

# Aquatic Physical Therapy for the trunk

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# Questions



- How active is the trunk in water?
- Is trunk activity in water helpful for LBP patients?
  - Can WST be related to core stabilization techniques like Pilates?



# How active is the trunk in water?



- We do not know!
- The trunk is active however
  - We can see and palpate trunk muscle activity during trunk exercises
  - Patients feel abdominals during trunk exercises
  - One can observe “active trunks”



# Is trunk activity helpful for LBP patients?



- Tulder M et al, Cochrane review, 2004:
- No indication that specific exercises are effective for the treatment of chronic LBP. Exercises help however to start the normal ADL again.
- What about AP and are conclusions supported by guidelines?

# Guidelines (1)



- It is unclear what kind of exercise is best, therefore it is recommended to offer a varied exercise programme, which suits the needs of the patient.
- Exercising (in water) according behavioral principles seems good for patients with chronic LBP.
- There is moderate evidence for AP in chronic LBP.
  - Guideline CLBP: KNGF 2003 (Netherlands)



# Guidelines (2)



- Consensus report “Pain rehabilitation in the Netherlands”
  - Pijn Kennis Centrum Maastricht 2005
- Hydrotherapy is mentioned as an intervention to increase endurance, mobility and strength for patients with aspecific CLBP.



# Guidelines (3)



- Low back: lumbar & thoracic guideline
  - National Guideline Clearinghouse USA '07
  - Aquatic therapy as an optional form of exercise therapy is recommended
- European guideline for prevention of LBP '04
  - Water exercise may be recommended to reduce LBP and work loss during and following pregnancy



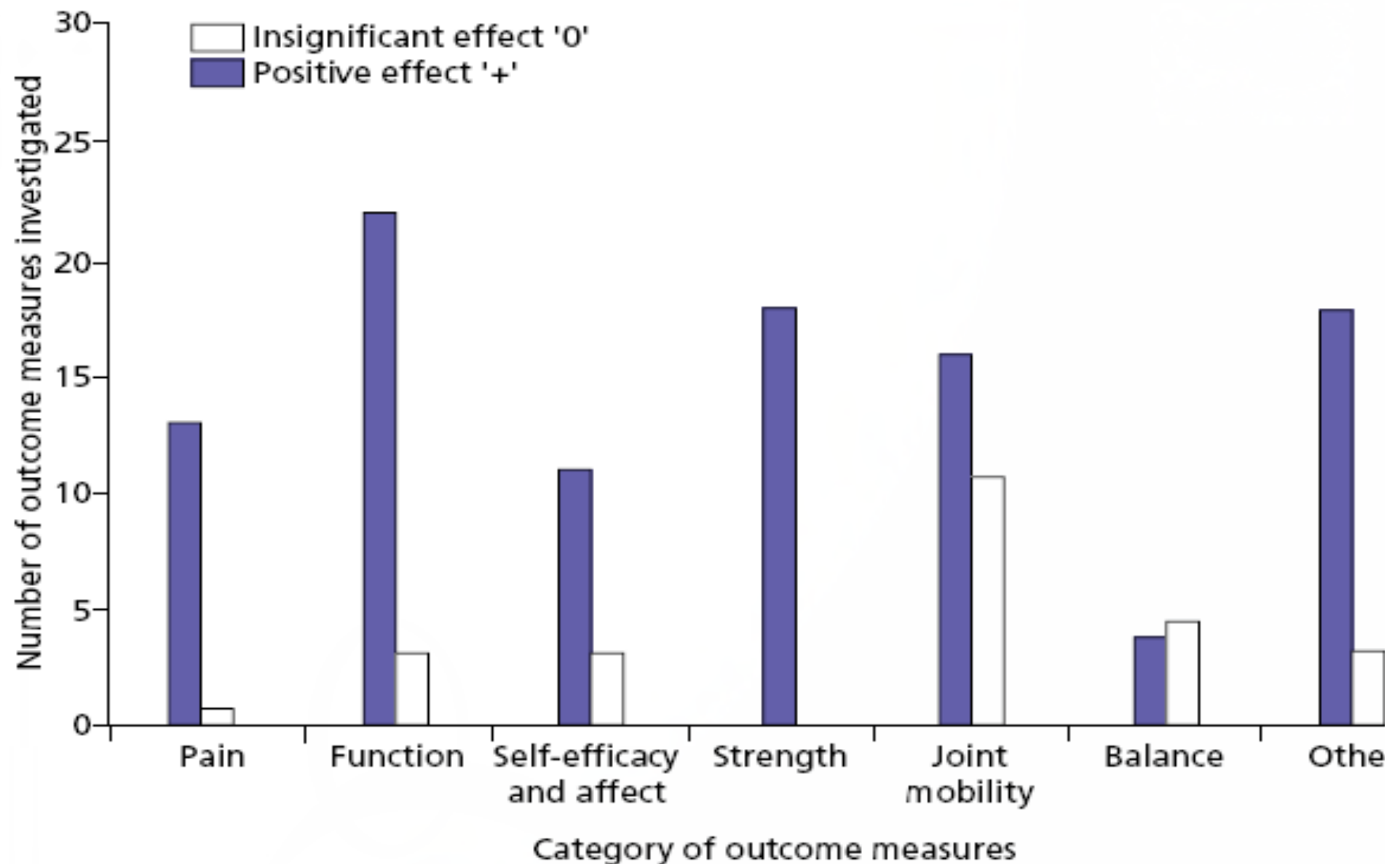
# Systematic reviews (1)



