# Treatment of Persistent Spinal Pain Syndrome
# Repeat Surgery vs. MIS Procedures


Ludger Gerdesmeyer

# Disclosure

Clincical research advisory bord at:

Aesculap
Lima implants
Storz medical
Heel biol Heilmittel
Union Cycliste Internationale UCI
Professional Triathlon Organisation
PTO
MindClon AI

KIEL
SAILING CITY

# My passion

- Bord member of the ISMST
- Bord member of the DIGEST
- Fellow of interventional pain practice FIPP
- Clinical application and research > 30 yrs
- >100 paper
- 15 RCTs
- 2 FDA trials
- > 6000 THA
- > 4000 TKA
- > 500 TSA
- > Spine Fusions
- Triathlete > 40 yrs

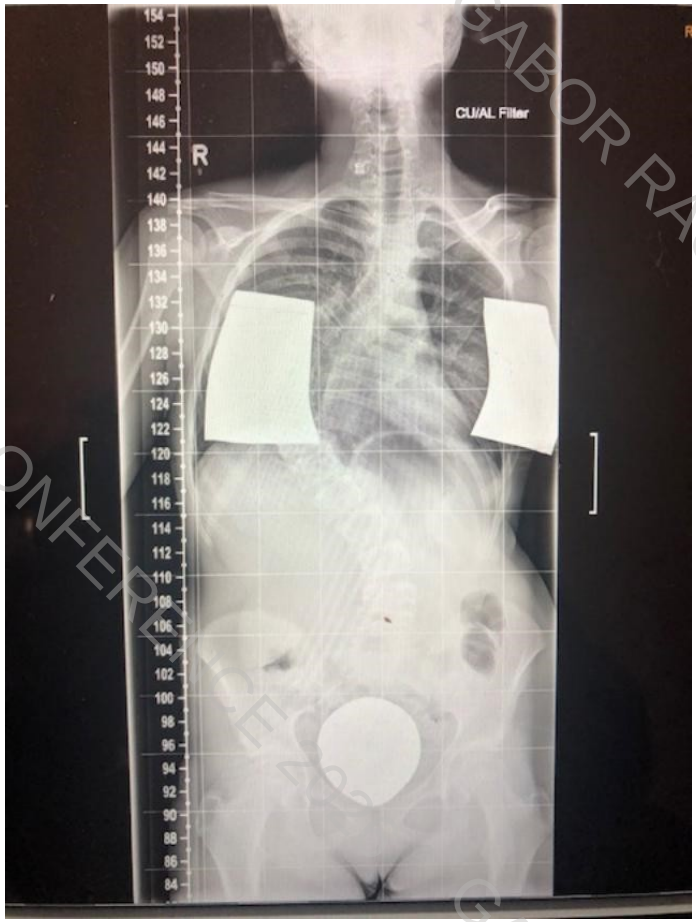
*Has nobody noticed the embarrassing fact that science is about to clone a human being, but it still can't cure the pain of a bad back?*

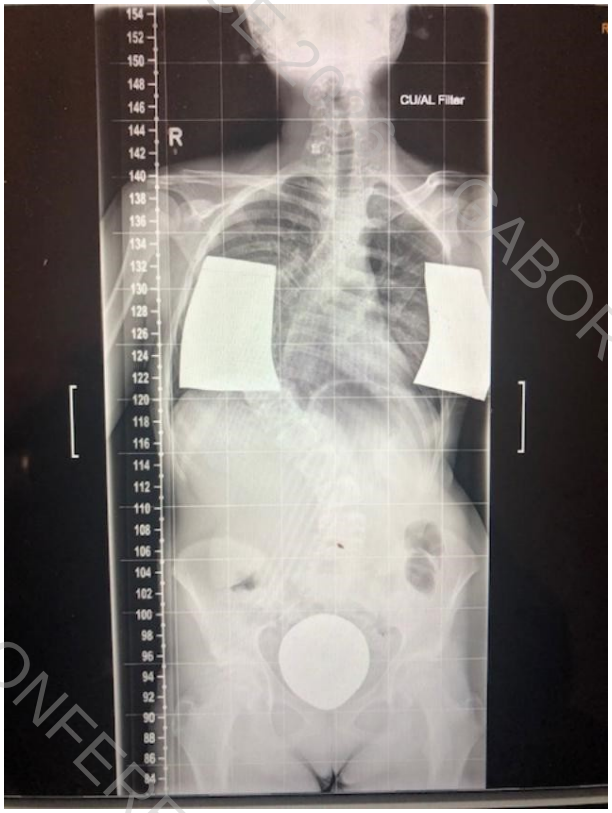
~ *Pain, by Marni Jackson, p. 5*

# Back Pain

## Most likely mechanical related

# Back Pain




*The evidence that tissue pathology does not explain chronic pain is overwhelming (e.g., in back pain, neck pain, and knee osteoarthritis).*

*Lorimer Moseley, "Teaching people about pain — why do we keep beating around the bush?" Pain Management. 2012.*

# Specific pain : specific Tx


| | |
|---|---|
| Initial phase: | specific pathology results in specific pain |
| Intermediate phase: | specific pathology goes along with specific & unspecific pain |
| Chronic phase: | specific pathology with unspecific pain |
| Diseased phase: | any specific pathology and chronic pain disease |

# Specific pain : specific Tx

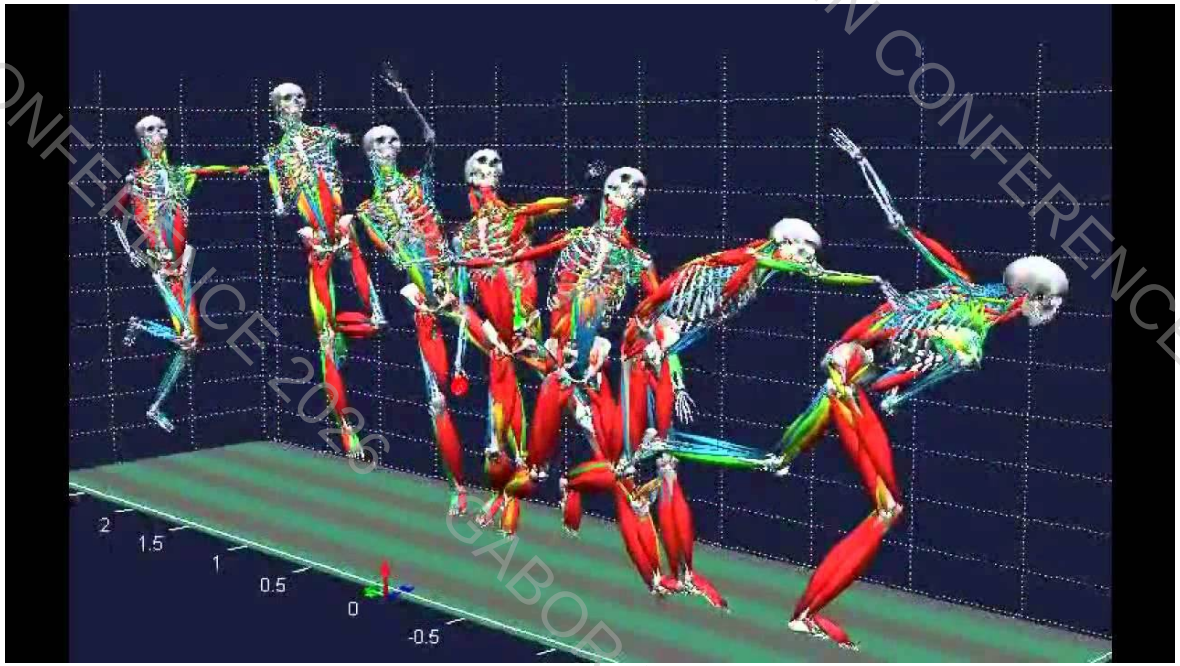
?

