

Die Psycho-Biomechanik des Rückens

Neuartige Erklärungsmodelle zur Entstehung von
chronischen Rückenschmerzen

Challenges in LPB research & treatment

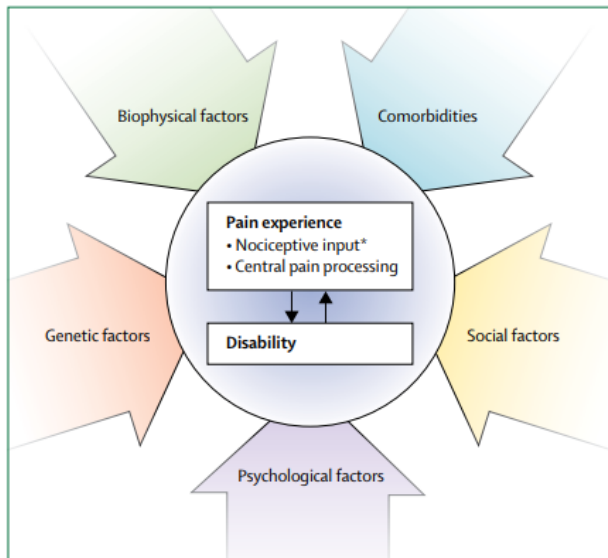
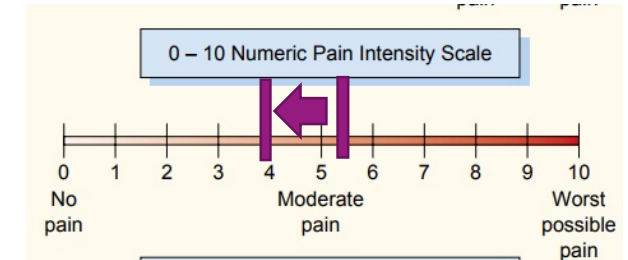
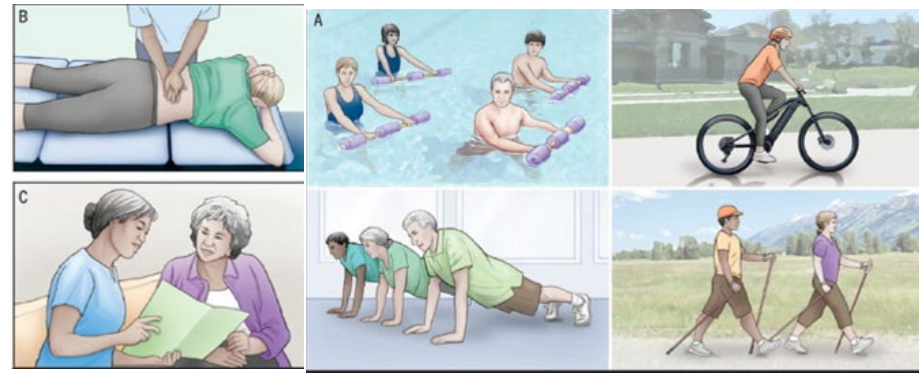


Pain generator ?

Unknown cause

Serious pathology

Koes et al., 2006
Maher et al., 2017



“We found high-quality evidence that paracetamol (4 g per day) **is no better than placebo** for relieving acute LBP in either the short or longer term.”



There is some evidence (very low to moderate quality) **for short-term efficacy (for both pain and function)** of opioids to treat CLBP compared to placebo. The very few trials that compared opioids to non-steroidal anti-inflammatory drugs (NSAIDs) or antidepressants **did not show any differences** regarding pain and function

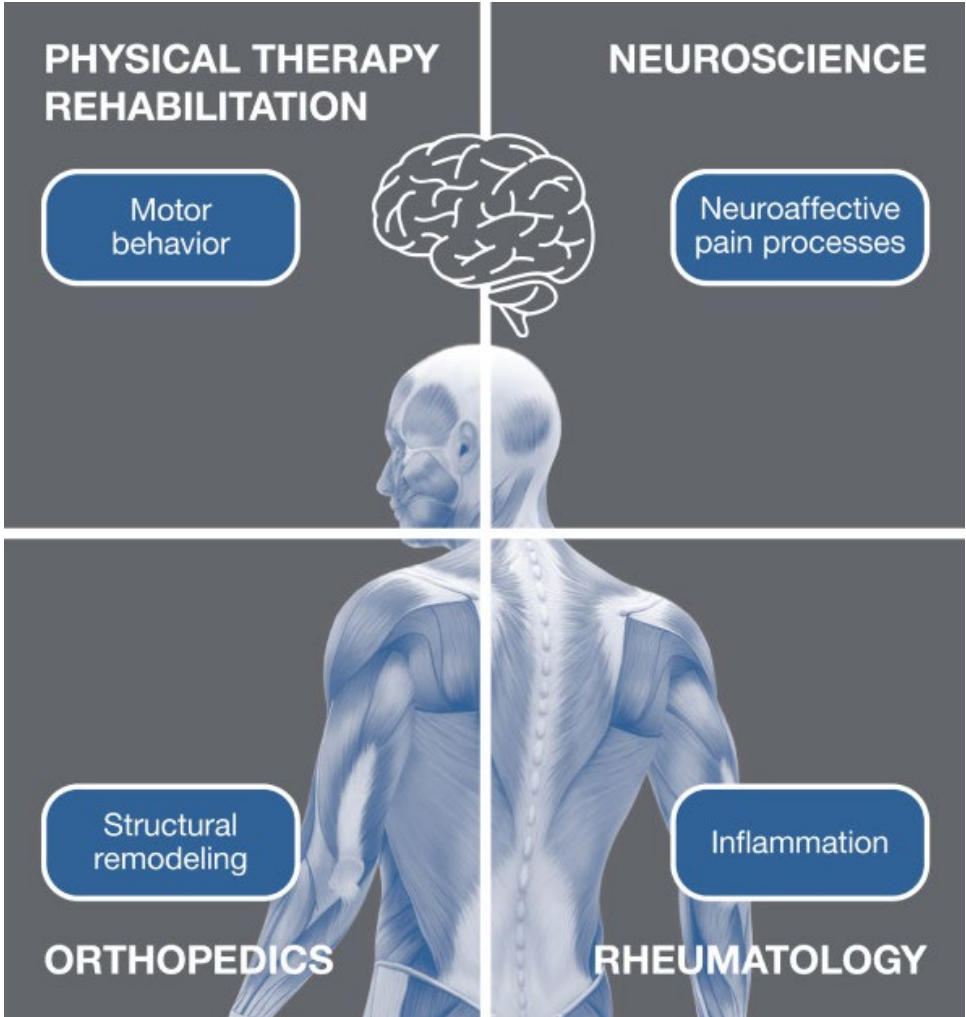
Challenges in LPB research & treatment

Pain mechanism	Definition
Nociceptive pain	Pain that arises from actual or threatened damage to non-neural tissue and is due to the activation of nociceptors.
Neuropathic pain	Pain caused by a lesion or disease of the somatosensory nervous system.
Nociplastic pain	Pain that arises from altered nociception despite no clear evidence of actual or threatened tissue damage causing the activation of peripheral nociceptors or evidence for disease or lesion of the somatosensory system causing the pain.

