NEW ZEALAND COLLEGE OF CHIROPRACTIC

The Latest Neuroscience Impacts of the Adjustment

Heidi Haavik BSc (chiropractic), PhD
VP Research, Dean Research
New Zealand College of Chiropractic

CENTRE FOR CHIROPRACTIC RESEARCH
New Zealand College of Chiropractic

1

Thank you!

MCA
MAINE CHIROPRACTIC ASSOCIATION

2

www.DrHeidi.net

Gifts

Gifts

The HANDOUT for today's Class (the slides)

3

HAAVIK RESEARCH

Key References for today's talk

NEW ZEALAND COLLEGE OF CHIROPRACTIC


The contemporary model of vertebral column joint dysfunction and impact of high-velocity, low-amplitude controlled vertebral thrusts on neuromuscular function

Heidi Haavik, Nitika Kumari, Kelly Holt, Imran Khan Niazi, Imran Amjad, Amit N. Pujari, Kemal Sitki Türker, Bernadette Murphy. (2021a) The contemporary model of vertebral column joint dysfunction and impact of high-velocity, low-amplitude controlled vertebral thrusts on neuromuscular function. Invited Review. European Journal of Applied Physiology. https://doi.org/10.1007/s00421-021-04727-z

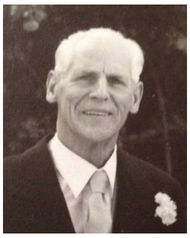
Heidi Haavik, Imran Khan Niazi, Nitika Kumari, Imran Amjad, Jenna Duehr, Kelly Holt. (2021b) The potential mechanisms of High-Velocity, Low-Amplitude, Controlled Vertebral Thrusts on Neuroimmune Function: A narrative review. Medicina 2021, 57, 536. https://doi.org10.3390/medicina57060536

Imran Khan Niazi, Muhammad Samran Navid, Christopher Merkle, Imran Amjad, Nitika Kumari, Robert J. Trager, Kelly Holt, Heidi Haavik. 2024 A randomized controlled trial comparing different sites of high-velocity low amplitude thrust on sensorimotor integration parameters. Scientific Report. 14(1), p.1159. https://www.nature.com/articles/s41598-024-51201-9


medicina
The Potential Mechanisms of High-Velocity, Low-Amplitude, Controlled Vertebral Thrusts on Neuroimmune Function: A Narrative Review

scientific reports
OPEN A randomized controlled trial comparing different sites of high-velocity low amplitude thrust on sensorimotor integration parameters

4



Dr William Charles
Lawson - Palmer
Graduate 1924

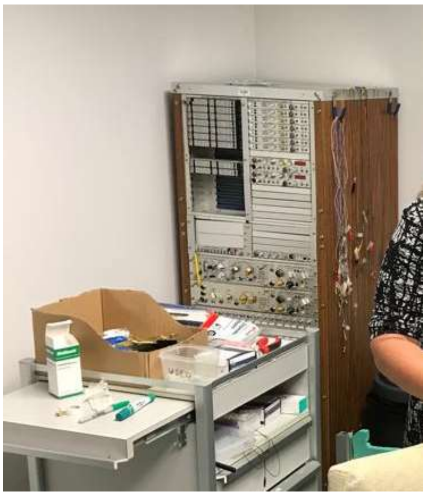
NEW ZEALAND
COLLEGE OF
CHIROPRACTIC
graduating hands, hearts & minds

1999 NZCC Graduate

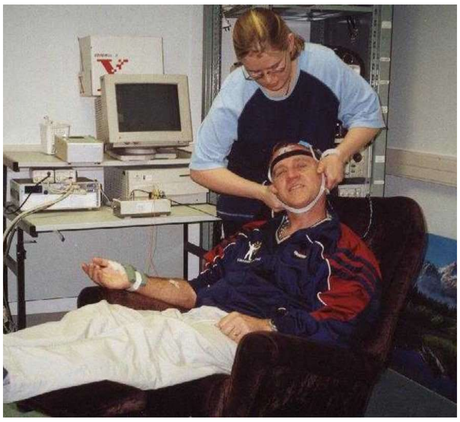
THE UNIVERSITY
OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

2008 PhD

5



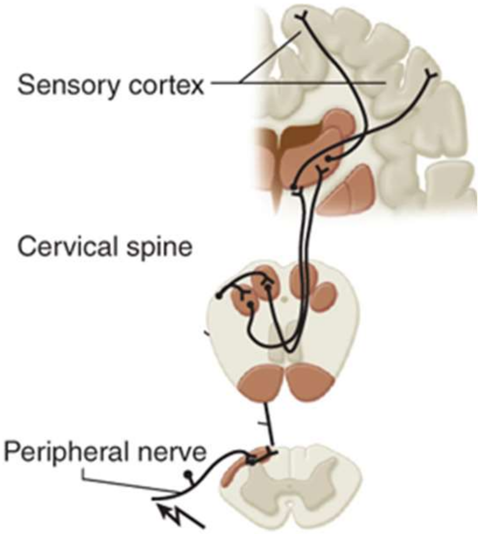
THE UNIVERSITY
OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau



HAAVIK
RESEARCH

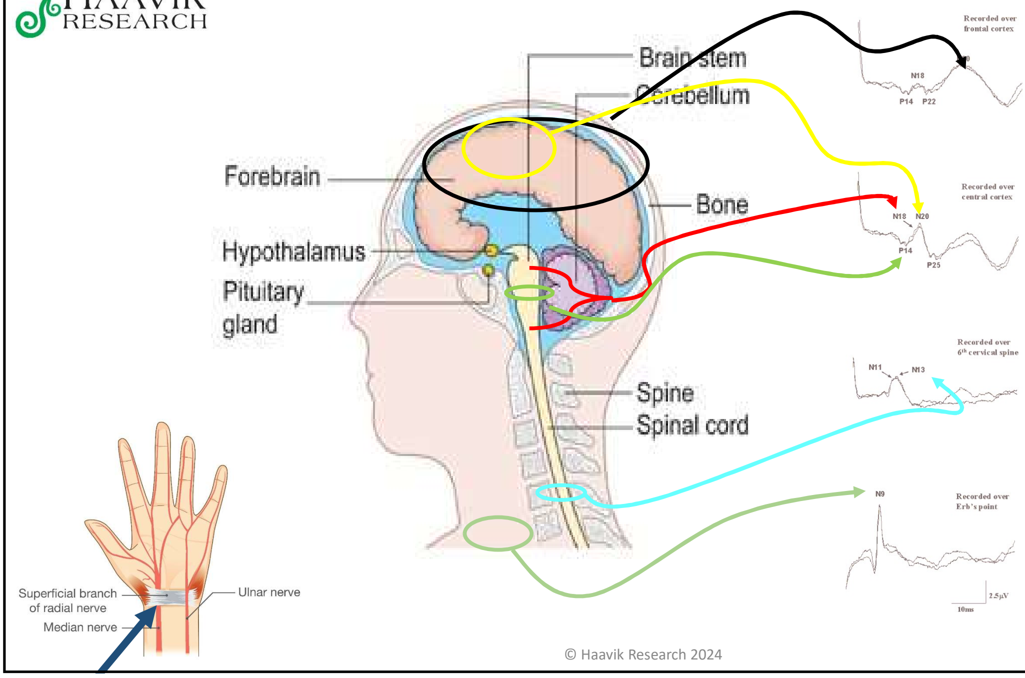
6

Somatosensory Evoked Potentials



Number of pulses = 1000
Frequency = 2.3 Hz
Length = 0.2 ms
Intensity = 1 mA above the stimulation intensity that elicited clear twitch of the thumb.

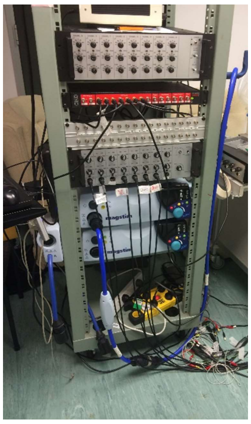
7



8

HAAVIK RESEARCH

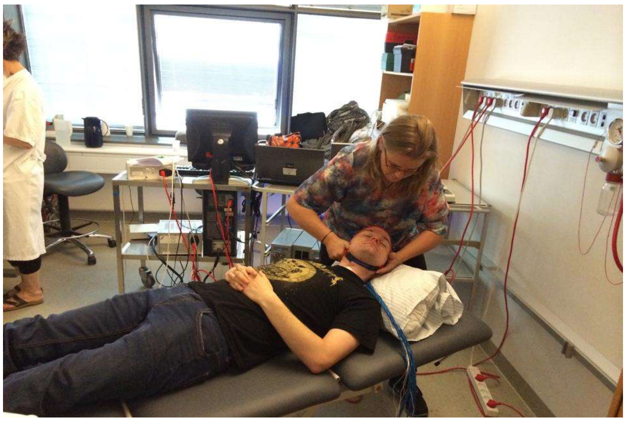
AUSTRALIAN spinal research FOUNDATION



9

HAAVIK RESEARCH

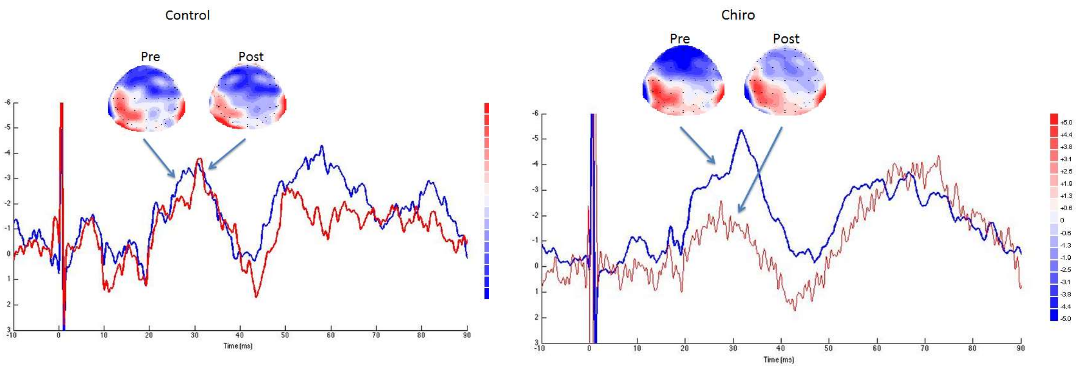
64 channel EEG and source localisation



Lelic, D., Niazi, I.K., Holt, K., Jochumsen, M., Dremstrup, K., Yielder, P., Murphy, B., Drewe,s A. M., & Haavik, H. (2016). Manipulation of dysfunctional spinal joints affects sensorimotor integration in the prefrontal cortex: A brain source localization study. Neural Plasticity, 1.doi:10.1155/2016/3704964.

10

N30 brain processing changes were occurring in the Pre-Frontal Cortex



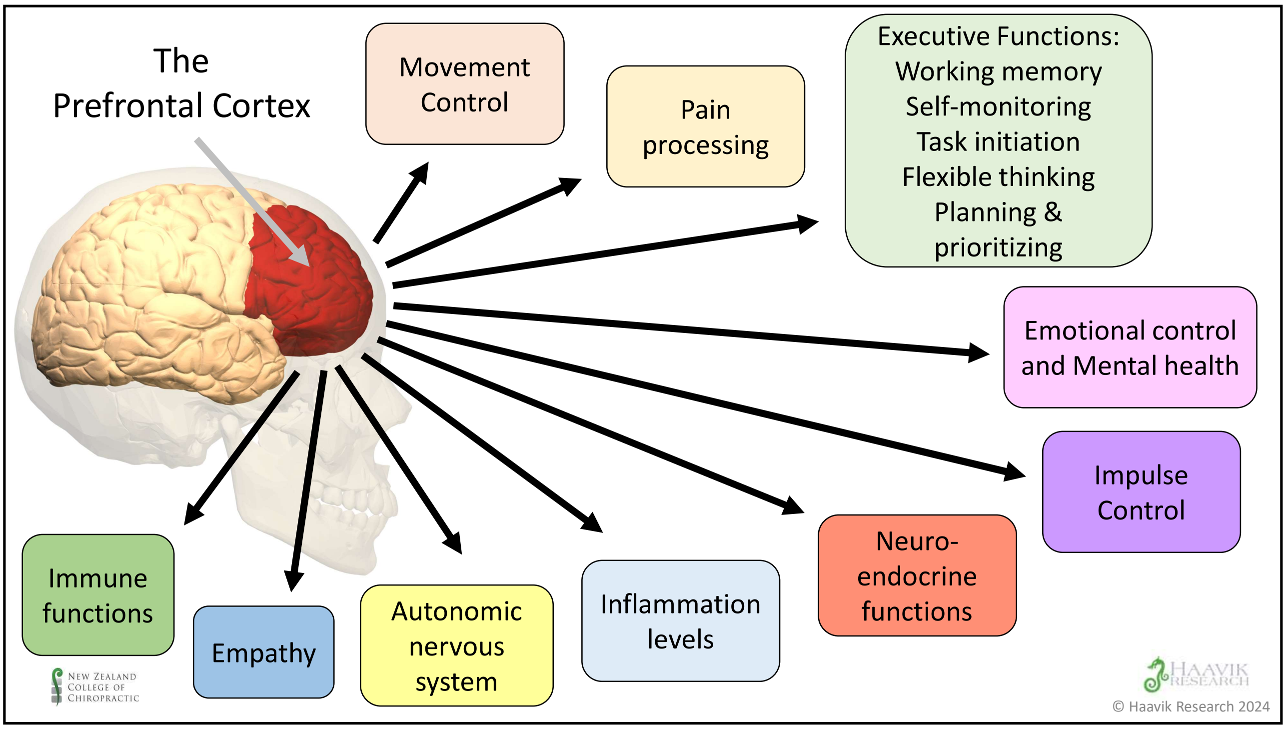
Lelic, D., Niazi, I.K., Holt, K., Jochumsen, M., Dremstrup, K., Yielder, P., Murphy, B., Drewe,s A. M., & Haavik, H. (2016). Manipulation of dysfunctional spinal joints affects sensorimotor integration in the prefrontal cortex: A brain source localization study. Neural Plasticity, 1.doi:10.1155/2016/3704964.

11

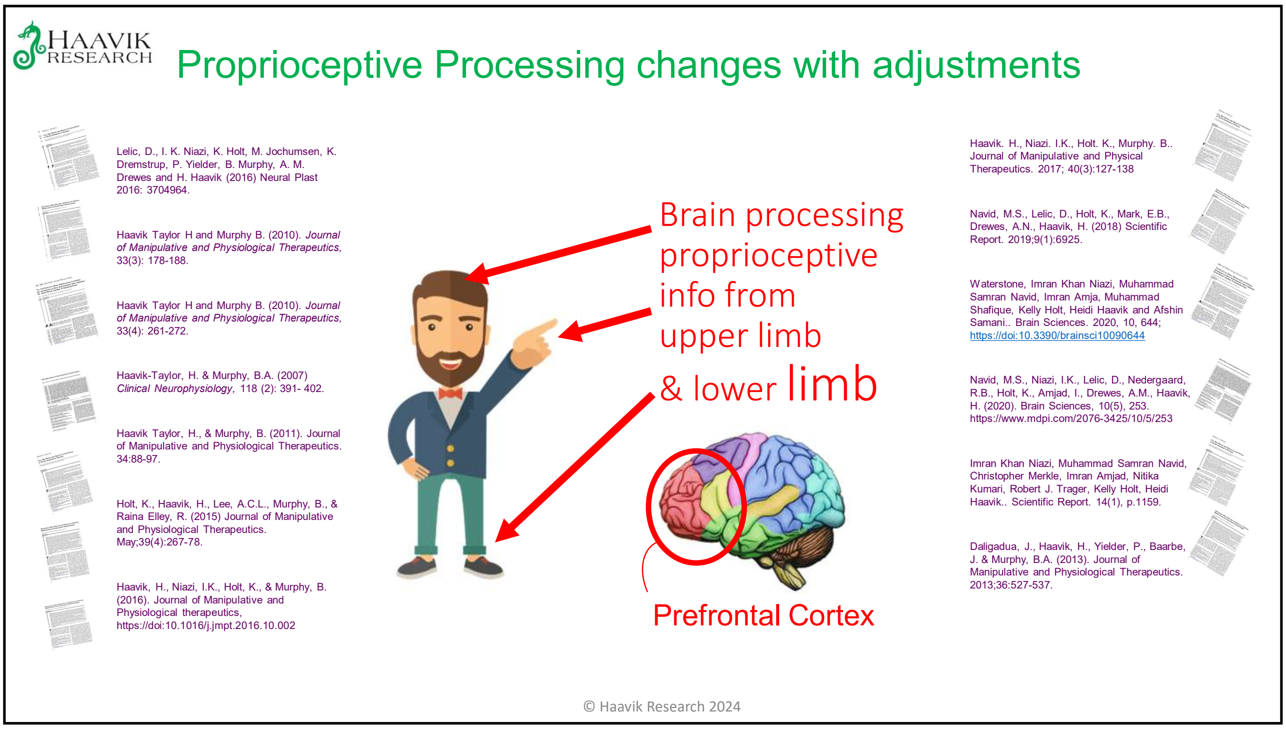
The Prefrontal Cortex

Chiropractic adjustments affect the prefrontal cortex

12


The
Prefrontal Cortex
Movement Control
Pain processing
Executive Functions:
Working memory
Self-monitoring
Task initiation
Flexible thinking
Planning & prioritizing
Emotional control and Mental health
Impulse Control
Neuro-endocrine functions
Inflammation levels
Autonomic nervous system
Empathy
Immune functions
New Zealand College of Chiropractic
Haavik Research
© Haavik Research 2024