- Jenny Geytenbeek concluded in 2002:
- The balance of high to moderate quality evidence supported benefit from hydro in pain, function, self-efficacy and affect, ROM, strength and balance, esp among older adults, subjects with rheumatic conditions and chronic low back pain







**Fig 2: Hydrotherapy effect on outcome measures in high and moderate quality trials** Geytenbeek 2002

# Systematic reviews (2)



- Based on evidence, active AP is potentially beneficial for patients with (pregnancy related) LBP. Not better than other interventions.
- Studies did not report negative effects
- We need better prove of more robust and high quality RCT's with good homogeneity.
  - Waller B, Lambeck J & Daly D. Therapeutic aquatic exercise in the treatment of low back pain: a systematic review. accepted in Clinical Rehabilitation.

# Included RCT's



- Sjögren 1997: aspecific LBP, disc degen
- McIlveen 1998: LBP & leg pain, disc
- Kihlstrand 1999: LBP pregnancy
- Schrepfer 2000: acute LBP
- Saggini 2004: LBP disc problem
- Yozbatiran 2004: LBP, no neuro
- Granath 2006: LBP/pelvic, pregnancy

# RCT's exercise descriptions



- Aquatic exercise with Lx ROM, strength and endurance
- 60 min active therapy: strength, flexibility and endurance
- 30 min exercise, 30 min relaxation
- Deep water walking
- 3 stage progressive programme
- Light aerobic ex, stretching, cool down

# No specific exercises?



- When we train functions like muscle power, endurance and mobility, physiological principles should be used.
  - KNGF guideline CLBP 2003, page 6



# ACSM 2003



## Lower Back Pain Syndrome: Exercise Programming

Modes	Goals	Intensity/ Frequency/Duration
<b>Strength</b> <ul style="list-style-type: none"> <li>• Resistance abdominal strengthening</li> <li>• Back extensions</li> </ul>	<ul style="list-style-type: none"> <li>• Increase abdominal strength</li> <li>• Increase lumbar extensor strength</li> </ul>	<ul style="list-style-type: none"> <li>• &gt; age 50: 10-15 reps/day</li> <li>• &lt; age 50: 8-12 reps/day</li> <li>• &gt; 2 days/wk</li> </ul>
<b>Flexibility</b> <ul style="list-style-type: none"> <li>• Any standard flexibility exercises that do not increase LBP</li> </ul>	<ul style="list-style-type: none"> <li>• Increase trunk and hip flexor and extensor ROM</li> </ul>	<ul style="list-style-type: none"> <li>• 2 min/mu 3 reps, 10</li> </ul>
<b>Functional</b> <ul style="list-style-type: none"> <li>• 5-min walk</li> <li>• 1-min chair sit and stand</li> </ul>	<ul style="list-style-type: none"> <li>• Increase/maintain ADLs</li> </ul>	<ul style="list-style-type: none"> <li>• Brisk walk, 3-5 days/wk</li> <li>• Chair sit and stand, 2-3 days/wk</li> </ul>

**Core  
stabilization**

# Variables for strength training



- 50 % of 1 RM or 70 % of 3 maximal repetition
- 1 - 3 series of 2 - 12 repetitions
- 20 - 40 minutes
- 2 - 3 days a week
- 2 to 3 months
  - ( Bloomfield, 1997, Minor & Kay, 2003 )



# Core stabilization?



- How to do this?
- Certain professionals support the focus on local stabilizers (transversus abdominus and multifidus). Others advocate a general programme of dynamic trunk stabilization.
  - Standaert, APMR 2007





# EMG studies (1)



## ■ Leinonen, APMR 2000

- Activity of the gluteus maximus during flex-ext when stooping is decreased in CLPB. Training can increase function and normalize the lumbo-pelvic rhythm.
  - Can we train the Gluteus maximus in water?

