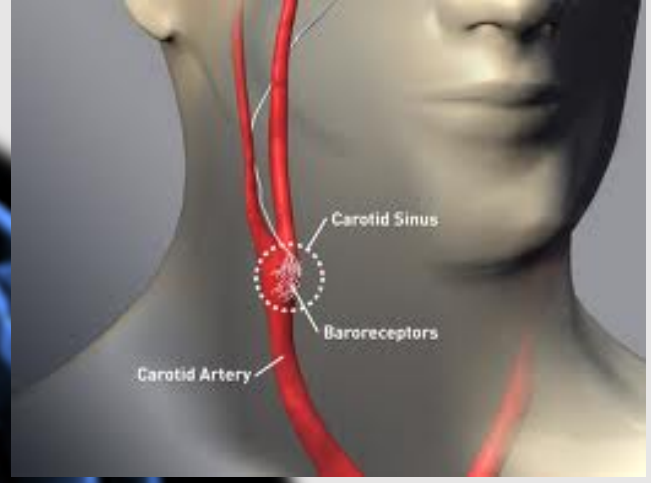
Using Movesense to guide therapy for chronic pain patients



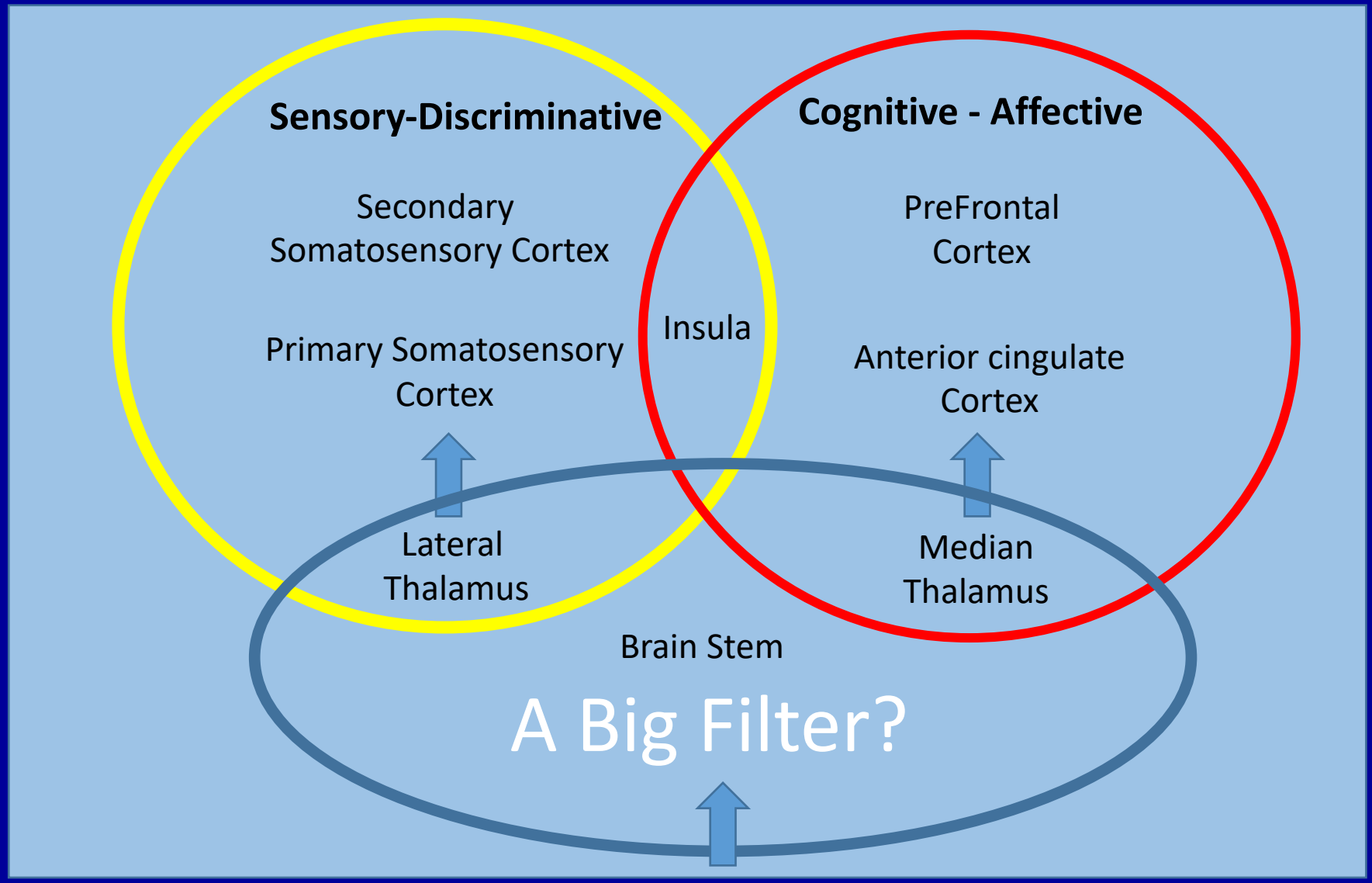
Movesense
Dec 3, 2019 Helsinki, Finland

- The 5th largest economy isn't a country, it's the US healthcare system.
- Americans will spend $4 trillion on healthcare in 2020, growing at 2x GDP growth rate. $6 trillion projected by 2027. Half of that is wasted.
- Europe is not far behind.
- 85% of diseases are chronic – this means that you will have them for over 5 years and the mental aspects are paramount.
- 50% of people over 50 have high blood pressure.

Psychobiological Learning in Pain Chronification

- Sensitization (Central & Peripheral)
- Classical conditioned
- Operant conditioned (Reward/Punishment)
- Model Learning
- Congnitive Factors
  (Helplessness, Catastrophizing)

Brain Pain Network

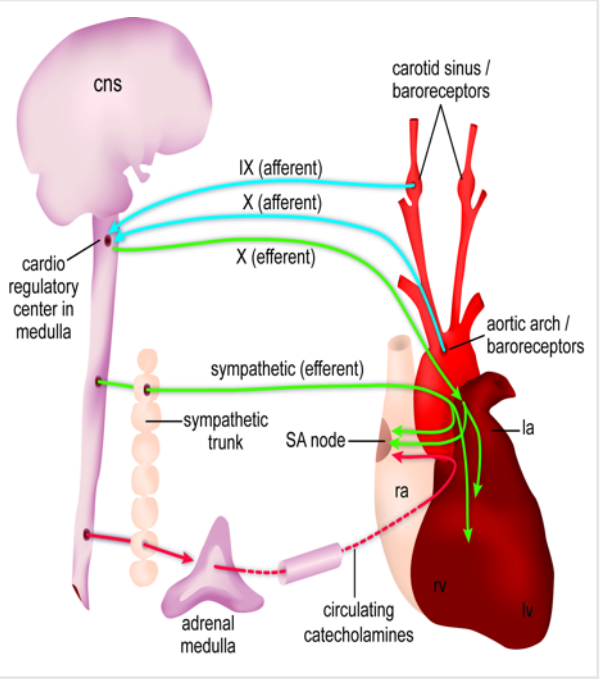


Activity of a spontanous active dorsal horn neuron of a rat that responds with a firing rate after painful electrical stimuli.

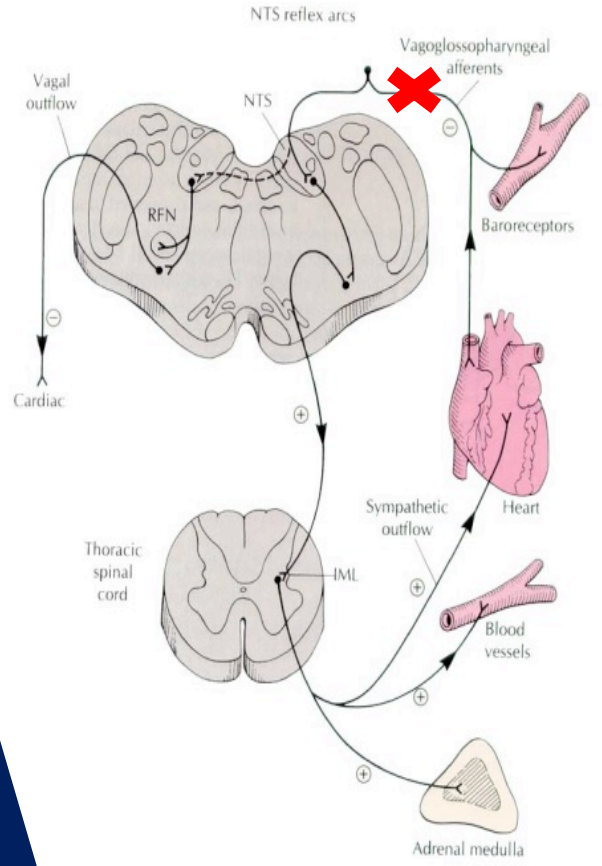
The action potentials are proportional to the stimulus intensity
in the first 30 minutes.

Then the behaviour of the cell changes…

The nerve cell fires spontaneously without any external stimulus



Baroreflex Sensitivity Nucleas Tractus Solitarius & NTS - reflex Arcs



Low HRV

- Inverse relationship between Baseline
  pain sensitivity in animals (Re
  human (Falcone et al
- Increased BR
  spinal and sup
- Reduced Barore
  pain patients

Nociceptive effect of Stress in Chronic Disease

Philipps Universität Marburg

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Duke UNIVERSITY

UNIVERSITY of WASHINGTON

Proc. Natl. Acad. Sci. USA
Vol. 91, pp. 6329–6333, July 1994
Medical Sciences

Central effects of baroreceptor activation in humans: Attenuation of skeletal reflexes and pain perception

B. R.
AND (

*Departı
Münster
Medical
Piazza C
**Tilbur

Commu

PSYCHOPHYSIOLOGY

Vol. 25, No. 1
Printed in U.S.A.