13

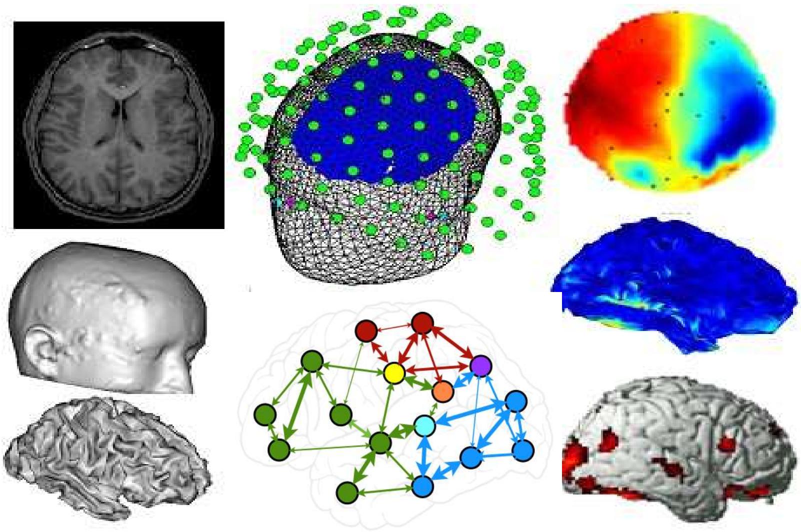

Haavik Research
Proprioceptive Processing changes with adjustments
Lelic, D., I. K. Niazi, K. Holt, M. Jochumsen, K. Dremstrup, P. Yielder, B. Murphy, A. M. Drewes and H. Haavik (2016) Neural Plast 2016: 3704964.
Haavik Taylor H and Murphy B. (2010). Journal of Manipulative and Physiological Therapeutics, 33(3): 178-188.
Haavik Taylor H and Murphy B. (2010). Journal of Manipulative and Physiological Therapeutics, 33(4): 261-272.
Haavik-Taylor, H. & Murphy, B.A. (2007) Clinical Neurophysiology, 118 (2): 391- 402.
Haavik Taylor, H., & Murphy, B. (2011). Journal of Manipulative and Physiological Therapeutics. 34:88-97.
Holt, K., Haavik, H., Lee, A.C.L., Murphy, B., & Raina Elley, R. (2015) Journal of Manipulative and Physiological Therapeutics. May;39(4):267-78.
Haavik, H., Niazi, I.K., Holt, K., & Murphy, B. (2016). Journal of Manipulative and Physiological therapeutics, https://doi:10.1016/j.jmpt.2016.10.002
Brain processing proprioceptive info from upper limb & lower limb
Prefrontal Cortex
Haavik. H., Niazi. I.K., Holt. K., Murphy. B.. Journal of Manipulative and Physical Therapeutics. 2017; 40(3):127-138
Navid, M.S., Lelic, D., Holt, K., Mark, E.B., Drewes, A.N., Haavik, H. (2018) Scientific Report. 2019;9(1):6925.
Waterstone, Imran Khan Niazi, Muhammad Samran Navid, Imran Amja, Muhammad Shafique, Kelly Holt, Heidi Haavik and Afshin Samani.. Brain Sciences. 2020, 10, 644; https://doi:10.3390/brainsci10090644
Navid, M.S., Niazi, I.K., Lelic, D., Nedergaard, R.B., Holt, K., Amjad, I., Drewes, A.M., Haavik, H. (2020). Brain Sciences, 10(5), 253. https://www.mdpi.com/2076-3425/10/5/253
Imran Khan Niazi, Muhammad Samran Navid, Christopher Merkle, Imran Amjad, Nitika Kumari, Robert J. Trager, Kelly Holt, Heidi Haavik.. Scientific Report. 14(1), p.1159.
Daligadua, J., Haavik, H., Yielder, P., Baarbe, J. & Murphy, B.A. (2013). Journal of Manipulative and Physiological Therapeutics. 2013;36:527-537.
© Haavik Research 2024

14

Electroencephalography (EEG) 2024

New Zealand College of Chiropractic

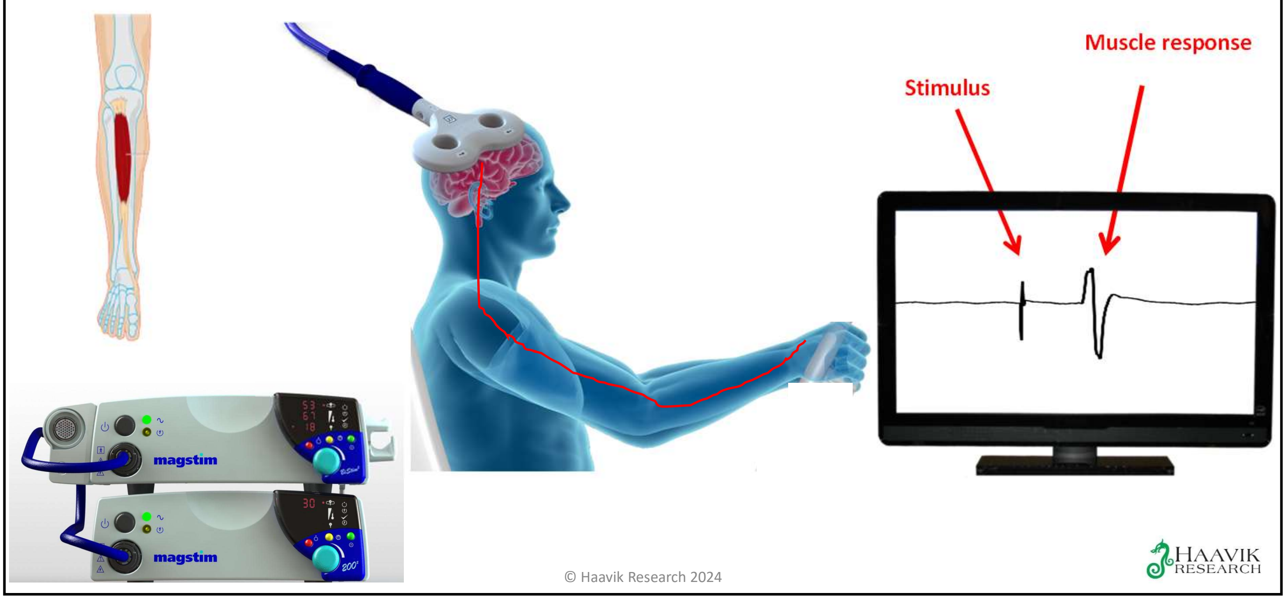
- SEPs
- Resting State
- Source localization analysis
- Connectivity analysis



HAAVIK RESEARCH

15

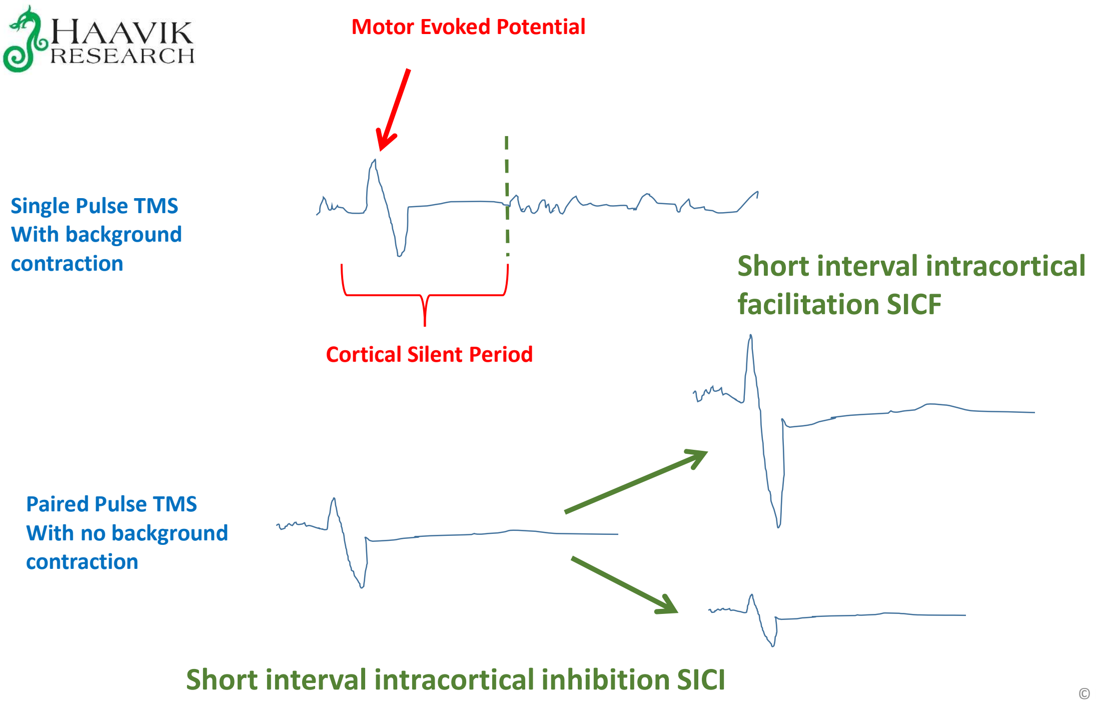
Transcranial Magnetic Brain Stimulation



HAAVIK RESEARCH

16

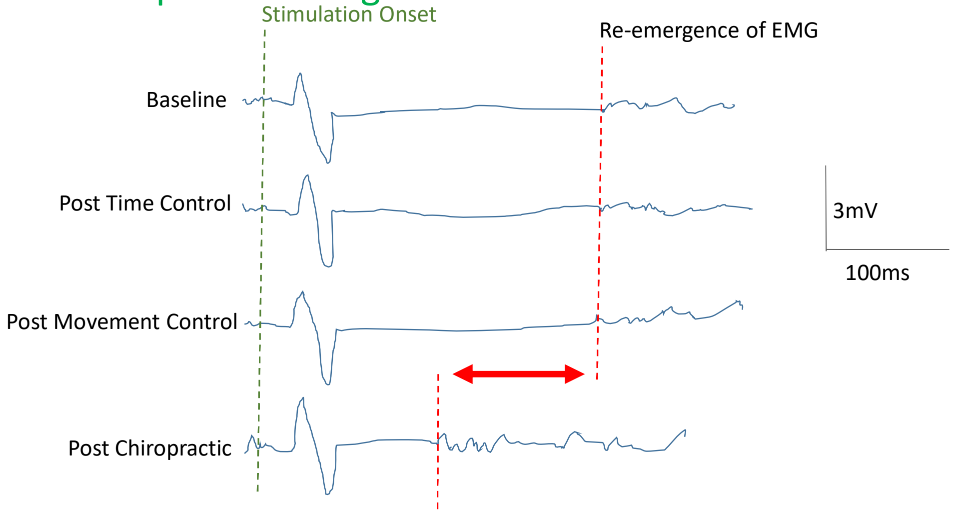
HAAVIK RESEARCH



17

HAAVIK RESEARCH

Muscle specific changes in the TMS-induced cortical silent period

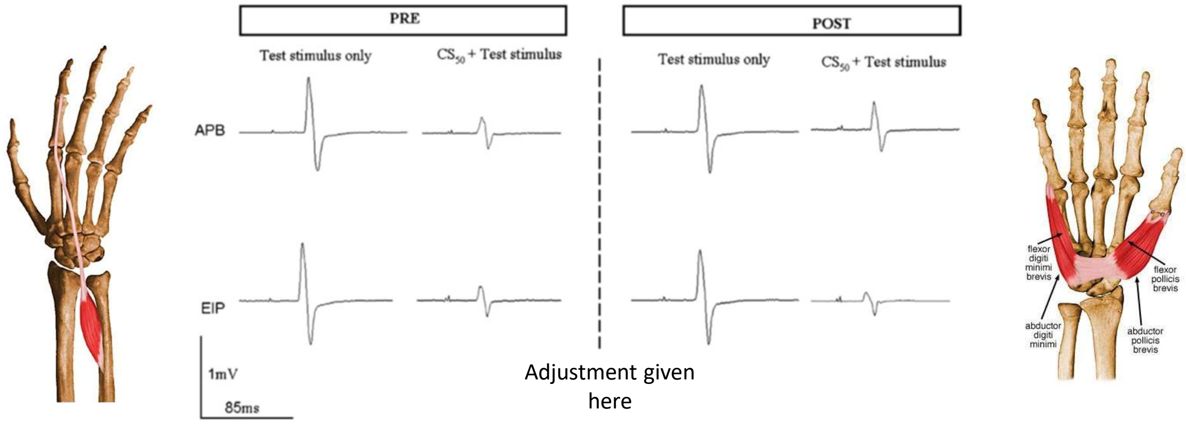


Haavik Taylor H, Murphy B. Transient modulation of intracortical inhibition following spinal manipulation. Chiropractic Journal of Australia. 2007;37:106-16. Haavik Taylor H, Murphy B. Altered sensorimotor integration with cervical spine manipulation. Journal of Manipulative and Physiological Therapeutics. 2008;31(2):115-26.

18

HAAVIK RESEARCH

Muscle specific changes in SICI after adjustment

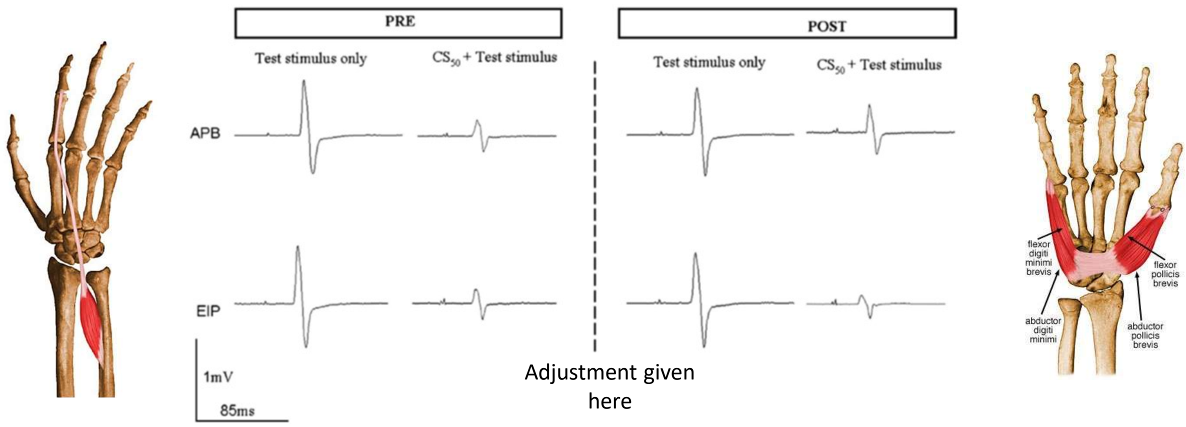


Haavik Taylor H, Murphy B. Altered sensorimotor integration with cervical spine manipulation. Journal of Manipulative and Physiological Therapeutics. 2008;31(2):115-26.

19

HAAVIK RESEARCH

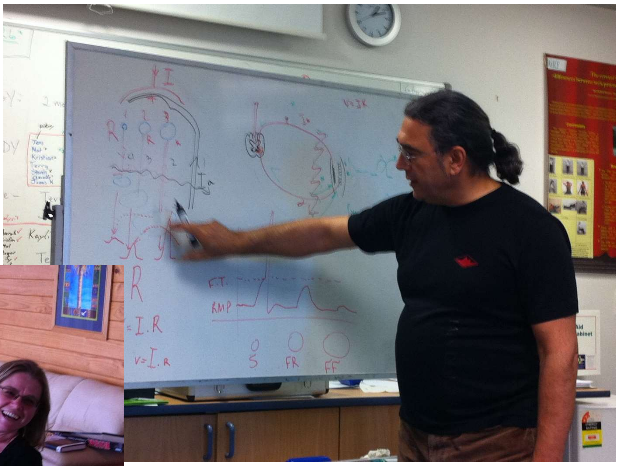
Muscle specific changes in SICF after adjustment

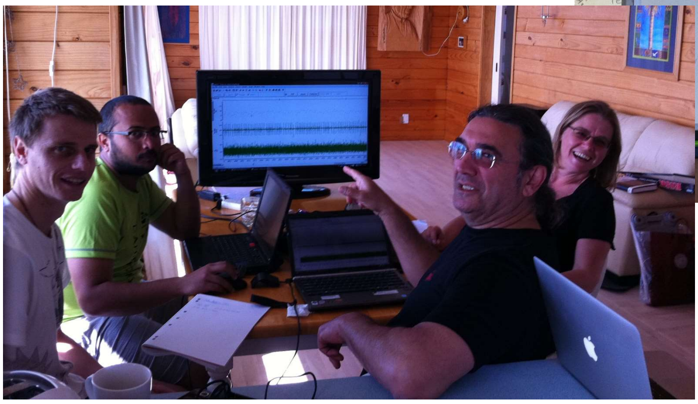


Haavik Taylor H, Murphy B. Altered sensorimotor integration with cervical spine manipulation. Journal of Manipulative and Physiological Therapeutics. 2008;31(2):115-26.

20

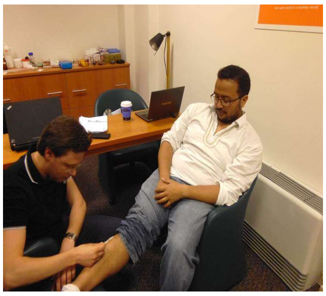
Professor Kemal Turker collaborations



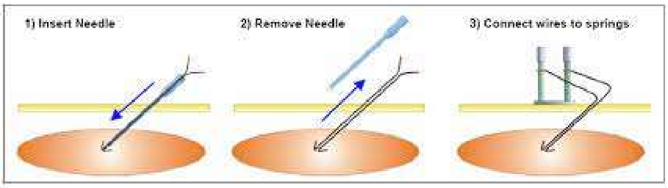


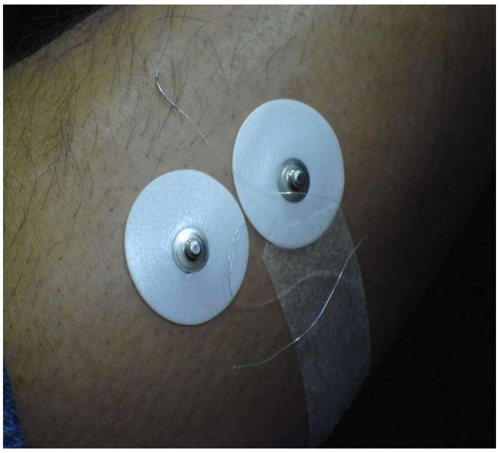
21

Our Intramuscular EMG studies



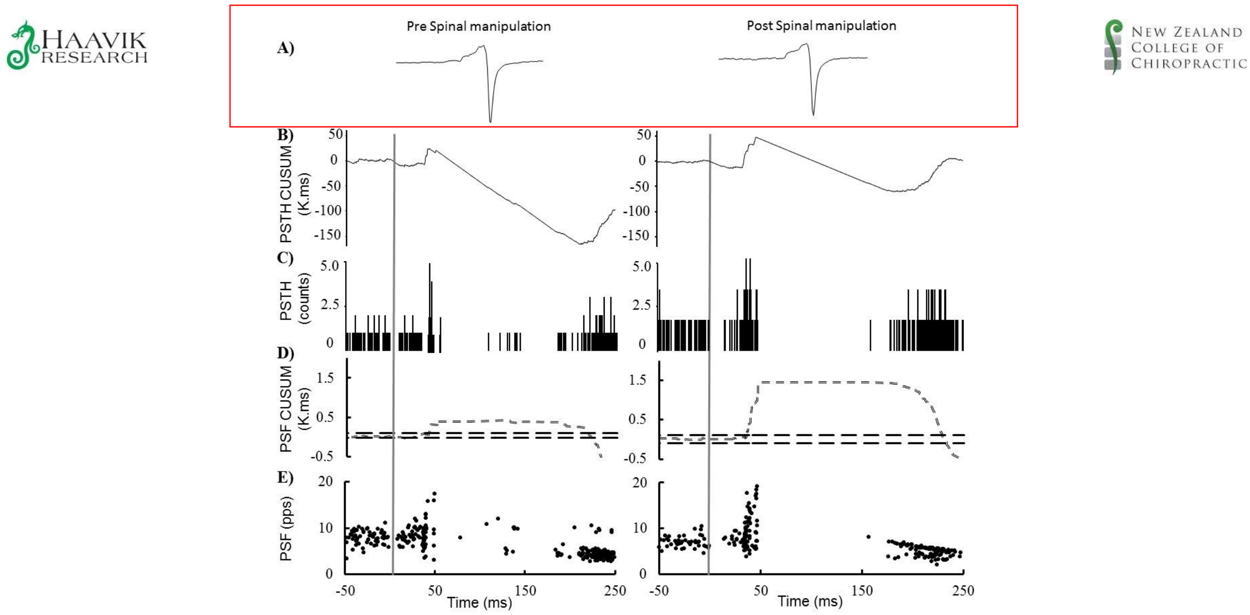
we were able to record 85 single motor units (using the needle-based technique) across 19 participants