## ■ Vezina, APMR 2000

- Supine abdominal “hollowing” gives an EMG signal of the erector spinae, multifidus, rectus abdominis and obliquus ext. None of the signals reached adequate values for strengthening.
  - Can we achieve adequate values in water?

# EMG studies (2)



- Newcomer, APMR 2002
  - LBP patients show less rectus abdominus activity during balance perturbations than controls
    - Can we facilitate rectus activity in water?
- Healy, APMR 2005
  - Despite a fast atrophy after a back episode, EMG activity of paraspinals has shown to be increased in CLBP patients.
    - Can we modify this (do we want?) in water?

# EMG studies (3)



- Extension and flexion strength levels are decreased in comparison with controls
- Extension / flexion strength ratio is diminished
- Muscular endurance is diminished
- Cross-sectional area of the lumbar spine region is decreased
- > strength recommendations: ACSM

•Tarmanen SP et al, Arch Phys Med Rehabil: 89, 2008

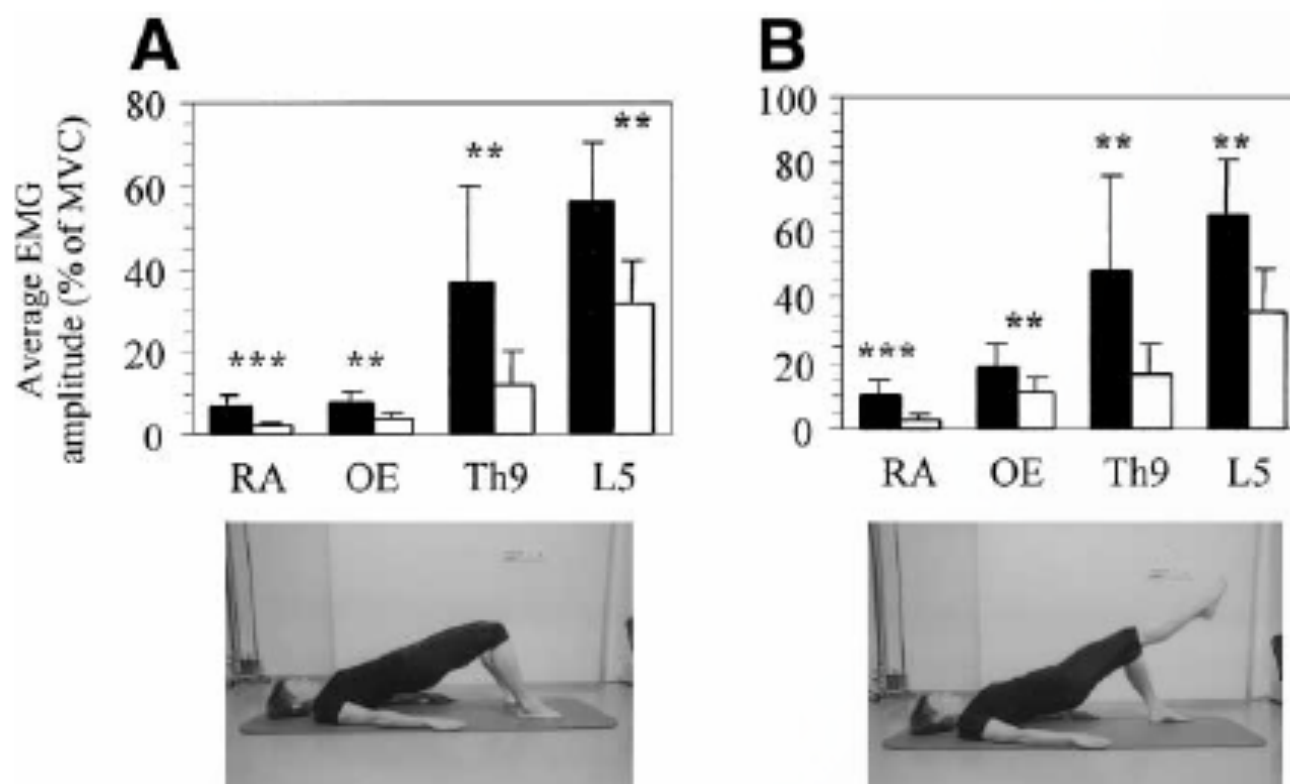
# Pilates and WST



- Pilates claims to include proper core stabilizing exercises
- Is there any EMG support?
- WST includes many trunk exercises
- Are Pilates and WST related?







