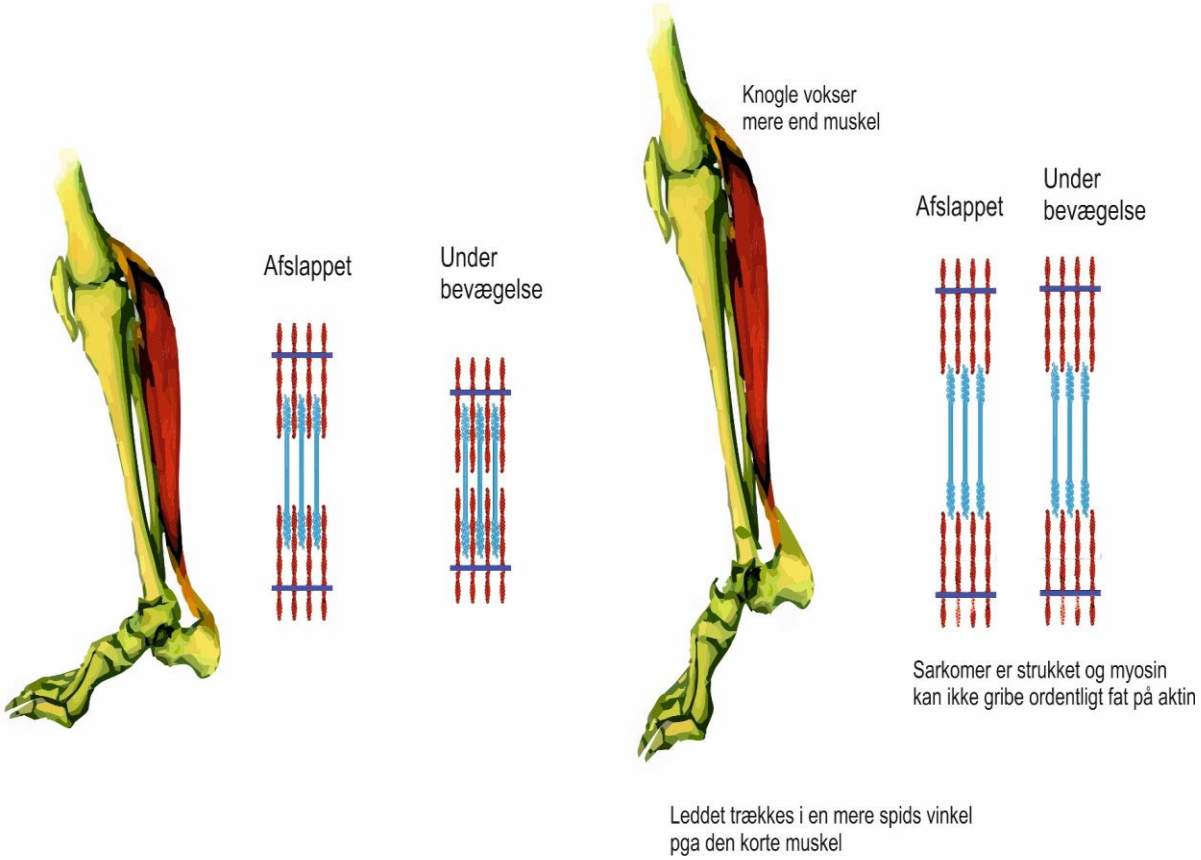


Herskind et al 2015

Lack of muscle growth probably plays a central role in development of contractures