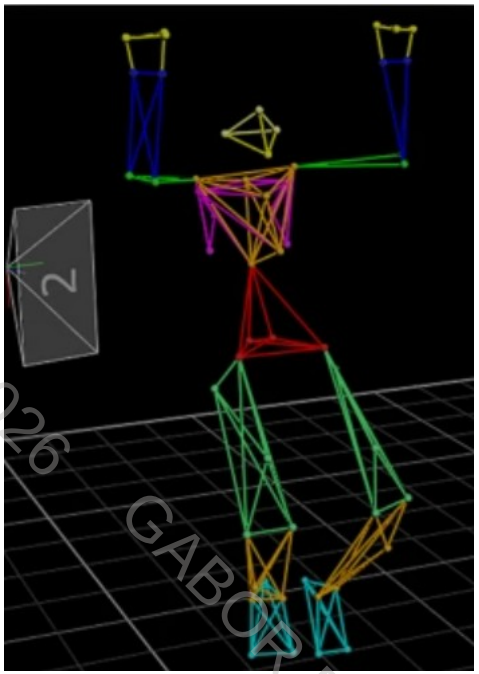
unspecific pain : unspecific Tx

specific pain : specific Tx

# Back Pain

hole body biomechnical phenotyping required to avoid intervention related disbalancing



# Back pain Tx

**Surgery adressing any mechanical realignement has unpredictable outcome**

**„Less is more“** ***Ludwig Mies van der Rohe***

“God is in the details.”

**Optimized is even better**

# Back Pain

Integrated AI based decision making


**The infrastructure behind every clinical decision**

MindClon is building the judgment infrastructure required to govern it

# 20 decades of learning, improving and communication

Gerdesmeyer L, Rechl H, Wagenpfeil S, Ulmer M, Lampe R, Wagner K. Die minimal-invasive perkutane epidurale Neurolyse beim chronischen Nervenwurzelreizsyndrom. Eine prospektive kontrollierte Pilotstudie zum Wirksamkeitsnachweis [Minimally invasive percutaneous epidural neurolysis in chronic radiculopathy. A prospective controlled pilot study to prove effectiveness]. Orthopade. 2003 Oct;32(10):869-76. German.

What´s the best Tx

in

Pain?

# best Tx biased

# by

- Personal experience
- personal performance
- diagnostic options
- economic factors
- EBM
- Tradition
- Expectation
- social environment

# What is pain

Pain means complexity

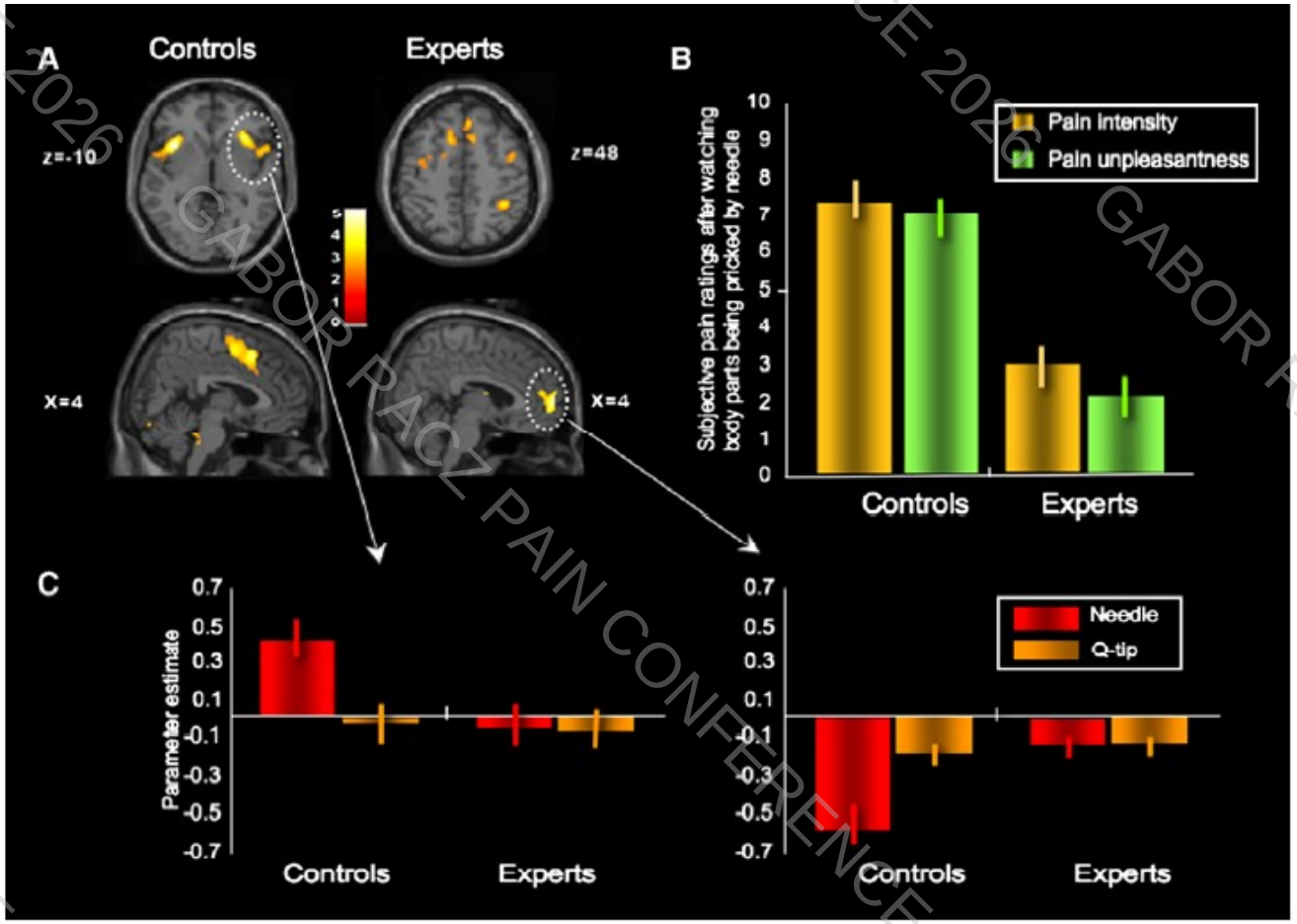



Figure 1. Differential Neural Activations between the Experts and Controls When Watching Body Parts Being Pricked by an Acupuncture Needle

(A) Participants from the control group activated bilateral insula, PAG, ACC, and SMA, whereas participants from the expert group activated right inferior parietal lobule and medial prefrontal gyrus.

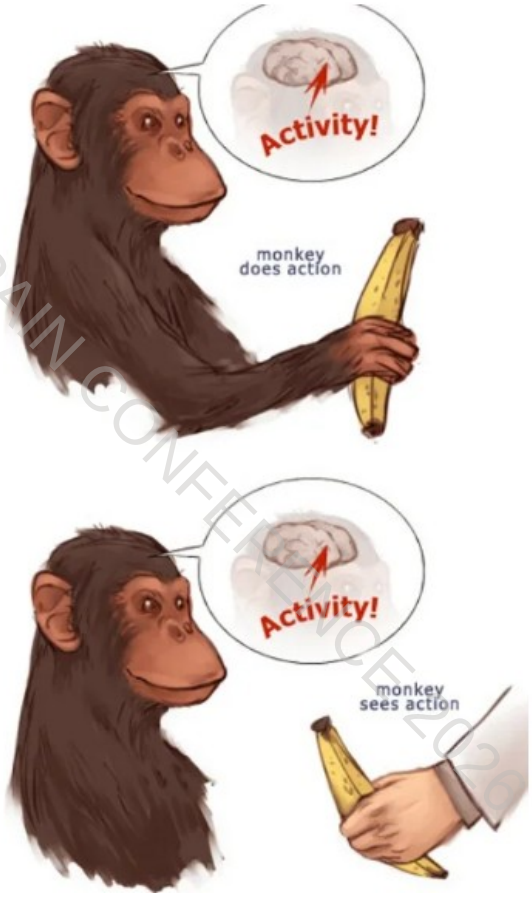
(B) Compared to the expert group, participants from the control group scored significantly higher on pain intensity and unpleasantness ratings.

(C) Parameter estimate graphs show signal change in the insula and medial prefrontal cortex for each condition in each group. When watching acupuncture procedures, stronger activation was detected in the anterior insula in the control group, whereas the experts showed stronger activation in the medial prefrontal cortex. When watching a Q-tip, there is no such double dissociation.