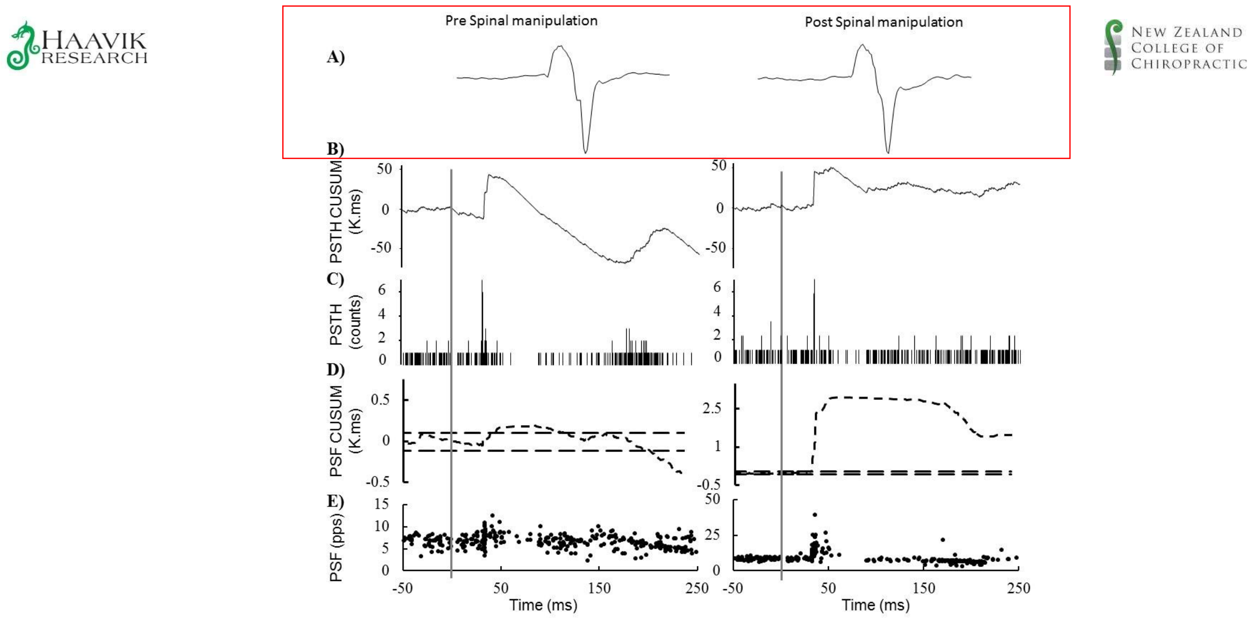
Haavik H, Niazi IK, Jochumsen M, et al. Chiropractic spinal manipulation alters TMS induced I-wave excitability and shortens the cortical silent period. J Electromyogr Kinesiol 2018;42:24-35. doi: 10.1016/j.jelekin.2018.06.010 [published Online First: 2018/06/25]

22



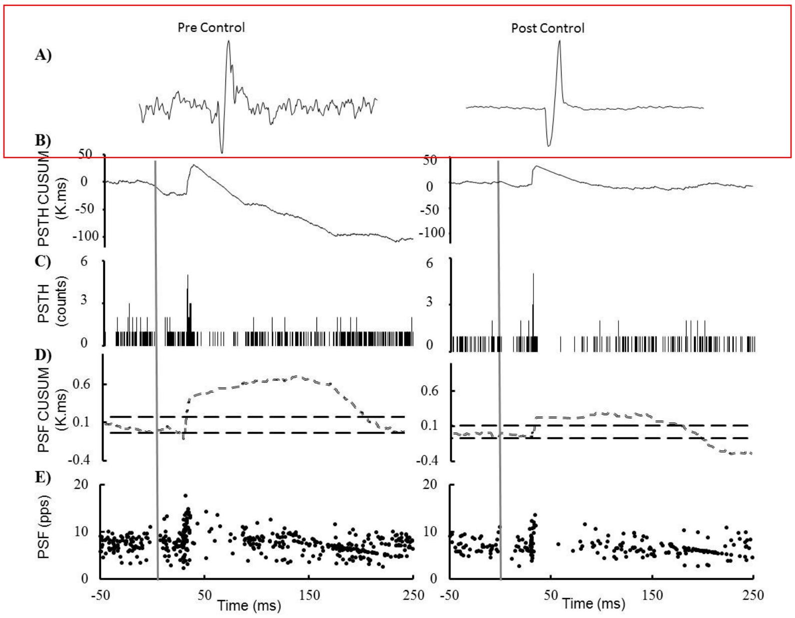
Haavik H, Niazi IK, Jochumsen M, et al. Chiropractic spinal manipulation alters TMS induced I-wave excitability and shortens the cortical silent period. *J Electromyogr Kinesiol* 2018;42:24-35. doi: 10.1016/j.jelekin.2018.06.010 [published Online First: 2018/06/25]

23



Haavik H, Niazi IK, Jochumsen M, et al. Chiropractic spinal manipulation alters TMS induced I-wave excitability and shortens the cortical silent period. *J Electromyogr Kinesiol* 2018;42:24-35. doi: 10.1016/j.jelekin.2018.06.010 [published Online First: 2018/06/25]

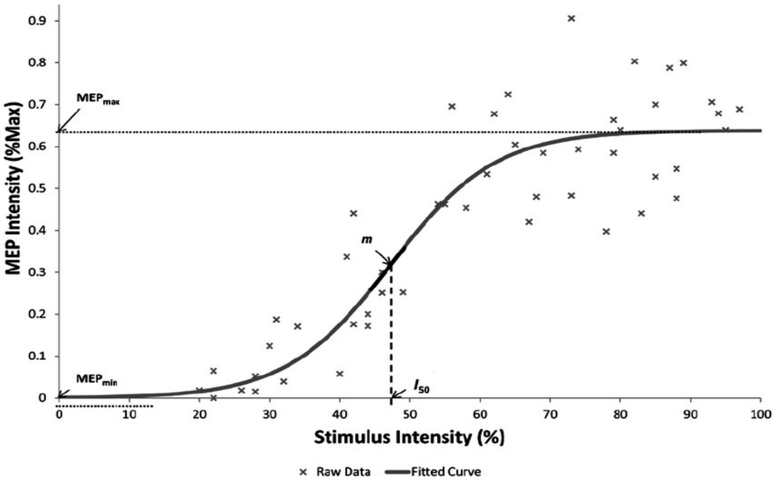
24



Haavik H, Niazi IK, Jochumsen M, et al. Chiropractic spinal manipulation alters TMS induced I-wave excitability and shortens the cortical silent period. *J Electromyogr Kinesiol* 2018;42:24-35. doi: 10.1016/j.jelekin.2018.06.010 [published Online First: 2018/06/25]

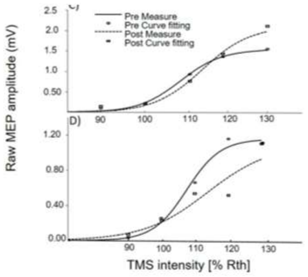
25

TMS-induced stimulus response curves

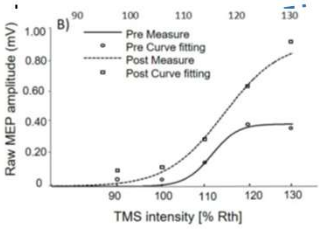


26

TMS-induced stimulus response curves



Control Session
Cervical Adjustment
Both Upper limb muscle



Full Spine Adjustment
Lower limb muscle


brain sciences
MDPI
Article

Impact of Spinal Manipulation on Cortical Drive to Upper and Lower Limb Muscles

Heidi Haavik [1,*], Imran Khan Niazi [1,2], Mads Jochumsen [2], Diane Sherwin [3], Stanley Flavel [1] and Kemal S. Türker [4]

Academic Editor: Bernadette Murphy
Received: 12 October 2016; Accepted: 21 December 2016; Published: 23 December 2016

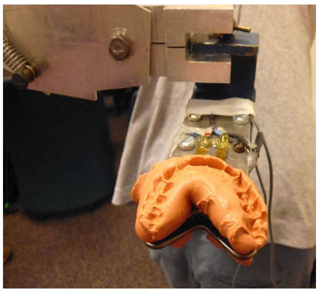
Abstract: This study investigates whether spinal manipulation leads to changes in motor control by measuring the recruitment pattern of motor units in both an upper and lower limb muscle and to see whether such changes may at least in part occur at the cortical level by recording movement related cortical potential (MRCP) amplitudes. In experiment one, transcranial magnetic stimulation input-output (TMS I/O) curves for an upper limb muscle (abductor pollicus brevis; APB) were recorded, along with F waves before and after either spinal manipulation or a control intervention for the same subjects on two different days. During two separate days, lower limb TMS I/O curves and MRCPs were recorded from tibialis anterior muscle (TA) pre and post spinal manipulation. Dependent measures were compared with repeated measures analysis of variance, with p set at 0.05. Spinal manipulation resulted in a 54.5% ± 93.1% increase in maximum motor evoked potential (MEPmax) for APB and a 44.6% ± 69.6% increase in MEPmax for TA. For the MRCP data following …

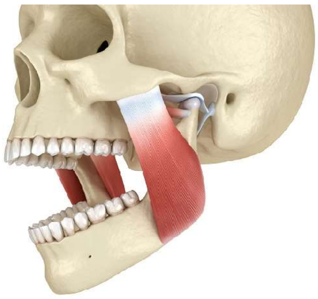
Haavik, H., Niazi, I.K., Jochumsen, M., Sherwin, D., Flavel, S., Turker, K.S., (2017) Impact of spinal manipulation on cortical drive to upper and lower limb muscles. Brain Sciences. 7 (1)

HAAVIK RESEARCH
NEW ZEALAND COLLEGE OF CHIROPRACTIC

27

Jaw Muscle Function with sEMG and iEMG





NEW ZEALAND COLLEGE OF CHIROPRACTIC

Haavik H, Özyurt MG, Niazi IK, et al. Chiropractic Manipulation Increases Maximal Bite Force in Healthy Individuals. Brain Sciences 2018;8(5):76. doi: 10.3390/brainsci8050076

HAAVIK RESEARCH

28

HAAVIK RESEARCH

NEW ZEALAND COLLEGE OF CHIROPRACTIC

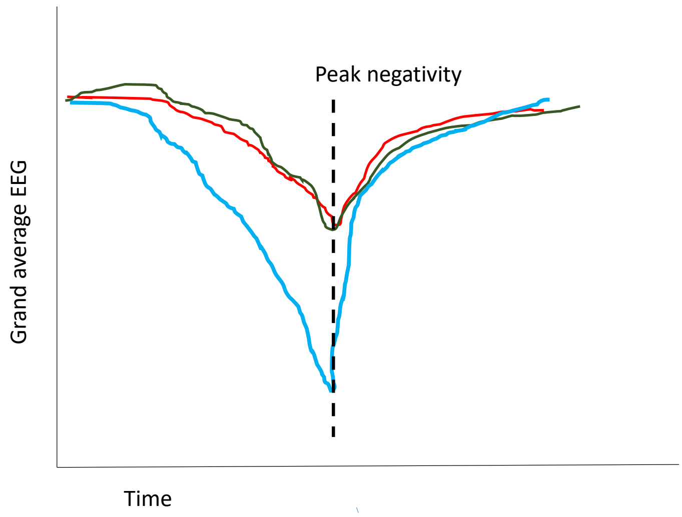
Sham chiropractic care does NOT change these same brain measures

29

HAAVIK RESEARCH

NEW ZEALAND COLLEGE OF CHIROPRACTIC

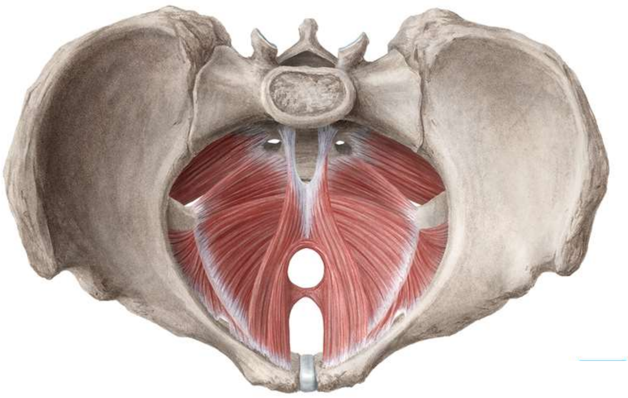
Movement Related Cortical Potentials (MRCPs)



Haavik H, Niazi I, Jochumsen M, Sherwin D, Flavel S, Türker K. Impact of Spinal Manipulation on Cortical Drive to Upper and Lower Limb Muscles. Brain Sciences. 2017;7(1):2.

30

Female Pelvic Floor muscle function



NEW ZEALAND COLLEGE OF CHIROPRACTIC

Haavik, H., Kruger, J., & Murphy, B. (2016) Pelvic floor functional changes with spinal manipulation in pregnant and non-pregnant women: A preliminary study. Journal of Manipulative and Physiological Therapeutics. Jun;39(5):339-47.

HAAVIK RESEARCH

31

HAAVIK RESEARCH

NEW ZEALAND COLLEGE OF CHIROPRACTIC

Strength Changes with chiropractic adjustments

Exp Brain Res
DOI 10.1007/s00221-014-4193-5

RESEARCH ARTICLE

Changes in H-reflex and V-waves following spinal manipulation

Imran Khan Niazi · Kemal S. Türker · Stanley Flavel · Mat Kinget · Jens Duehr · Heidi Haavik

Received: 14 May 2014 / Accepted: 22 December 2014

Abstract This study investigates whether spinal manipulation leads to neural plastic changes involving cortical drive and the H-reflex pathway. Soleus evoked V-wave, H-reflex, and M-wave recruitment curves and maximum voluntary contraction (MVC) in surface electromyogra- in afferents. Spinal manipulation appears to prevent fatigue developed during maximal contractions. Spinal manipulation appears to alter the net excitability of the low-threshold motor units, increase cortical drive, and prevent fatigue.

Niazi I, Türker K, Flavel S, Kinget M, Duehr J, Haavik H. Changes in H-reflex and V waves following spinal manipulation. Exp Brain Res. 2015;233:1165-73.

32

HAAVIK RESEARCH

NEW ZEALAND COLLEGE OF CHIROPRACTIC

16% increase in strength
No change H-reflex
Large increase in V wave

6% increase in strength
No change H-reflex
Large increase in V wave

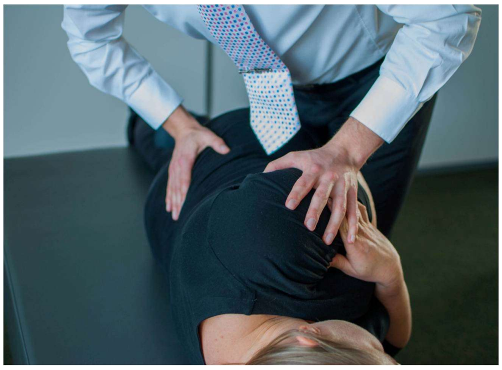
Niazi I, Türker K, Flavel S, Kinget M, Duehr J, Haavik H. Changes in H-reflex and V waves following spinal manipulation. Exp Brain Res. 2015;233:1165-73; Christiansen, T. L., Niazi, I. K., Holt, K., Nedergaard, R. W., Duehr, J., Allen, K., Marshall, P., Türker, K.S., Hartvigsen, J. & Haavik, H. (2018). The effects of a single session of spinal manipulation on strength and cortical drive in athletes. *European Journal of Applied Physiology*, 1-13. https://doi.org/10.1007/s00421-018-3799-x

33

HAAVIK RESEARCH

NEW ZEALAND COLLEGE OF CHIROPRACTIC

One adjustment vs 3 weeks of strength training



Niazi I, Türker K, Flavel S, Kinget M, Duehr J, Haavik H. Changes in H-reflex and V waves following spinal manipulation. Exp Brain Res. 2015;233:1165-73. Vila-Chã C, Falla D, Correia MV, Farina D. Changes in H reflex and V wave following short-term endurance and strength training. Journal of Applied Physiology. 2012;112(1):54-63.

34

HAAVIK RESEARCH

PA 13 strength

ARE YOU A CONFIDANT COMMUNICATOR?

ChirosHub

35

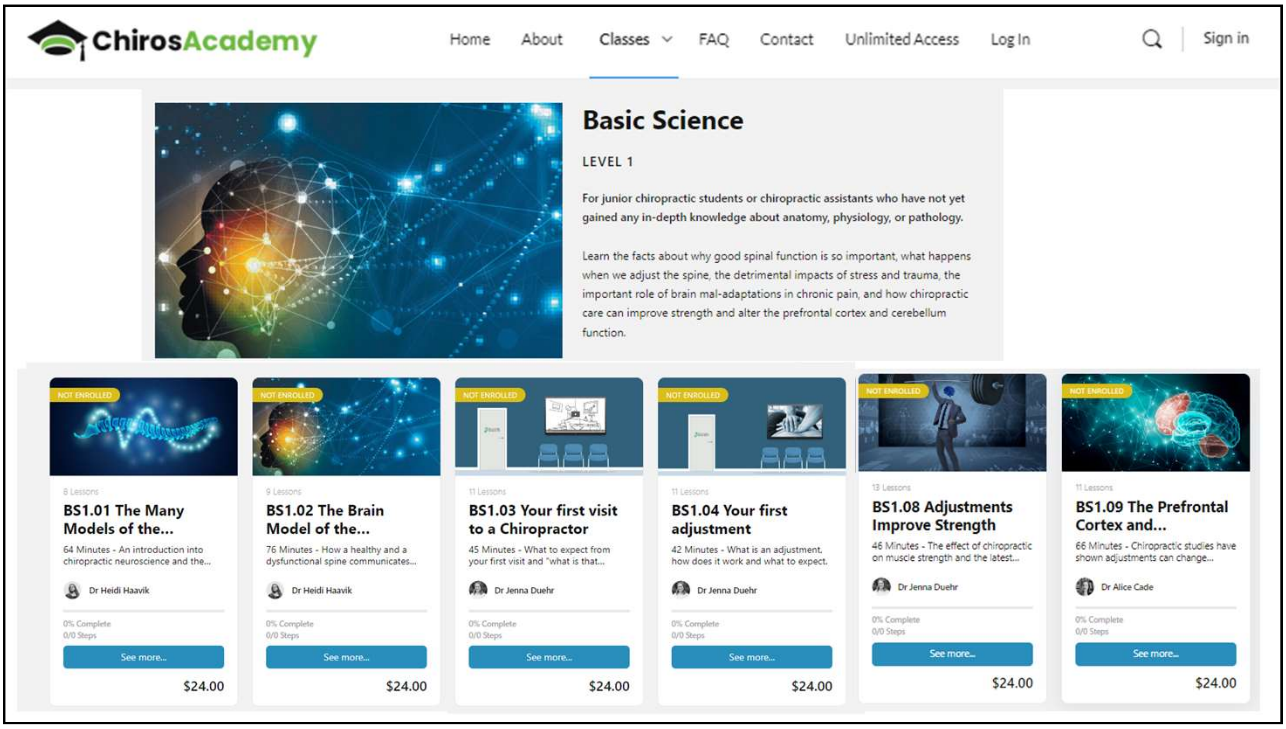
36

HAAVIK RESEARCH

DO YOU OWN YOUR SCIENCE?