Child before development of contracture

Older child after development of contracture



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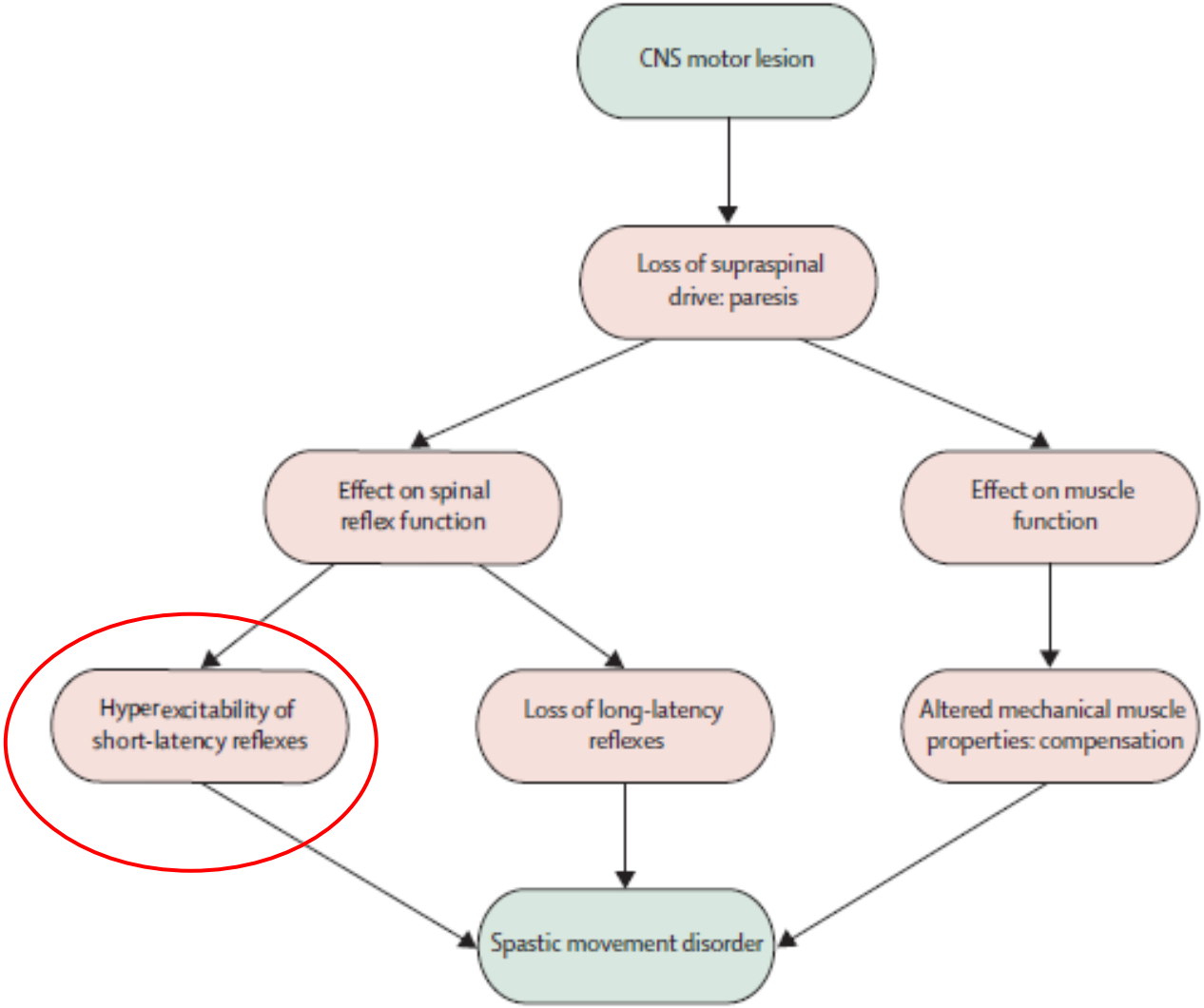
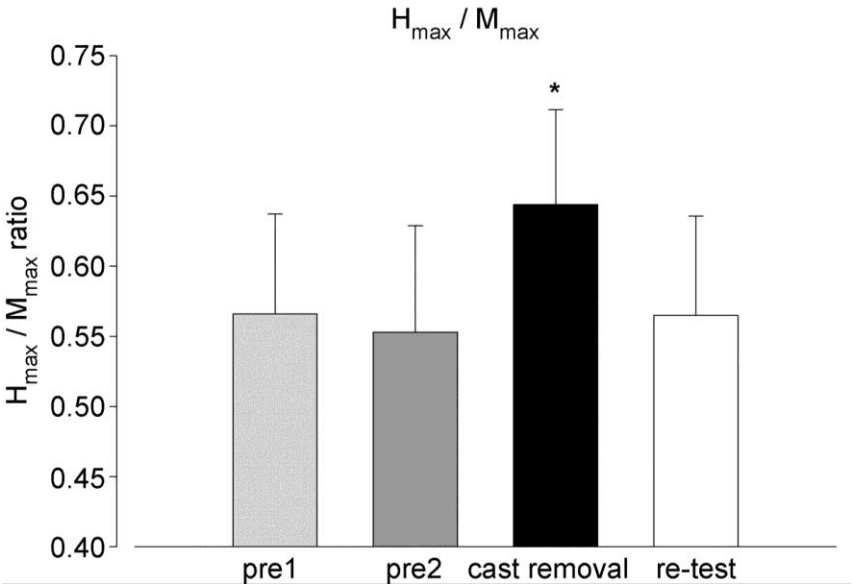
Behandling / Træning



Volker Dietz, Thomas Sinkjaer

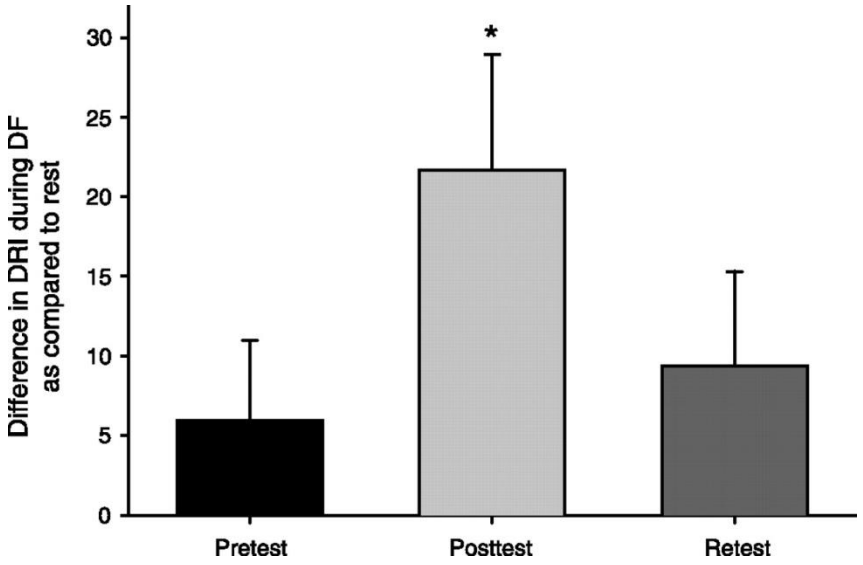
Lancet Neurol 2007; 6: 725–33

Immobilisering / refleks



Lundbye-Jensen J, Nielsen JB.
J Physiol. 2008 Sep 1;586(Pt 17):4121-35. Epub 2008 Jul 3.