Aus: Current Biology 17, 1708-1713, October 9, 2007

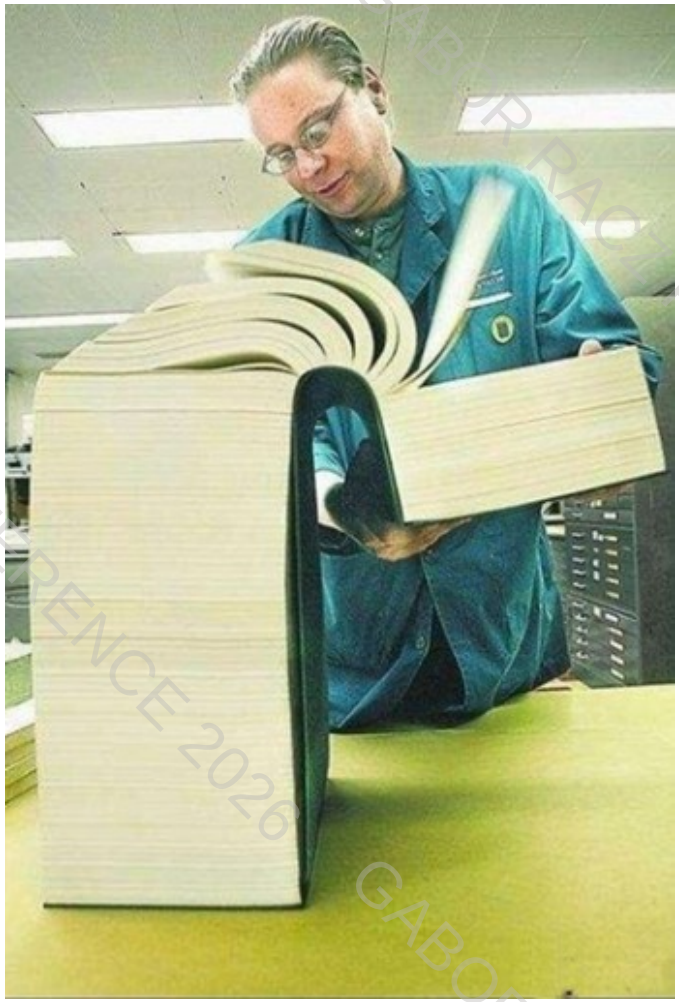
# Myofascial pain

"Mirror Neurons"



# Myofascial pain

# understanding pain

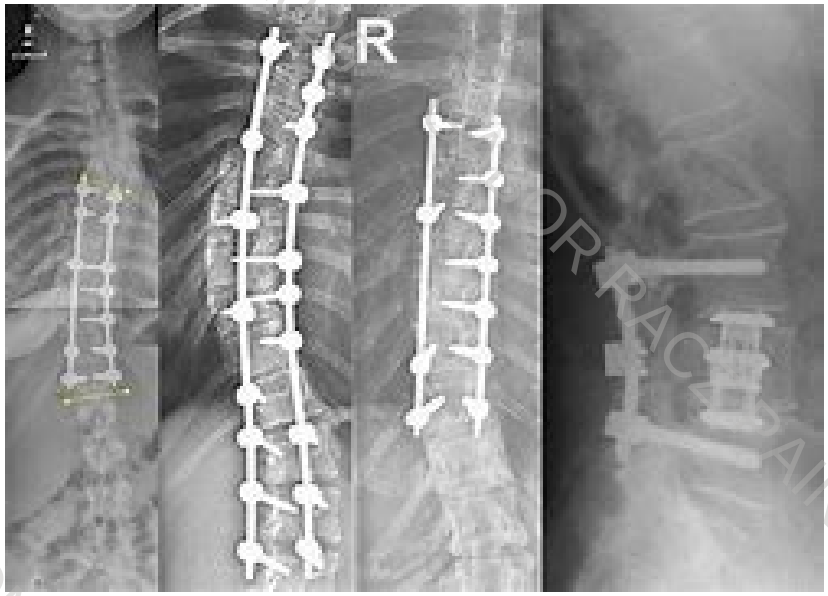


***Understanding Pain”***

***now out in paperback***

*Gerdesmeyer et al.: 2025 “Understanding Pain”*

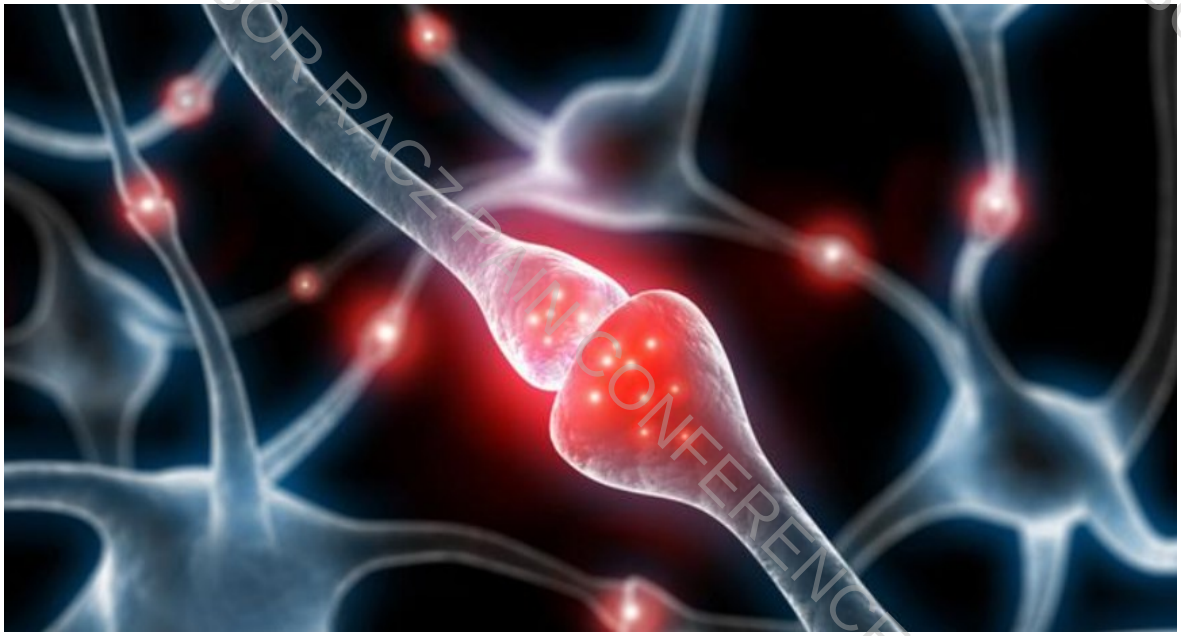
# Soft tissue pain




# Myofascial Soft tissue engineering

# Pain becomes a disease

*worst case scenario*



## Prevention of chronicity

*Gangadharan V, Zheng H, Taberner FJ, Landry J, Nees TA, Pistolic J, Agarwal N, Männich D, Benes V, Helmstaedter M, Ommer B, Lechner SG, Kuner T, Kuner R. Neuropathic pain caused by miswiring and abnormal end organ targeting. Nature. 2022 Jun;606(7912):137-145*

# Pain becomes a disease

*worst case scenario*



Article | Open Access | Published: 25 May 2022

## Neuropathic pain caused by miswiring and abnormal end organ targeting

Vijayan Gangadharan, Hongwei Zheng, Francisco J. Taberner, Jonathan Landry, Timo A. Nees, Jelena Pistolic, Nitin Agarwal, Deepitha Männich, Vladimir Benes, Moritz Helmstaedter, Björn Ommer, Stefan G. Lechner, Thomas Kuner & Rohini Kuner

# Pain becomes a disease
## *worst case scenario*

- After injury: sensoric nerve fibre shows slow regeneration. Pain signal transmitting fibre shows faster recovery and take over sensoric properties
- Normal sensoric structures are replaced by modified pain transmitting fibre with faster recovery
- Normal Sensoric impulses becomes pain impulses via modified pain transmitting fibres
- Chronic pain syndrome results from new reinnervation and mis-transmitting as regular sensoric structure recovery incomplete – post traumatic phantom pain syndrome
- **Up to date no Tx option to prevent this mis-rennervation phenomen**

*Gangadharan V, Zheng H, Taberner FJ, Landry J, Nees TA, Pistolic J, Agarwal N, Männich D, Benes V, Helmstaedter M, Ommer B, Lechner SG, Kuner T, Kuner R. Neuropathic pain caused by miswiring and abnormal end organ targeting. Nature. 2022 Jun;606(7912):137-145*

# Pain becomes a disease

*worst case scenario*


Effective Pain intervention starts with prevention !!