Arokoski JP et al. Back and abdominal muscle function during stabilization exercises, APMR 2001, 82: 1089 – 1098.

RA = rectus abdominis, OE = obliquus externus

Th9 and L5 = paraspinals

White bars: men. Black bars: women

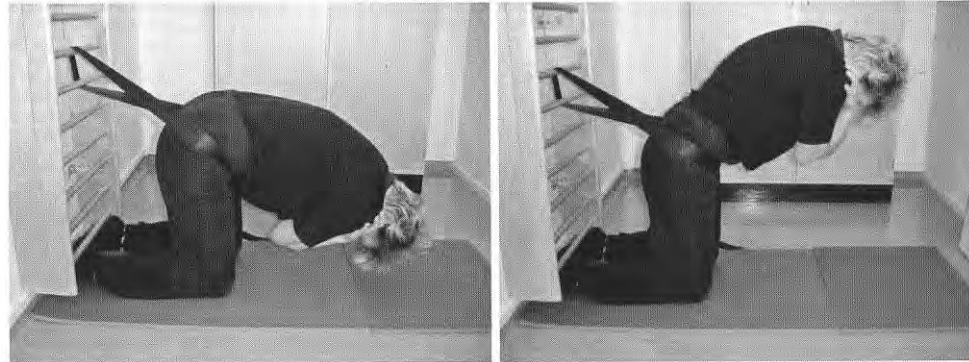












The patient relaxes his back and rotates up with the help of hamstrings and gluteal muscles. When this is achieved, lumbar spine action is added. After the sagittal mobility is controlled next step is to integrate it to standing activities.



McGill S, 2002 / 2004





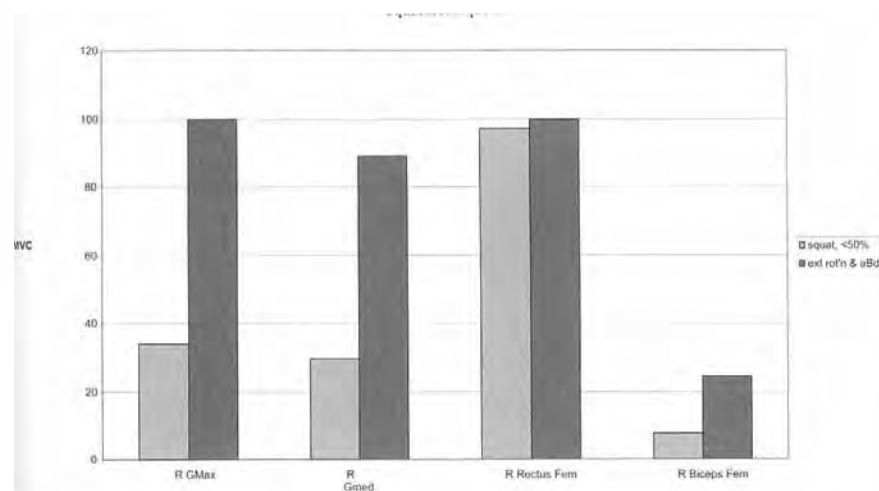
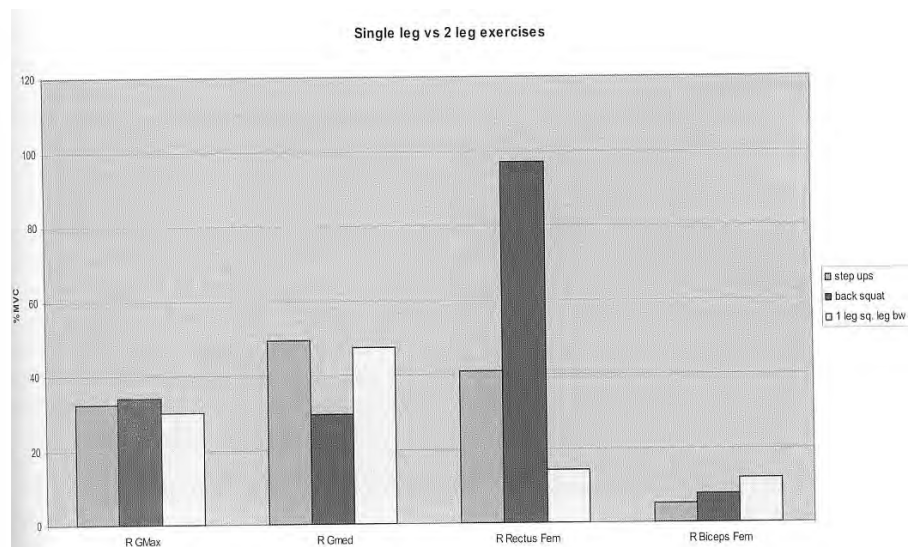