IASP 2017

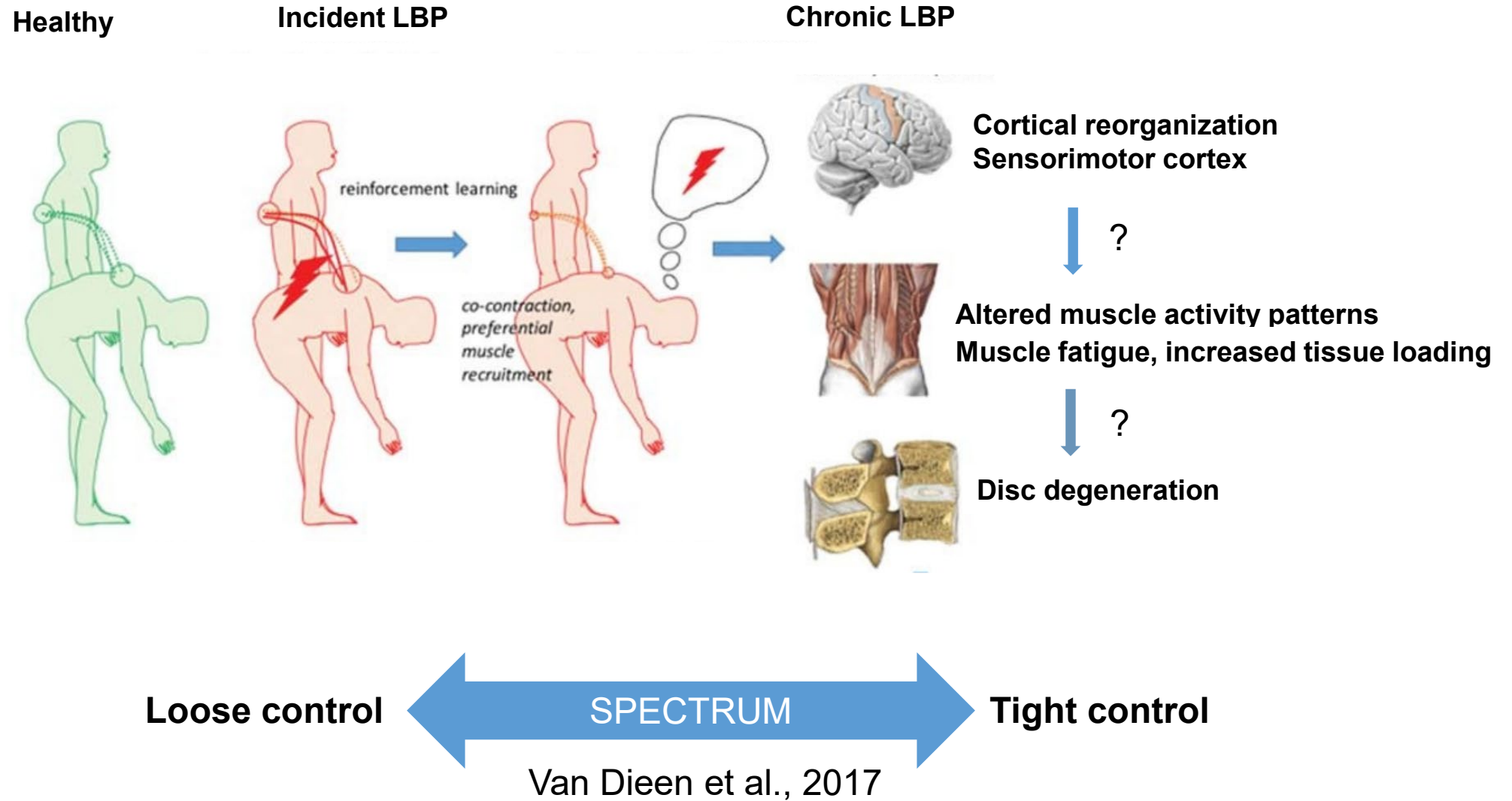
Responsiveness to NSAIDs, signs of inflammation
neurologically plausible distribution of pain, characteristic signs/symptoms such as numbness, and diagnostic tests confirming nerve damage
diffuse, widespread, or poorly localized pain, generalized hypersensitivity, multiple somatic symptoms (eg, fatigue, memory/concentration/sleep disturbances)

Shraim et al., 2022
PAIN

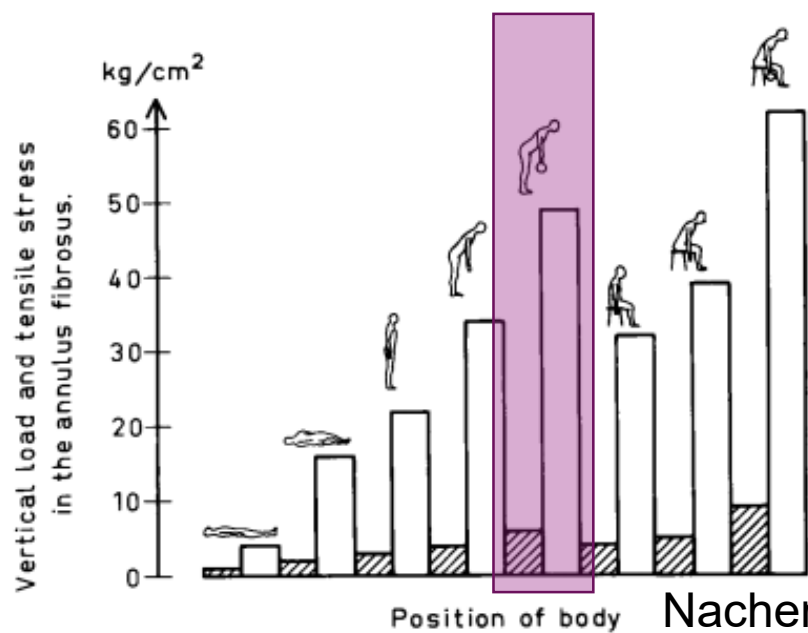
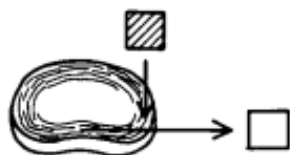
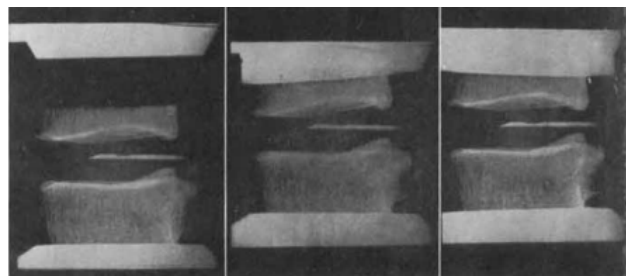


Langevin, 2021
The Journal of Pain

A potential role of movement strategies in LBP



Measurement of spinal load



Nachemson, 1966

NOTICE

**HOW TO LIFT
CORRECTLY
BEND
KNEES
TO LIFT**



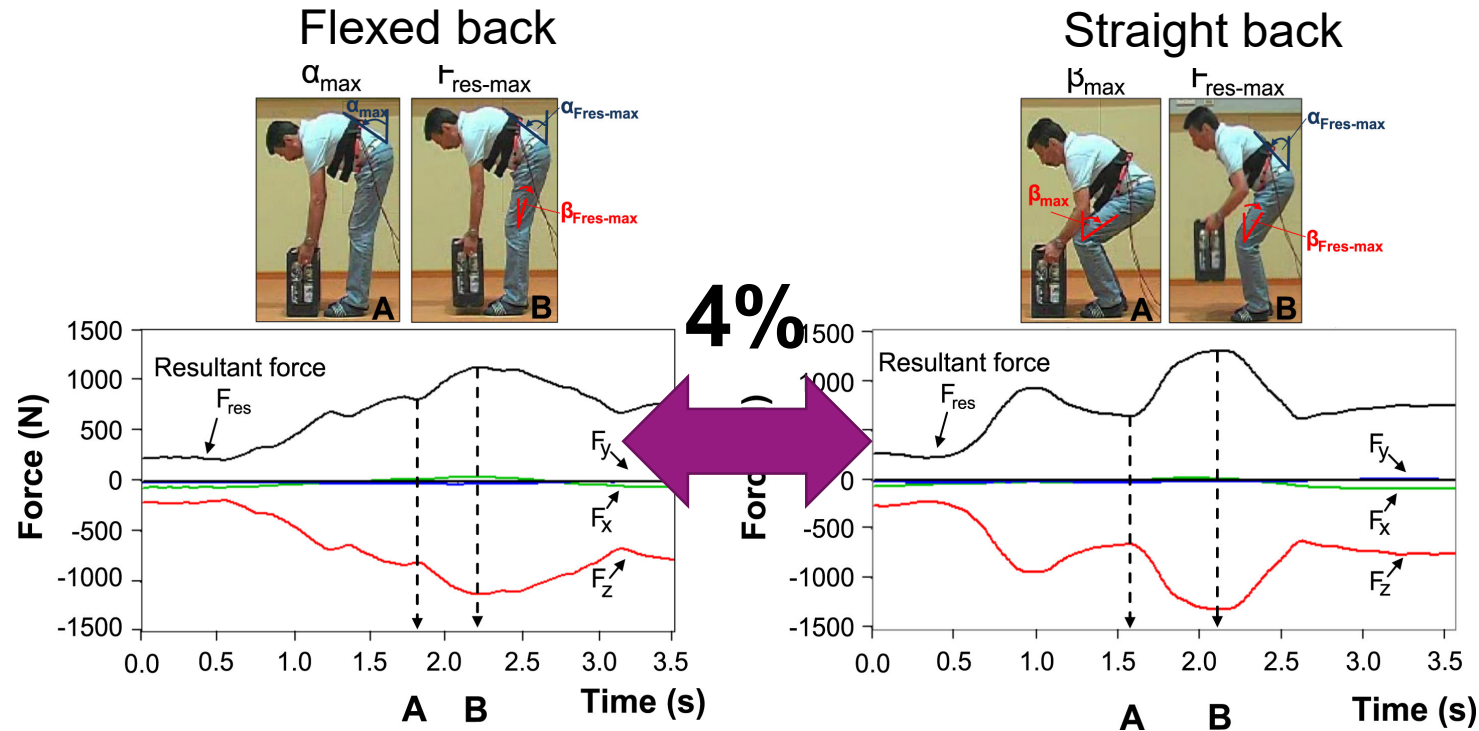
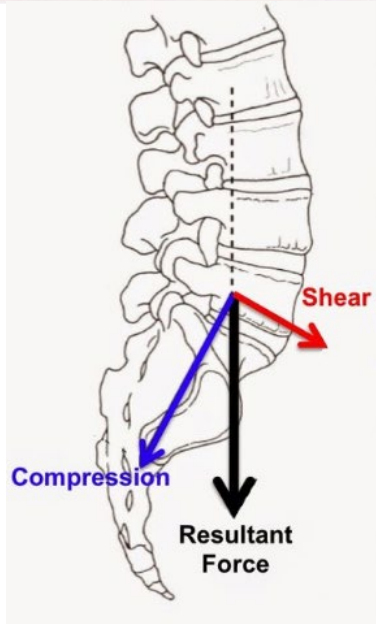
PREVENT BACK INJURY