Træning / Disynaptic reciprocal inhibition

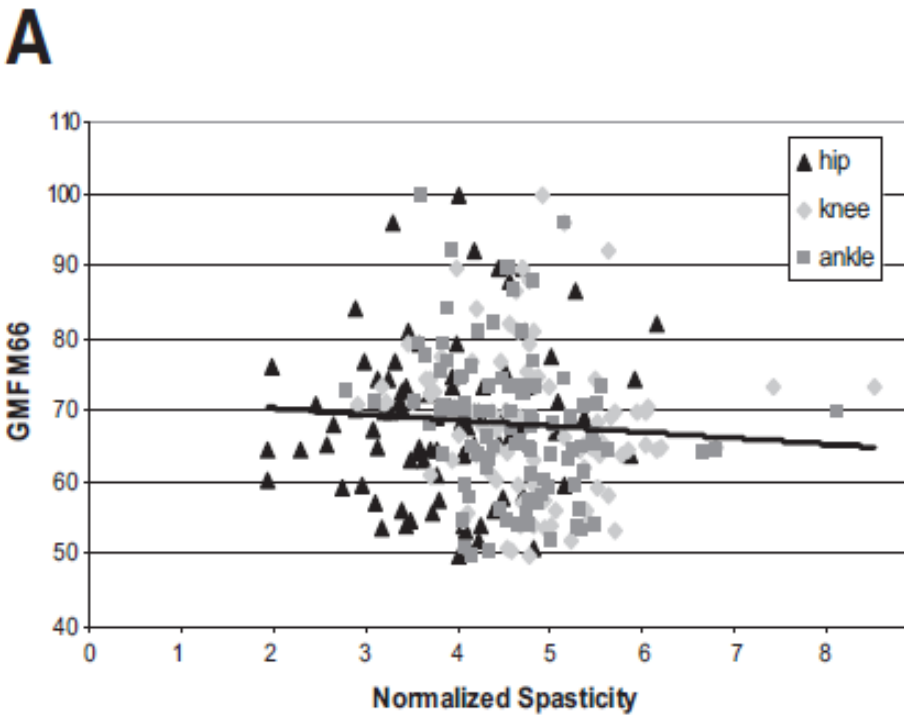


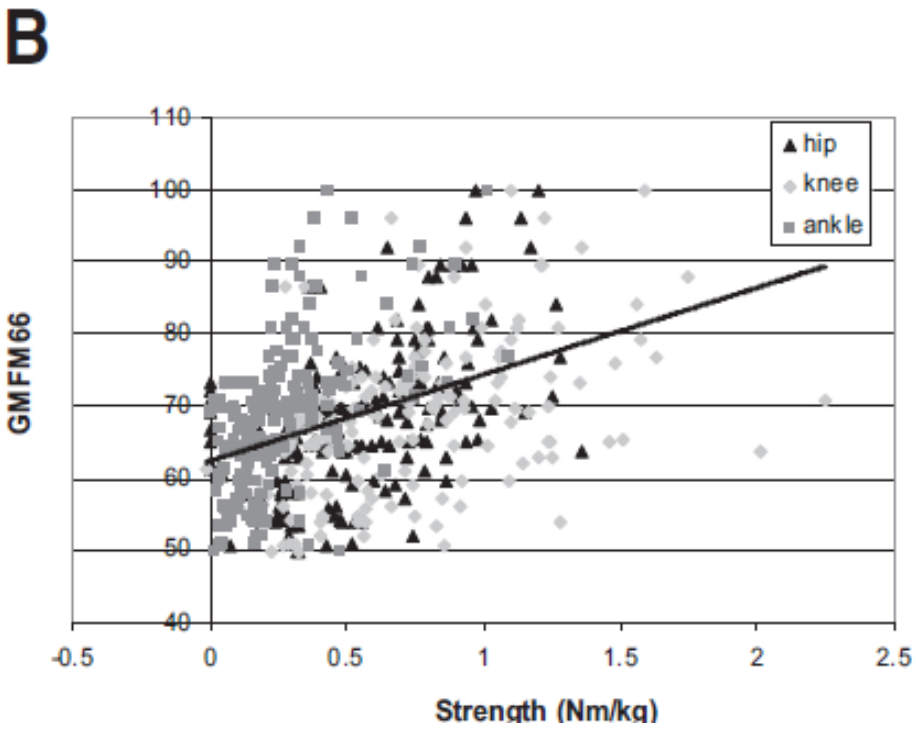
Geertsen SS, Lundbye-Jensen J, Nielsen JB.
J Appl Physiol. 2008 Sep;105(3):915-22. Epub 2008 Jun 26.