Baroreceptor Stimulation Alters Pain Sensation Depending on Tonic Blood Pressure

D

Pain 124 (2006) 287–294

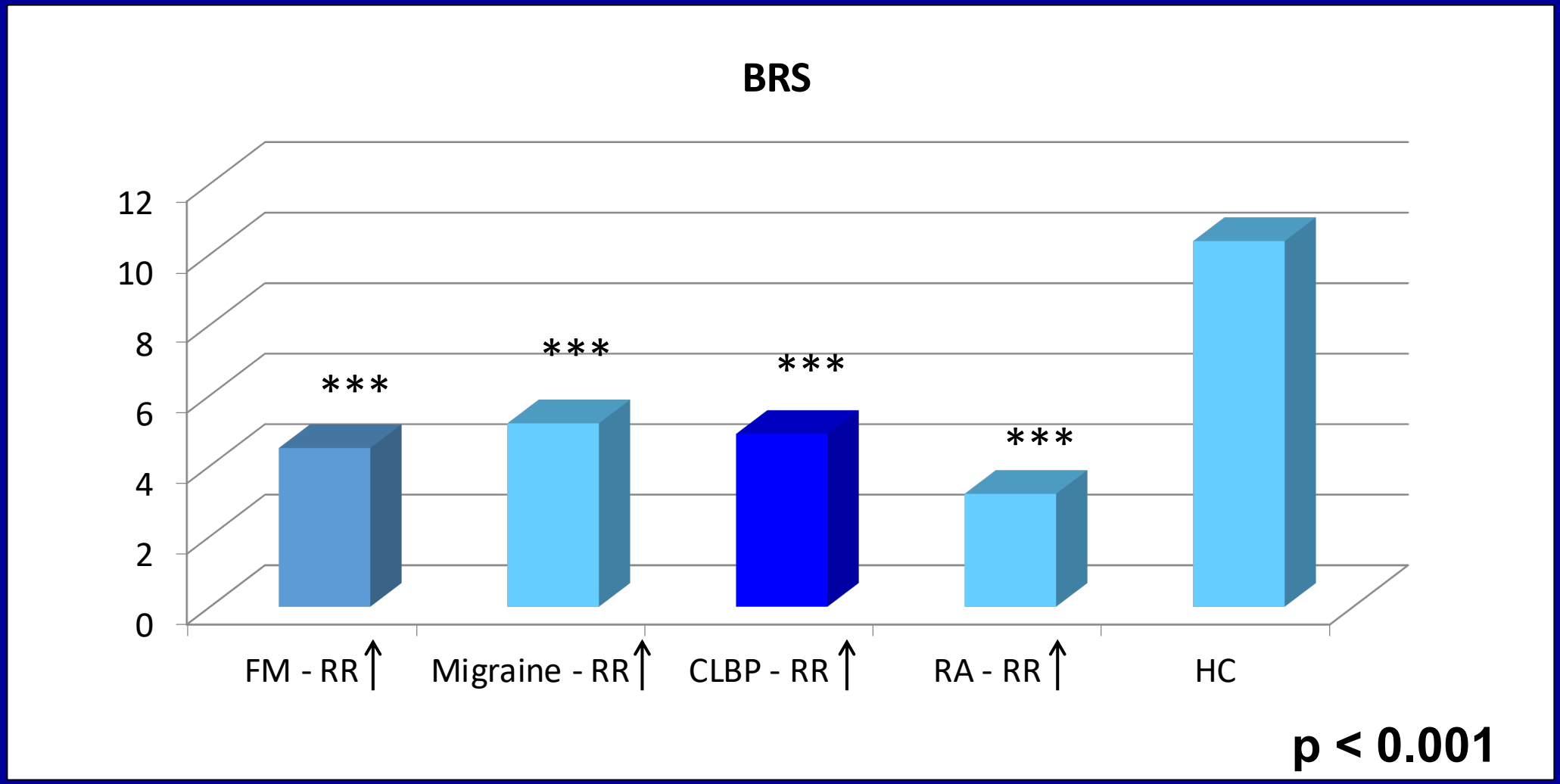
PAIN

www.elsevier.com/locate/pain

Parental history of chronic pain may be associated with impairments in endogenous opioid analgesic systems

Stephen Bruehl *, Ok Yung Chung

Diminished Baroreflex Sensitivity in Patients with chronic Pain



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American Pain Society
RESEARCH
EDUCATION
TREATMENT
ADVOCACY
PUBLISHED BY ELSEVIER
The Journal of Pain, Vol 16, No 2 (February), 2015: pp 186-196
Available online at www.jpain.org and www.sciencedirect.com

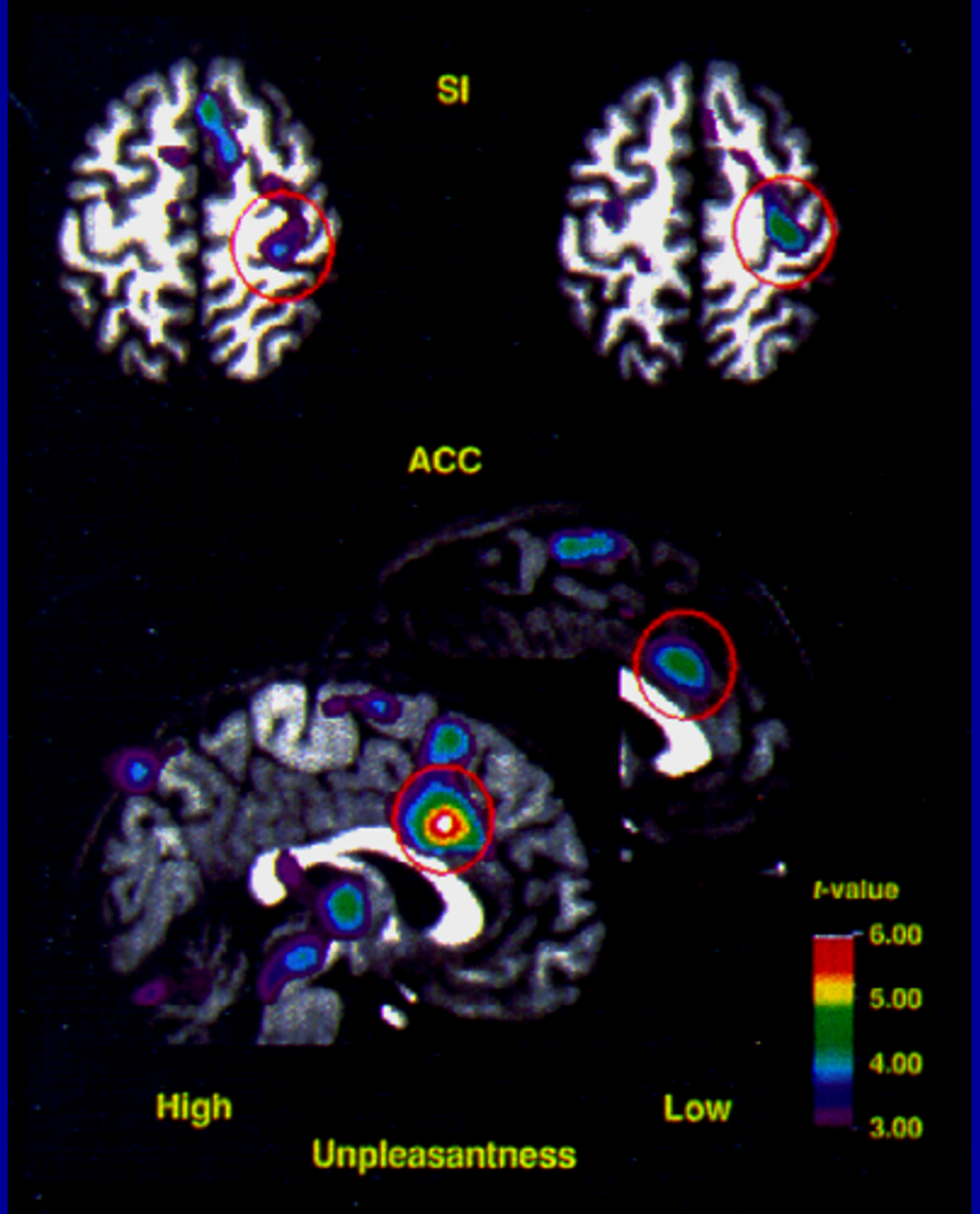
The Relationship Among Psychological and Psychophysiological Characteristics of Fibromyalgia Patients

Kati Thieme,*,† Dennis C. Turk,‡ Richard H. Gracely,§ William Maixner,§ and Herta Flor†

For example patients with hypertensive baseline and stress reactivity display:

- Higher Pain Intensity (MPI) ($F(3,116) = 15.42$, $p<0.001$)
- Higher Interference (MPI) ($F(3,116) = 15.83$, $p<0.001$)
- Less Activity (MPI) ($F(3,116) = 8.41$, $p<0.005$)
- Extensive Pain Behaviors (TPB) ($F(3,116) = 7.41$, $p<0.005$)