# Post Op pain management

ELSEVIER

The SPINE JOURNAL

The Spine Journal 24 (2024) 1615–1624

Clinical Study

## Poor postoperative pain control is associated with poor long-term patient-reported outcomes after elective spine surgery: an observational cohort study

Michael M.H. Yang, MD, MSc, M.Biotech[a,b,c,*], Rena Far, MD[a], Jay Riva-Cambrin, MD, MSc[a,b], Tolulope T. Sajobi, PhD[b], Steven Casha, MD, PhD[a,d]

[a] *Department of Clinical Neurosciences, Section of Neurosurgery, University of Calgary, 1403 29 Street NW, Calgary, Alberta, T2N 2T9, Canada*

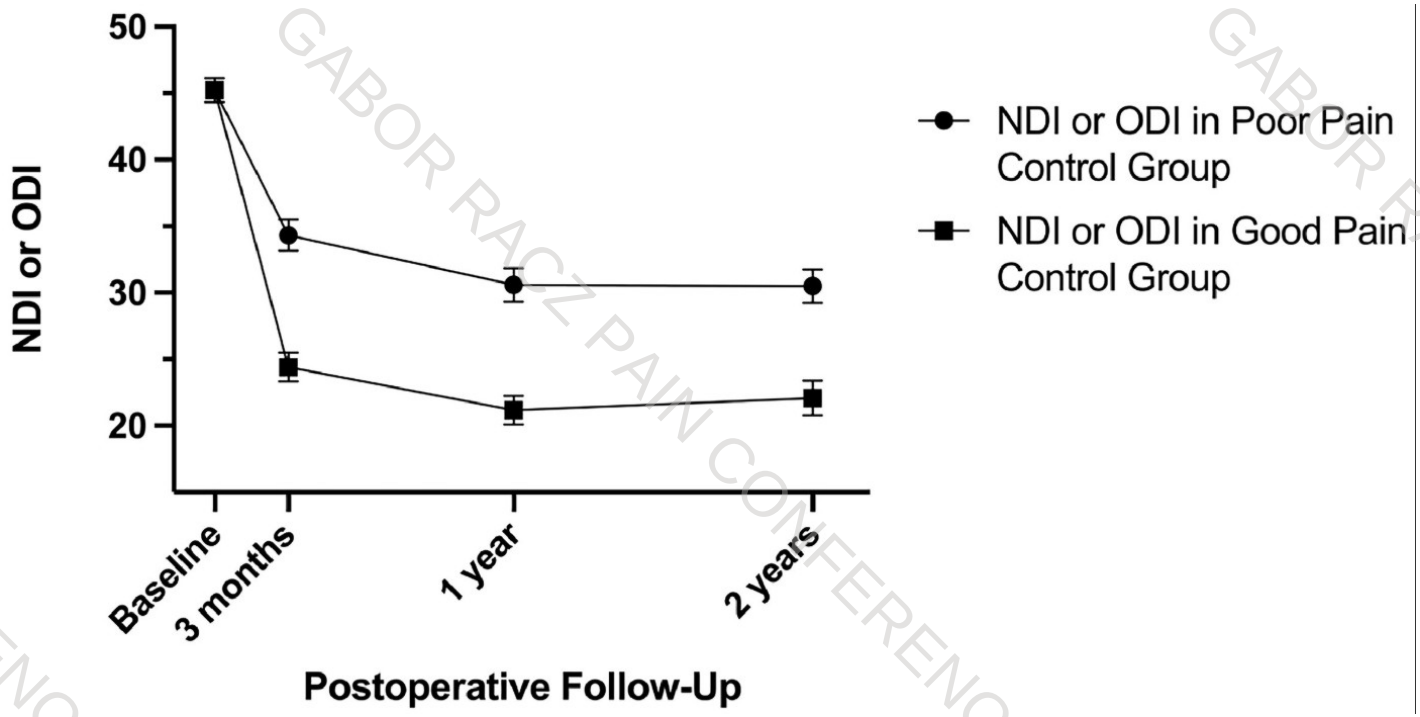
*Yang MMH, Far R, Riva-Cambrin J, Sajobi TT, Casha S. Poor postoperative pain control is associated with poor long-term patient-reported outcomes after elective spine surgery: an observational cohort study. Spine J. 2024 Sep;24(9):1615-1624.*

# Post Op pain management

- **Purpose:** To investigate the association between poor postoperative pain control and patient-reported outcomes after spine surgery.
- **Study design:** cohort study, n:1294.
- **Outcome measure:** Poor surgical outcome was defined as failure to achieve a minimal clinically important difference (MCID) of 30% improvement on the Oswestry Disability Index or Neck Disability Index at follow-up (3-months, 1-year, and 2-years).
- **Methods:** Poor pain control was defined as a mean numeric rating scale score of >4 during the first 24-hours after surgery. Multivariable mixed-effects regression was used to investigate the relationship between poor pain control and changes in surgical outcomes while adjusting for known confounders.

*Yang MMH, Far R, Riva-Cambrin J, Sajobi TT, Casha S. Poor postoperative pain control is associated with poor long-term patient-reported outcomes after elective spine surgery: an observational cohort study. Spine J. 2024 Sep;24(9):1615-1624.*

# Post Op pain management




stratified by postoperative pain control status
(poor pain control group; mean VAS>4 in the first 24-hours after surgery)

*Yang MMH, Far R, Riva-Cambrin J, Sajobi TT, Casha S. Poor postoperative pain control is associated with poor long-term patient-reported outcomes after elective spine surgery: an observational cohort study. Spine J. 2024 Sep;24(9):1615-1624.*

# Post Op pain management

**Conclusion**

Poor pain control in the first 24-hours after elective spine surgery was an independent risk factor for poor surgical outcome

*Yang MMH, Far R, Riva-Cambrin J, Sajobi TT, Casha S. Poor postoperative pain control is associated with poor long-term patient-reported outcomes after elective spine surgery: an observational cohort study. Spine J. 2024 Sep;24(9):1615-1624.*

# MIS long-term outcome

Eur Spine J. 2024 Jun;33(6):2206-2212. doi: 10.1007/s00586-024-08199-5. Epub 2024 Mar 21.

## The long-term outcome of revision microdiscectomy for recurrent sciatica

M B Lequin [1 2 3], D Verbaan [4 5], P R Schuurman [4 5], Saskia Tasche [6], W C Peul [7], W P Vandertop [4 5], G J Bouma [4 5 6]

Affiliations – collapse

### Affiliations

1 Department of Neurosurgery, Amsterdam University Medical Centers Location Acadamic Medical Center, Neurosurgery, Meibergdreef 9, 1105 EZ, Amsterdam, The Netherlands.

*Lequin MB et al The long-term outcome of revision microdiscectomy for recurrent sciatica. Eur Spine J. 2024 Jun;33(6):2206-2212*

# MIS long-term outcome

**Purpose:** To study the long-term outcome of revision microdiscectomy after classic microdiscectomy for lumbosacral radicular syndrome (LSRS).
**Methods:** Eighty-eight of 216 patients (41%) who underwent a revision microdiscectomy
**Results:** Mean age was 59.8 (12.8)
mean follow-up 10.0 years

- A favourable general perceived recovery was reported by 40%
- A favourable outcome (leg pain) in 45%
- A favourable outcome in back pain 41%
- Re-revision operation occurred in 35%
- no significant difference in the rate of favourable outcome between patients with or without a re-revision operation.

*Lequin MB et al The long-term outcome of revision microdiscectomy for recurrent sciatica. Eur Spine J. 2024 Jun;33(6):2206-2212*

# MIS long-term outcome

**Conclusion:**

The long-term results after revision microdiscectomy show an unfavourable outcome in the majority of patients and a high risk of re-revision microdiscectomy, with similar results.

Based on the disappointing results of alternative treatments, revision microdiscectomy for recurrent radiculopathy seems to be a valid treatment.