Cerebral Parese

Spasticitet / Funktionsniveau

Styrke / Funktionsniveau





Sandy A. Ross, PT, DPT, MHS, PCS, Jack R. Engsberg, PhD

Relationships Between Spasticity, Strength, Gait, and the GMFM-66 in Persons With Spastic Diplegia Cerebral Palsy

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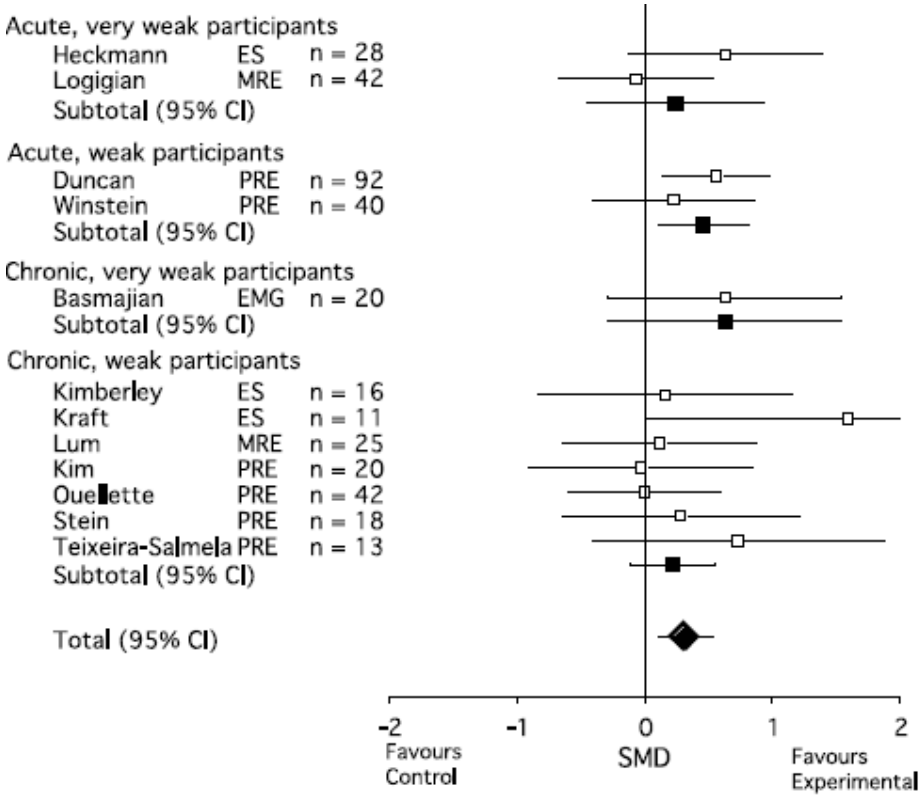
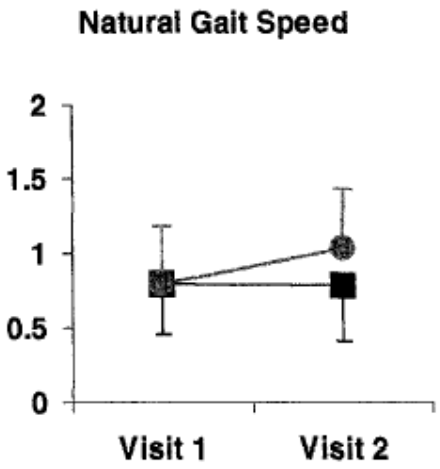
Apopleksi

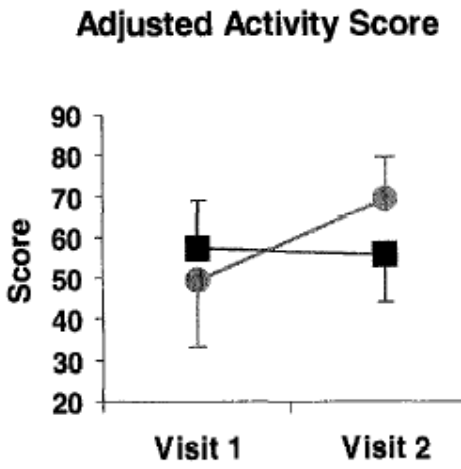
Styrke



Ada L, Dorsch S, Canning CG.
Aust J Physiother. 2006;52(4):241-8. Review.

Funktionsniveau





Kilde: Teixeira-Salmela LF.Muscle stregthening and Physical Conditioning to Reduce Impairment and Disability in Chroic Stroke Survivors. Arch Phys Med Rehabil Vol 80, Oct 1999.