ChirosAcademy

37



38

First Chronic Stroke Study

California Jam

65% increase in strength
No change H-reflex
Large increase in V wave

Holt, K., Niazi, I.K., Nedergaard, R.W., Duehr, J., Amjad, I., Shafiq, M., Anwar, M.N., Ndetan, H., Haavik, H. (2019) The effects of a single session of chiropractic care on strength, cortical drive, and spinal excitability in stroke patients Scientific Reports. 9:2673 https://doi.org/10.1038/s41598-019-39577-5

39

40

Code heiditalk
Gives you 15% off

ChirosHub

ChirosHub

All the resources for your patients and the public!

ChirosAcademy

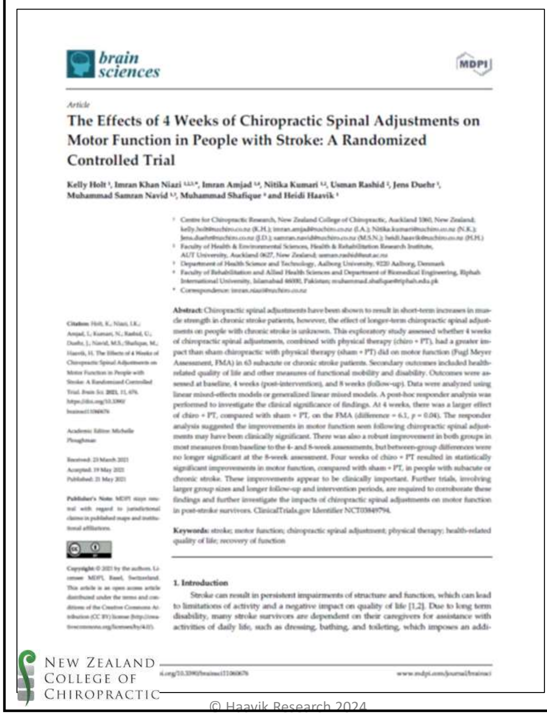
Over 70 online classes about the science of chiropractic for you!

LearningHub

Online classes for your chiropractic assistants!

41

HAAVIK RESEARCH



brain sciences MDPI

Article

The Effects of 4 Weeks of Chiropractic Spinal Adjustments on Motor Function in People with Stroke: A Randomized Controlled Trial

Kelly Holt [1], Imran Khan Niazi [1,2,3,*], Imran Amjad [1,4], Nitika Kumari [1,2], Usman Rashid [2], Jens Duehr [1], Muhammad Samran Navid [1,3], Muhammad Shafique [4] and Heidi Haavik [1]

[1] Centre for Chiropractic Research, New Zealand College of Chiropractic, Auckland 1060, New Zealand
[2] Faculty of Health & Environmental Sciences, Health & Rehabilitation Research Institute, AUT University, Auckland 0627, New Zealand
[3] Department of Health Science and Technology, Aalborg University, 9220 Aalborg, Denmark
[4] Faculty of Rehabilitation and Allied Health Sciences and Department of Biomedical Engineering, Riphah International University, Islamabad 46000, Pakistan
* Correspondence: imran.niazi@nzchiro.co.nz

Abstract: Chiropractic spinal adjustments have been shown to result in short-term increases in muscle strength in chronic stroke patients, however, the effect of longer-term chiropractic spinal adjustments on people with chronic stroke is unknown. This exploratory study assessed whether 4 weeks of chiropractic spinal adjustments, combined with physical therapy (chiro + PT), had a greater impact than sham chiropractic with physical therapy (sham + PT) did on motor function (Fugl Meyer Assessment, FMA) in 63 subacute or chronic stroke patients. Secondary outcomes included health-related quality of life and other measures of functional mobility and disability. Outcomes were assessed at baseline, 4 weeks (post-intervention), and 8 weeks (follow-up). Data were analyzed using linear mixed-effects models or generalized linear mixed models. A post-hoc responder analysis was performed to investigate the clinical significance of findings. At 4 weeks, there was a larger effect of chiro + PT, compared with sham + PT, on the FMA (difference = 6.1, $p = 0.04$). The responder analysis suggested the improvements in motor function seen following chiropractic spinal adjustments may have been clinically significant. There was also a robust improvement in both groups in most measures from baseline to the 4- and 8-week assessments, but between-group differences were no longer significant at the 8-week assessment. Four weeks of chiro + PT resulted in statistically significant improvements in motor function, compared with sham + PT, in people with subacute or chronic stroke. These improvements appear to be clinically important. Further trials, involving larger group sizes and longer follow-up and intervention periods, are required to corroborate these findings and further investigate the impacts of chiropractic spinal adjustments on motor function in post-stroke survivors. ClinicalTrials.gov Identifier NCT03849794.

Keywords: stroke; motor function; chiropractic spinal adjustment; physical therapy; health-related quality of life; recovery of function

1. Introduction

Stroke can result in persistent impairments of structure and function, which can lead to limitations of activity and a negative impact on quality of life [1,2]. Due to long term disability, many stroke survivors are dependent on their caregivers for assistance with activities of daily life, such as dressing, bathing, and toileting, which imposes an addi-

www.mdpi.com/journal/brainsci

Functional Clinical Outcomes also improved!

- 4 weeks Chiropractic/Control Randomised controlled trial
- Physical Therapy + sham vs Physical Therapy + Chiro
- Motor Function (Fugl Meyer Assessment)
- 63 subacute stroke victims
- Quality of Life
- Measures week 0, week 4, week 8

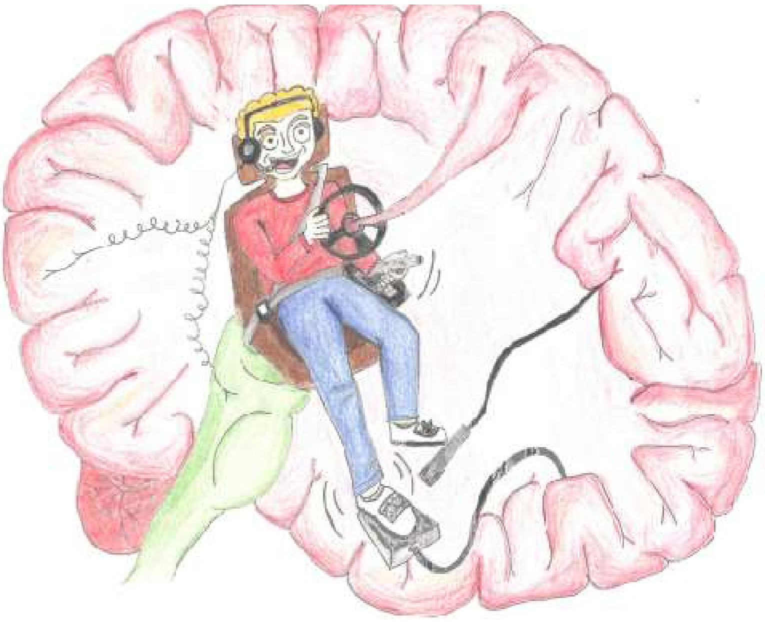
- At week 4 – LARGE effect in chiro group vs sham
- Appear to be clinically important improvement!
- Both groups improved at 8 weeks

Holt, Niazi, Amjad, Kumari, Rashid, Duehr; Navid, Shafique, Haavik. (2021) The effects of 4 weeks of chiropractic care on motor function in chronic stroke: A randomized controlled trial. Brain Sci. 2021, 11, 676. https://doi.org/10.3390/brainsci11060676

NEW ZEALAND COLLEGE OF CHIROPRACTIC

42

HAAVIK RESEARCH



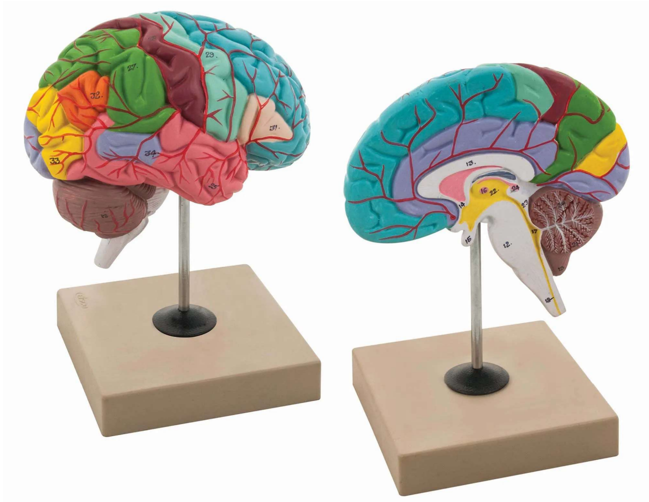
43

HAAVIK RESEARCH

How many of you have a spine model in your practice?

44

How many of you have a brain model in your practice?



45

Motor Control changes with adjustments

Haavik Taylor, H, & Murphy, B (2008). *Journal of Manipulative and Physiological Therapeutics,* 31 (2): 115-126.

Murphy, Haavik-Taylor & Marshall JMPT 2010 33(3):168-177

Daligadua, J., Haavik, H., Yielder, P., Baarbe, J. & Murphy, B.A. (2013). *Journal of Manipulative and Physiological Therapeutics.* 2013;36:527-537.

Niazi, I., Turker, K., Flavel, S., Kingett, M., Duehr, J., & Haavik, H. (2015). *Experimental Brain Research,* 233(4), 1165. https://doi:10.1007/s00221-014-4193-5

Haavik, H., Kruger, J., & Murphy, B. (2016) *Journal of Manipulative and Physiological Therapeutics.* Jun;39(5):339-47. https://doi:10.1016/j.jmpt.2016.04.004

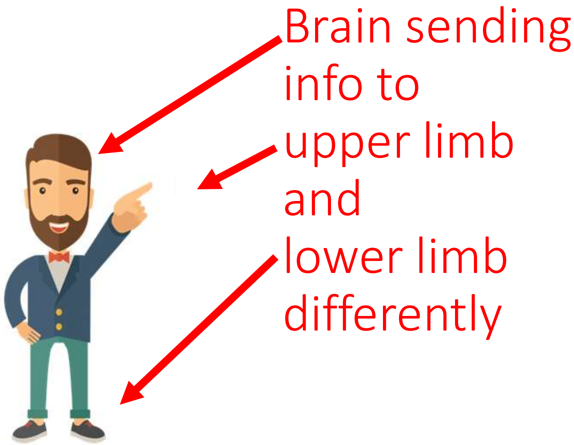
Haavik, H., Niazi, I.K., Jochumsen, M., Sherwin, D., Flavel, S., Turker, K.S., (2017) *Brain Sciences.* Brain Sciences. 7 (1), 2. https://doi.org/10.3390/brainsci7010002

Christiansen, et al. (2018). European Journal of Applied Physiology, 1-13. https://doi.org/10.1007/s00421-018-3799-x

Andrew, et al. (2018). Experimental Brain Research. 236 (1)1–11.

Haavik, et al (2018) Journal of Electromyography & Kinesiology. 42; 24–35.

Baarbé, J.K., et al. (2018. Plos One. 2018;13(2):e0193413.



Holt, K., et al. (2019Scientific Reports. 9:2673 https://doi.org/10.1038/s41598-019-39577-5

Kingett, M., et al (2019). Brain sciences, 9(6), 136.

Niazi et al (2020) Healthcare., 8(4), 548; https://doi.org/10.3390/healthcare8040548

Robinault, Aleš Holobar, Sylvain Crémoux, Usman Rashid, Imran Khan Niazi, Kelly Holt, Jimmy Lauber & Heidi Haavik. Brain Sciences: Special Issue: Mechanisms and Application of Clinical Neurophysiology: State of the Art. 11(1), 105; https://doi.org/10.3390/brainsci11010105

Holt, et al. (2021) Brain Sci. 2021, 11, 676. https://doi.org/10.3390/brainsci11060676

Haavik, et al (2021). European Journal of Applied Physiology. 121(10), pp.2675-2720 https://doi.org/10.1007/s00421-021-04727-z

Cade et al (2021) Brain Sciences. 11, 1047. https://doi.org/10.3390/brainsci11081047

Navid et al. 2022. Frontiers in Neurology. 2663.

Lucien et al. 2023. Brain Sciences. Jun 13;13(6):946.

46

HAAVIK RESEARCH

Review on Motor control changes with chiropractic care

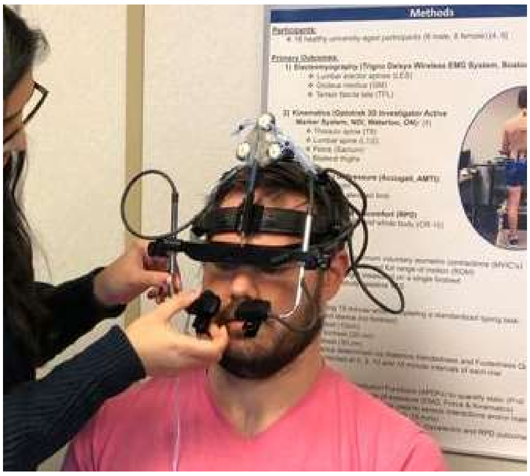
NEW ZEALAND COLLEGE OF CHIROPRACTIC

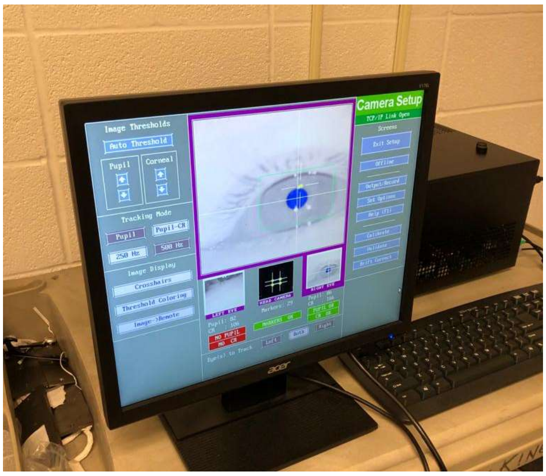

INVITED REVIEW

The contemporary model of vertebral column joint dysfunction and impact of high-velocity, low-amplitude controlled vertebral thrusts on neuromuscular function

Heidi Haavik, Nitika Kumari, Kelly Holt, Imran Khan Niazi, Imran Amjad, Amit N. Pujari, Kemal Sitki Türker, Bernadette Murphy. (2021a) The contemporary model of vertebral column joint dysfunction and impact of high-velocity, low-amplitude controlled vertebral thrusts on neuromuscular function. Invited Review. European Journal of Applied Physiology. https://doi.org/10.1007/s00421-021-04727-z

47





NCMIC

NEW ZEALAND COLLEGE OF CHIROPRACTIC

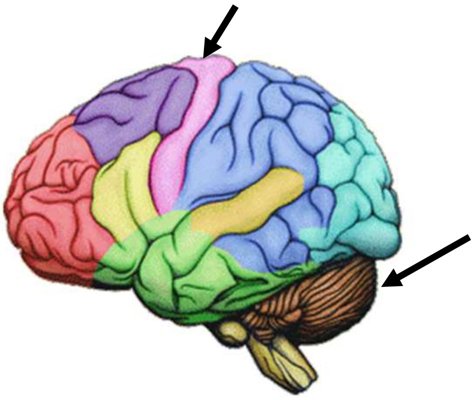
Devonte T. Campbell, Paul C Yielder, Ushani Ambalavanar, Heidi Haavik & Bernadette Murphy. 2024. The Cervico-ocular Reflex Changes Following Treatment in Individuals with Subclinical Neck Pain: A Randomized Control Trial. Experimental Brain Research. In press.

HAAVIK RESEARCH

48

HAAVIK RESEARCH

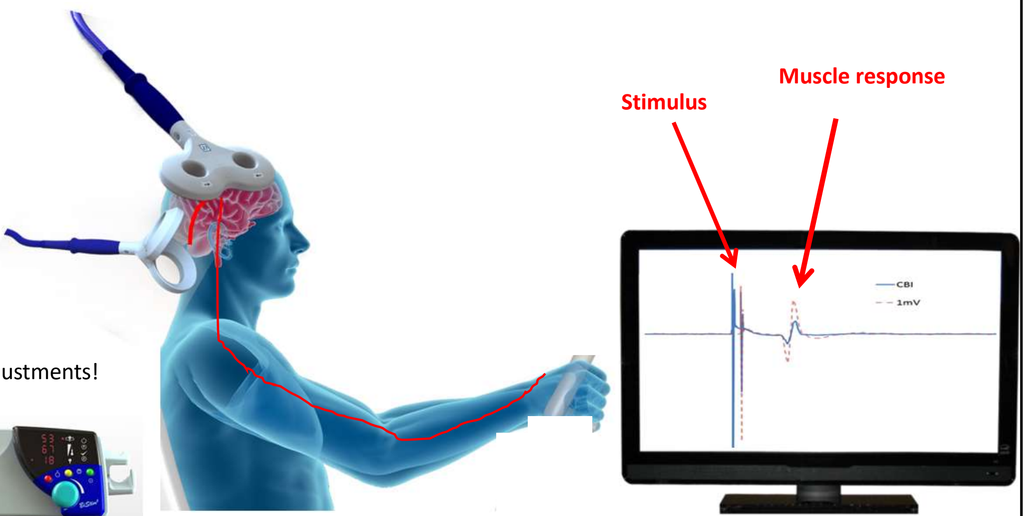
The Cerebellum



49

HAAVIK RESEARCH

Cerebellum- M1 Inhibition with TMS

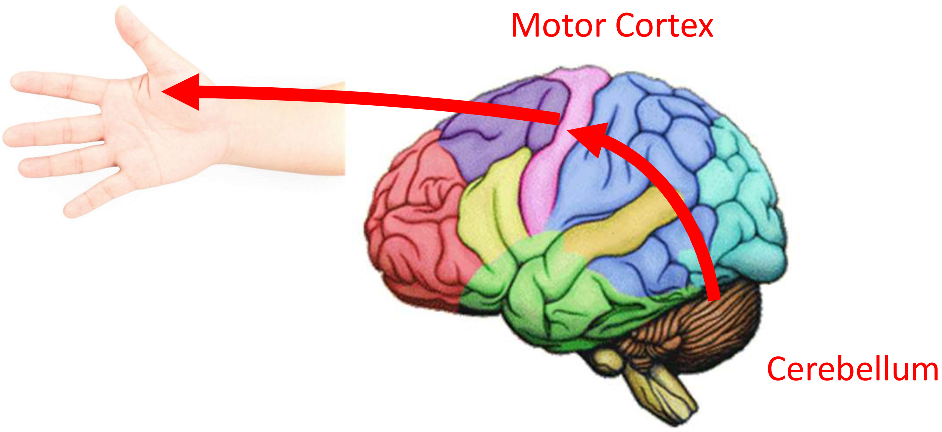


SCNP have poor CBI
Increase CBI after adjustments!