**DON'T
BEND
OVER**



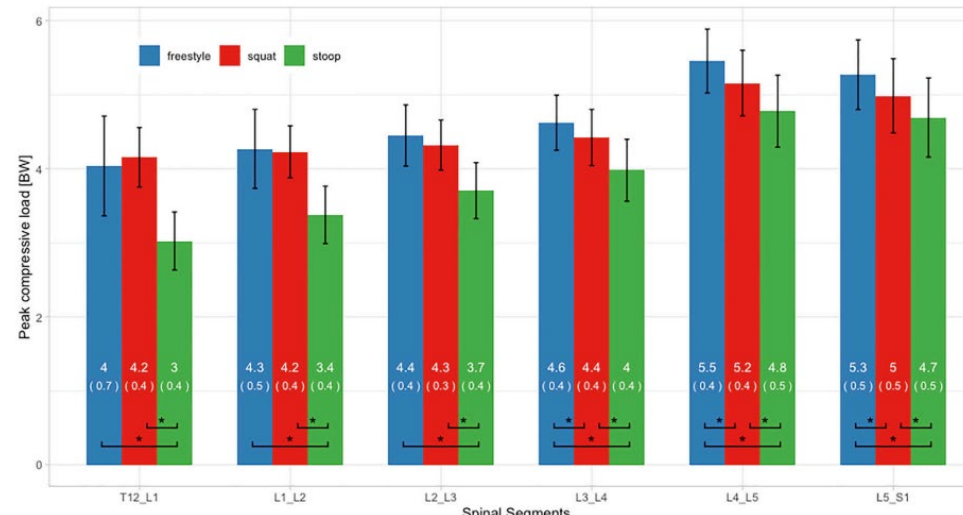
Dogma
«Always lift with a straight back»

Measurement of spinal load



Dreischarf et al. (2016)

N = 30, pain-free



Von Arx et al. (2021)

Literature Review

To Flex or Not to Flex? Is There a Relationship Between Lumbar Spine Flexion During Lifting and Low Back Pain? A Systematic Review With Meta-analysis

AUTHORS ▾

AFFILIATIONS ▾

Journal of Orthopaedic & Sports Physical Therapy

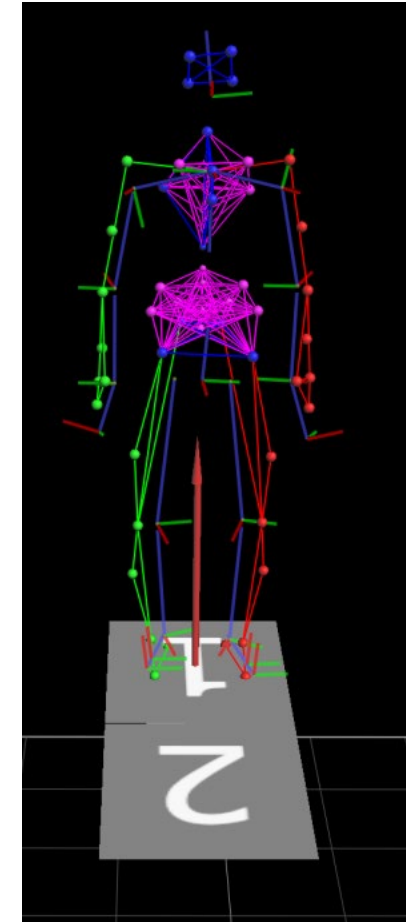
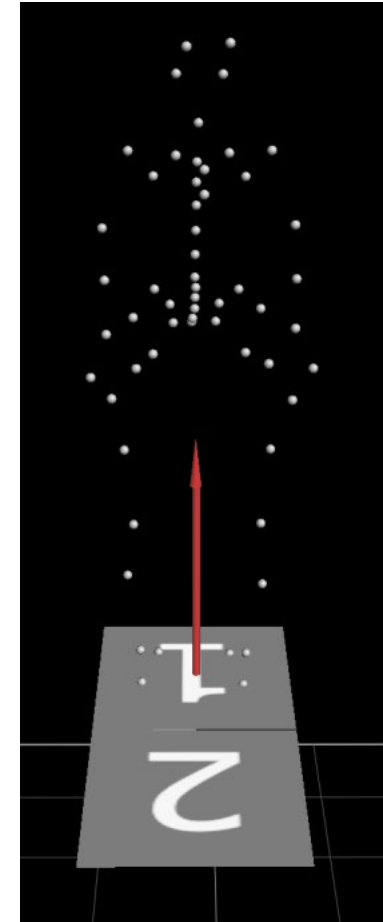
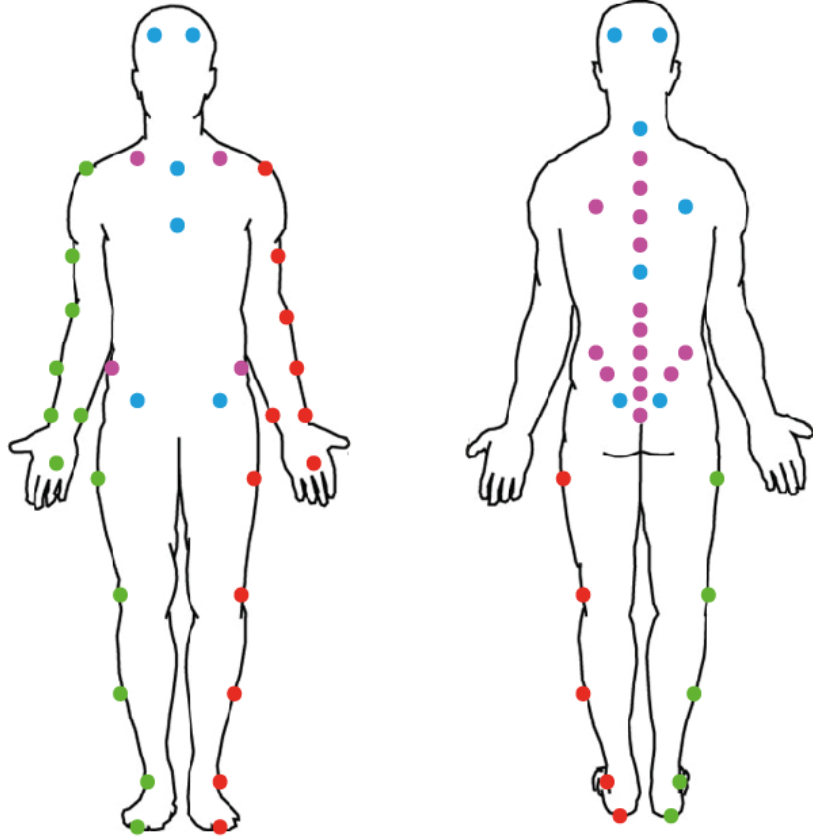
Published Online: February 29, 2020 | Volume 50 Issue 3 | Pages 121-130

<https://www.jospt.org/doi/10.2519/jospt.2020.9218> ⓘ

Conclusion

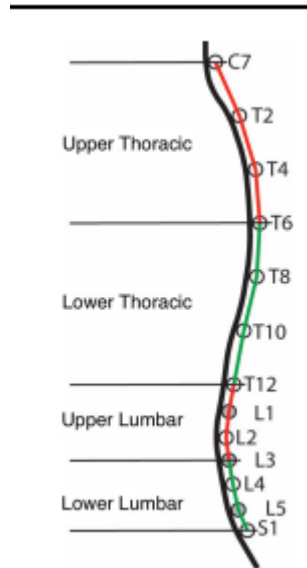
Currently, there are **no credible longitudinal or cross-sectional data** to suggest that a more flexed spine during lifting is a risk factor for the onset or persistence of back pain.