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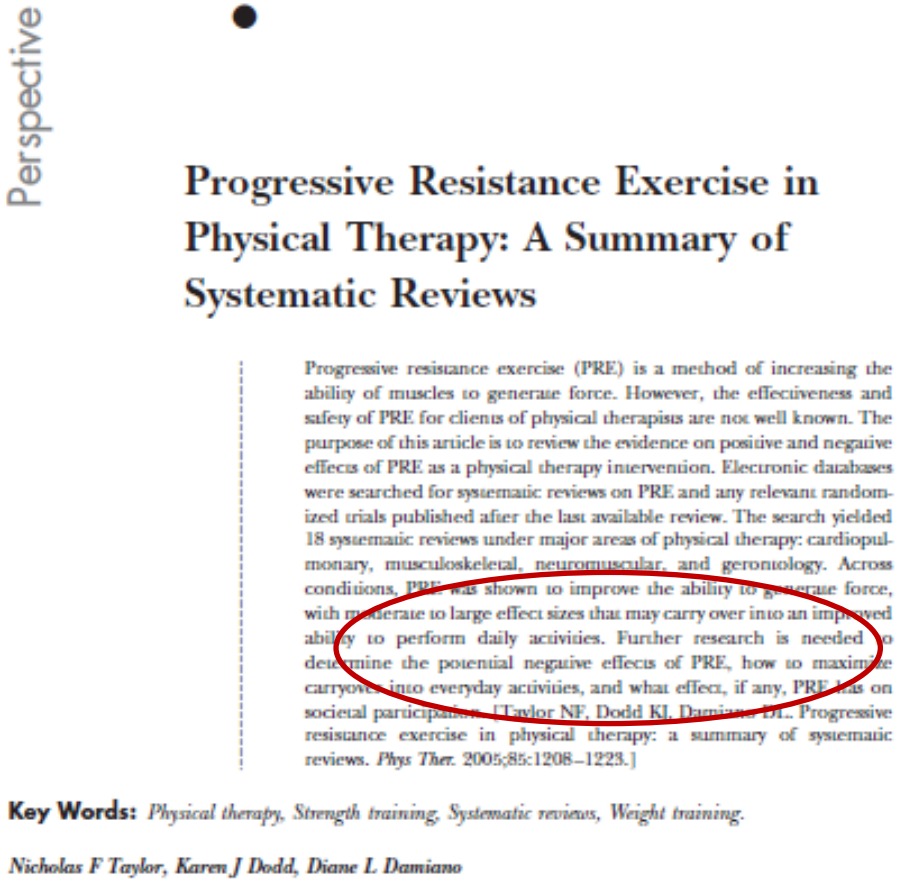

Perspective

Progressive Resistance Exercise in Physical Therapy: A Summary of Systematic Reviews

Progressive resistance exercise (PRE) is a method of increasing the ability of muscles to generate force. However, the effectiveness and safety of PRE for clients of physical therapists are not well known. The purpose of this article is to review the evidence on positive and negative effects of PRE as a physical therapy intervention. Electronic databases were searched for systematic reviews on PRE and any relevant randomized trials published after the last available review. The search yielded 18 systematic reviews under major areas of physical therapy: cardiopulmonary, musculoskeletal, neuromuscular, and gerontology. Across conditions, PRE was shown to improve the ability to generate force, with moderate to large effect sizes that may carry over into an improved ability to perform daily activities. Further research is needed to determine the potential negative effects of PRE, how to maximize carryover into everyday activities, and what effect, if any, PRE has on societal participation. [Taylor NF, Dodd KJ, Damiano DL. Progressive resistance exercise in physical therapy: a summary of systematic reviews. *Phys Ther.* 2005;85:1208–1223.]

Key Words: *Physical therapy, Strength training, Systematic reviews, Weight training.*

Nicholas F Taylor, Karen J Dodd, Diane L Damiano

Across conditions, PRE was shown to improve the ability to generate force, with moderate to large effect sizes that may carry over into an improved ability to perform daily activities.

Neurodynamik

Neurodynamics is no different from random passive movements in reducing spasticity.

[1,2]Jakob Lorentzen, [1]Dorthe Nielsen, [1]Karl Holm, [1]Susanne Baagø, [2, 3]Michael J. Grey, [2,3]Jens B. Nielsen

REGION H

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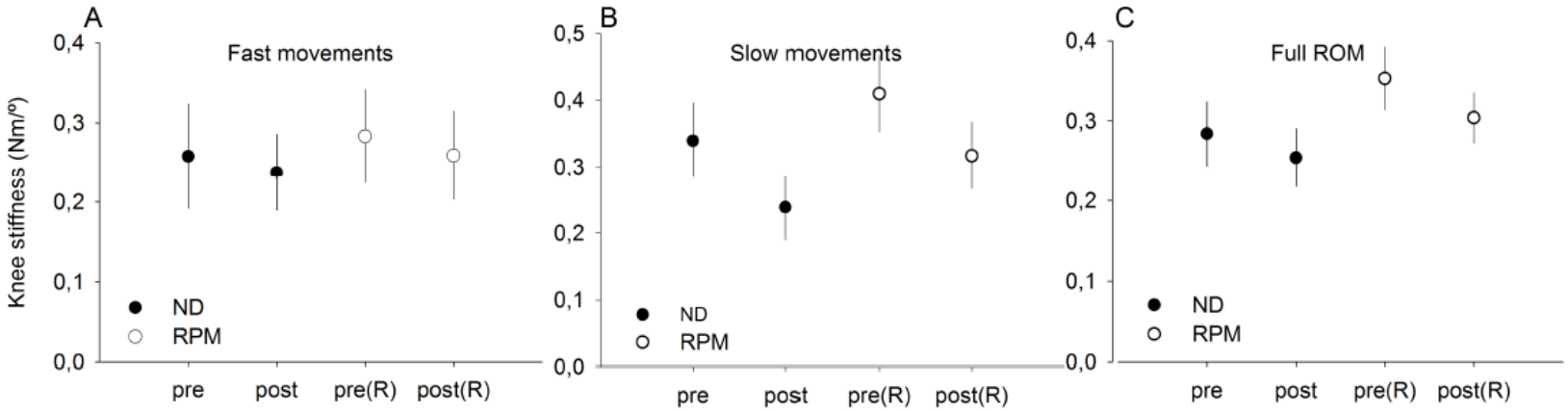
Ændring i stivhed og ROM