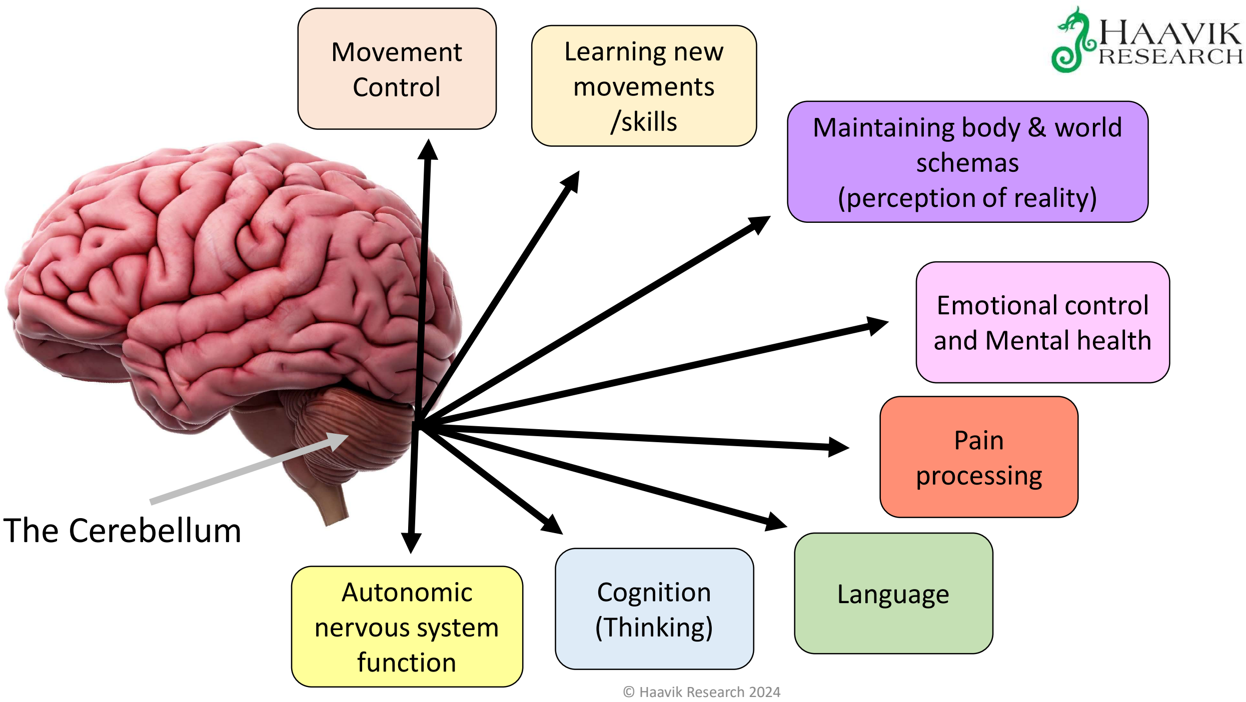
Baarbé, J.K., Yielder, P., Haavik, H., Holmes M.W.R., Murphy, B. (2018) Subclinical recurrent neck pain and its treatment impacts motor training-induced plasticity of the cerebellum and motor cortex. Plos One. 2018;13(2):e0193413. Daligadu, Haavik, Yielder, Baarbé & Murphy (2013) Alterations in cortical and cerebellar motor processing in SCNP following spinal manipulation. JMPT. 36:527-537

50

What does this mean?

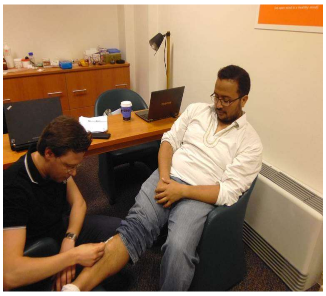


51

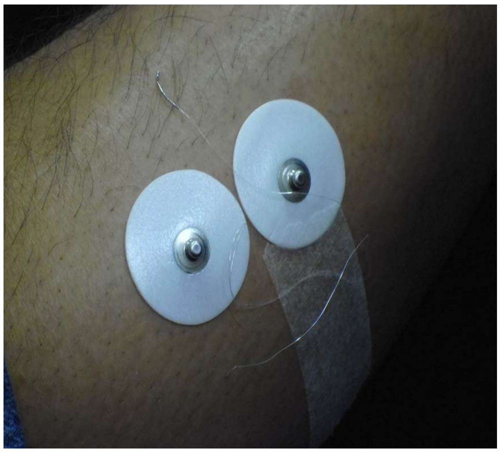


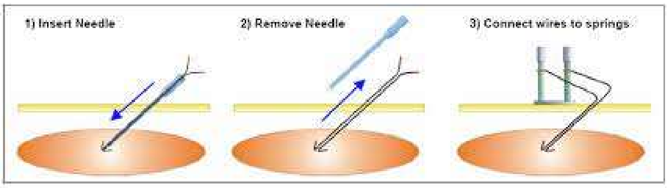
52

Our Intramuscular EMG studies



we were able to record 85 single motor units (using the needle-based technique) across 19 participants





New Zealand College of Chiropractic

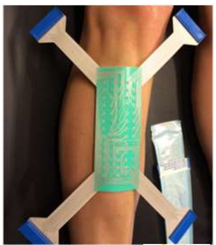
Haavik H, Niazi IK, Jochumsen M, et al. Chiropractic spinal manipulation alters TMS induced I-wave excitability and shortens the cortical silent period. J Electromyogr Kinesiol 2018;42:24-35. doi: 10.1016/j.jelekin.2018.06.010

Haavik Research

53

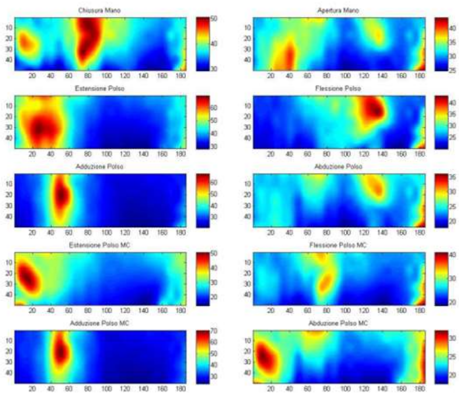
High Density Surface Electromyography (HDsEMG)

HDsEMG electrodes

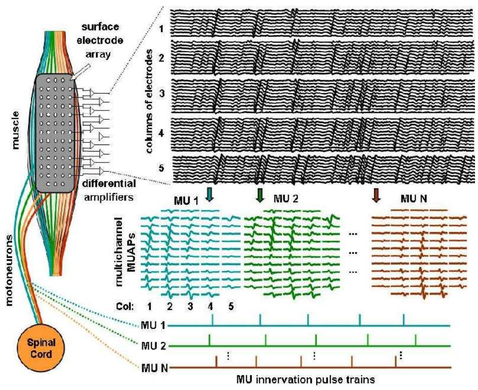


64 channels

Activation MAP



EMG Decomposition



New Zealand College of Chiropractic

Haavik Research

*Robinault, Holobar, Crémoux, Rashid, Niazi, Holt, Lauber & **Haavik**. The Effects of Spinal Manipulation on Motor Unit Behavior. Brain Sciences: Special Issue: Mechanisms and Application of Clinical Neurophysiology: State of the Art. 11(1), 105; https://doi.org/10.3390/brainsci11010105*

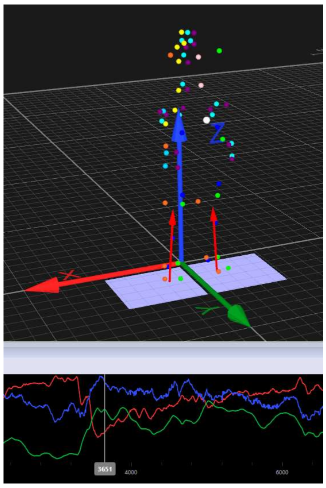
54

500 channel HDsEMG and 3D motion capture

New Zealand College of Chiropractic

- Biomechanics by using 3D motion analysis system
- 500 High Density EMG over erector spinae muscles

NCMIC



Haavik Research

*Robinault, Niazi, Kumari, Amjad, Menard, **Haavik**. Non-Specific Low Back Pain: An Inductive Exploratory Analysis through Factor Analysis and Deep Learning for Better Clustering. Brain Sciences. 2023 Jun 13;13(6):946.*

55

Centre for Chiropractic Research

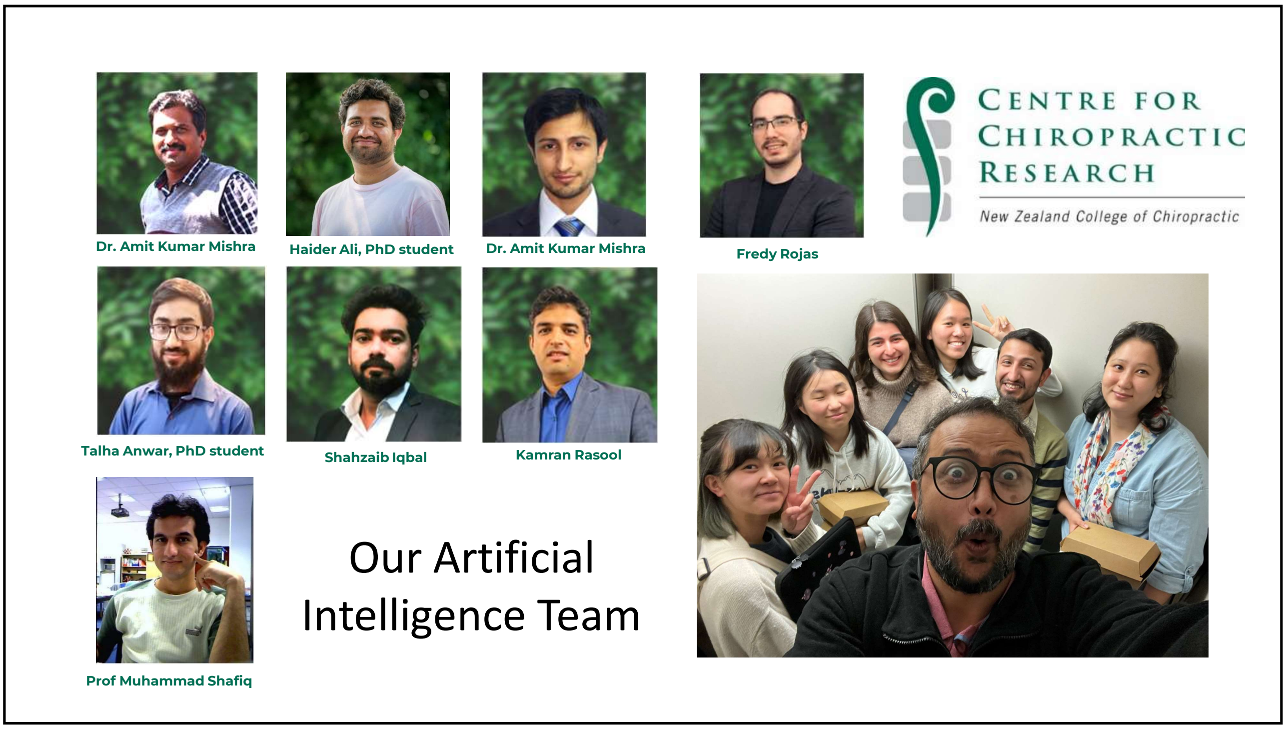
New Zealand College of Chiropractic

New Zealand College of Chiropractic

56

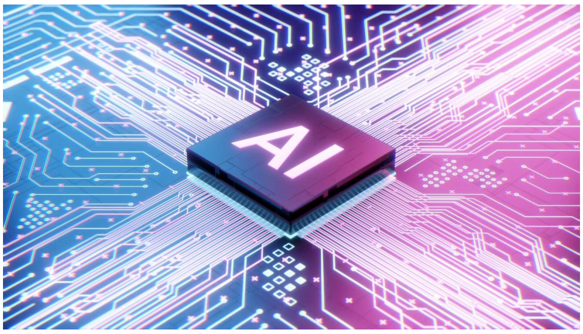

Dr Heidi Haavik
Dr Kelly Holt
Dr Nitika Kumari
Dr Imran Khan Niazi
Dr Jenna Duehr
Dr Tanja Glucina
Dr Usman Ghani
Dr Alice Cade
New Zealand College of Chiropractic
graduating hands, hearts & minds
Dr Samran Navid
Dr Usman Rashid
Dr Imran Amjad
Centre for Chiropractic Research
New Zealand College of Chiropractic

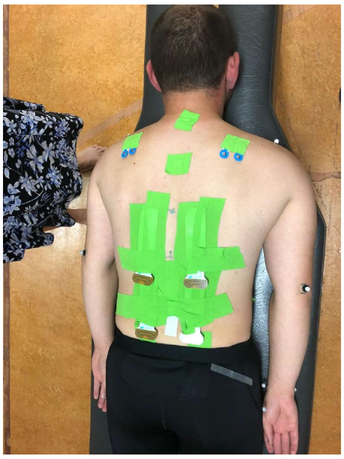
57


Dr. Amit Kumar Mishra
Haider Ali, PhD student
Dr. Amit Kumar Mishra
Fredy Rojas
Centre for Chiropractic Research
New Zealand College of Chiropractic
Talha Anwar, PhD student
Shahzaib Iqbal
Kamran Rasool
Our Artificial Intelligence Team
Prof Muhammad Shafiq

58

Artificial Intelligence





New Zealand College of Chiropractic

Nikolaj Justesen and Nicklas Fleisher (2023) AI analysis and interpretation of high density surface EMG data following chiropractic intervention in healthy, subclinical pain and chronic pain subjects. MSc project. Aalborg University

Haavik Research

59

BioDesign Hub Research Theme Leaders

Dr Catherine Crofts
Theme leader: Metabolic Health Monitoring and Modification
Metabolic Health

Dr Amira Hassouna
Researcher: Metabolic Health Monitoring and Modification
Metabolic Health

Dr Lorenzo Garcia
Theme leader: Musculoskeletal Biomechanics and Biomechatronics
Biomechanics

Dr Kelvin Lau
Theme leader: Technology and Human-Microbe Interactions
Human-Microbiome

Dr Jeff Kilby
Theme leader: Wearable Sensor Signal Processing and Integration
Wearable Sensors

Dr Mangor Pedersen
Artificial Intelligence

Ass Prof David White
Augmented Breathing

Dr Christian Thoma
Autonomic Nervous System

Dr Maryam Doborjeh
Artificial Intelligence

Dr Samaneh (Sam) Madanian
e-Health Technologies

Dr Stefan Marks
3D Data Visualisation

Dr Imran Niazi
Artificial Intelligence

60

61

What is Vitalism?
What is a vitalistic research approach?

- Self aware
- Self organising
- Self developing
- Self healing

Centre for Chiropractic Research
New Zealand College of Chiropractic

- Together, each of us working to our strengths, collaboratively, we can outperform the sum of what each of us could do on our own individually
- We share the work, we share the credit, we share the outputs (grants, publications, etc)

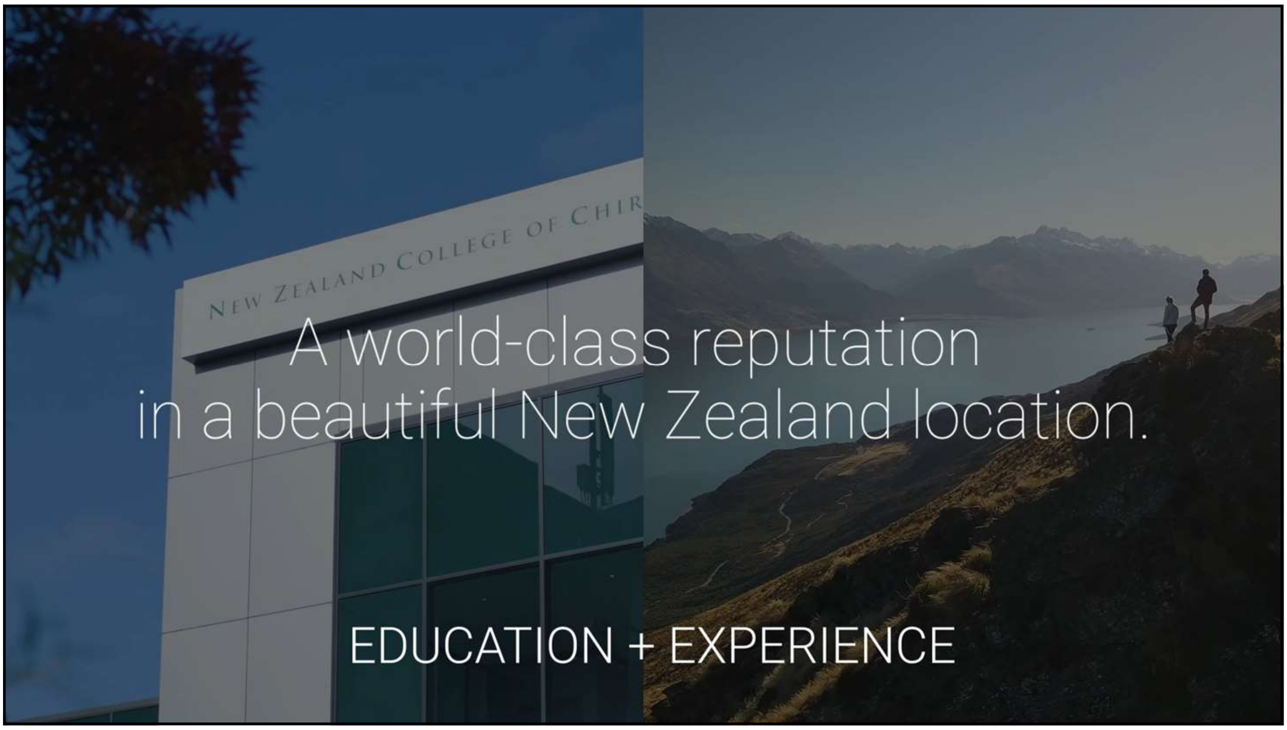
62

NEW ZEALAND COLLEGE OF CHIROPRACTIC

graduating hands, hearts & minds

Please send us your best students!