Thieme et al., 2015



Sensory Memory

Affective Memory

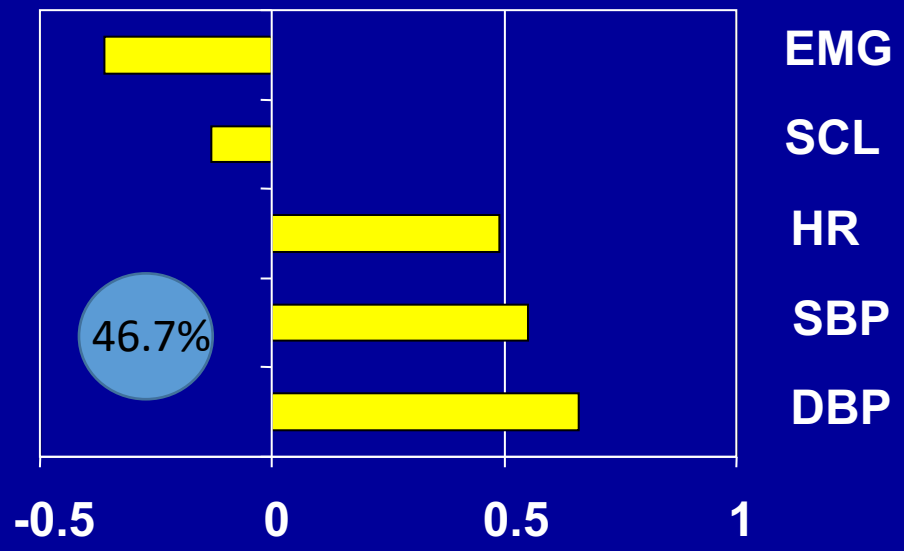
Rainville et al., Science, 1997

Heterogeneity in psychophysiological stress response patterns in FM

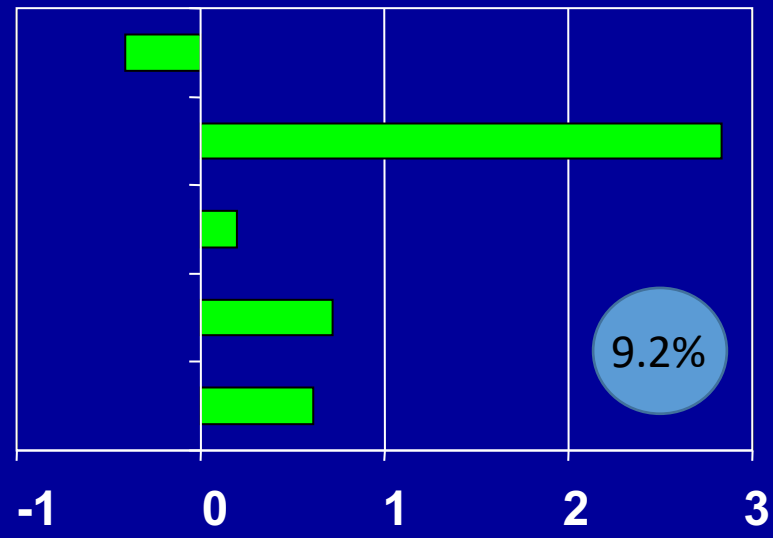
Thieme & Turk, 2006

4 patterns

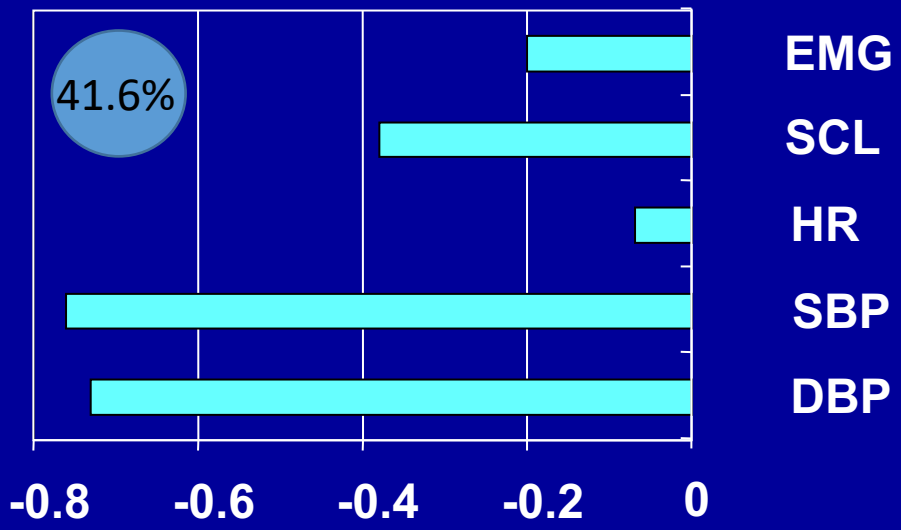
Sympathetic-vasomotor Pattern



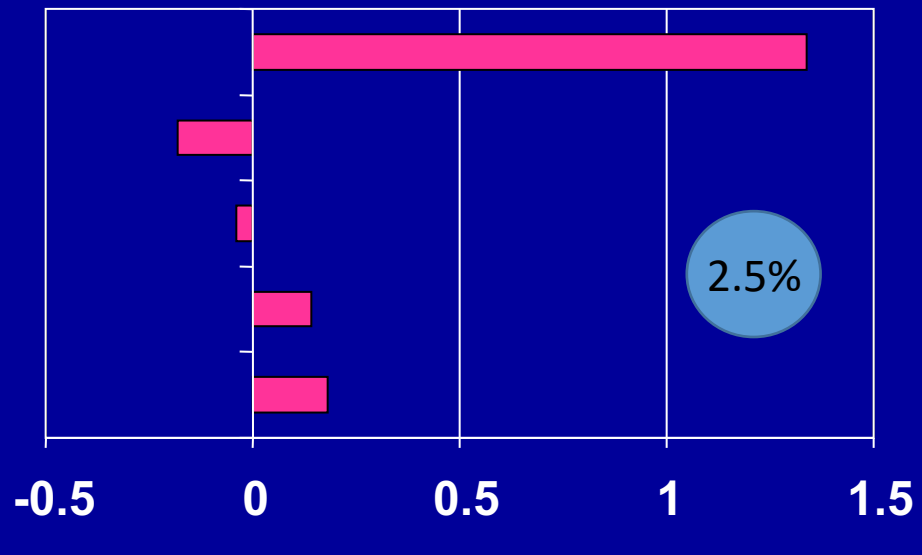
Sympathetic-sudomotor Pattern



Parasympathetic-vasomotor Pattern



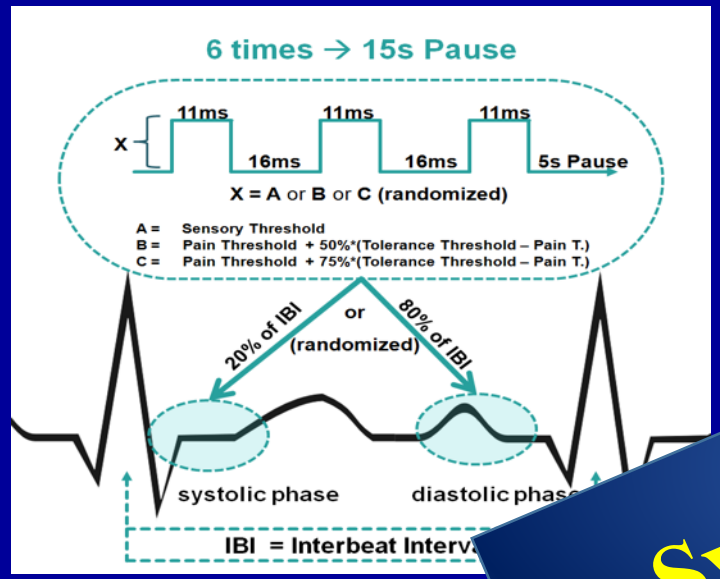
Increased Muscular Pattern



Pain Behaviors

- Nonverbal signals (Fordyce, 1976; Baumstark et al., 1993)
- Deficient activity levels (Romano et al., 1992,5)
- Excessive use of medication (Turk et al., 1998)
- Intake of opioids (Turk et al., 1997)
- Excessive use of doctor visits
  (Thieme et al., 2003)
- Avoidance behavior in various
  areas of the patients life
  (Vlayen et al., 1990: Nicassio et al., 2000)

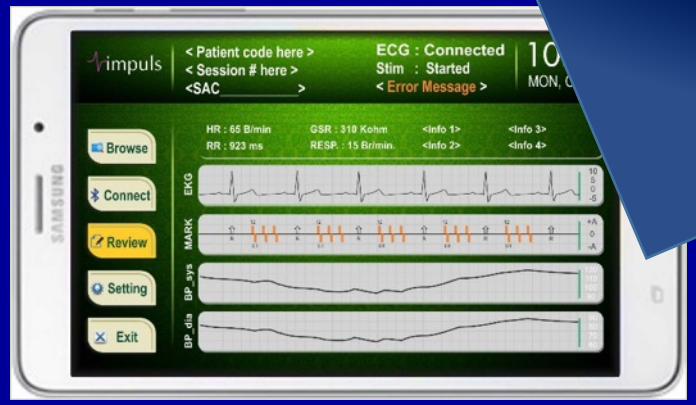
New Approach: Baroreceptor Training and Extinction Training



Behavioral training to prevent and extinguish pa… …mories

- Training of pain-incompatible health…
- Reduction of pain expressi…
- Work with spou… …s
- Traini…

Systolic Extinction Training
SET
setmarburg.com



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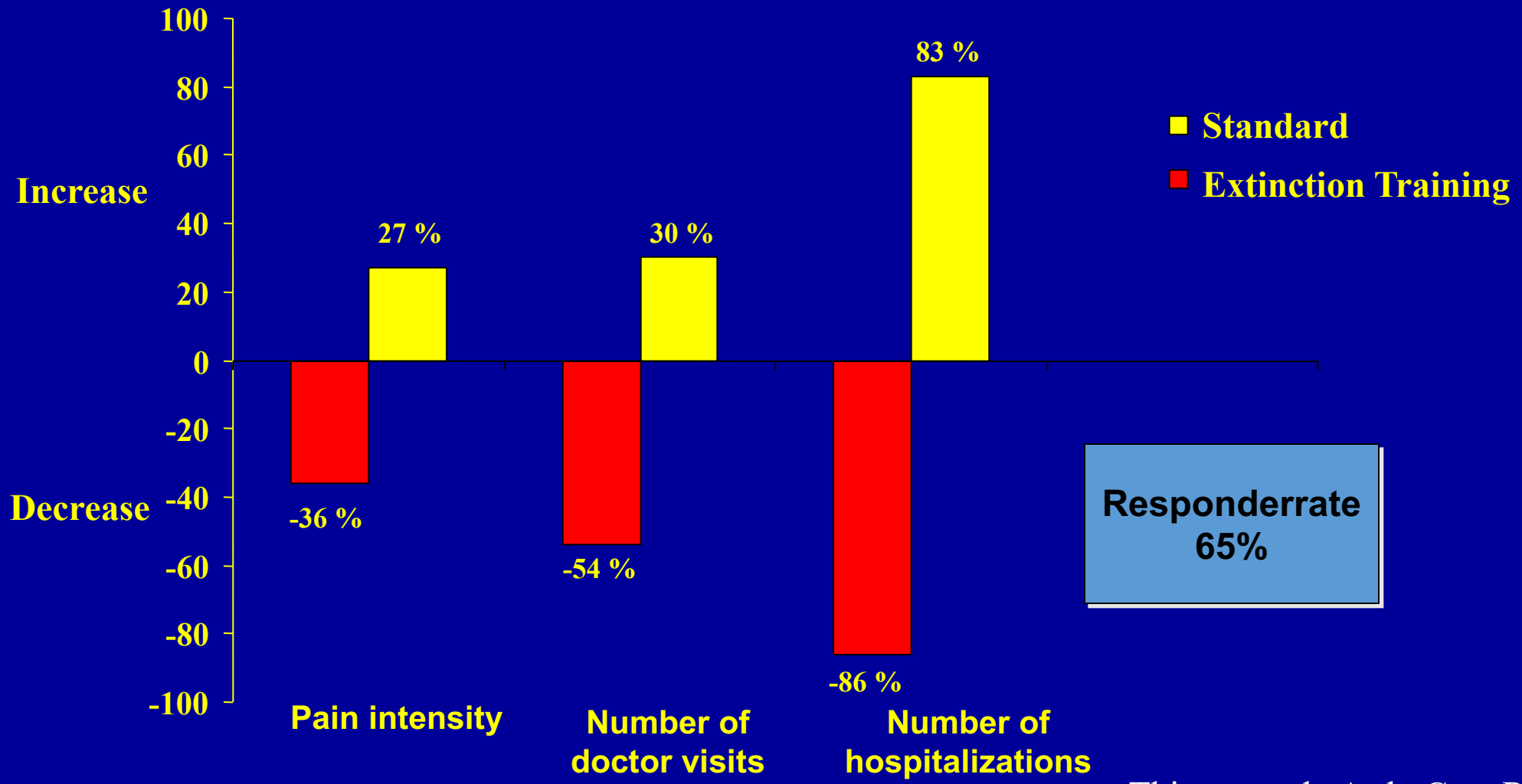
CNS-Therapy Th/2014

Privat Fundings by patients

Extinction Training versus Standardtreatment (Antidepressants, passive Physiotherapy) in FM