Objective stiffness measurements



Lorentzen et al 2012
Disability and Rehabilitation

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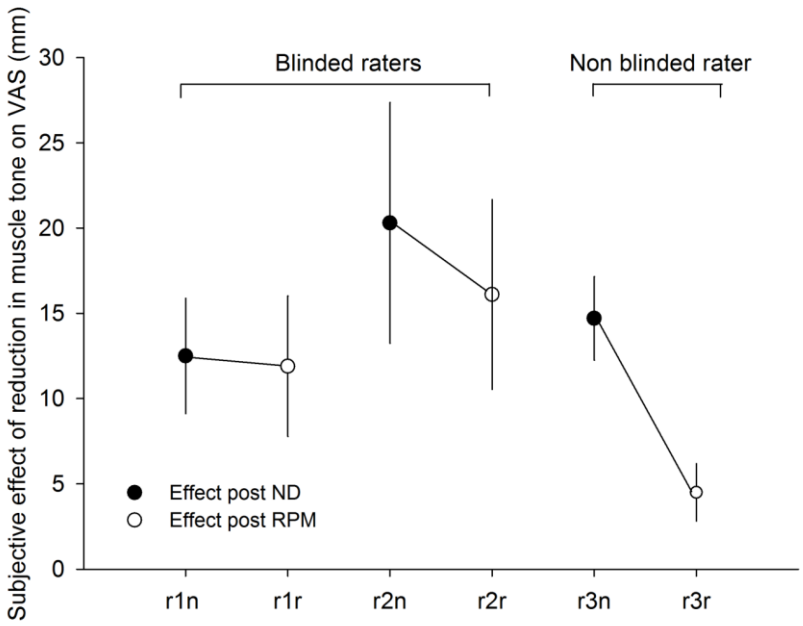
Subjektivt bestemt stivhed



Conclusion

- An objective evaluation of the ND demonstrates that it [illegible]se spasticity-[illegible]e ROM with [illegible]s random [illegible]ent.

Og måske mange forskellige andre aktiviteter??

Lorentzen et al 2012
Disability and Rehabilitation

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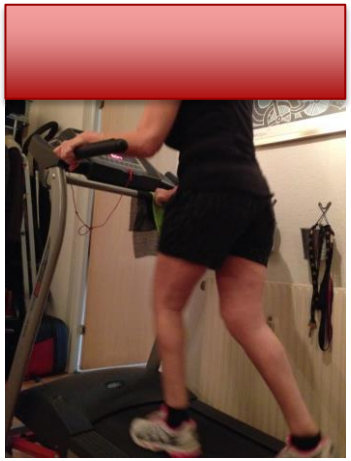
gangtræningsprojekt

The participants in the training group trained on average:
29.3 SD 1.6 minutes pr day for
34 SD 9.5 days (16.6 training hours)

The average initial speed of gait during the training was **3.1 km/hr** with an average increase of **1.3 km/hr** during the 6 weeks of training.

The average initial incline of the treadmill was **5.5 SD 2.4º** with an increase of **5.4 SD 2.2º** during the training period.