63



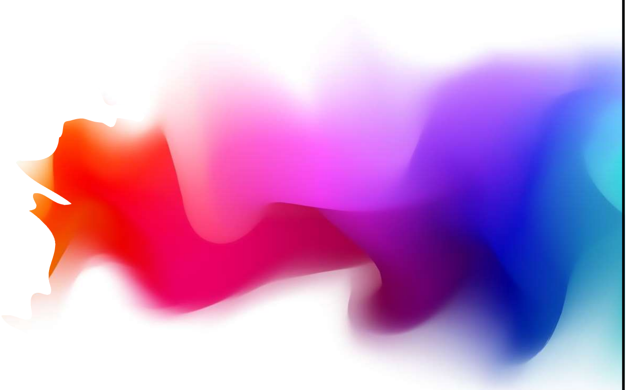
64

65

HAAVIK RESEARCH

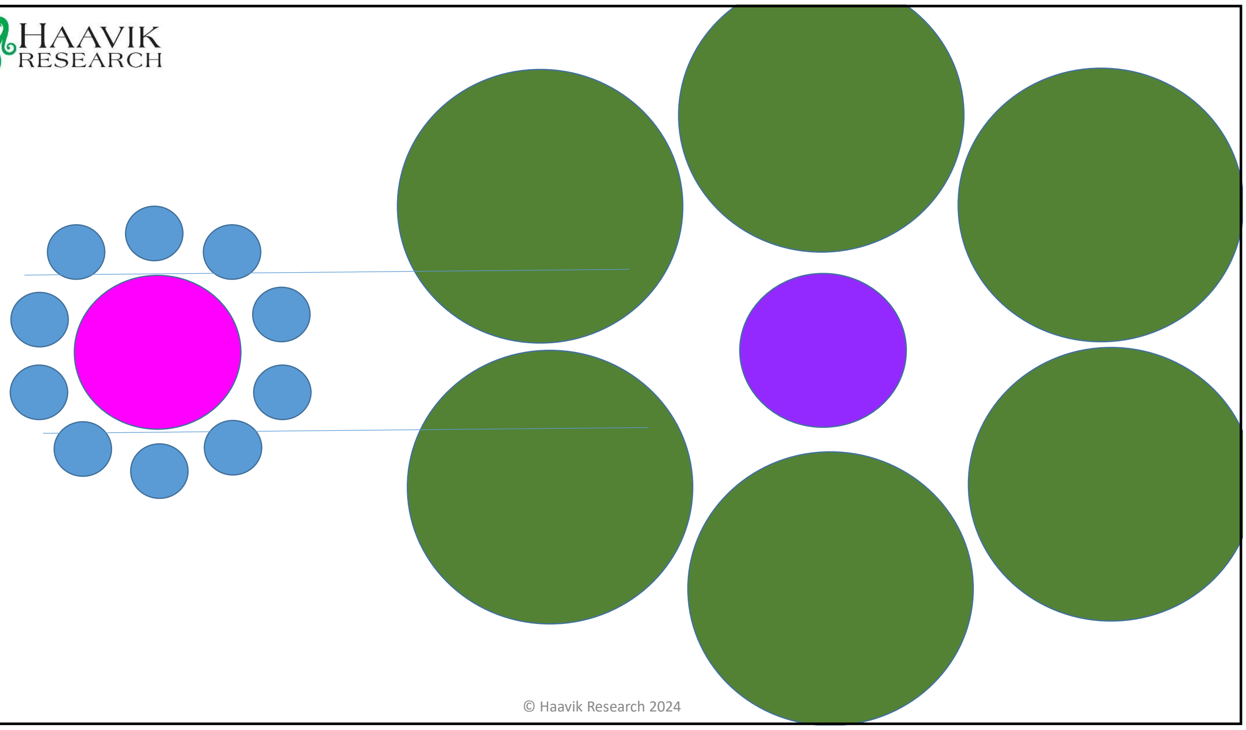
Did you know…….

Do you know your brain does not tell you exactly what it sees, hears, feels, tastes and smells? It INTERPRETS what its sensing, integrates this with your past memories and future expectations, AND is influence by the functioning of your spine!!



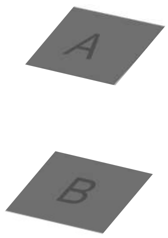
66

HAAVIK RESEARCH

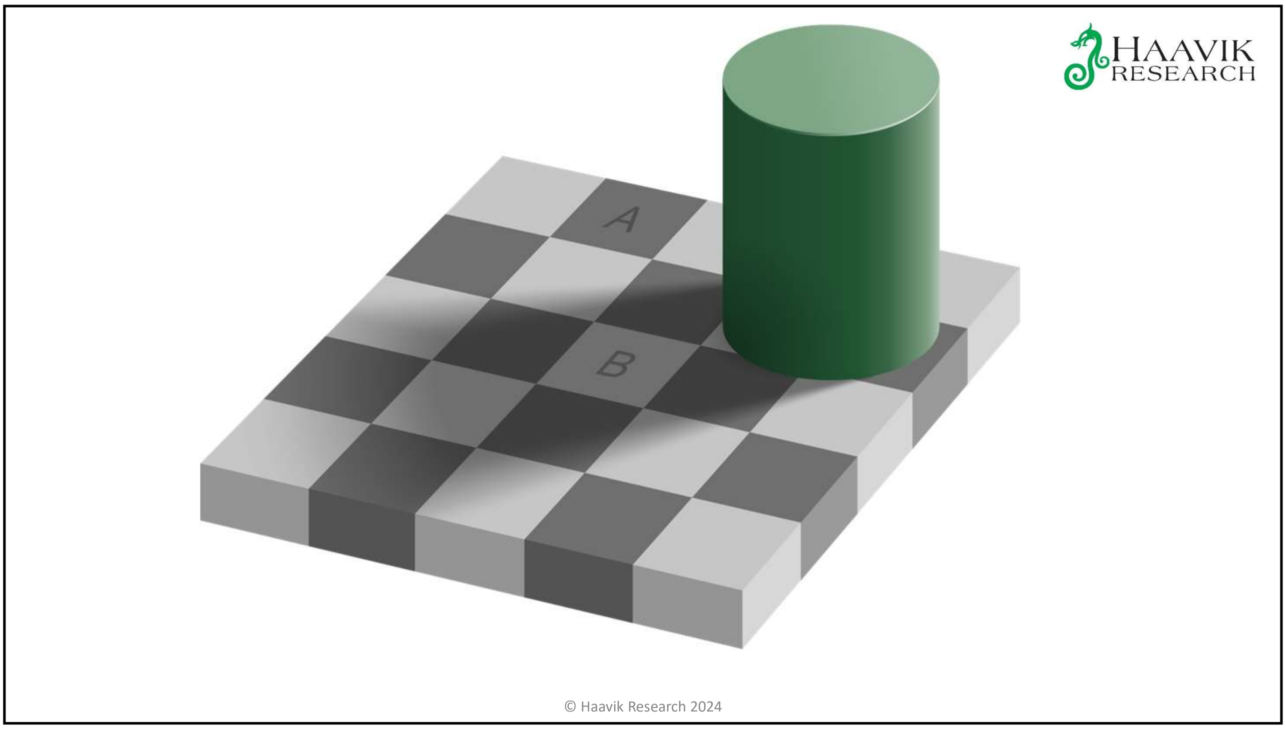


67

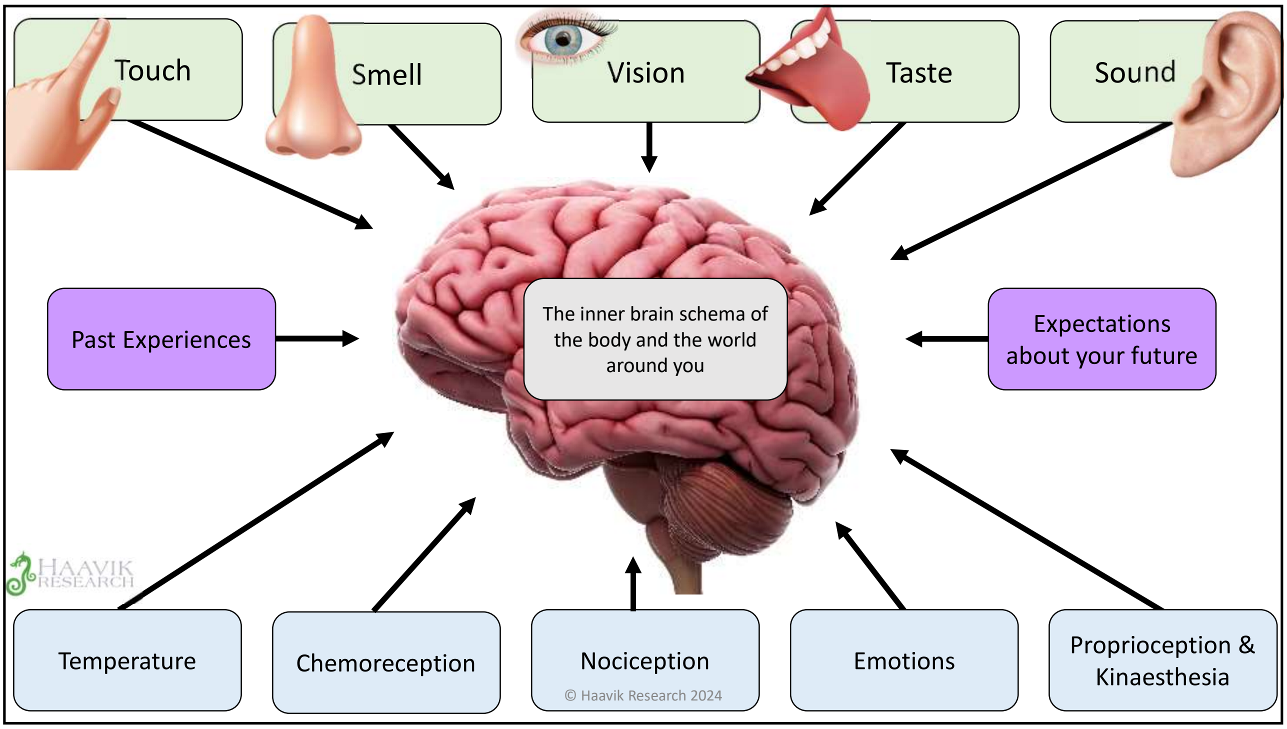
HAAVIK RESEARCH



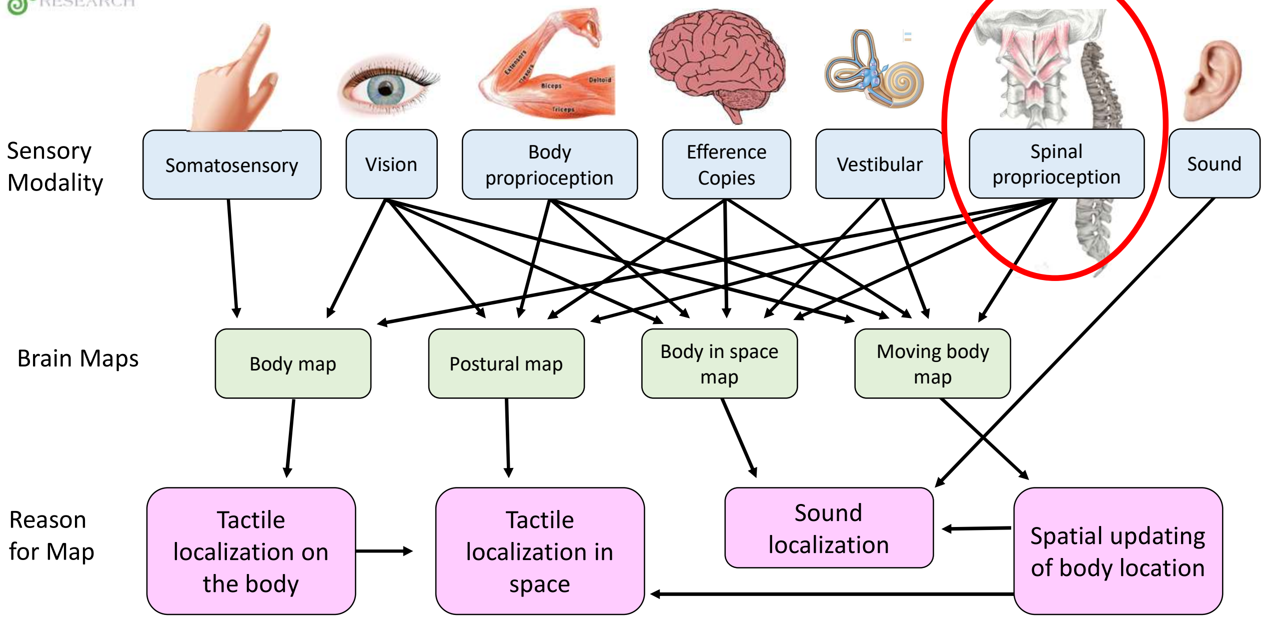
68


HAAVIK
RESEARCH
A
B

69

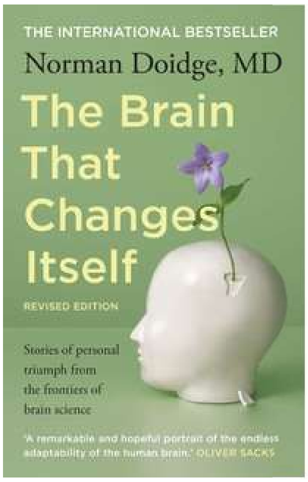

Touch
Smell
Vision
Taste
Sound
Past Experiences
The inner brain schema of the body and the world around you
Expectations about your future
HAAVIK
RESEARCH
Temperature
Chemoreception
Nociception
Emotions
Proprioception & Kinaesthesia

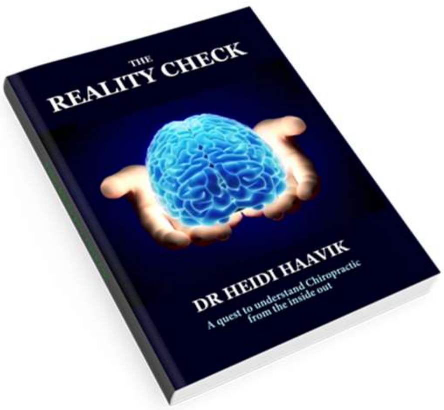
70

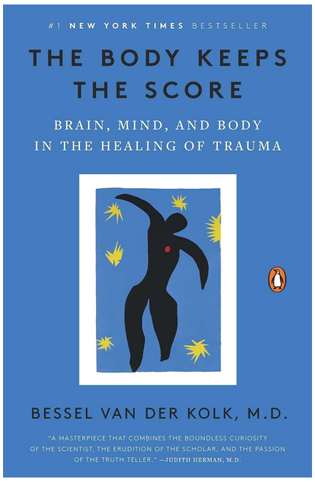


Haavik et al 2021 EJAP

71







72

Also in pamphlet:

Your Brain Fills in the Gaps

...and/or alters your reality based on past expectations,
surrounding information and intentions.

""Ceoinsdr the anmzaig pweor of the hmuan biran.

It dseno't metatr in waht oredr the lrttees in a wrod are, the olny tihng taht is iproamtnt is the frsit and lsat ltetres are in the rghit pclae. The rset can be a tatol mses and you can sitll raed it wuhotit a plboerm. Azanimg huh?"

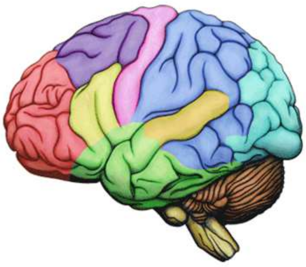
73

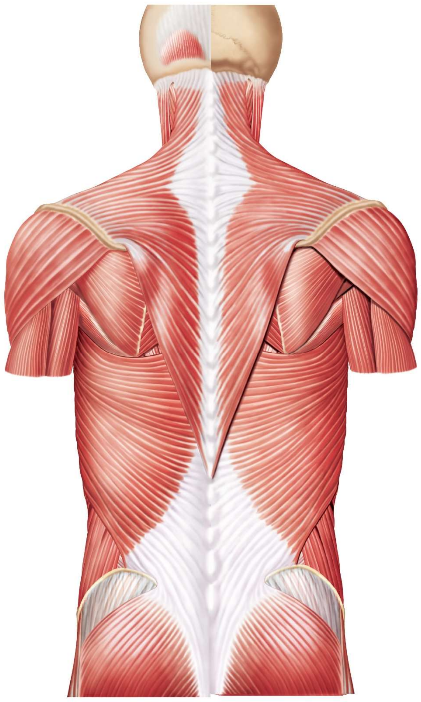
Essential Spinal Functions

74

HAAVIK RESEARCH

Spinal bones don't move themselves!





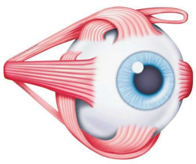
75

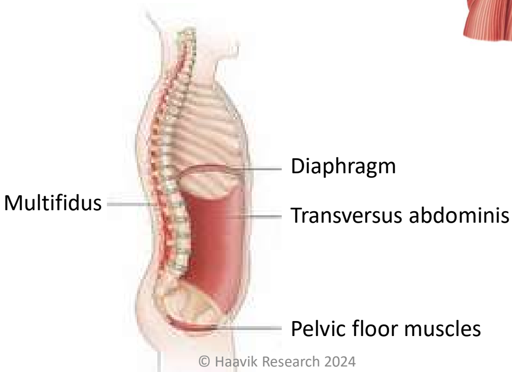
HAAVIK RESEARCH

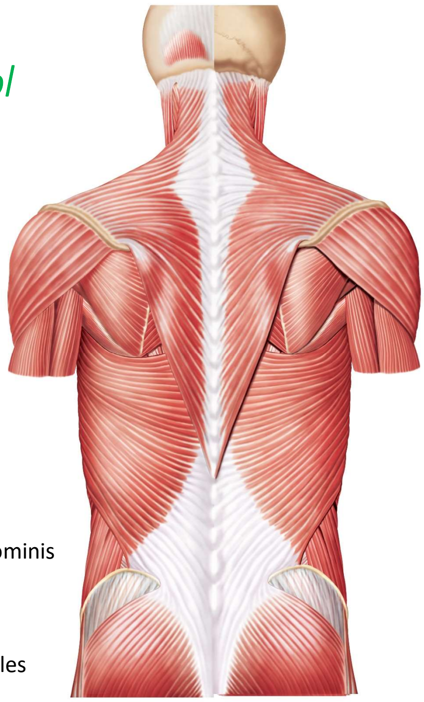
The complexity of spinal movement control

<u>Multiple tissue layers:</u>
Muscles
Skin
Fat
Fascia
Ligaments
tendons

<u>CNS Strategies:</u>
Anticipatory
Reactive
Tonic







76

HAAVIK RESEARCH

Postural Control Systems

Movement Strategies
- Reactive
- Anticipatory
- Voluntary
- Gait

Sensory Strategies
- Sensory Integration
  - Somatosensory (70%)
  - Visual (10%)
  - Vestibular (20%)
- Sensory Reweighting

Cognitive Processes
- Attention
- Learning

Biomechanical constraints
- Strength
- Ligaments
- tendons

Internal Framework
- Internal maps
- gravity

77

HAAVIK RESEARCH

PA19 Neck Falls Risk

ARE YOU A CONFIDANT COMMUNICATOR?

ChirosHub

78

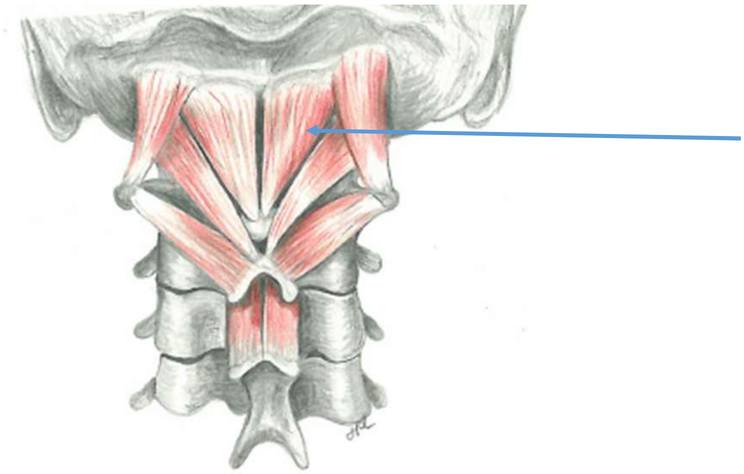
79


Code heiditalk
Gives you 15% off
ChirosHub
GOLD
Membership
Exclusive
Platinum Member
Healthy Ageing
Keep your Spine Moving
Effects of an Adjustment
Las neuronas que se activan simultáneamente refuerzan la sinapsis
ChirosHub
All the resources for your patients and the public!
ChirosAcademy
Over 70 online classes about the science of chiropractic for you!
LearningHub
Online classes for your chiropractic assistants!