*Lequin MB et al The long-term outcome of revision microdiscectomy for recurrent sciatica. Eur Spine J. 2024 Jun;33(6):2206-2212*

# MIS in Neurolysis procedure

Pain Physician 2021; 24:359-367 • ISSN 1533-3159

**Randomized Trial**

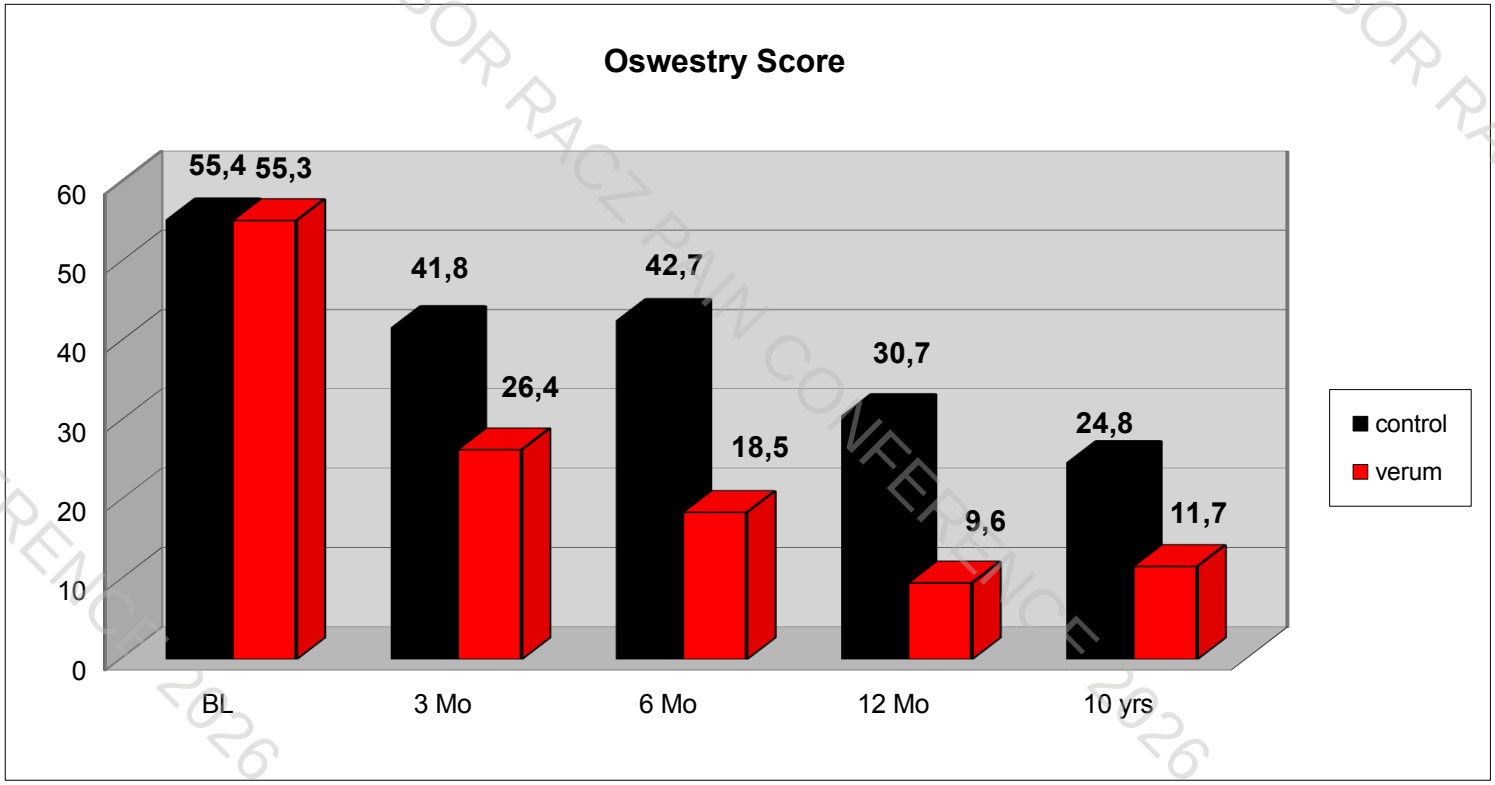
## Long-term Efficacy of Percutaneous Epidural Neurolysis of Adhesions in Chronic Lumbar Radicular Pain: 10 Year Follow-up of a Randomized Controlled Trial

Ludger Gerdesmeyer, MD, PhD[1,2], Carl Noe, MD[3], Alexander Prehn-Kristensen, MD[4], Norbert Harrasser, MD[3], Munjed Al Muderis, MD[6], Matthias Weuster, MD[1,5], and Tim Klueter, MD[1]

*Gerdesmeyer L, Noe C, Prehn-Kristensen A, Harrasser N, Muderis MA, Weuster M, Klueter T. Long-term Efficacy of Percutaneous Epidural Neurolysis of Adhesions in Chronic Lumbar Radicular Pain: 10 Year Follow-up of a Randomized Controlled Trial. Pain Physician. 2021 Aug;24(5):359-367*

# Results (primary endpoint) *(ODS)*

Primary Efficacy Criteria as *Defined in the submitted study protocol*
Confirmatory Analysis, ITT, LOCF

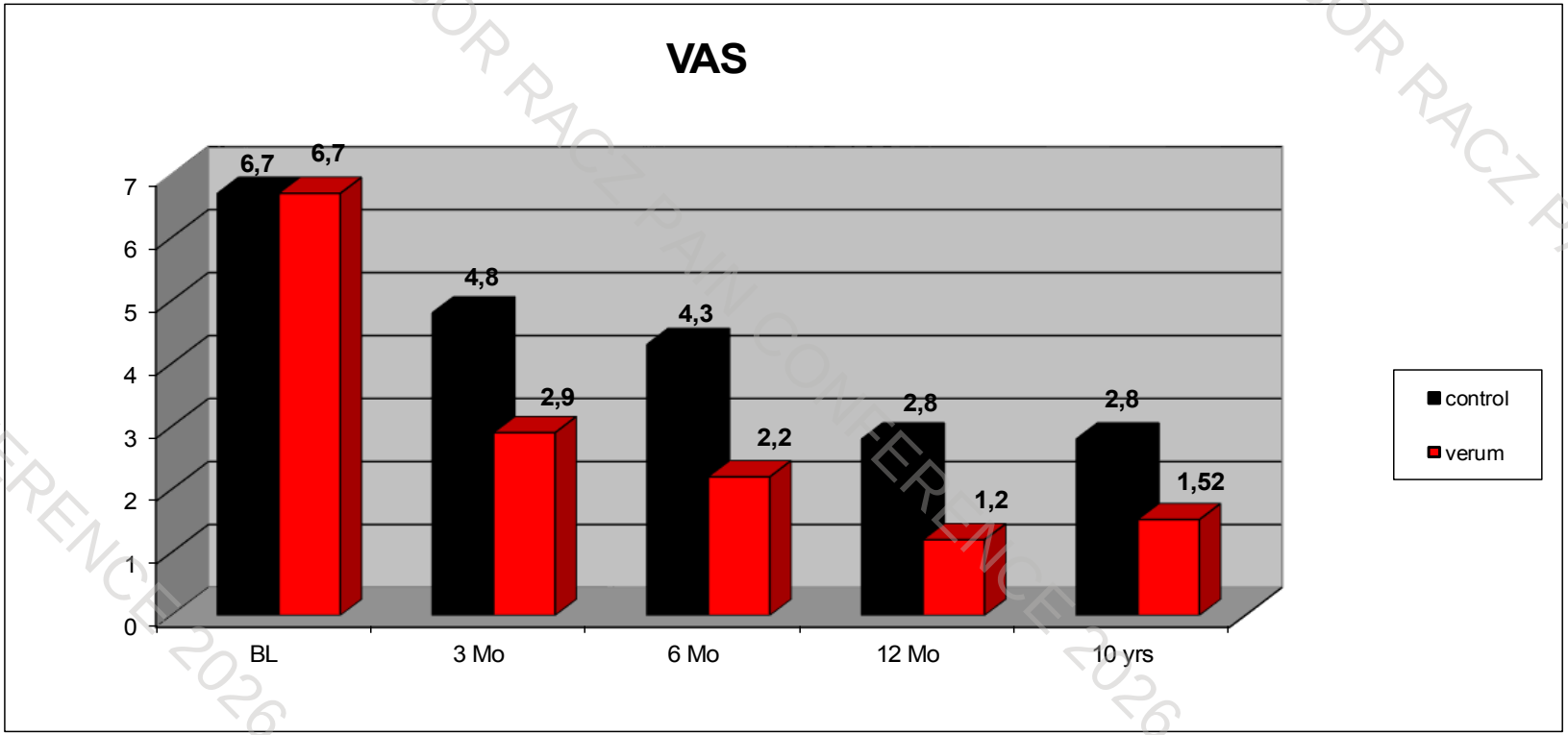



ODS 10 years after Intervention
(Mann-Whitney U-Test (ITT, LOCF): $p < 10^{-3}$
Median difference ( V – P) = 0.31 with 95% confidence interval (0.17 … 0.42)

n:52

# Results (primary endpoint) *(VAS)*

Primary Efficacy Criteria as *Defined in the submitted study protocol*
Confirmatory Analysis, ITT, LOCF