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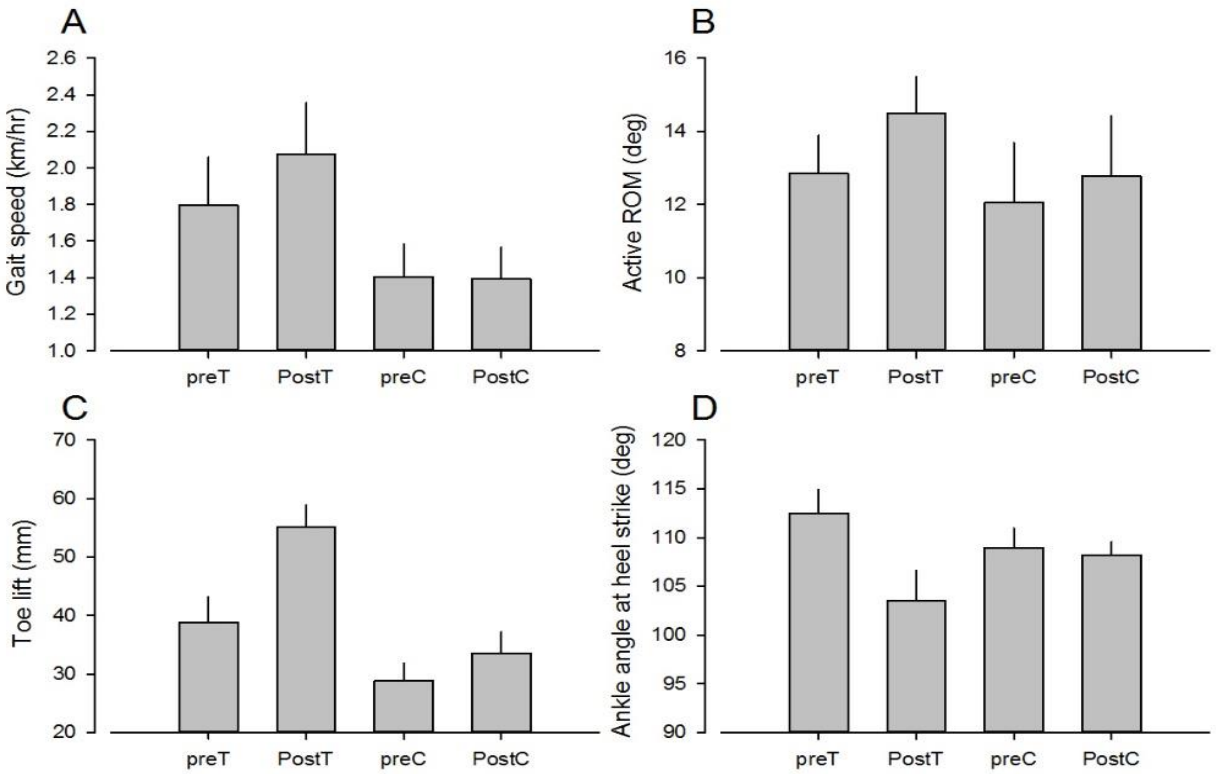
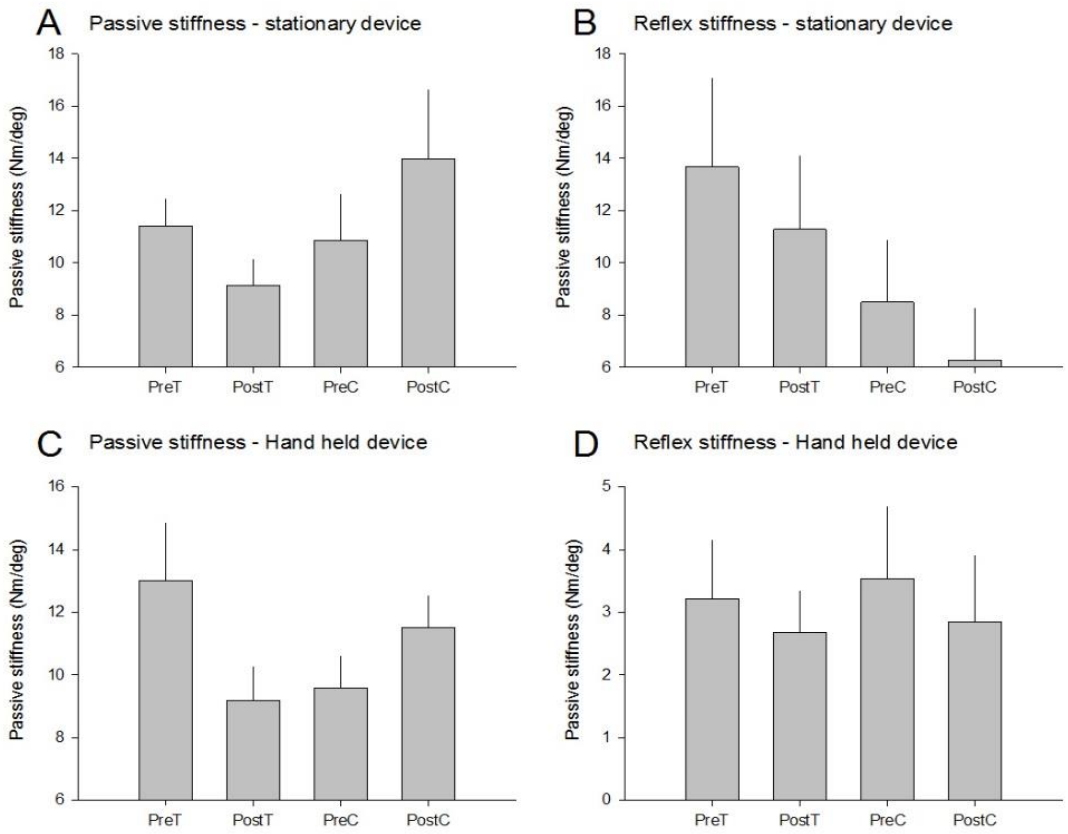
Gaittraining in adults with cp



Lorentzen et al. 2016

Gaittraining in adults with cp



Lorentzen et al. 2016

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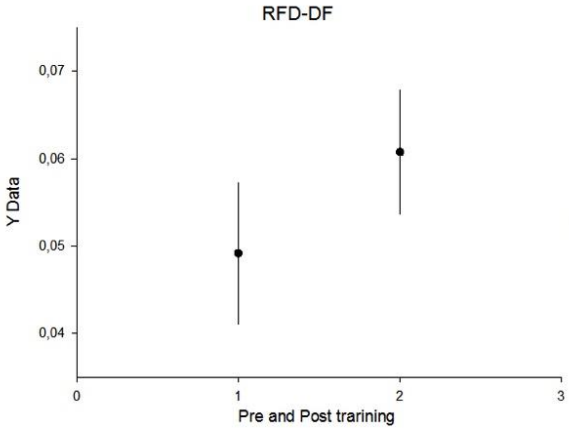