Spine kinematics assessment



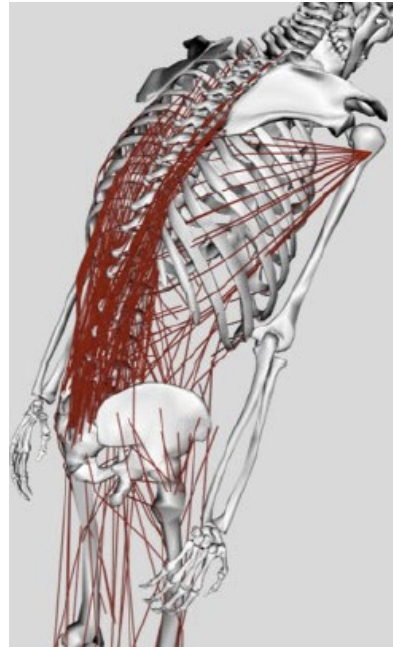
Spine kinematics assessment

Kinematic assessment

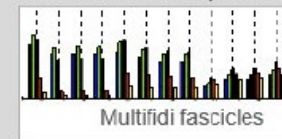


Output: e.g. sagittal angles, range of motion etc.

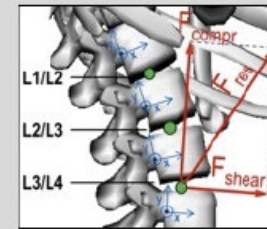
Biomechanical modeling



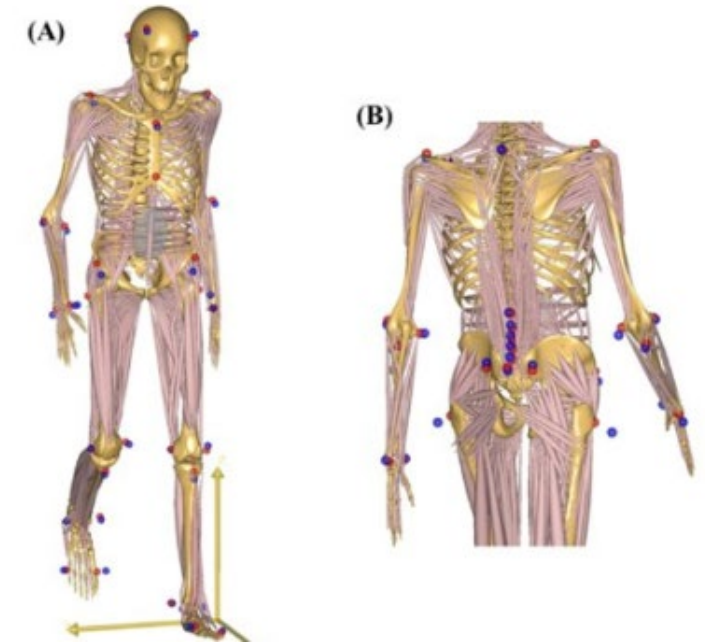
Muscle forces
Muscle activation patterns



Segmental loading

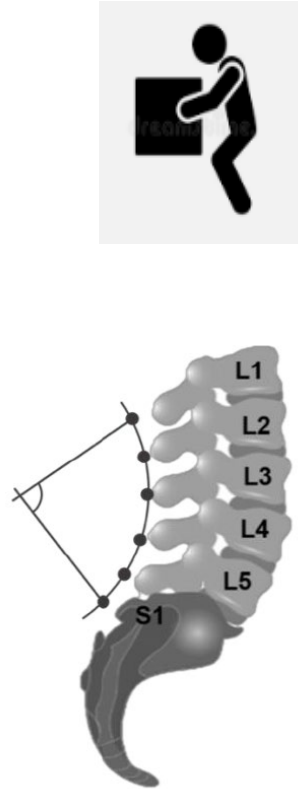
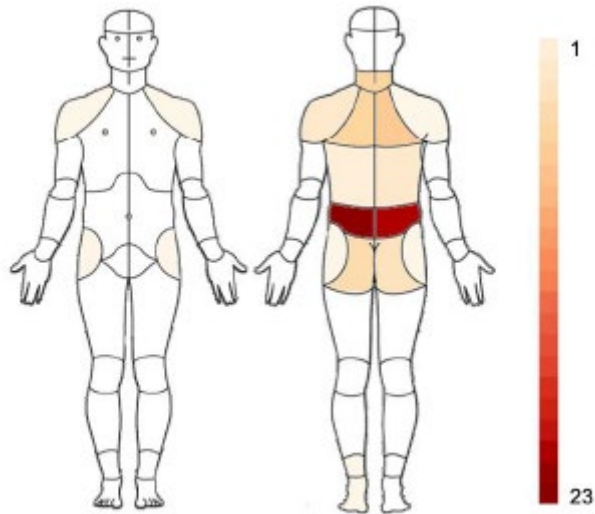


Output: muscle forces, segmental loads



A protective (tight) movement strategy ?

LBP patients N = 23



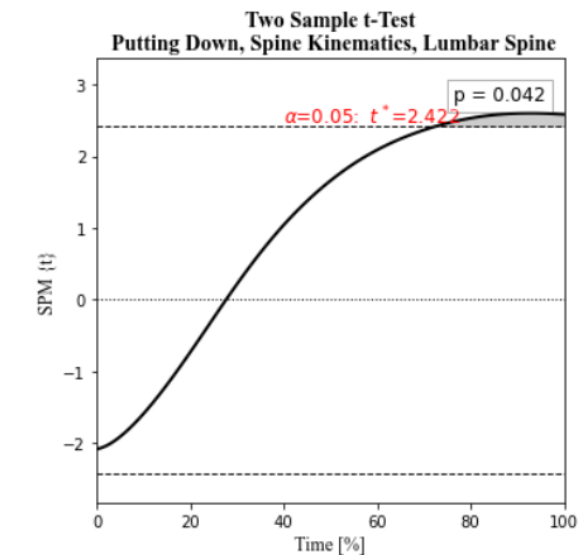
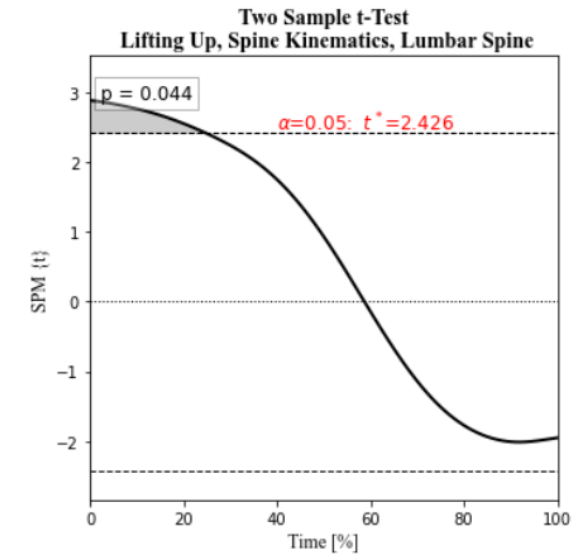
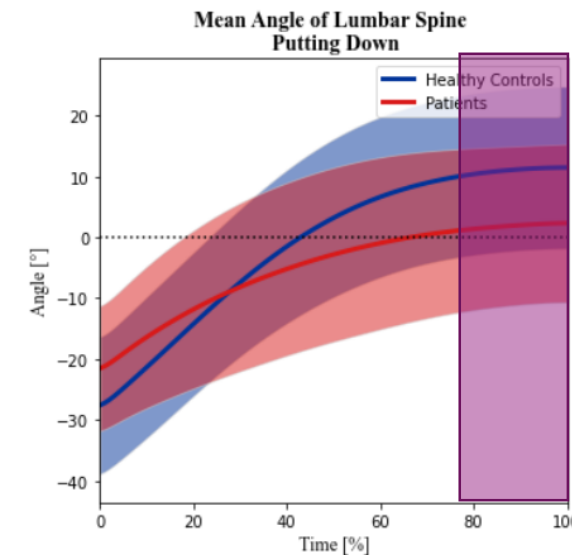
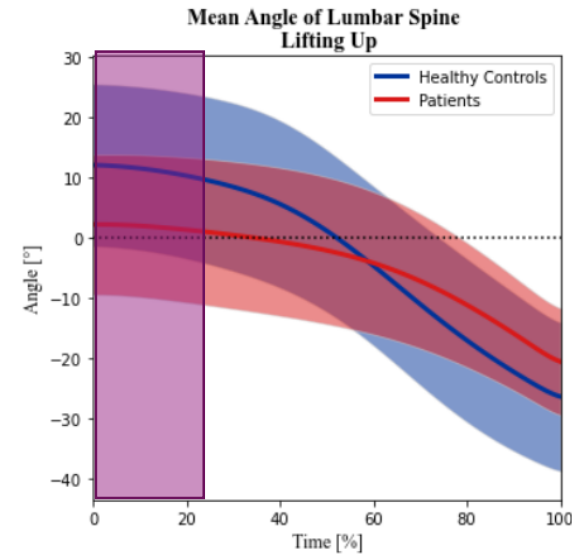
vs pain-free subjects N = 35