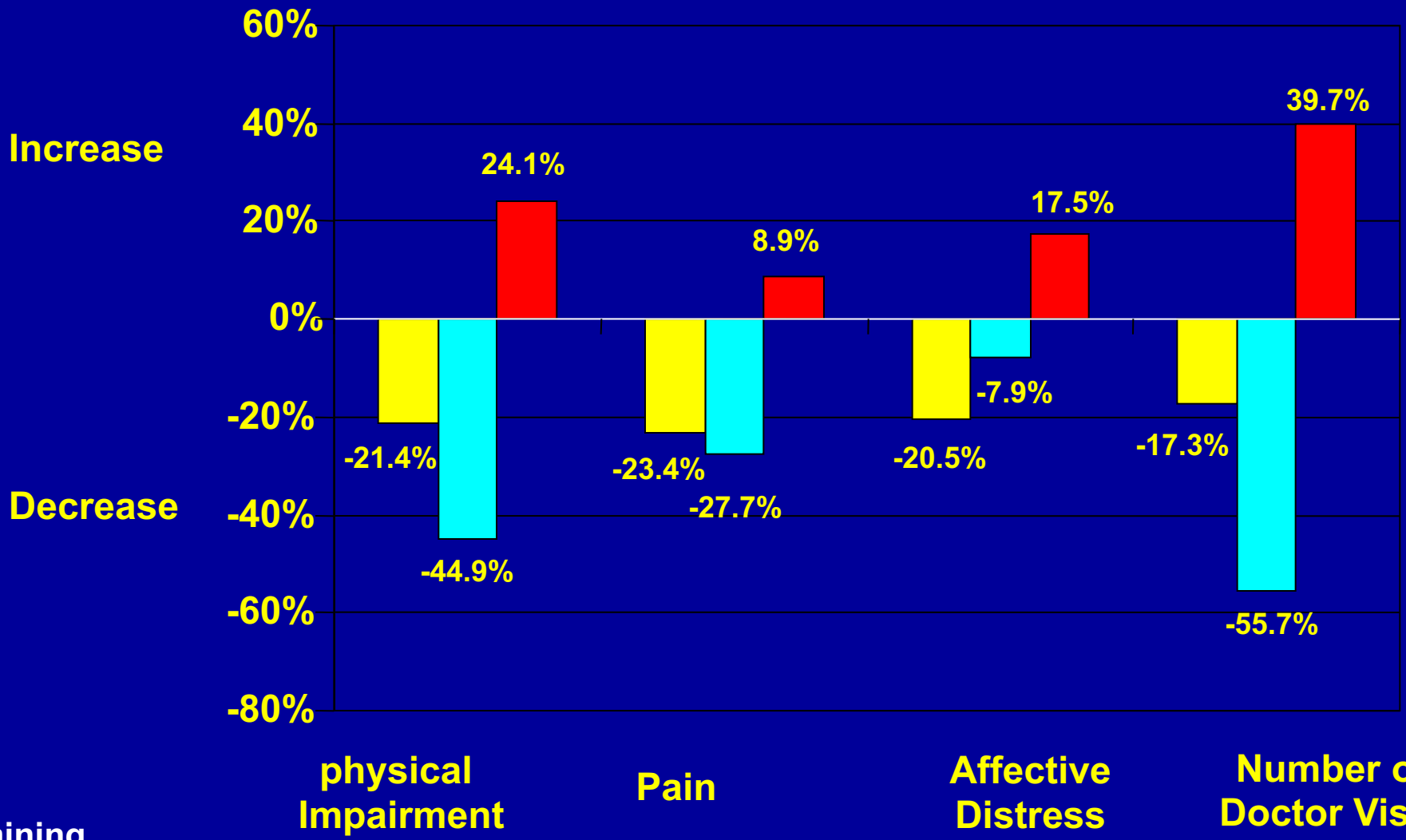
Setting:
Inpatient
5 weeks



Thieme et al, Arth. Care Res., 2003

Extinction Training, CBT versus Attention Placebo in FM

Setting:
Outpatient
15 weeks



Responderrate 53%

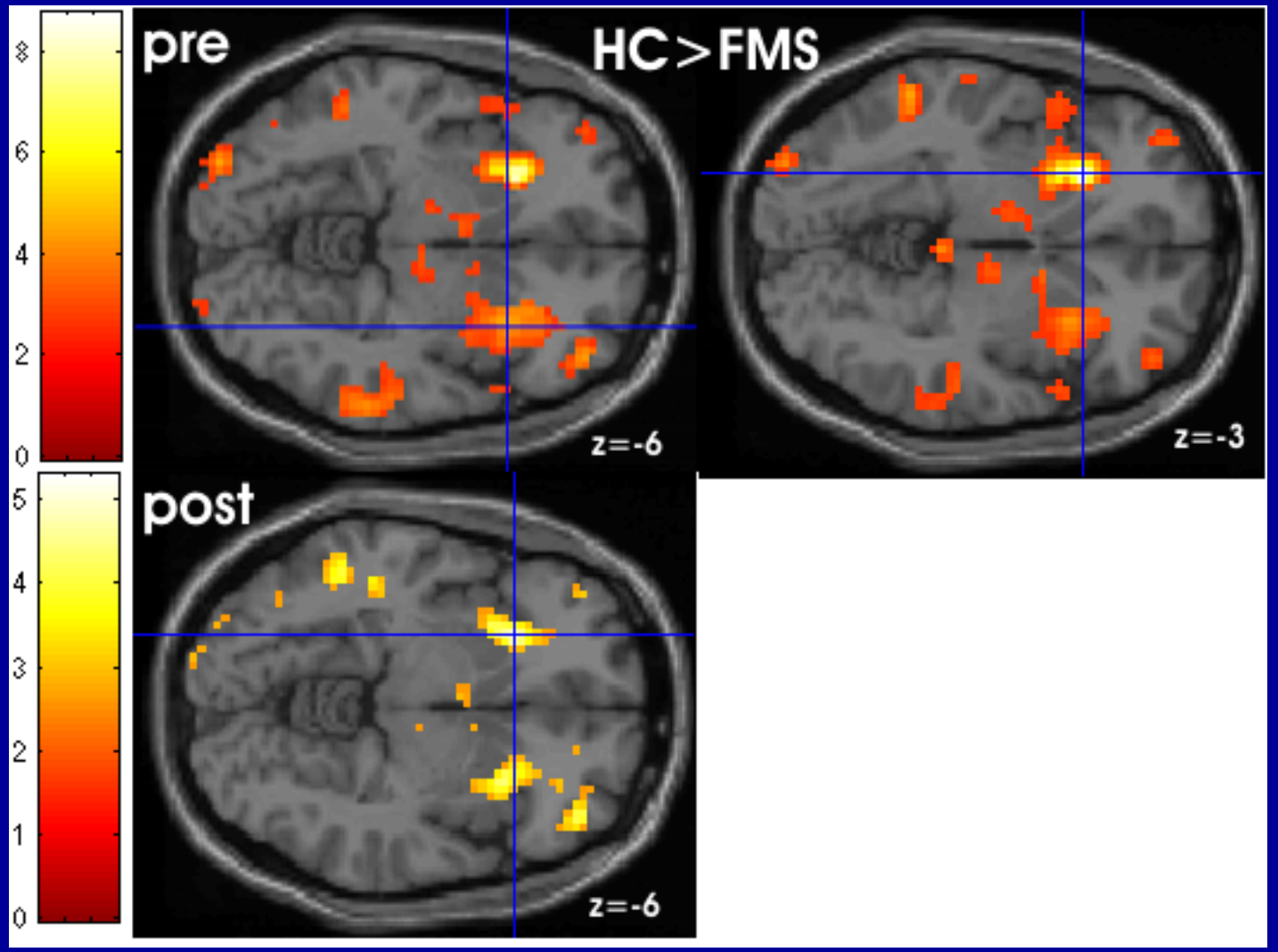
Extinction Training

Cognitive-behavior Pain Therapy

Attention Placebo (Discussion about Pain and Stress)

Thieme et al., Arth Res Ther, 2006

Central Changes after Extinction Training



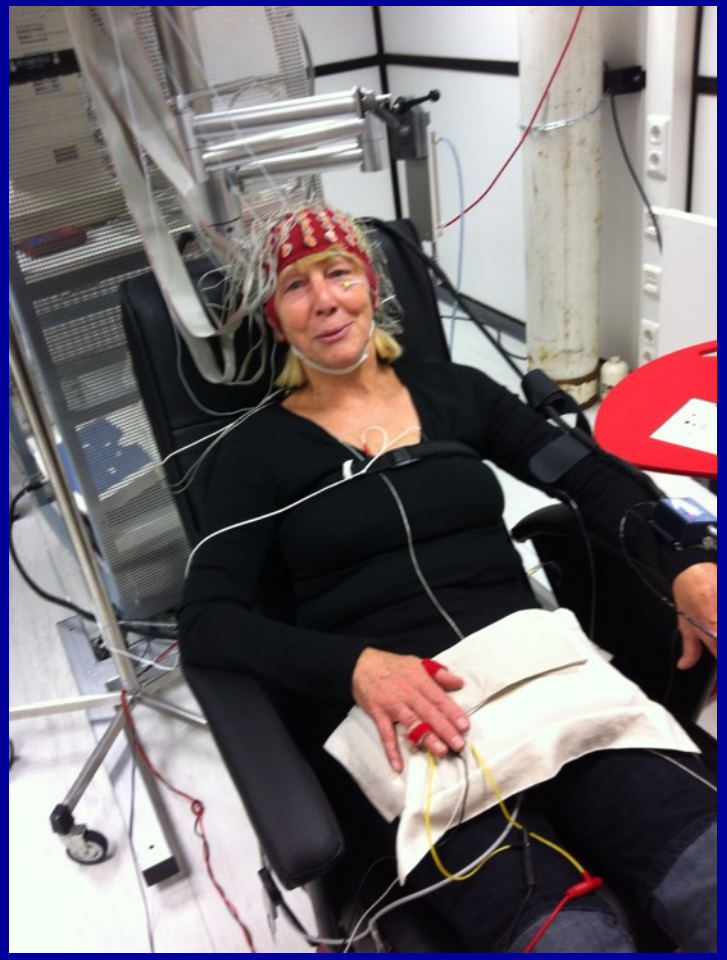
After ET:
Increased Bold response in
SS-I and SS-II,
ACC,
Amygdala and Insula
associated with
Clinically sign. Pain reduction