80

HAAVIK RESEARCH

Small Intervertebral Paraspinal muscles are primarily sensors

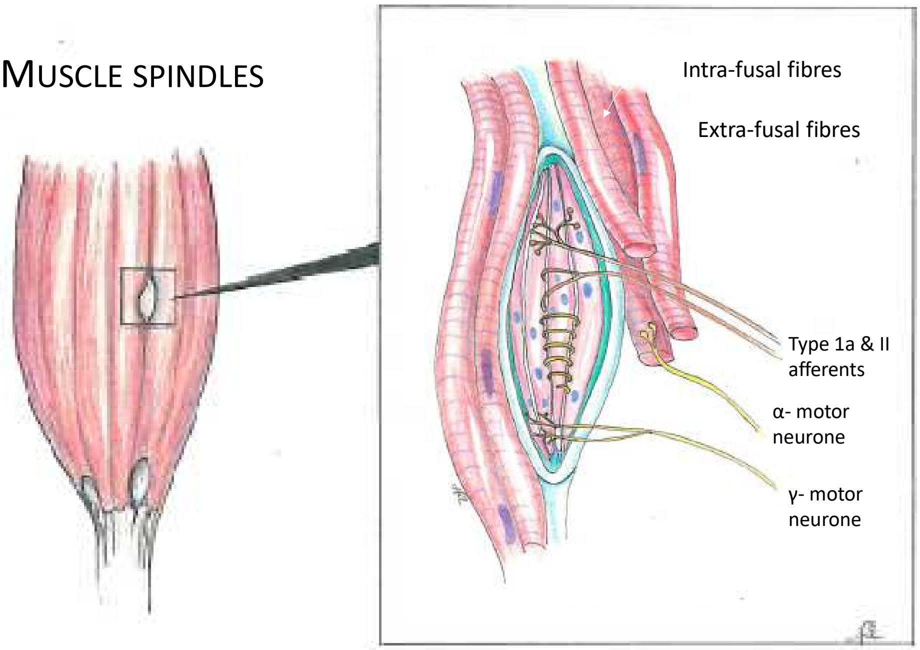


Sense change in position (accelerometers)

81

HAAVIK RESEARCH

MUSCLE SPINDLES



82

HAAVIK RESEARCH

Research literature suggests at least 3 causes of the vertebral subluxation

Physical Trauma	TRAUMA
Chemical Trauma / inflammation	TOXINS
Psychological, social and/or spiritual stress	THOUGHTS

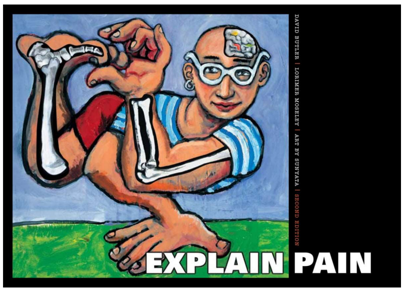
83

HAAVIK RESEARCH

Biologically plausible mechanisms for how you get subluxated

STRESS (emotional, chemical or structural)

"However, if the long muscles are turned on, the shorter ones, for example the stabilizing muscles between vertebrae, ***go to sleep*** – there is no need for them if you are trying to avoid danger."



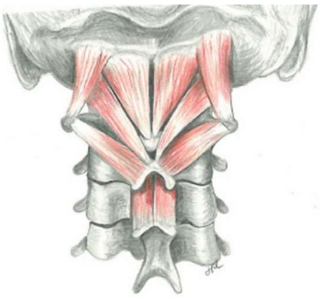
Butler D, Moseley GL. Explain Pain. Adelaide, Australia: Noigroup Publications 2003, p.90

84

What happens when the spine dysfunctions?

Deep paraspinal muscles around a **'healthy' segment** are:

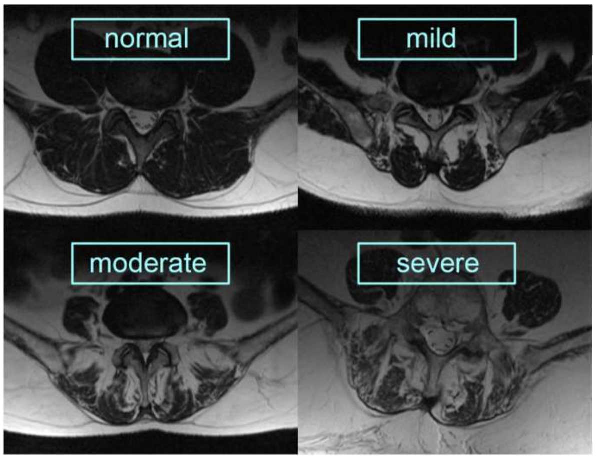
- Plump
- Larger in size
- Slow-twitch fibre type
- No fatty infiltration
- Healthy muscle spindles
- Move freely

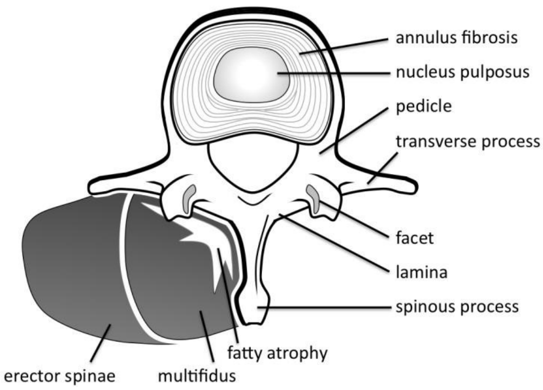


Subluxated segment deep paraspinal muscles over time become:

- Fibrotic
- Atrophied
- Fatty infiltration
- Change fibre type (slow to fast)
- Muscle spindles dysfunction
- DJD around joint

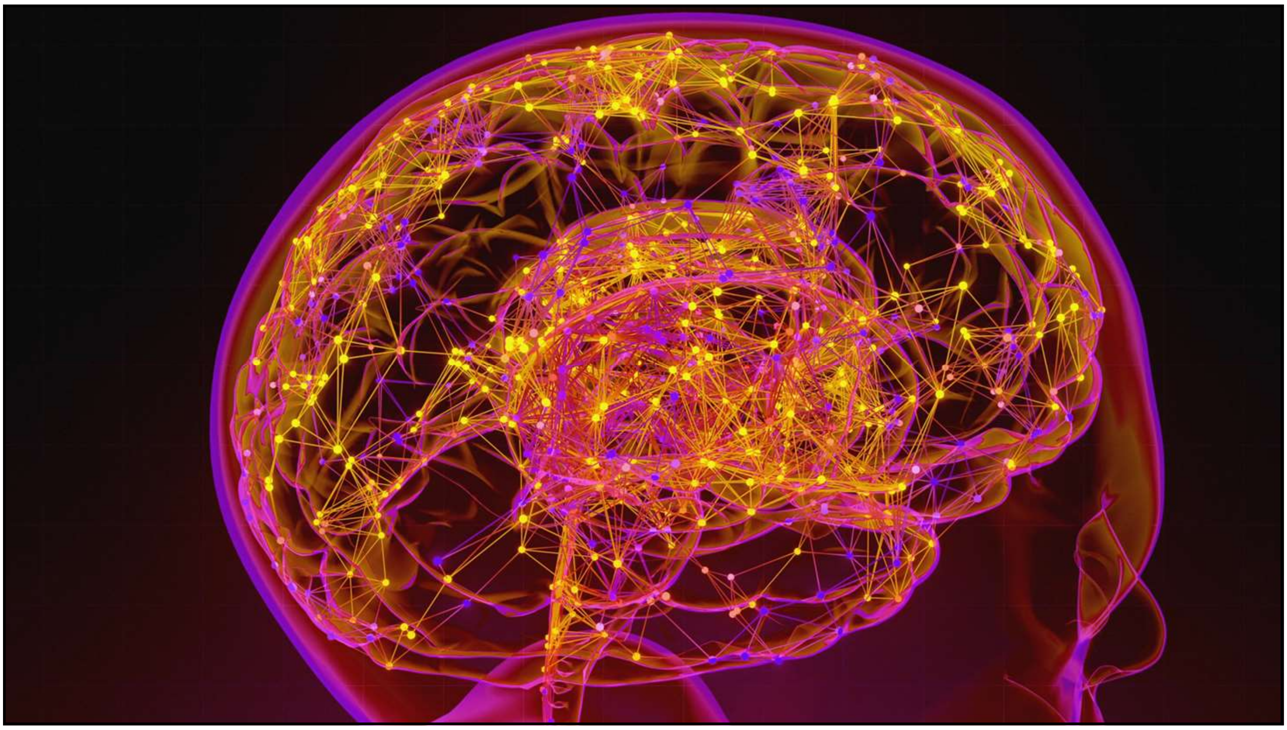
85





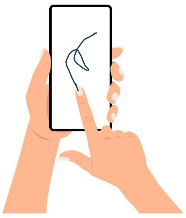
Faur, C., Patrascu, J.M., Haragus, H. and Anglitoiu, B., 2019. Correlation between multifidus fatty atrophy and lumbar disc degeneration in low back pain. BMC musculoskeletal disorders, 20(1), pp.1-6.

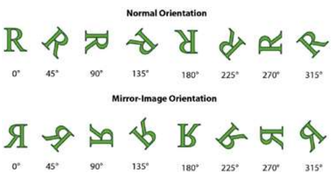
86

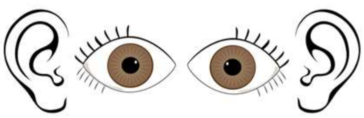


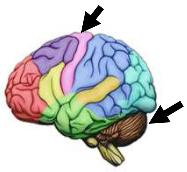
87

Spinal dysfunction vs Healthy people









88

Why are these functions important?

But do we know for sure we reduce car accident?

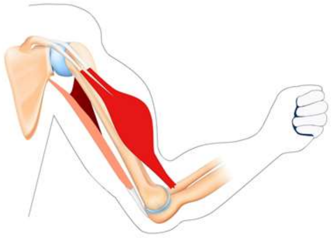
89

A person comes in and you discover they have recurring mild ache pain or tension in their spine…

What MIGHT be going on for this person:	How MIGHT this be expressed for this person ? What questions could you ask?
Poor shoulder proprioception	Might bump into things
Poor elbow proprioception	Might knock elbow on door frames
Poor multimodal integration of sound and visual information	May have more falls (as slower to identify surroundings and respond to them appropriately), may find it hard to function in noisy sensory-rich surroundings, may struggle to identify objects fast
Poor arm movements	May be clumsy, miss objects they are trying to grasp, put cup down so falls off table (as missed table edge), etc
Poor cerebellar-cortex communication	Clumsiness, poor motor learning, struggling to learn instrument, sport, work tasks, shaky, poor fine motor control,
Neck muscle fatigue	Gets sore neck, feels head is too heavy for their body, needs to rest often

90

Microtrauma



91

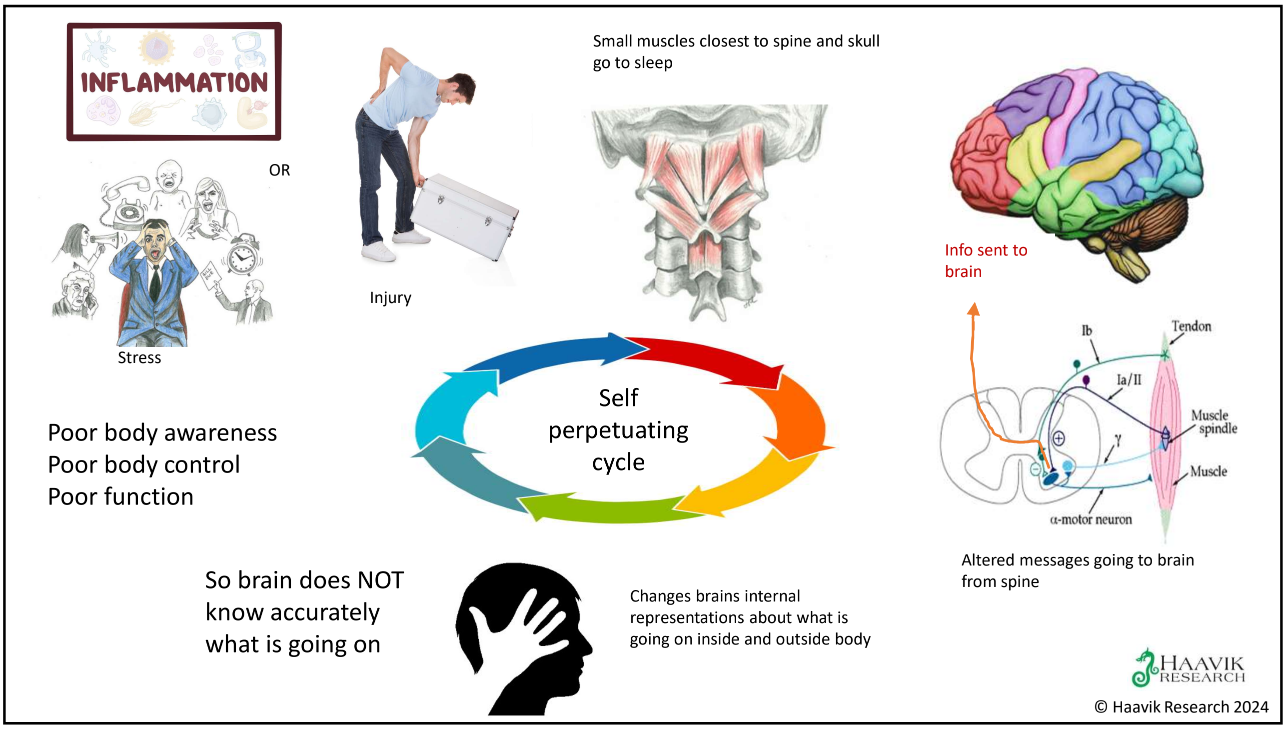
PA24: mild dysfunction brain change

ARE YOU A CONFIDANT COMMUNICATOR?

ChirosHub

92

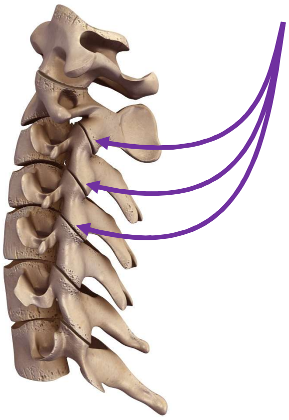
93



INFLAMMATION
OR
Stress
Injury
Small muscles closest to spine and skull go to sleep
Info sent to brain
Ib
Tendon
Ia/II
γ
Muscle spindle
Muscle
α-motor neuron
Self perpetuating cycle
Poor body awareness
Poor body control
Poor function
Altered messages going to brain from spine
So brain does NOT know accurately what is going on
Changes brains internal representations about what is going on inside and outside body
HAAVIK RESEARCH
© Haavik Research 2024

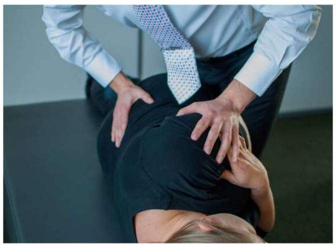
94

The facet joints gap during a thrust and you get increased intersegmental ROM!



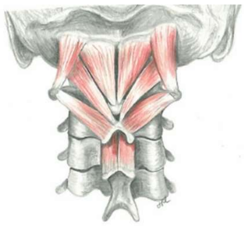
Anderst WJ, Gale T, LeVasseur C, Raj S, Gongaware K, Schneider M. Intervertebral Kinematics of the Cervical Spine Before, During and After High Velocity Low Amplitude Manipulation. The Spine Journal. 2018/08/22/ 2018.

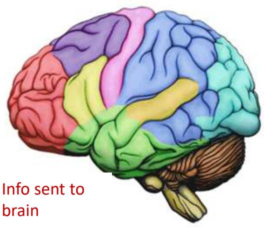
95



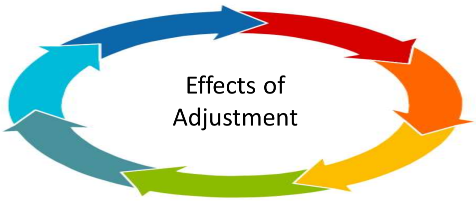
Adjustment

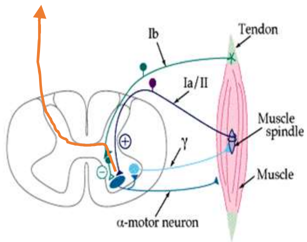
Stretches small muscles closest to spine and scull





Info sent to brain





Bombards brain with mechanoreceptor input

Improved body awareness
Improved body control
Improved function

So brain knows MORE accurately what is going on

Changes brains internal representations about what is going on inside and outside body

96

Bruce Lipton & Heidi Haavik

https://www.youtube.com/watch?v=WDWS3Xgj4WM

97

Implications

- The brain model is FAR MORE impactful that the structural pathology MOPI model ever could be
- Because EVERY adjustment impacts the BRAIN!!! (Prefrontal cortex and Cerebellum)

98

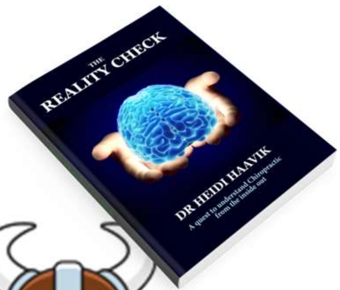
Enlighten the world about the science of the spine

HAAVIK RESEARCH

99

TODAY'S HANDOUT & Gifts

www.heidihaavik.com



Thank you!

Enlightening the world about the science of chiropractic

100

Contemporary Model of Segmental Dysfunction and Neurophysiological Impacts of the HVLA Adjustment

NEW ZEALAND COLLEGE OF CHIROPRACTIC

Heidi Haavik BSc (chiropractic), PhD
VP Research, Dean Research
New Zealand College of Chiropractic

CENTRE FOR CHIROPRACTIC RESEARCH
New Zealand College of Chiropractic

101

MCA
MAINE CHIROPRACTIC ASSOCIATION

Thank you!