VAS 10 yrs after intervention
(Mann-Whitney U-Test (ITT, LOCF): $p < 10^{-3}$
Median difference (V – P) = 0.29 with 95% confidence interval (0.14 … 0.45)

n:51

# Revision surgery

› Eur Spine J. 2025 May;34(5):1943-1953. doi: 10.1007/s00586-025-08726-y. Epub 2025 Mar 10.

## Early revision rate after posterior spinal fusion surgery increases with every additional BMI point

Alexander Hammer [1 2], Achim Götz [3 4], Denis Rappert [3], Olga Cheremina [3], Thomas Eibl [5], Thomas Tischer [4 6], Björn Lembcke [4], Klaus John Schnake [3 7]

*Hammer A et al. Early revision rate after posterior spinal fusion surgery increases with every additional BMI point. Eur Spine J. 2025 May;34(5):1943-1953*

# Revision surgery

**Methods:** prospective single-institution cohort study.

227 patients with spinal fusion up to four segments

Objective: to identify factors associated with early revision surgery occurring within three months.

**Results:**

- obesity (25.3% BMI ≥ 30 vs. 10.9%
- BMI < 30, p = 0.005)
- ASA-grade (12.4% ASA grade 1 and 2 vs. 24.4% ASA grade ≥ 3, p = 0.019)
- increased intraoperative blood loss (474.1 ml ± 275.3 ml vs. 587.2 ml ± 310.5 ml, p = 0.026)

significant factors associated with increased revision rates

*Hammer A et al. Early revision rate after posterior spinal fusion surgery increases with every additional BMI point. Eur Spine J. 2025 May;34(5):1943-1953*

# robotics

Meta-Analysis > J Robot Surg. 2025 Aug 28;19(1):523. doi: 10.1007/s11701-025-02697-4.

## Robotic-assisted spine surgery: hype or game-changer?

D E Ogolo [1] [2], O R Akwada [3], E C Ajare [4] [5], C A Ndubuisi [4], S C Ohaegbulam [4]

*Ogolo DE, Akwada OR, Ajare EC, Ndubuisi CA, Ohaegbulam SC. Robotic-assisted spine surgery: hype or game-changer? J Robot Surg. 2025 Aug 28;19(1):523.*

# robotics

- meta-analysis and systematic review aimed to evaluate the accuracy, safety, and operative efficiency of RASS versus conventional freehand/navigation techniques
- assess the impact of surgeon experience and robotic systems
- followed PRISMA guidelines, incorporating 13 studies (5 RCTs, 3 prospective trials, 5 retrospective analyses)

*Ogolo DE, Akwada OR, Ajare EC, Ndubuisi CA, Ohaegbulam SC. Robotic-assisted spine surgery: hype or game-changer? J Robot Surg. 2025 Aug 28;19(1):523.*

# robotics

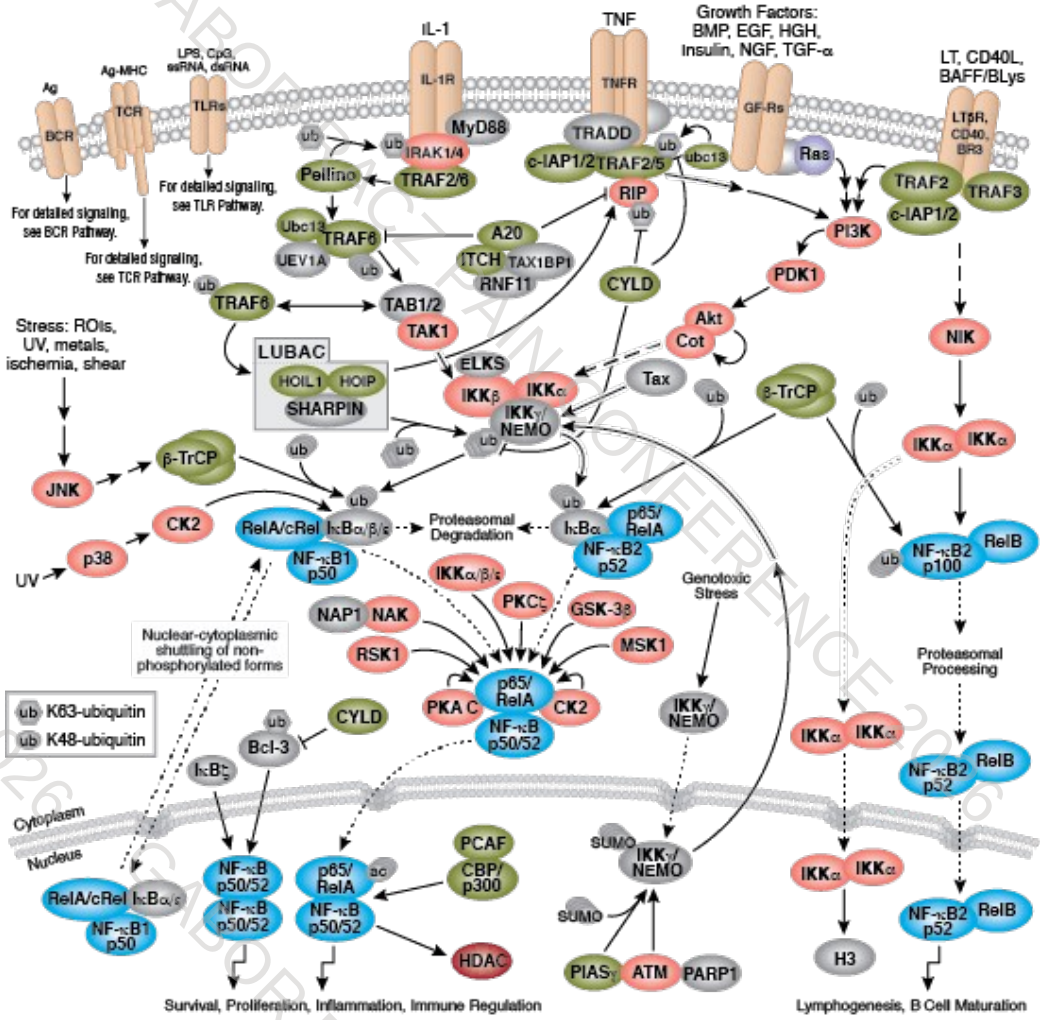
- RASS demonstrated significantly higher perfect screw accuracy (94.2% vs. 85.1%; OR 2.41, p < 0.001)
- less neurological injuries (1.9% vs. 4.3%; OR 0.45, p = 0.001)
- less revision surgeries (3.1% vs. 5.2%; OR 0.59, p = 0.02)
- operative times longer (+ 12.4 min, p = 0.001

*Ogolo DE, Akwada OR, Ajare EC, Ndubuisi CA, Ohaegbulam SC. Robotic-assisted spine surgery: hype or game-changer? J Robot Surg. 2025 Aug 28;19(1):523.*