Cortical Reorganisation
based of
Plasticity and Learning

Diers et al., 2007

SET - Schedule

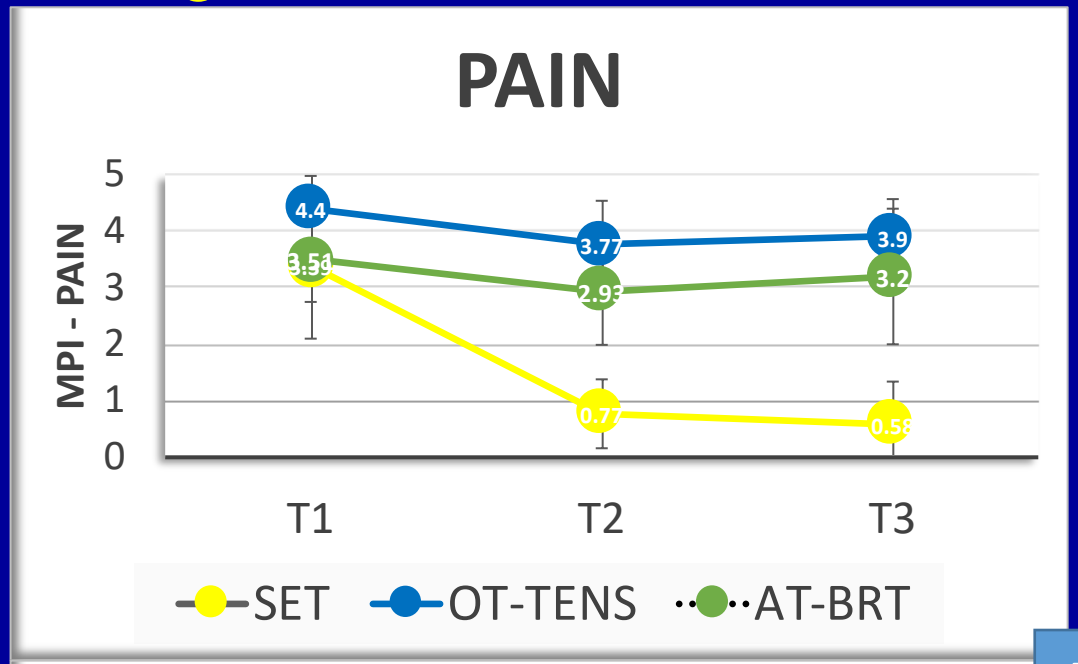
10 Sessions in 5 weeks with 2 x 2 hours per week

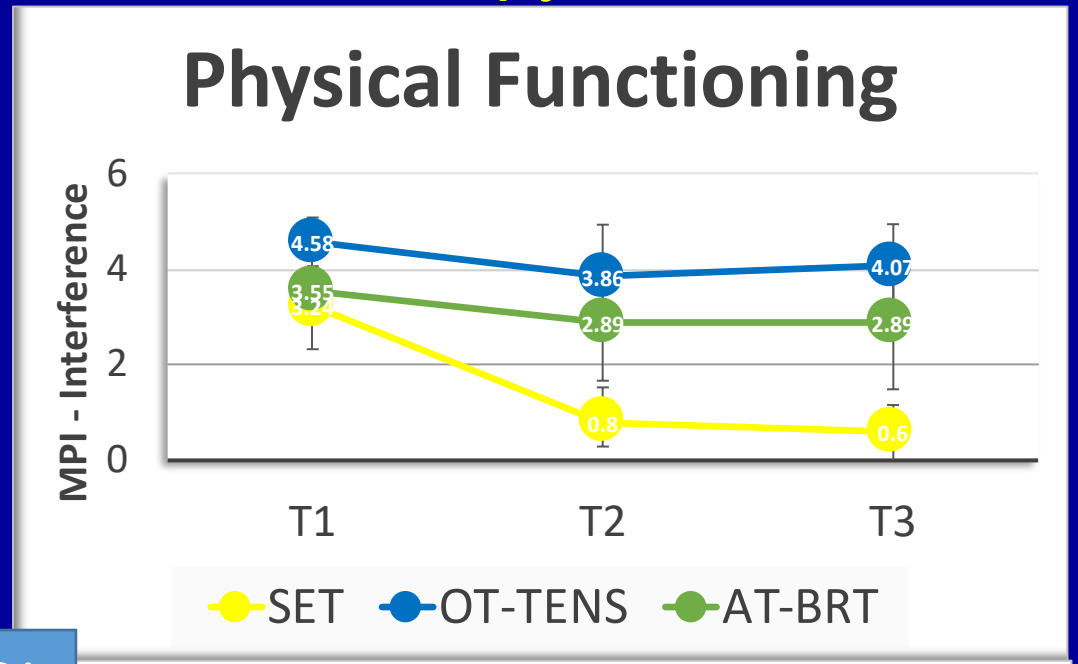


1st hour: Extinction Training with practices of muscle perception and graded activity as well as healthy behaviors

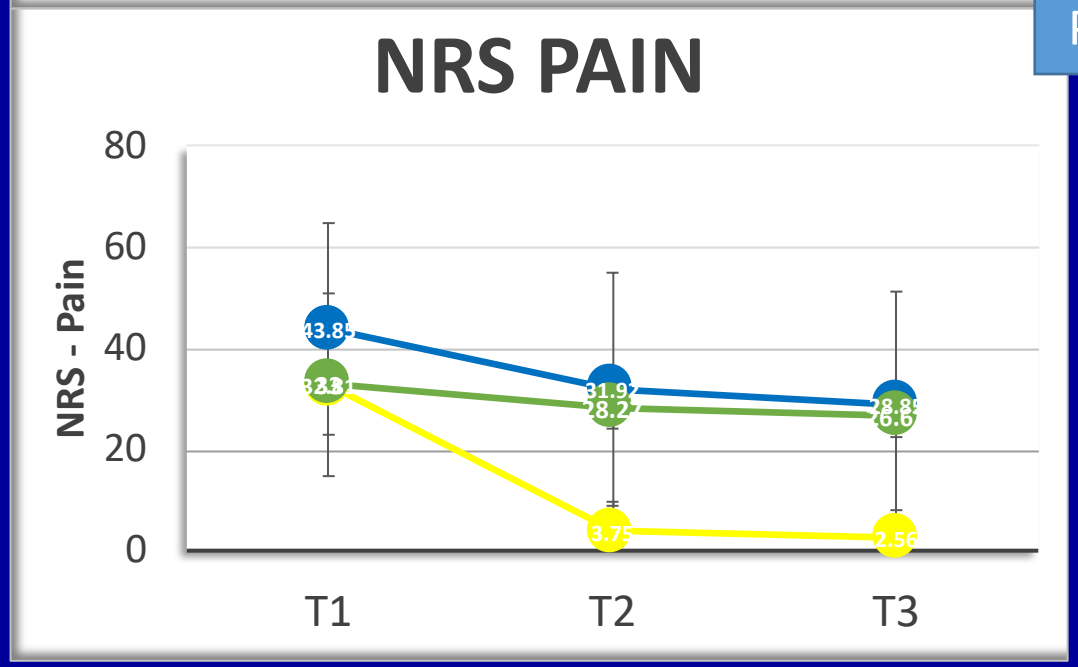
2nd hour: Baroreflex Training

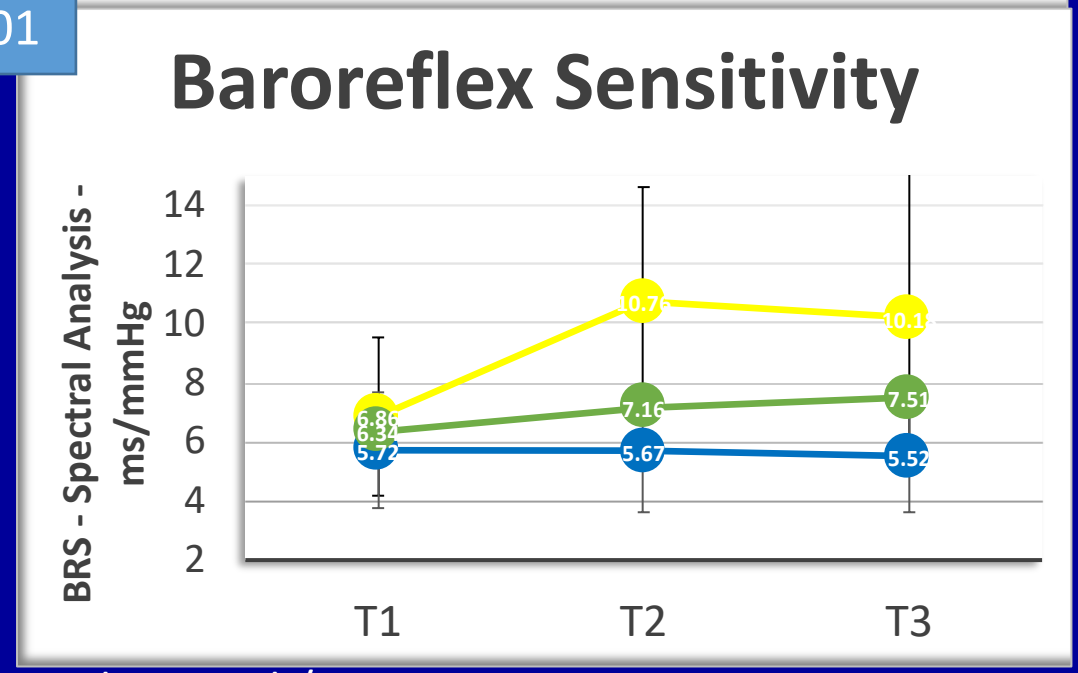
Changes in Pain, Interference and BRS after Therapy - 12 months f/u