ORIGINAL ARTICLE

Lumbar range of motion in chronic low back pain is predicted by task-specific, but not by general measures of pain-related fear

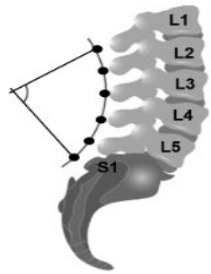
Thomas Matheve, Liesbet De Baets, Katleen Bogaerts, Annick Timmermans



unpublished data

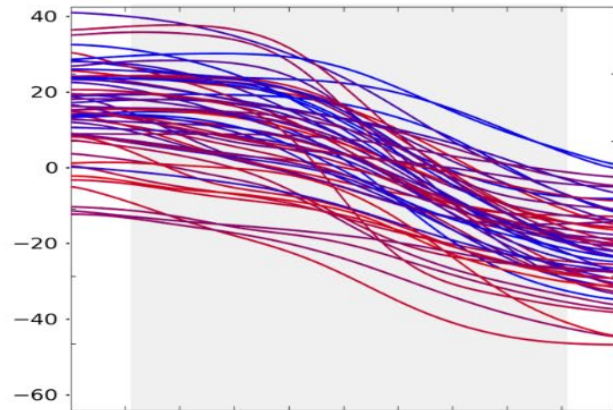
A protective (tight) movement strategy ?

N = 57, pain-free subjects

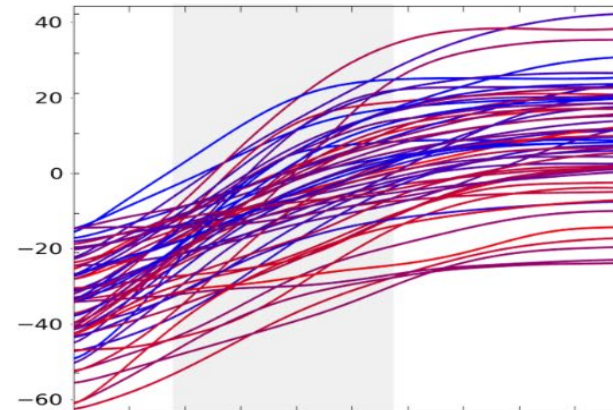


Lumbar lordosis angle (deg)

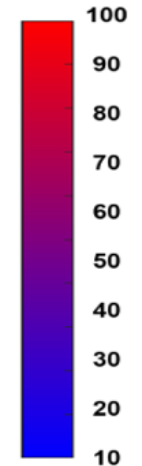
Lifting-up



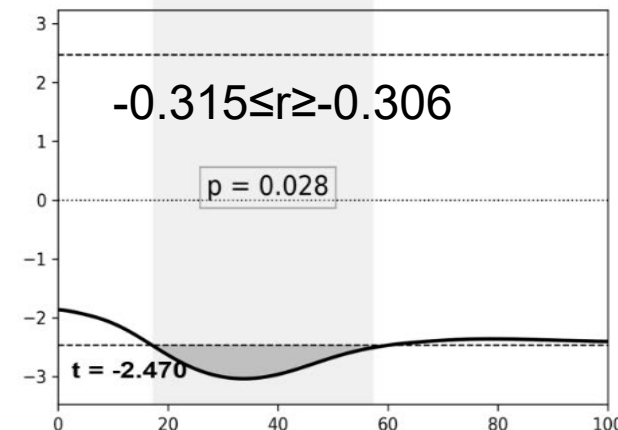
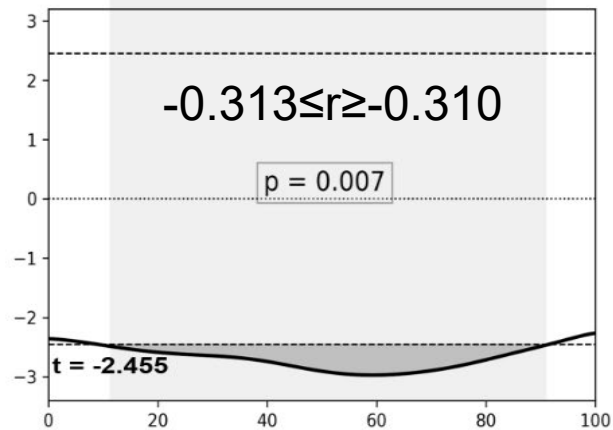
Putting-down