Figure 4 EMG data showing the additional Glut med. and max. activity with the technique of simultaneous hip external rotation and abduction.



**Figure 1**  
Traditional squats are superior for challenging the quadriceps. Single legged squats, even with no additional weight, are superior for training the gluteus medius.





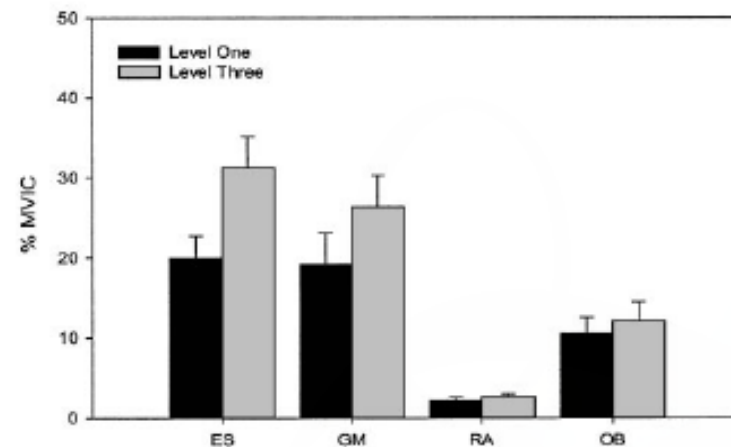






Fig 2. (A) Starting position for level 1 of the Quadruped exercise. (B) Subject performing level 1 of the Quadruped exercise, at the end of phase 1.

#### Quadruped Phase 1



ES = erector spinae

GM = gluteus maximus

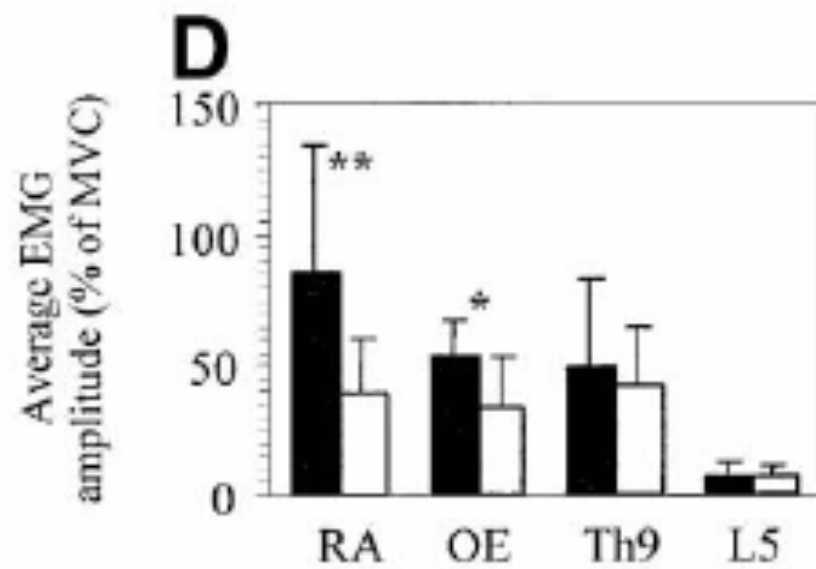
RA = rectus abdominis

OB = obliquus abdominis

Souza GM et al. Electromyographic activity of selected trunk muscles during dynamic spine stabilization exercises. APMR 2001, 82: 1551-1557







Patient pushes down



# Conclusions



The trunk is active during AP

We do not know the differences in activity between water and land exercises, which seem to be the same in movement execution

We definitely need research