P < 0.01





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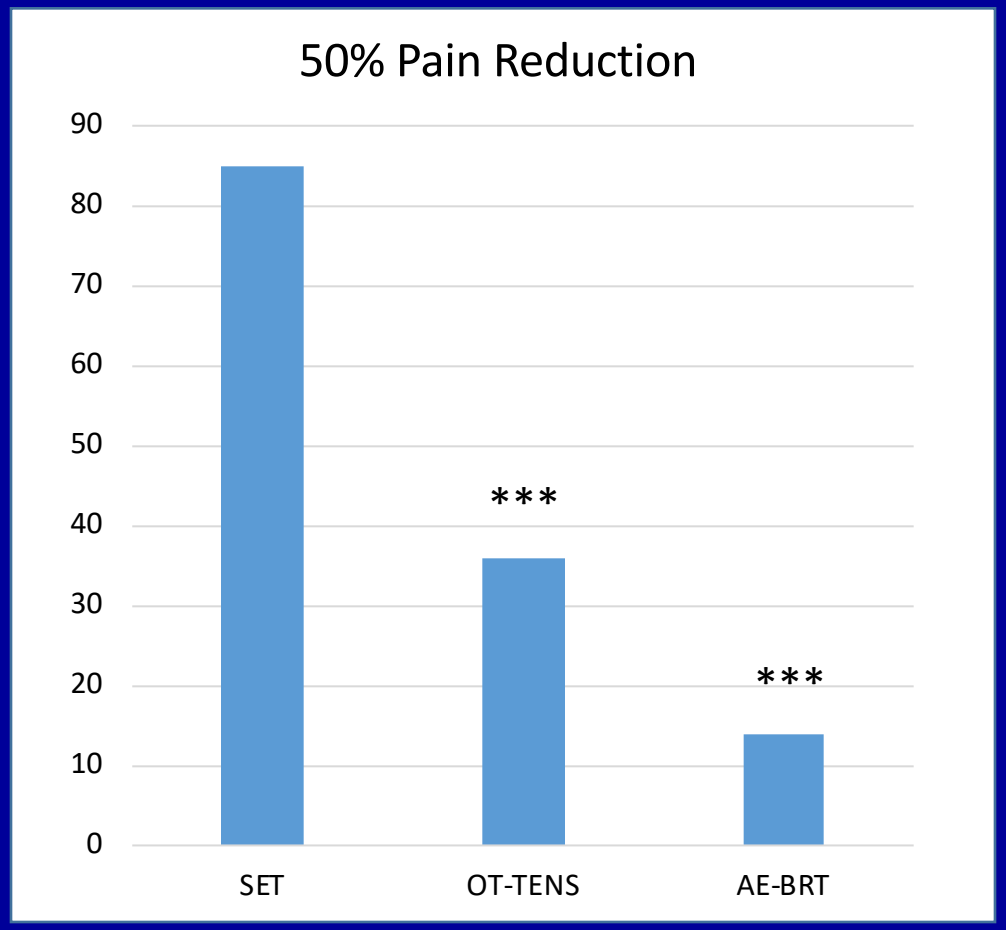
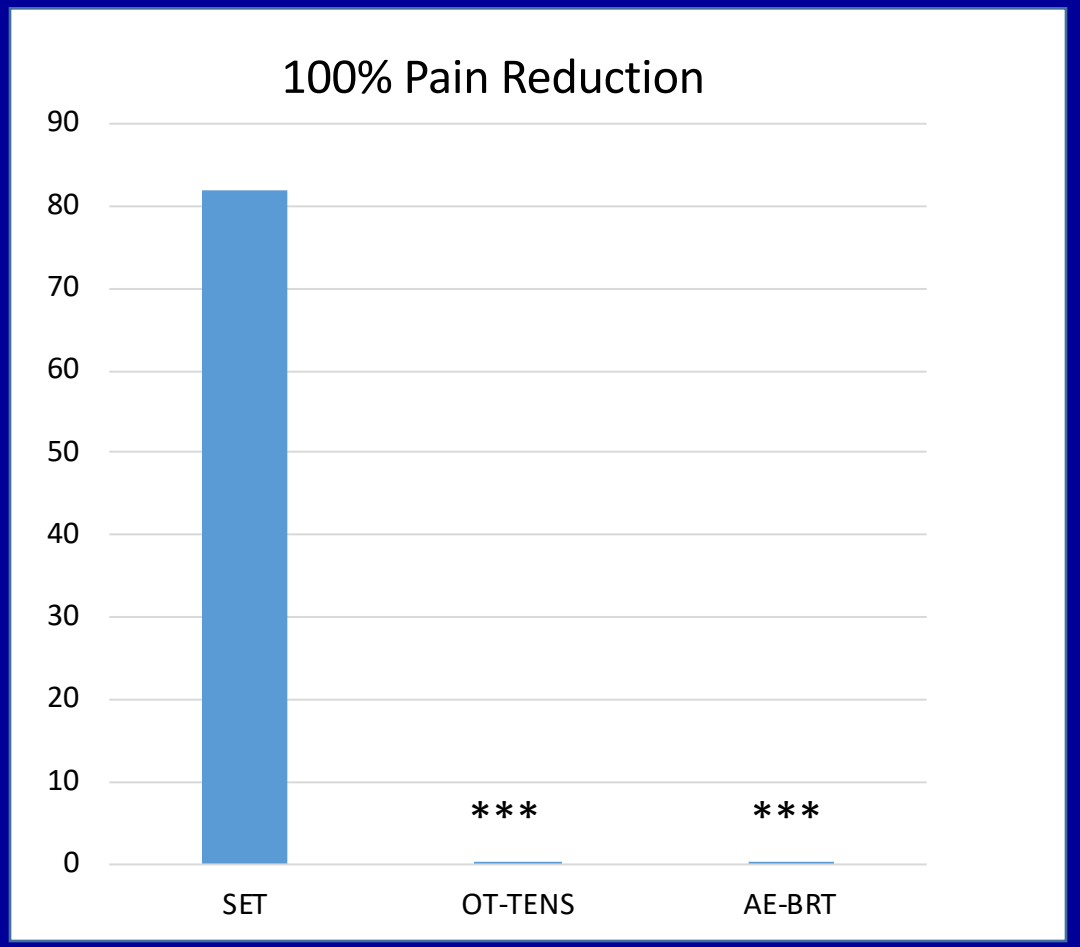
Responder rates 12 months after Treatment



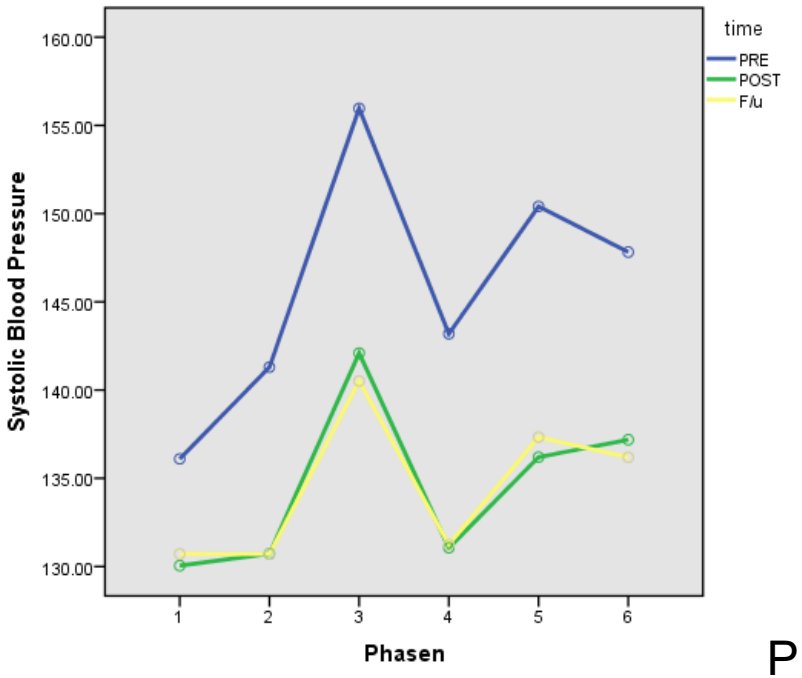


How do we know if NTS reflex arcs are re-activated after SET?

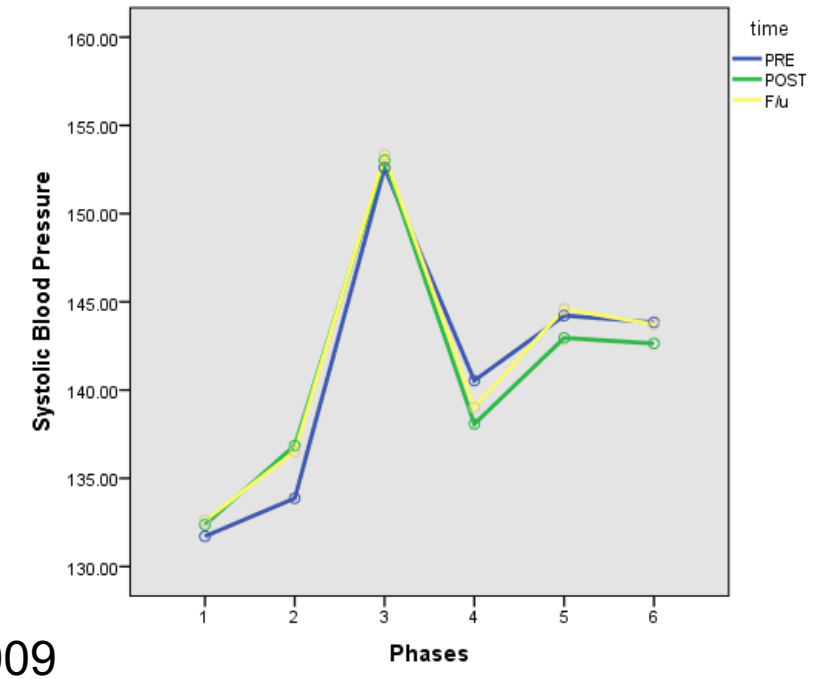
Clinically significant Reduction of Systolic Blood Pressure after SET