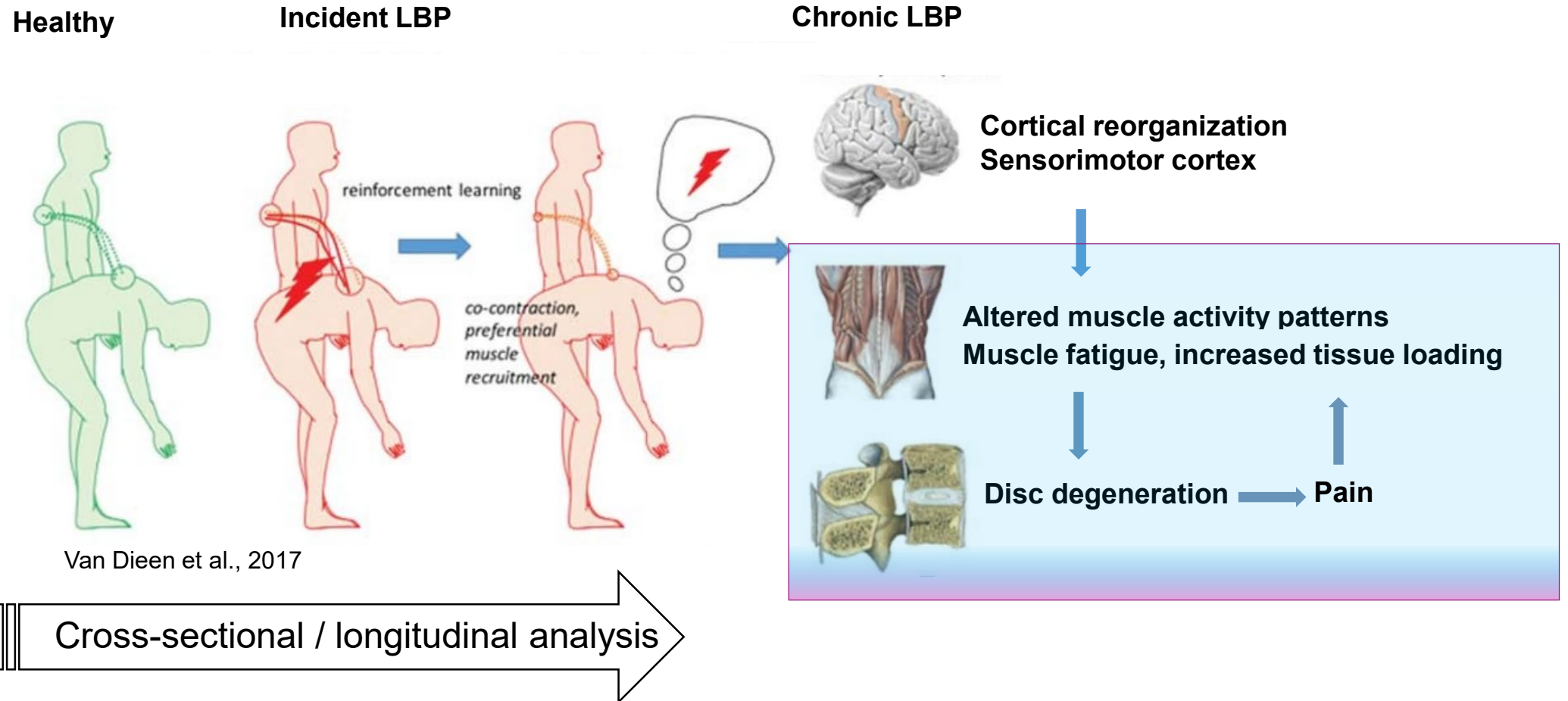
PHODA-lift score



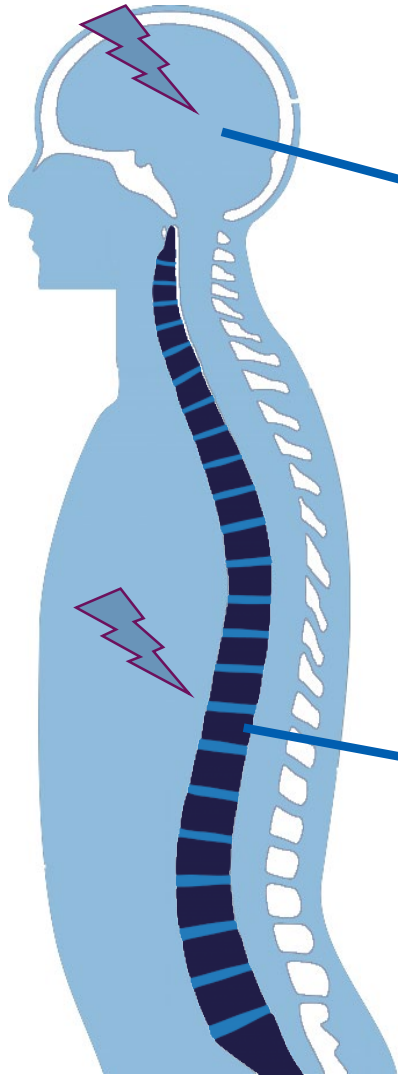
SPM {t}



Knechtle et al, 2020, PAIN

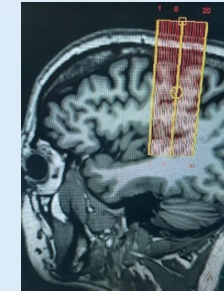
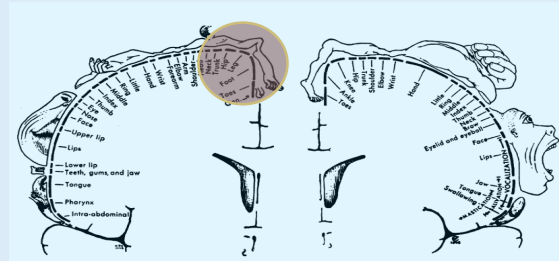


An interdisciplinary approach



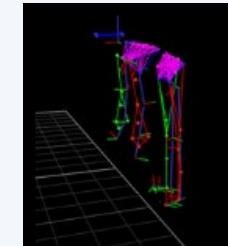
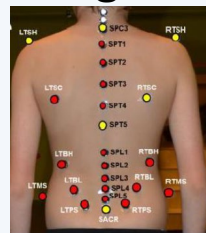
Does LBP change the cortical representation of the back ?

fMRI - Target areas: sensorimotor cortices



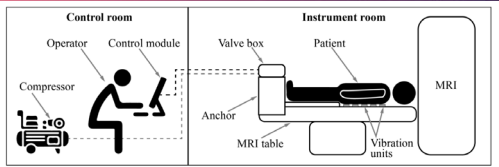
Is LBP associated with specific movement strategies?

Spine kinematics during daily activities and biomechanical modelling

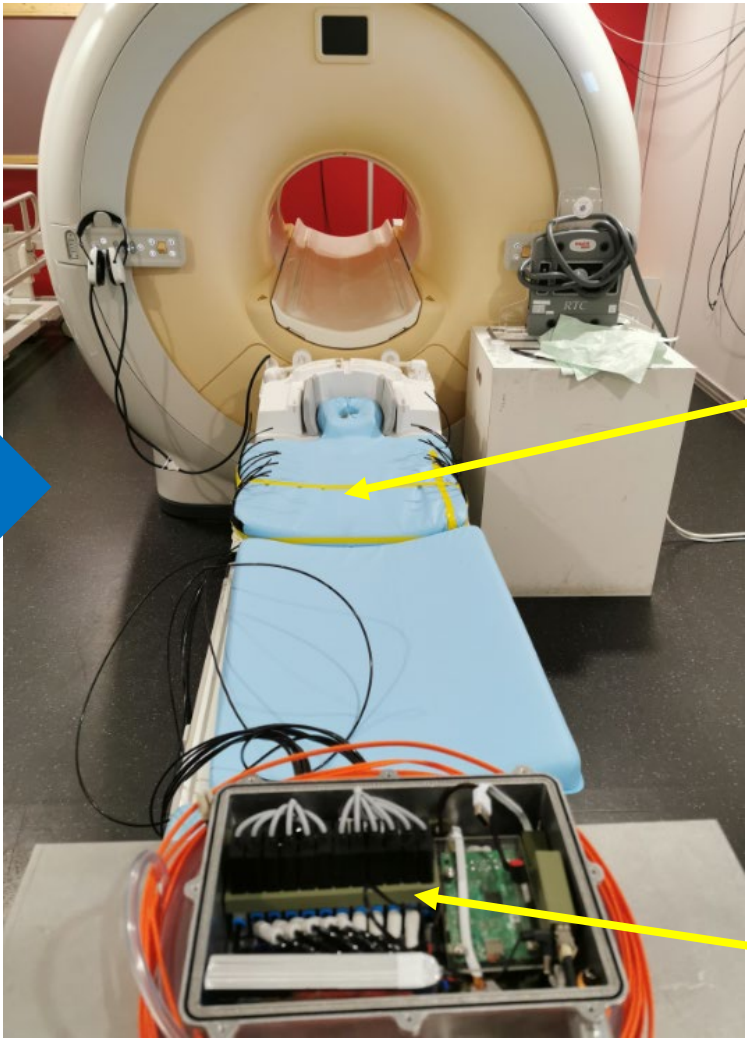
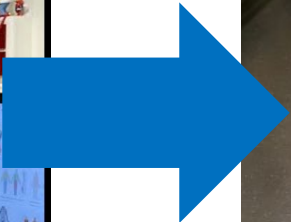
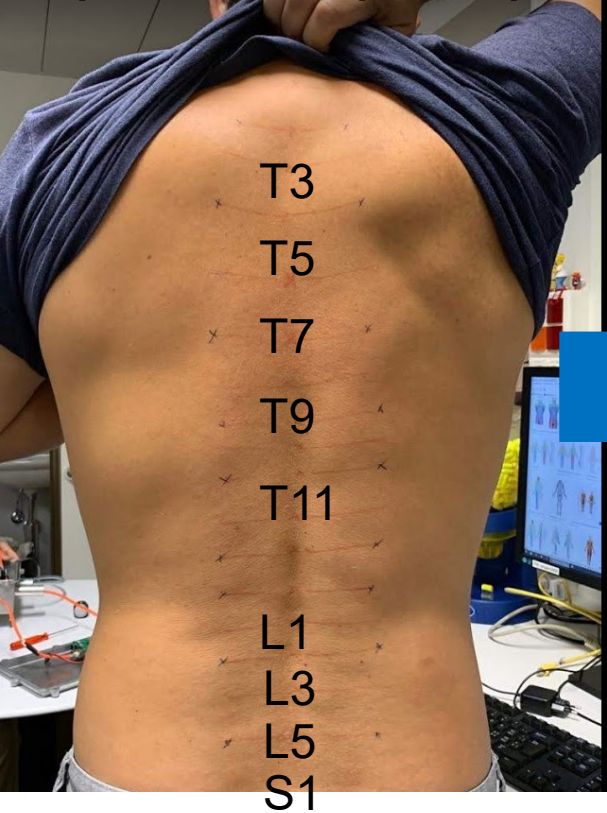


Explore potential associations

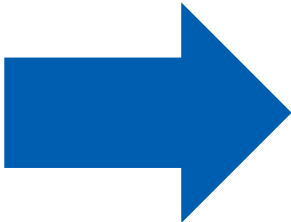
Pneumatic vibration device (pneuVID) and high-res fMRI