# Post Op pain management

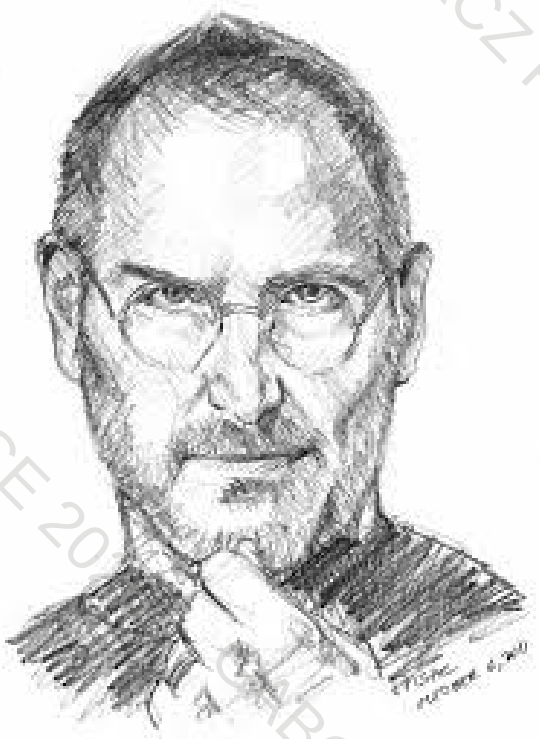

**All in concept for advanced STI pain**

# SOFT TISSUE ENGINEERING
# NANO TECHNOLOGY – MIRCOMETABOLISM



“I think the biggest innovations of the 21st century will be at the intersection of **biology** and technology.
A new era is beginning.”

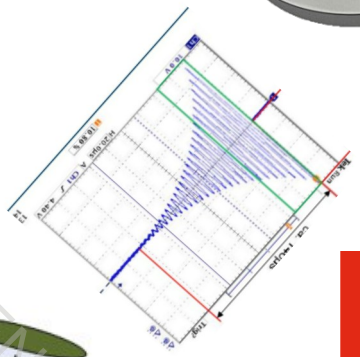
Steve Jobs



# soft tissue engineering
# Nano Technology – mircometabolism

## The 2 biological options

Mechano transduktion



Electro magnetic transduktion




# Soft tissue engineering in facet joint pain


Randomized Controlled Trial > Int J Surg. 2025 Jul 1;111(7):4177-4186.
doi: 10.1097/JS9.0000000000002538. Epub 2025 May 20.

## Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial

Tomas Nedelka [1 2 3], Jakub Katolicky [2 4], Jiri Nedelka [2], Paul Hobrough [5], Karsten Knobloch [6]

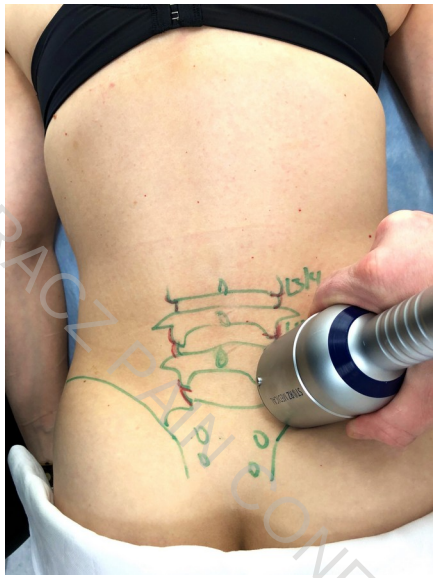
*Nedelka T, et al Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial. Int J Surg. 2025 Jul 1;111(7):4177-4186*

# ESWT focused therapy in facet joint pain

**Methods:** prospective RCT in 128 patients with chronic lumbar facet pain
Patients were randomized to receive either focused ESWT (Group A, n = 64; 0.35 mJ/mm 2 , 1200 shocks/session = 600 shocks per segment, 5 weekly sessions) or sham therapy (Group B, n = 64).
Pain intensity (VAS), disability (ODI), and neuropathic pain features (PainDETECT questionnaire) were assessed at 2, 6, and 12 months.
Lumbar spine MRI was performed at baseline and 6 months post-treatment.

*Nedelka T, et al Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial. Int J Surg. 2025 Jul 1;111(7):4177-4186*

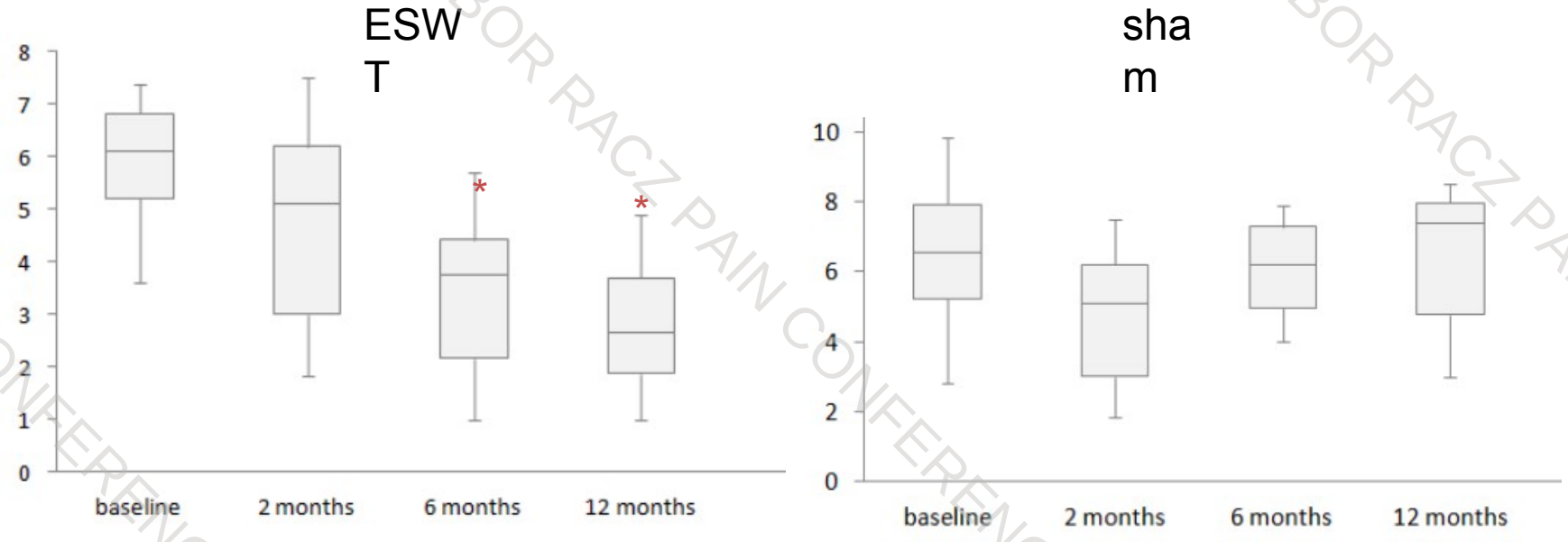
# ESWT in lumbar FJ pain



Setup: Electromagnetic ESWT device, 0,25mJ/mm2, 2000 shocks, 3 sessions

*Nedelka T, et al Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial. Int J Surg. 2025 Jul 1;111(7):4177-4186*