Increased HRV after SET

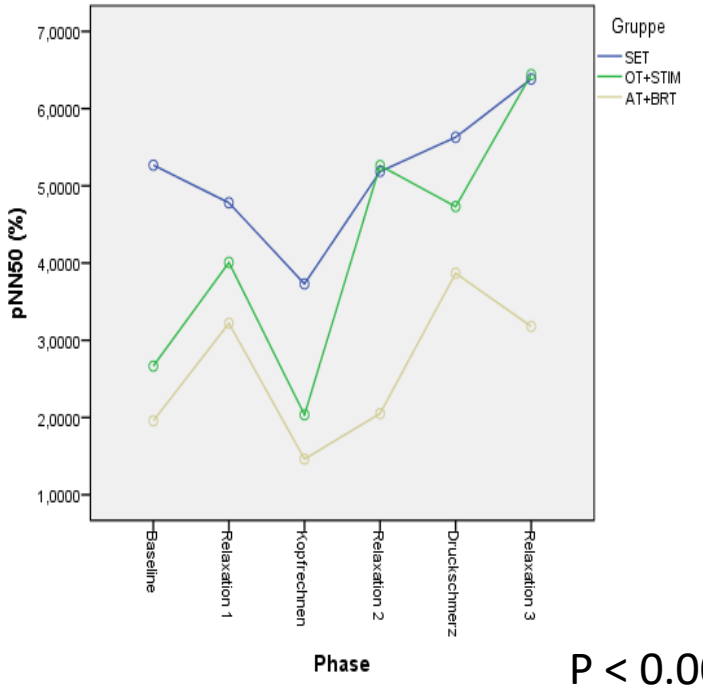
SET



Physiotherapy with BRT



P < 0.009

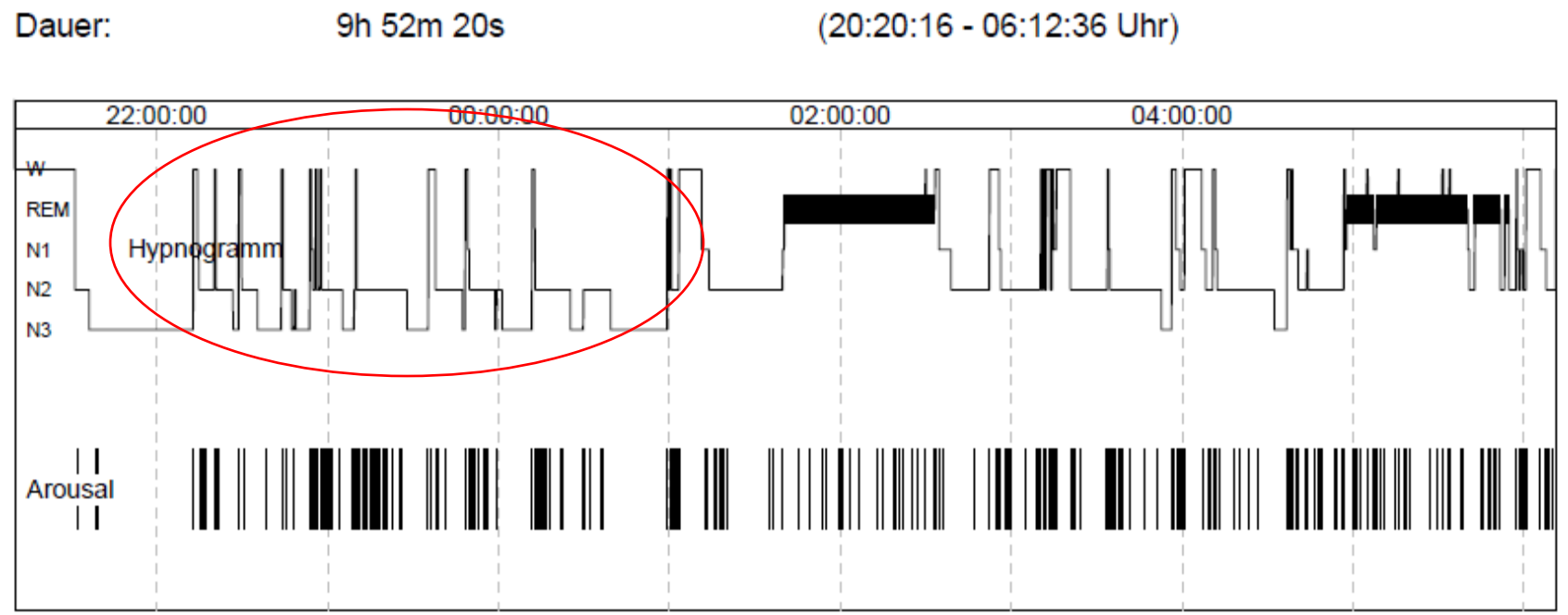


P < 0.004

Changed ***Sleep Pattern*** after SET in FM with sig. ***more Deep Sleep Phases*** in the 1st half of the night