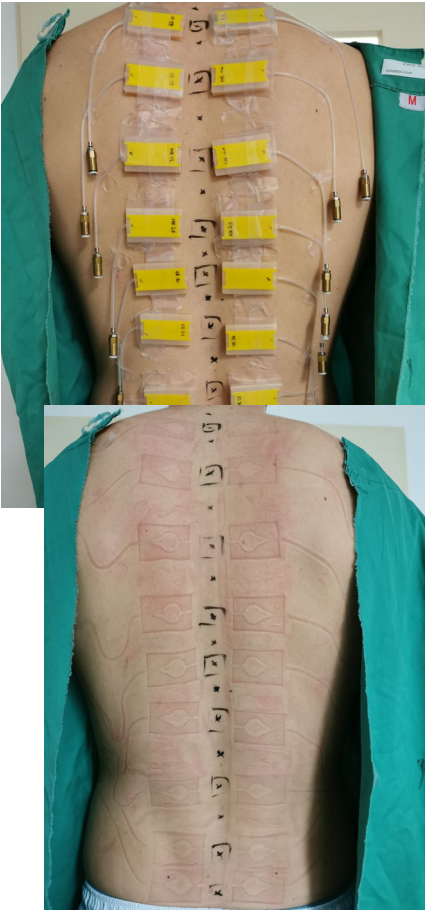
Palpate & mark spinous processes



Pillow with attachments for pneuVID stimulation units

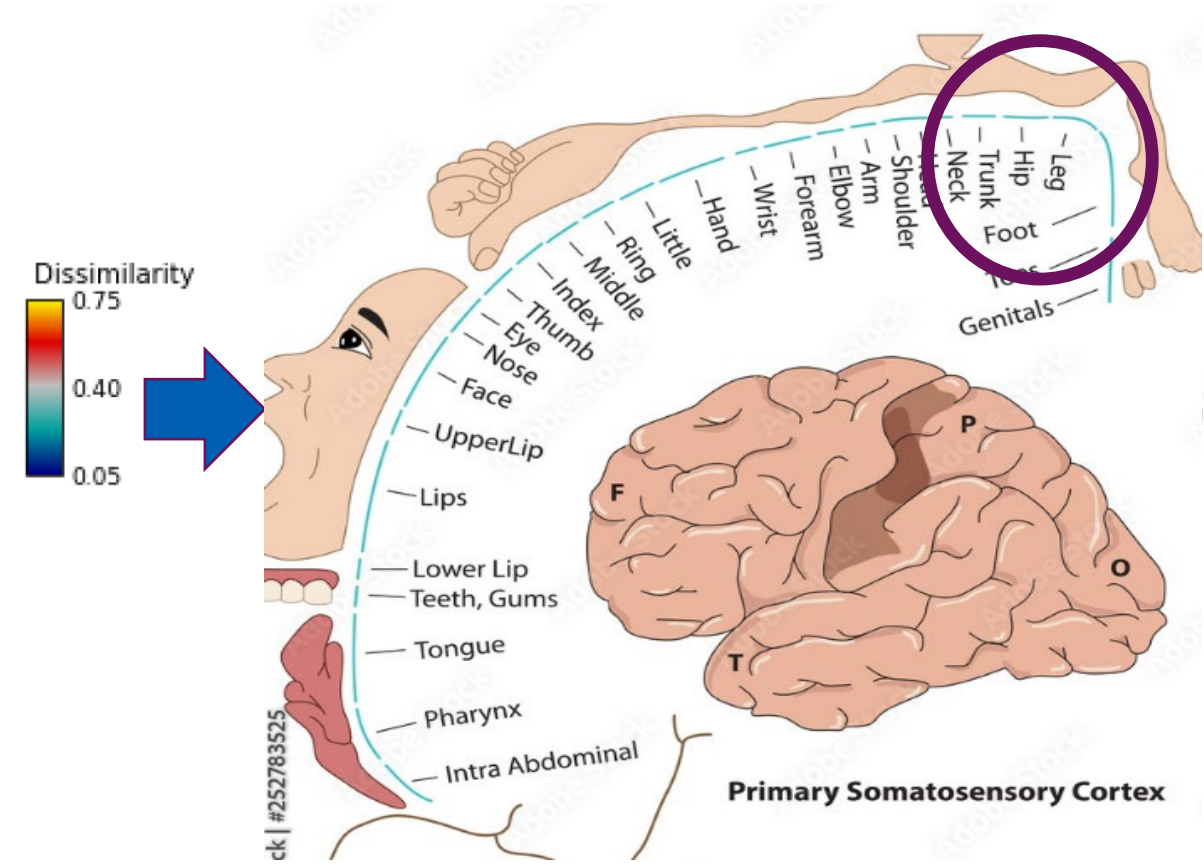
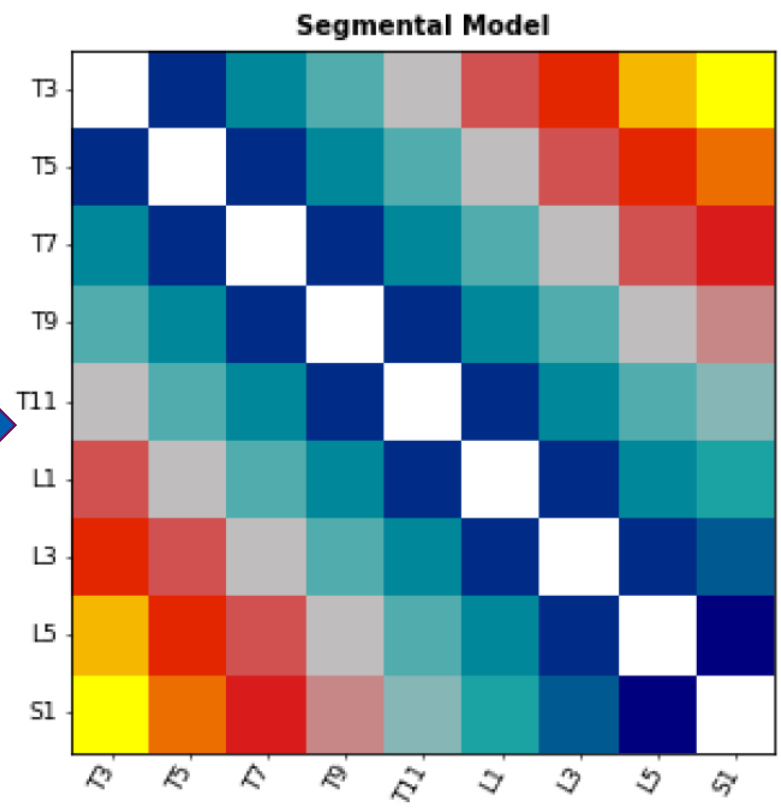
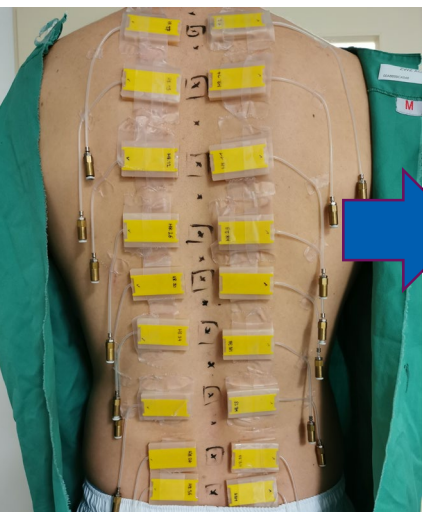


Check placement of pneuVID units

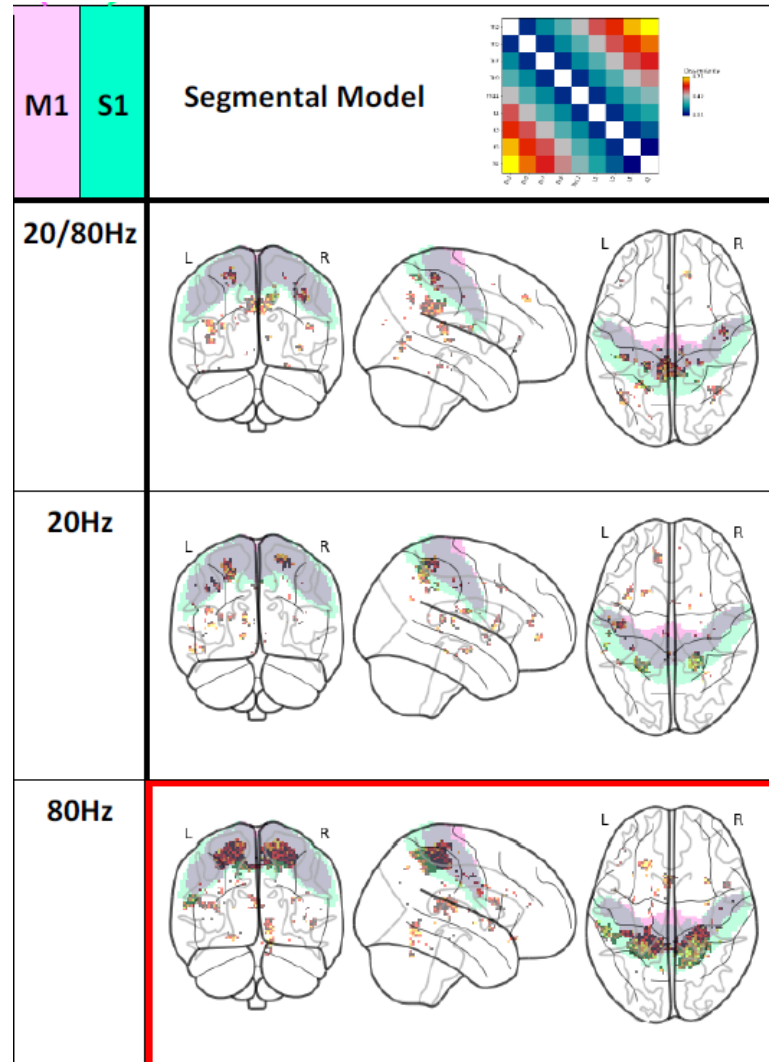


pneuVID controller (10 valves)