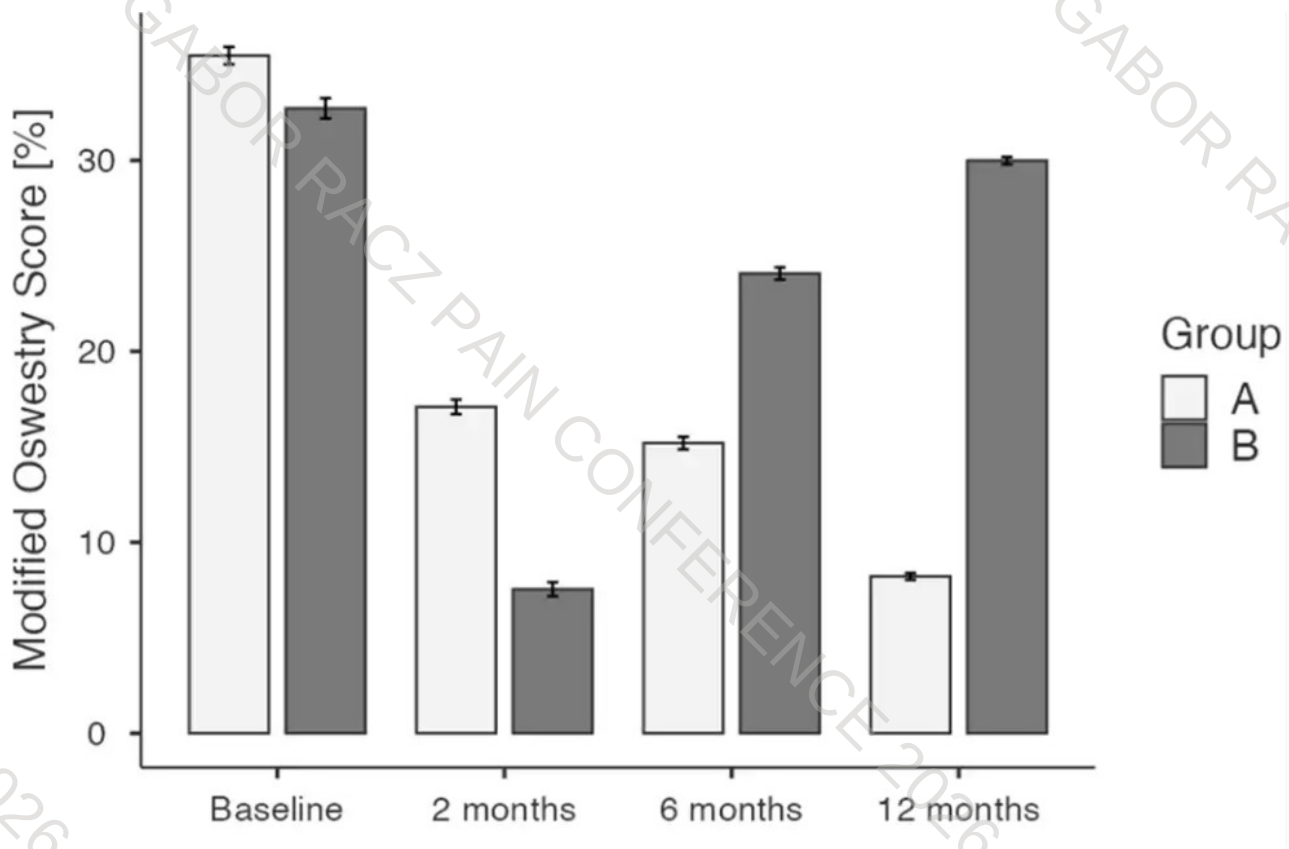
# ESWT focused therapy in facet joint pain




*VAS [cm] values comparison between Group A and Group B at 2, 6 and 12 months follow-up. Mean, maximum and minimal values for each parameter are stated graphically. Significant results [p<0.05] marked with *.*

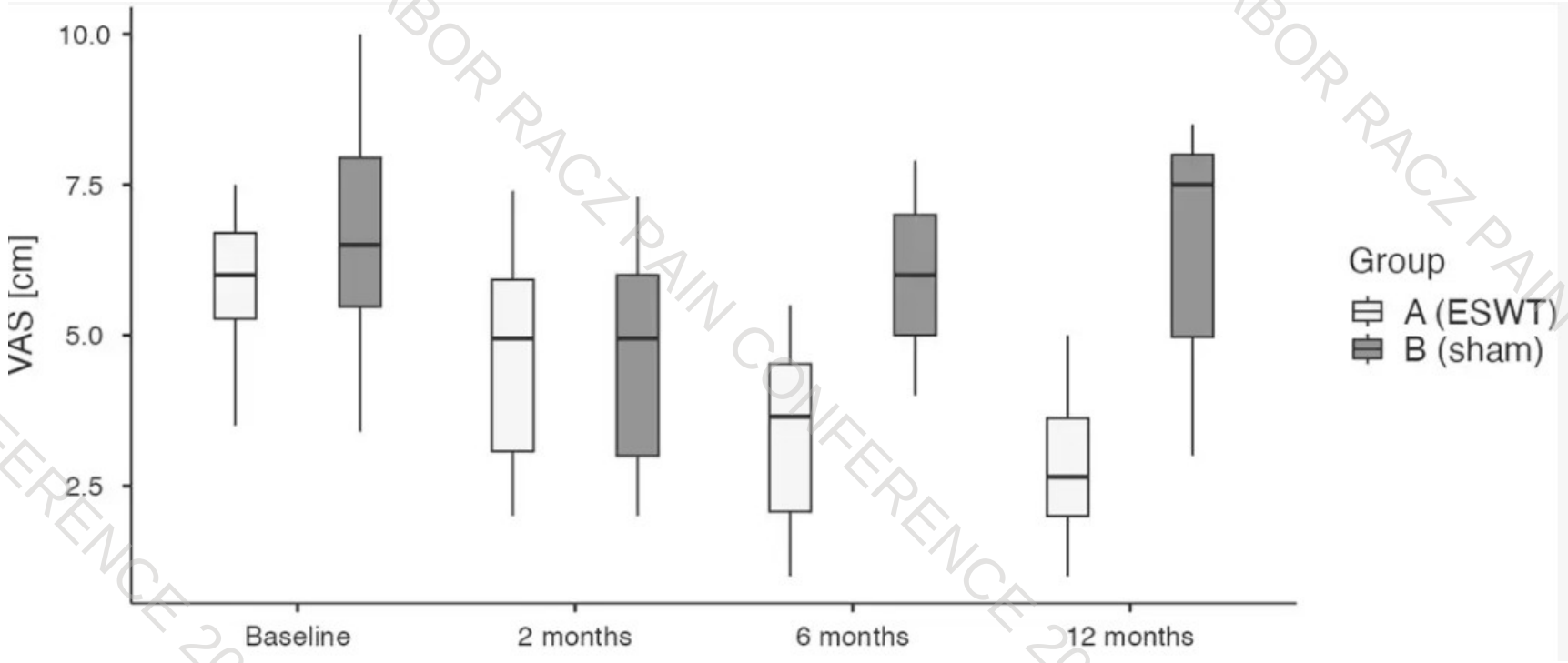
*Nedelka T, et al Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial. Int J Surg. 2025 Jul 1;111(7):4177-4186*

# ESWT focused therapy in facet joint pain




*Nedelka T, et al Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial. Int J Surg. 2025 Jul 1;111(7):4177-4186*

# ESWT focused therapy in facet joint pain




*Nedelka T, et al Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial. Int J Surg. 2025 Jul 1;111(7):4177-4186*

# ESWT focused therapy in facet joint pain

**Results:**

- Group A showed significant reductions in VAS scores at 6 and 12 months (mean 64.4% reduction at 12 months, P <0.01), with an effect size (Cohen's d = 1.12).
- ODI decreased by 42.3% in Group A compared to 12.5% in the sham group
- Neuropathic pain symptoms improved significantly only in Group A (PD-Q reduction from 18.3 ± 2.4 to 10.2 ± 1.9; P <0.01).
- MRI follow-up demonstrated resolution of bone marrow edema in 58.8% of ESWT-treated patients versus none in the control group.
- No adverse effects were reported.

*Nedelka T, et al Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial. Int J Surg. 2025 Jul 1;111(7):4177-4186*

# ESWT focused therapy in facet joint pain

**Conclusion**:

- high-energy, focused extracorporeal shockwave therapy is a safe and effective non-invasive treatment for chronic lumbar facet joint pain
- Statistically and clinically significant improvements in pain intensity, functional disability, and neuropathic pain symptoms were sustained over a 12-month follow-up period
- Focused ESWT showed particular efficacy in subgroups with elevated BMI and those exhibiting neuropathic pain features
- spinal bone marrow edema resolution on MRI following ESWT
- ESWT-mediated modulation of joint inflammation and nociceptive and neuropathic sensitization.

*Nedelka T, et al Efficacy of high-energy, focused ESWT in treatment of lumbar facet joint pain: a randomized sham-controlled trial. Int J Surg. 2025 Jul 1;111(7):4177-4186*

# Take home

Beware of the unhappy patient with no obvious cause for their pain – revision is unpredictable

# Thank you

Gerdesmeyer@aol.com