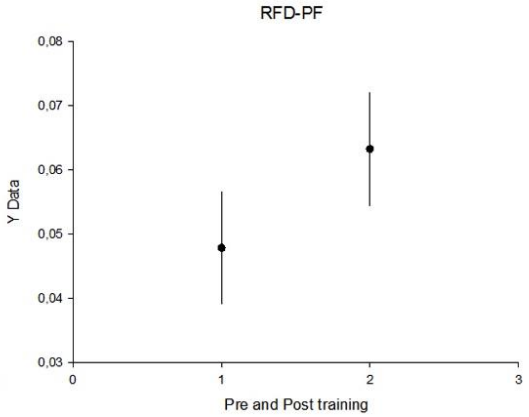

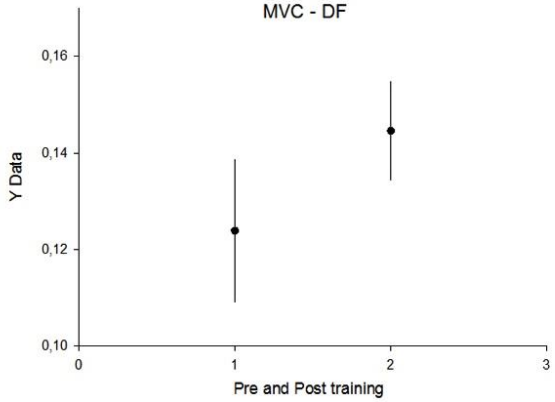

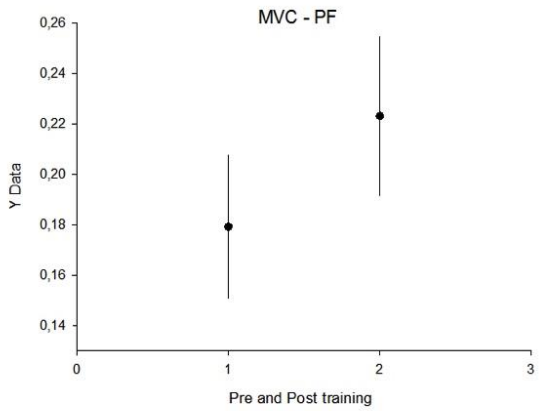

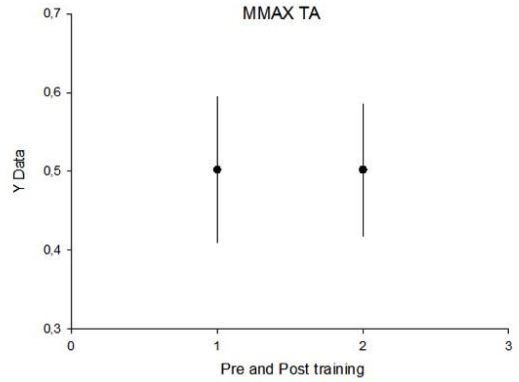

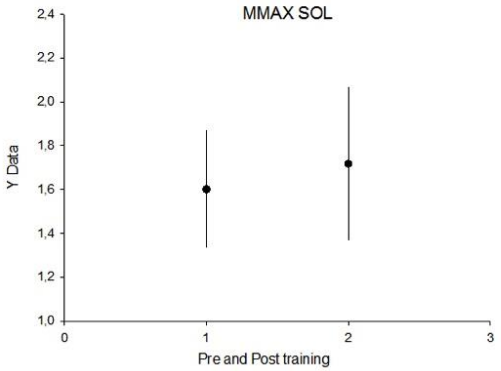

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Klatring

Motiverende aktivitet

	Total duration	Physical activity	Very vigorous	Vigorous	Moderate	*Light*	*Sedentary*
All (N=17)	02:32:42	**01:45:32**	00:00:04	00:14:39	01:30:49	*00:46:42*	*00:00:28*
CP (N=11)	02:33:38	**01:45:27**	00:00:05	00:14:27	01:30:55	*00:48:00*	*00:00:11*
TD (N=6)	02:31:00	**01:45:40**	00:00:00	00:15:00	01:30:40	*00:44:20*	*00:01:00*

Forbedrer ROM

Ankle joint	cp pre-post	TD pre-post
Stiffness[2]	Z=-1.002, p=0.533	Z=0.379, p=0.913
ROM[2]	Z=2.764, **p=0.0114***	Z=1.019, p=0.5214
Strength[3]	Z=1.387, p=0.304	Z=-1.476, p=0.260

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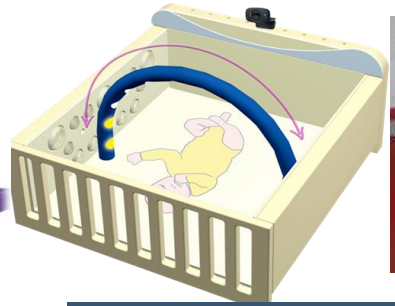
Schram Christensen et al 2016
- Paper in progress

Therefore less passive training / treatment

and much more activity



Tak for idag

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