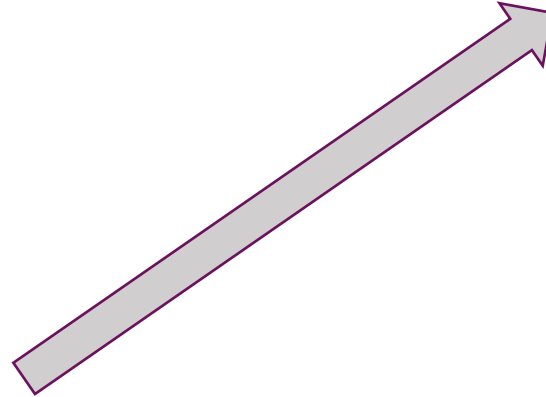
Representation similarity analysis (RSA)



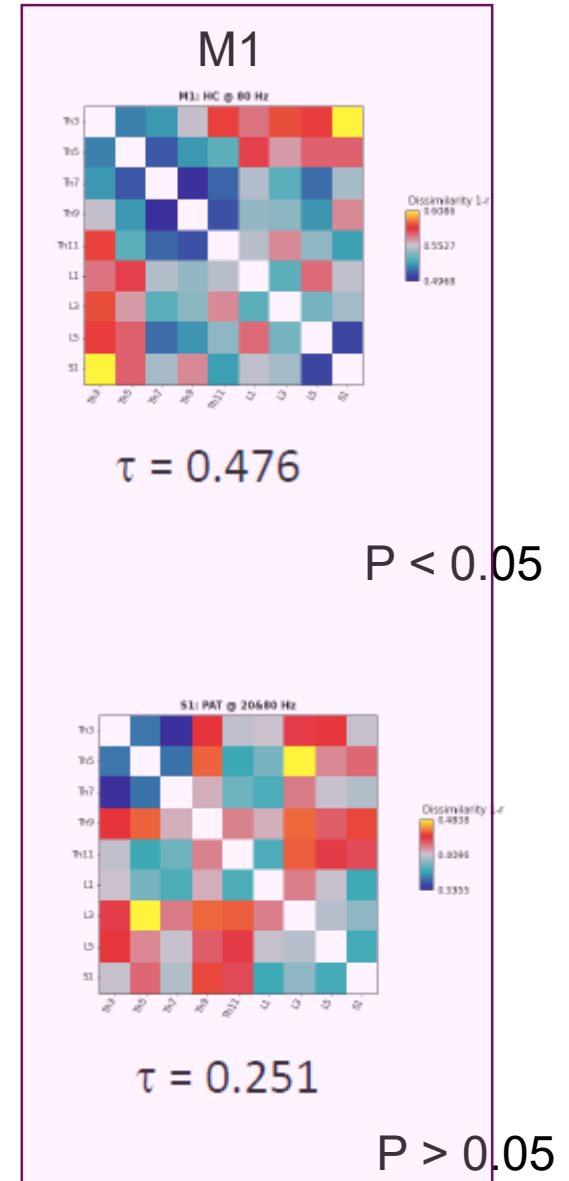
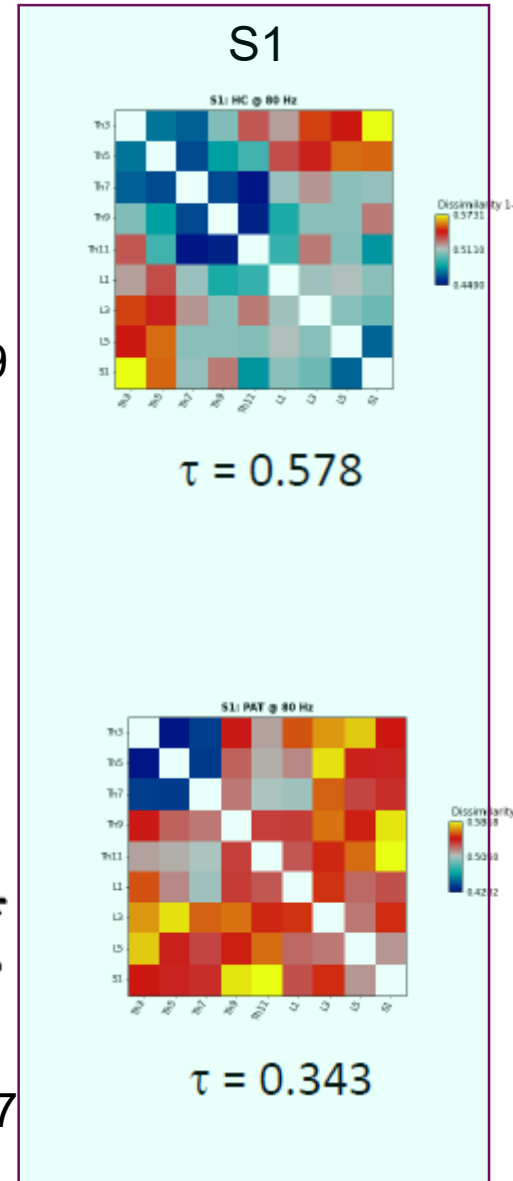
Representation similarity analysis (RSA)



N = 29



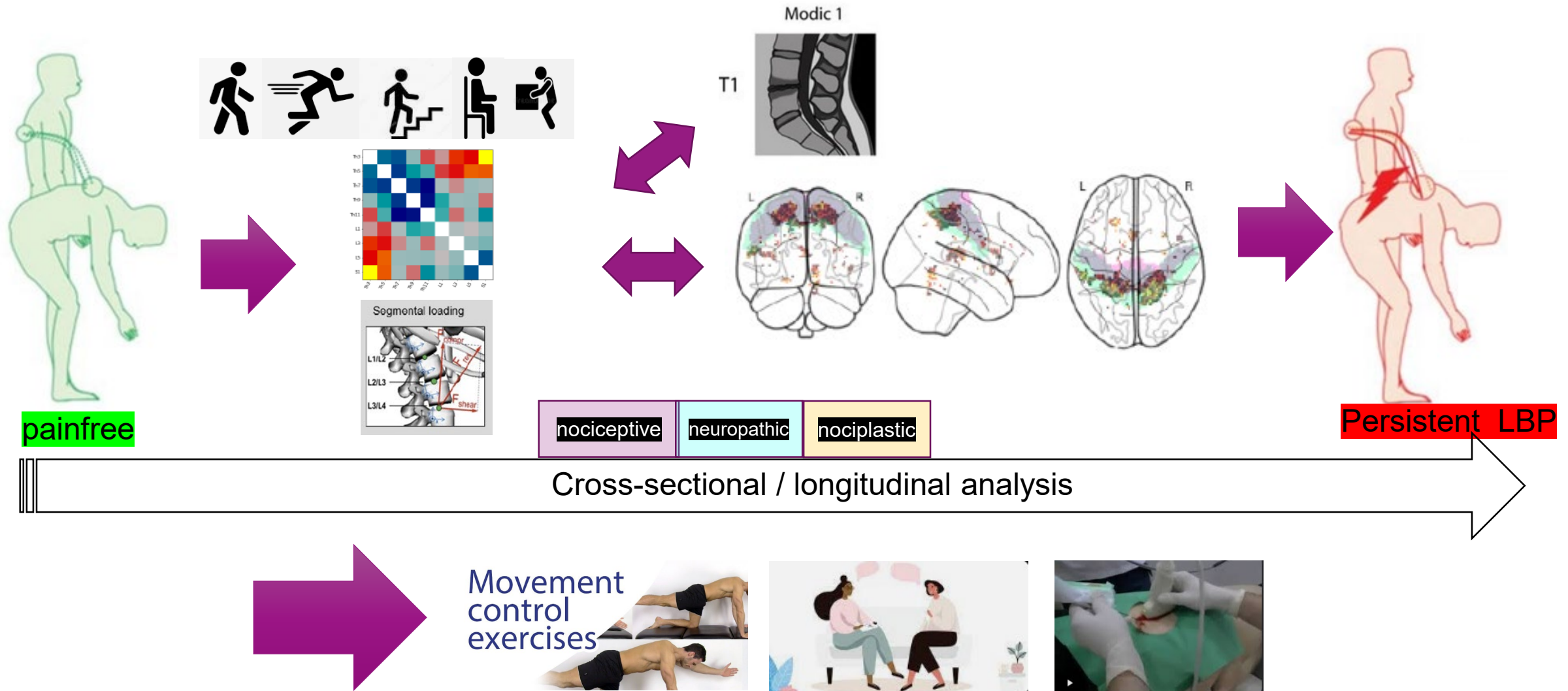
N = 37



manuscript in prep.

Outlook

Bridging «research siloes» for better treatments



Vielen Dank für die Aufmerksamkeit!

Spine kinematics / biomechanics
Balgrist, ETH, BFH



MR, engineering
Zurich, HSLU Lucerne