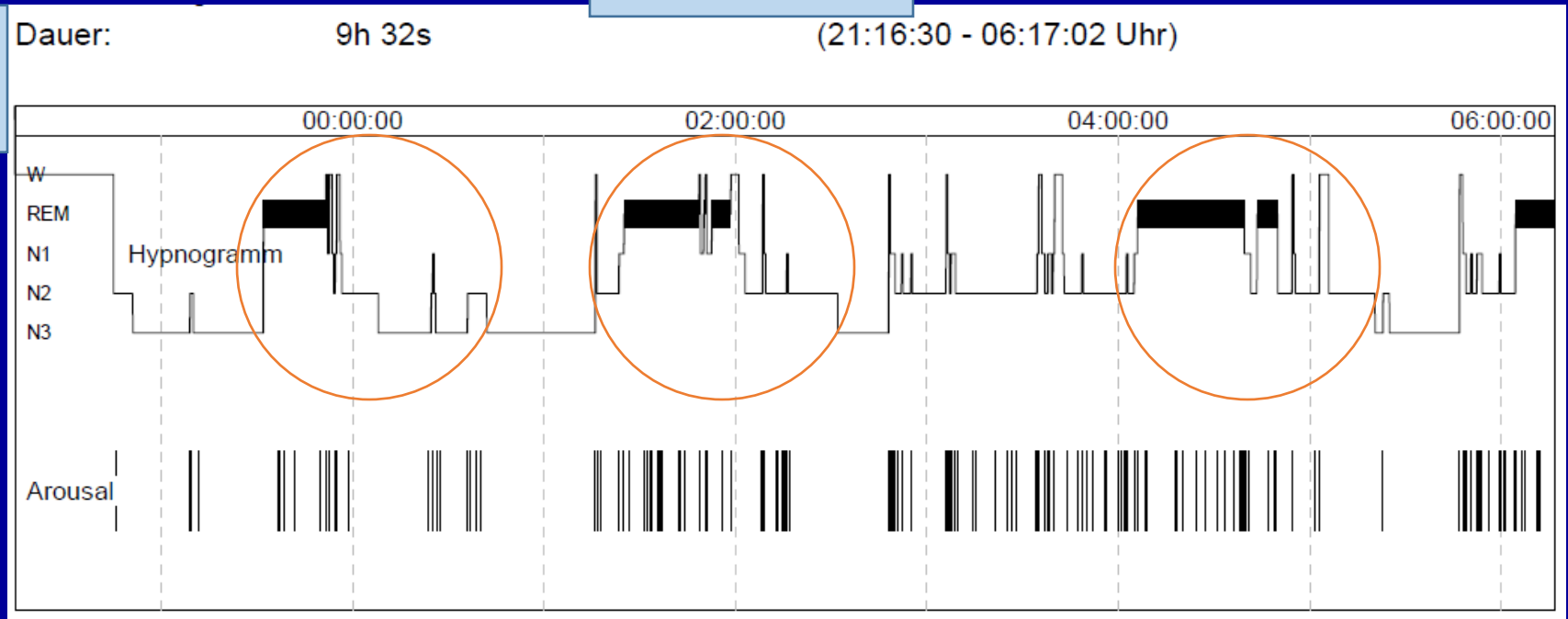
Assessment: Polysomnography

Pre

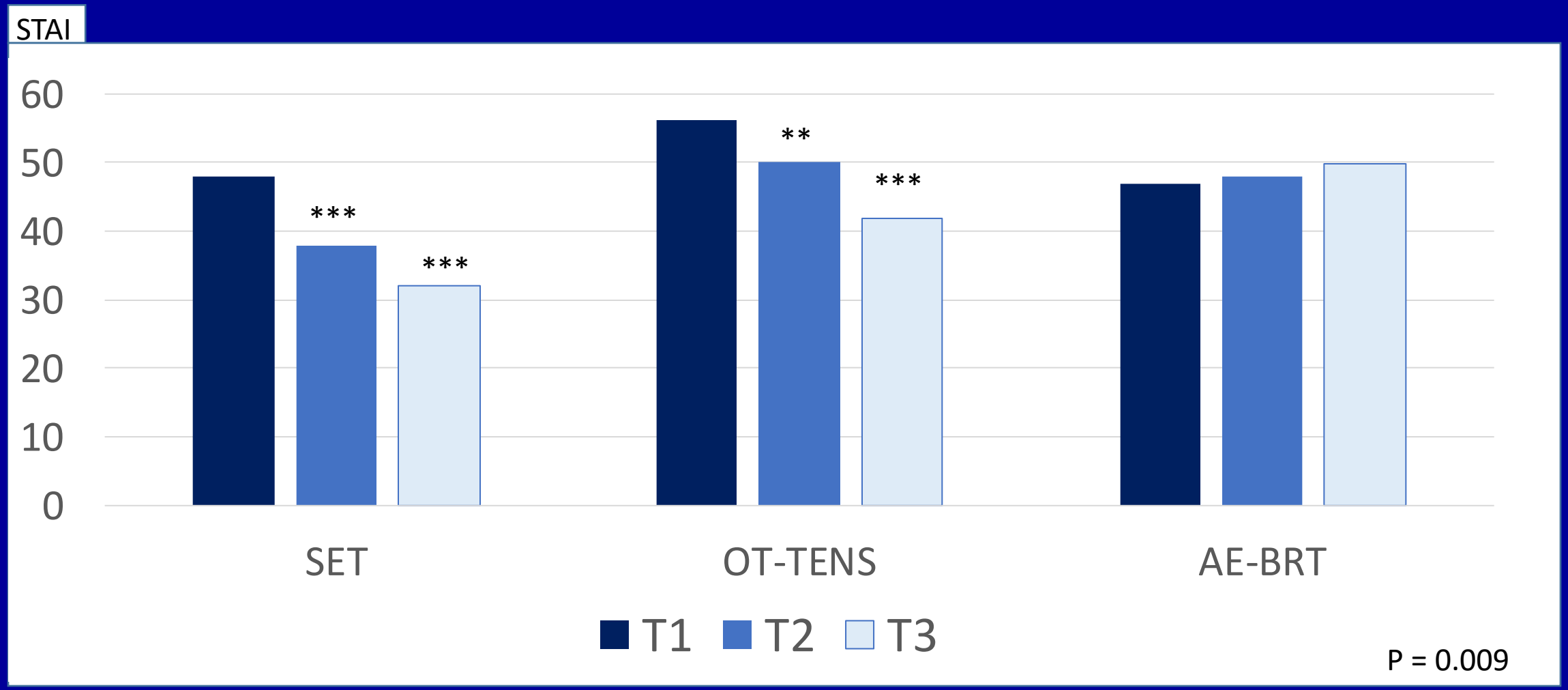


2nd Night

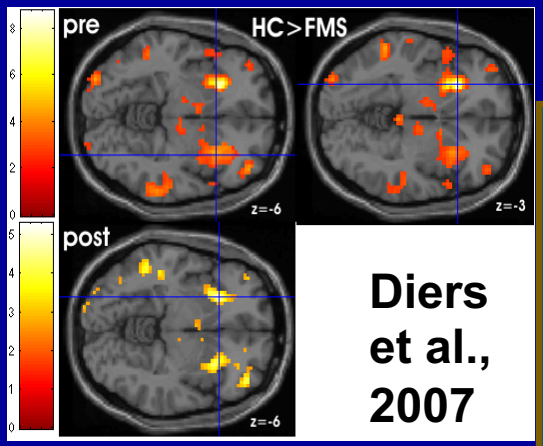
Post



Clinically significant *Reduction in Trait Anxiety*

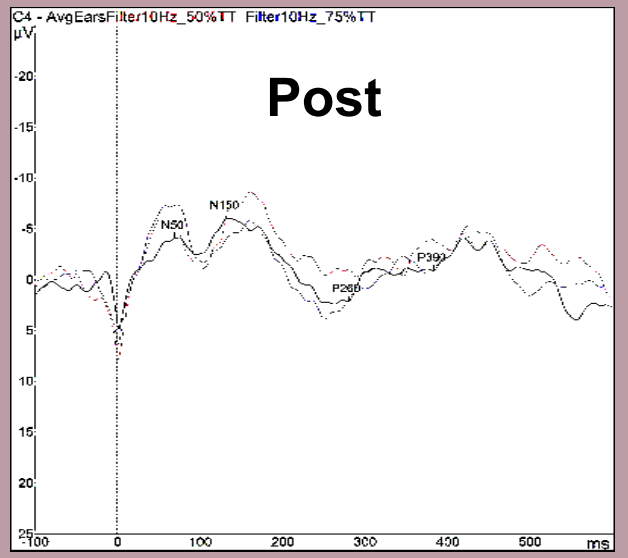


Higher Cortical Pain Inhibition after SET

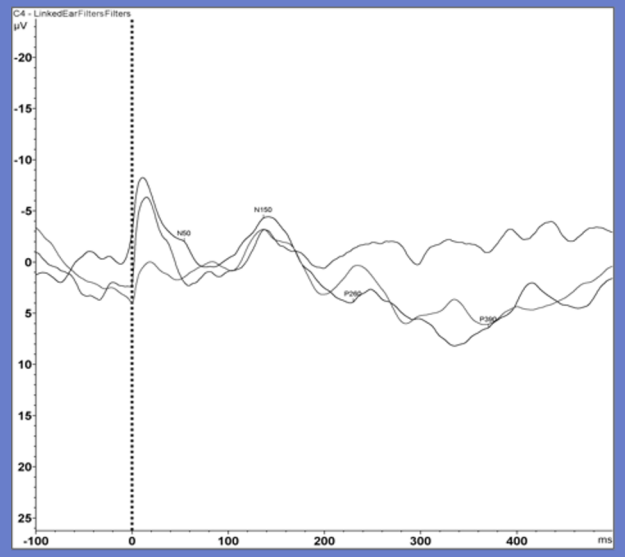


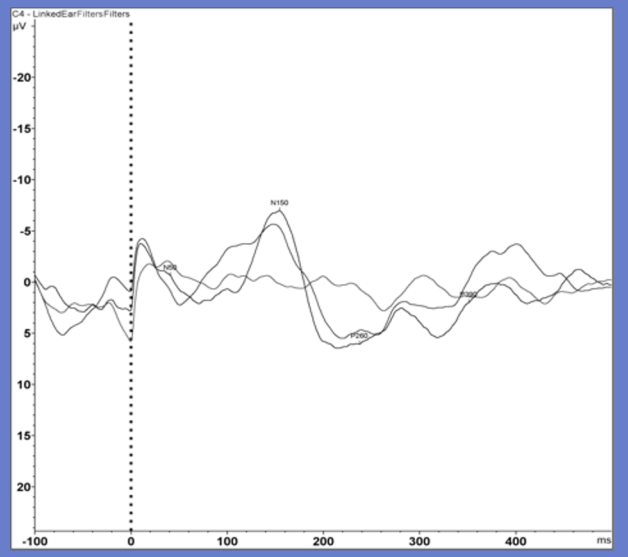
Diers et al., 2007

SET



OT-TENS





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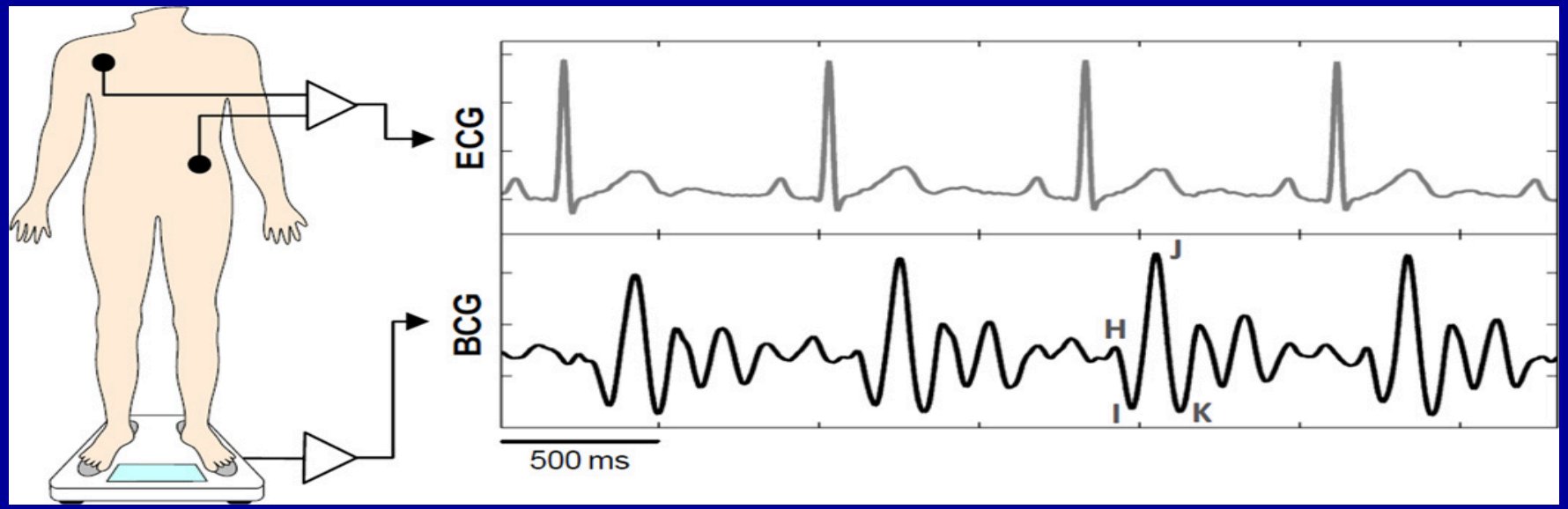
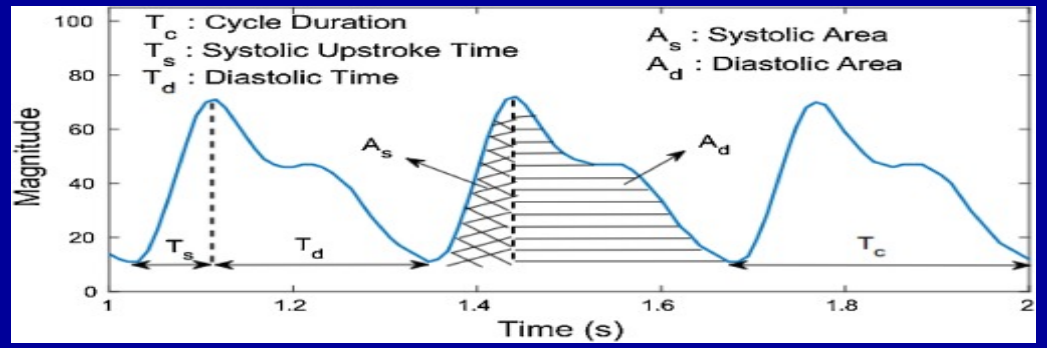
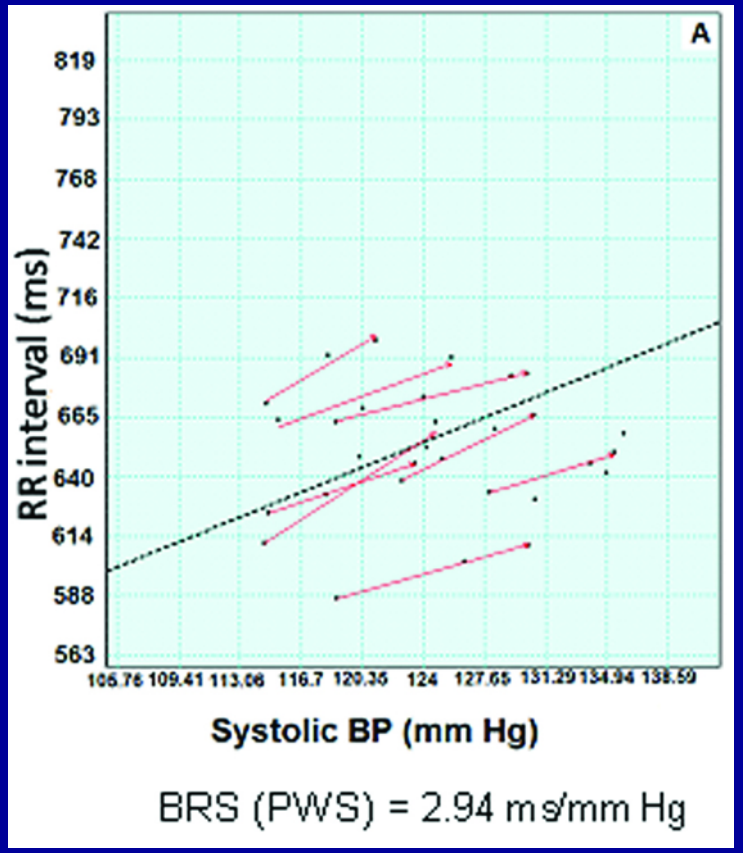
Privat Fundings by patients

The biosignals



Blood Pressure





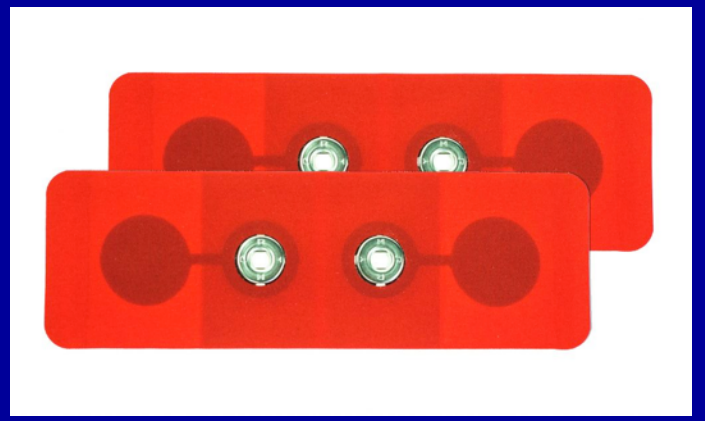
Baroreflex Sensitivity

So 85% of disease is chronic. The patient knows - exercise, weight, sleep, and diet; **but doesn‘t do it.**

- Lifestyle (behavioral) change is needed.
- Fitbit shows that tracking alone works for few and can even harm.
- Psychological therapists can induce behavioral change.
  - Unfortunately the only metric is whether the therapist and patient like each other / feel that the therapy is working.
- BRS and other bio signals give therapists feedback, track progress, allow approach change, and motivate the patients.
- A dual Bio and Psycho intervention is highly synergistic.

So why Movesense?

- Therapists require a simple low cost innocent looking device that a they can use.
- Device need to monitor EKG and BCG, temperature may also be important.
- BT/Cell phone interface.
- Long term activity tracking.



Take Home Message

Chronic pain and diseases show diminished BRS and autonomic nervous system.

Movesense device captures EKG and BCG which can be used to calculate BRS

A combination of Baroreceptor Training and Behavioral Therapy increases BRS and reduces blood pressure, sleep, anxiety and pain.

BRS tracking, session by session, allows therapy modification.

Long-term pain relief is possible (> 12 months).

for your attention!

Contact: mathys@uni-marburg.de