102

www.DrHeidi.net

Gifts

Gifts

The HANDOUT for today's Class (the slides)

103

HAAVIK RESEARCH

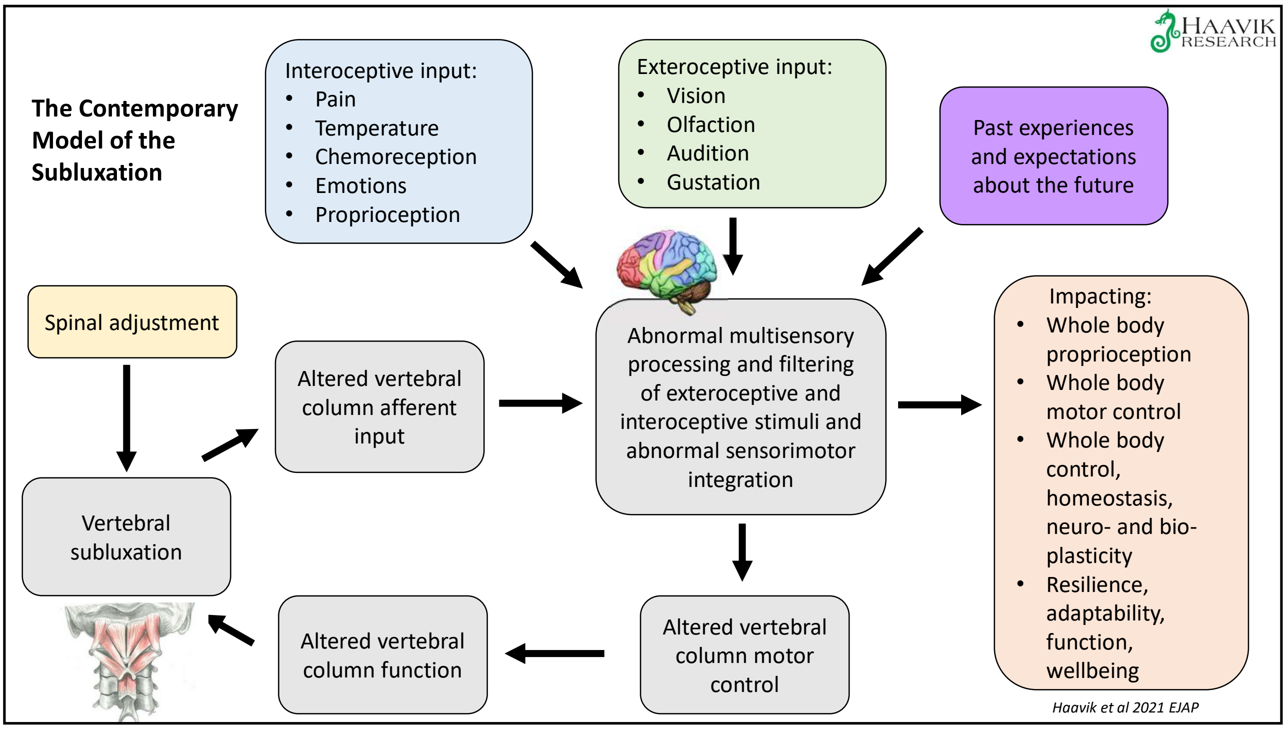
Key References for today's talk

Heidi Haavik, Nitika Kumari, Kelly Holt, Imran Khan Niazi, Imran Amjad, Amit N. Pujari, Kemal Sitki Türker, Bernadette Murphy. (2021a) The contemporary model of vertebral column joint dysfunction and impact of high-velocity, low-amplitude controlled vertebral thrusts on neuromuscular function. Invited Review. European Journal of Applied Physiology. https://doi.org/10.1007/s00421-021-04727-z

Heidi Haavik, Imran Khan Niazi, Nitika Kumari, Imran Amjad, Jenna Duehr, Kelly Holt. (2021b) The potential mechanisms of High-Velocity, Low-Amplitude, Controlled Vertebral Thrusts on Neuroimmune Function: A narrative review. Medicina 2021, 57, 536. https://doi.org10.3390/medicina57060536

Imran Khan Niazi, Muhammad Samran Navid, Christopher Merkle, Imran Amjad, Nitika Kumari, Robert J. Trager, Kelly Holt, Heidi Haavik. 2024 A randomized controlled trial comparing different sites of high-velocity low amplitude thrust on sensorimotor integration parameters. Scientific Report. 14(1), p.1159. https://www.nature.com/articles/s41598-024-51201-9

104



105

PA3: muscles sensors & corridor

Are you a Confidant Communicator?

ChirosHub

106


HAAVIK
RESEARCH

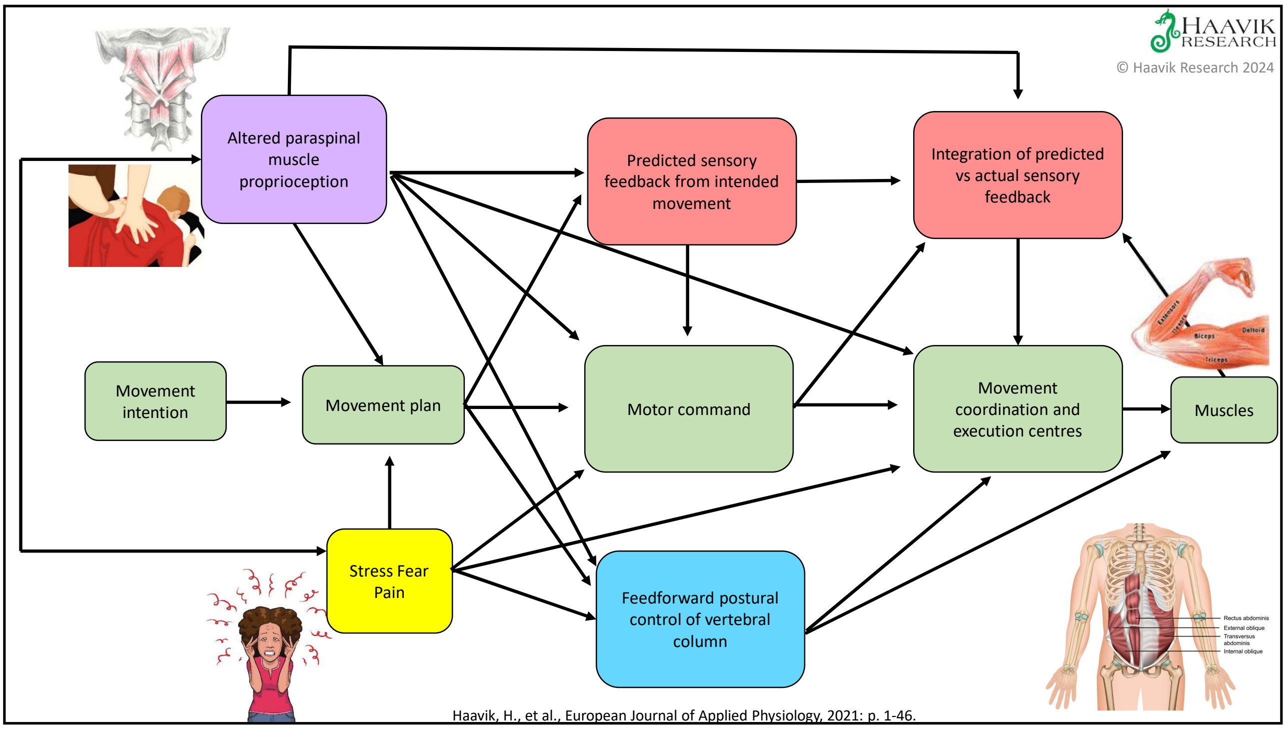
107


Code heiditalk
Gives you 15% off
ChirosHub
GOLD
Membership
Exclusive
Platinum Member
Las neuronas que se activan
simultáneamente refuerzan la sinapsis
Healthy Ageing
Keep your Spine Moving
Effects of an Adjustment
ChirosHub
All the resources for your
patients and the public!
ChirosAcademy
Over 70 online classes
about the science of
chiropractic for you!
LearningHub
Online classes for your
chiropractic assistants!

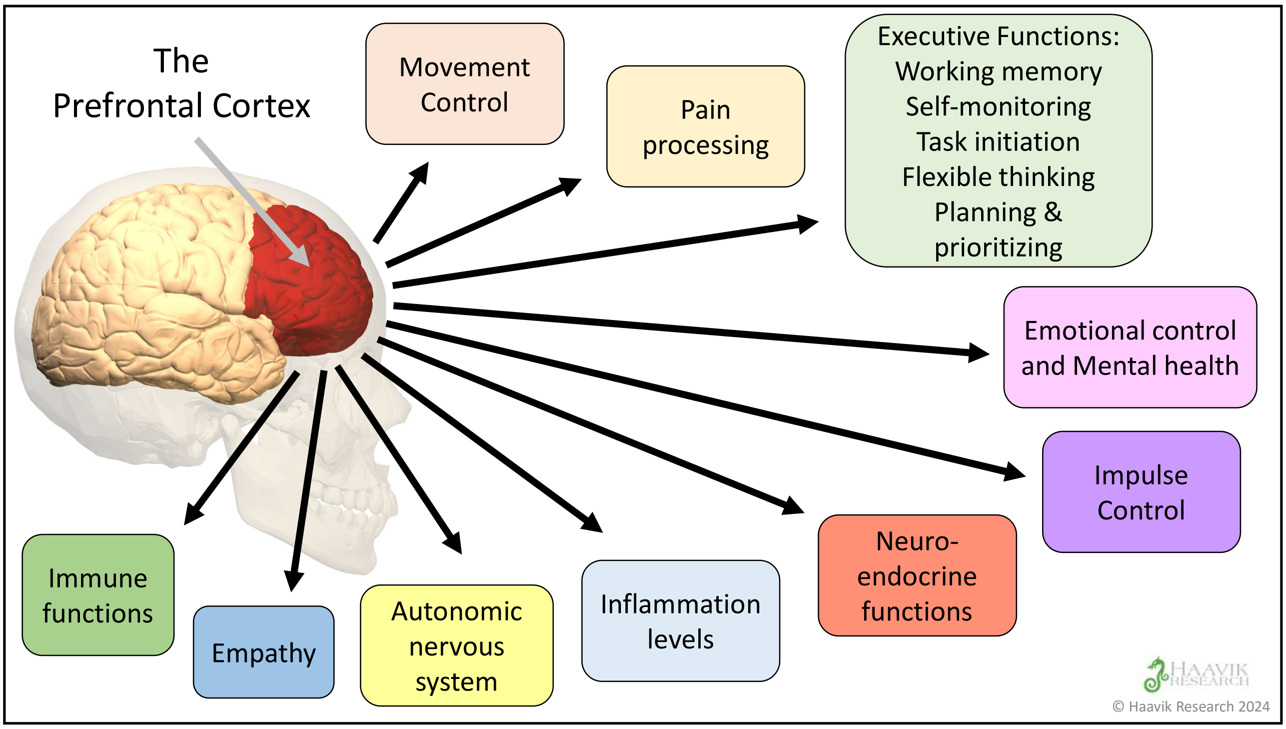
108


HAAVIK
RESEARCH

109


HAAVIK
RESEARCH
© Haavik Research 2024
Altered paraspinal muscle proprioception
Predicted sensory feedback from intended movement
Integration of predicted vs actual sensory feedback
Movement intention
Movement plan
Motor command
Movement coordination and execution centres
Muscles
Stress Fear Pain
Feedforward postural control of vertebral column
Haavik, H., et al., European Journal of Applied Physiology, 2021: p. 1-46.

110

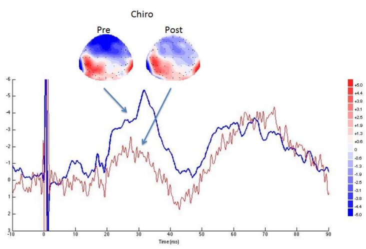


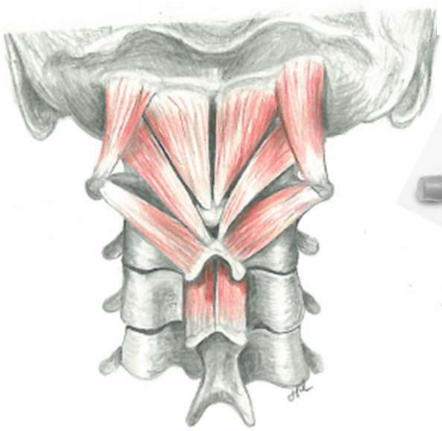
111

HAAVIK RESEARCH

NEW ZEALAND COLLEGE OF CHIROPRACTIC

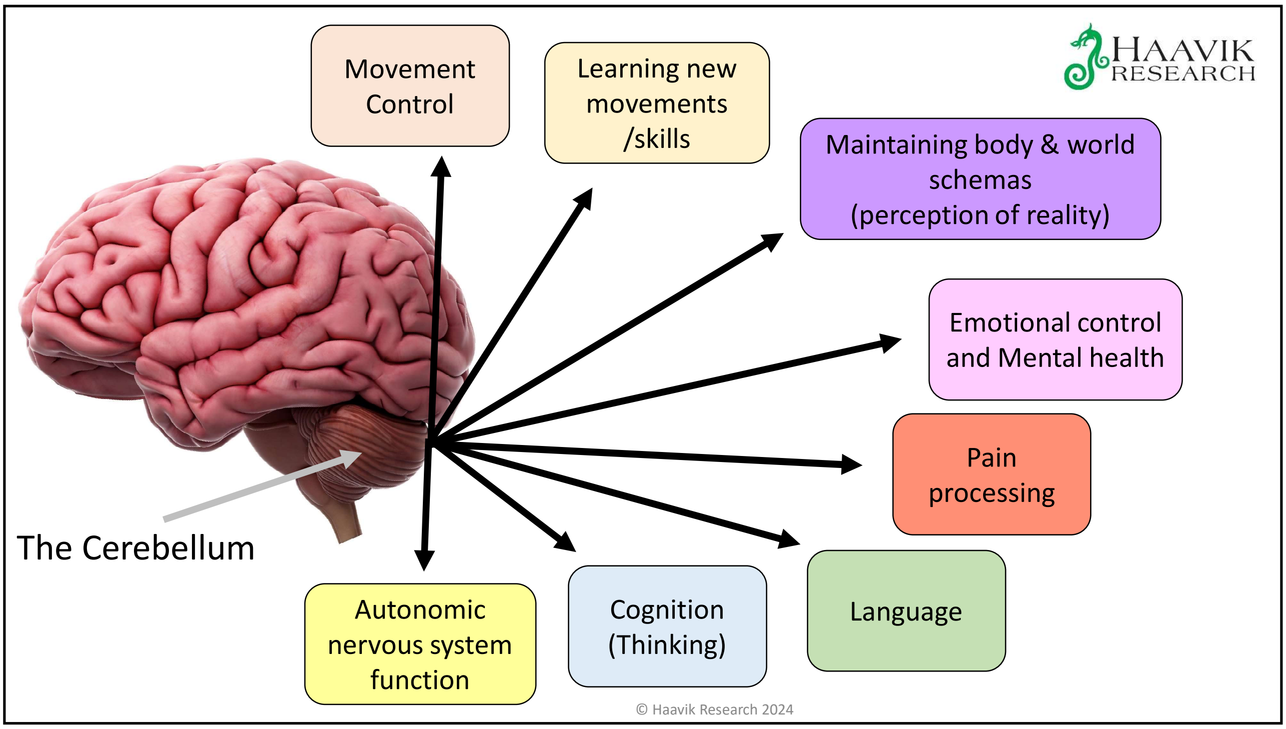
Does specificity matter?





Imran Khan Niazi, Muhammad Samran Navid, Christopher Merkle, Imran Amjad, Nitika Kumari, Robert J. Trager, Kelly Holt, Heidi Haavik. 2024 A randomized controlled trial comparing different sites of high-velocity low amplitude thrust on sensorimotor integration parameters. Scientific Report. 14(1), p.1159.

112

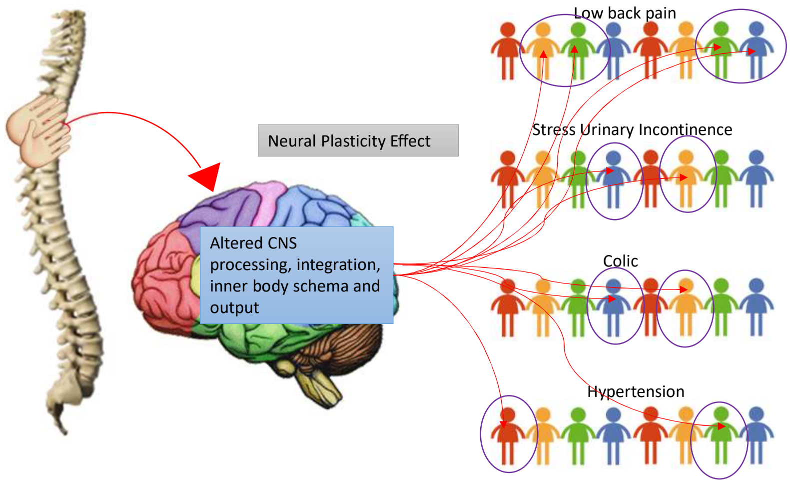

HAAVIK RESEARCH
Movement Control
Learning new movements /skills
Maintaining body & world schemas (perception of reality)
Emotional control and Mental health
Pain processing
The Cerebellum
Autonomic nervous system function
Cognition (Thinking)
Language
© Haavik Research 2024

113


HAAVIK RESEARCH
We don't yet know exactly what symptoms your subluxations will be causing for you!
© Haavik Research 2024

114

Responders vs Non-responders



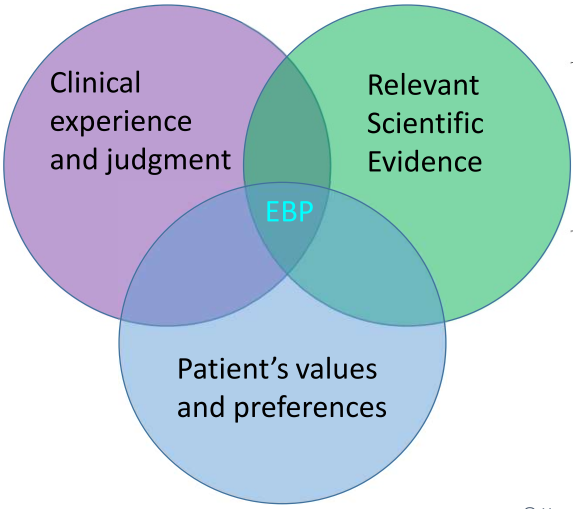
115

How do you incorporate this new science into practice?

116

Patient-Focused, Evidence-Based Practice

Dr David Sackett - The father of evidence-based medicine



1. What the condition is
2. How your care works
3. The efficacy & safety of chiropractic care
4. The efficacy & safety of current medical care

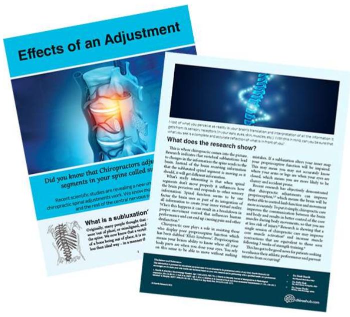
Basic Science (1–2)

Clinical Science (3–4)

117

ChirosHub

Built to help you implement the brain model of chiropractic in practice



- 50+ videos to use on website / social channels
- Chiropractic research articles fully referenced
- Posters, screensavers and digital resources

And much more for Gold Members

118

119

1

On your smart phone click on Safari and type in ChirosAcademy.com

2

Click on the up arrow

3

Click on 'Add to Home Screen'

4

Change the name to 'Chiros Hub'

5

Chiros Hub will now appear as an App on your phone!

120


HAAVIK RESEARCH
PATIENT VIDEOS
RESOURCES
PRACTICE CONTENT
HELP
LOGOUT
CHIROPRACTIC ASSESSMENTS

121

122

Code heiditalk
Gives you 15% off

ChirosHub

ChirosHub

All the resources for your patients and the public!

ChirosAcademy

Over 70 online classes about the science of chiropractic for you!

LearningHub

Online classes for your chiropractic assistants!

123

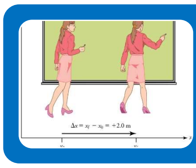
ChirosHub

Searching the Literature

- Search engines
- Key word strategies

Evaluating the literature

- Strengths and weaknesses of different methodologies
- Hierarchy of evidence



Translating the evidence

- Simplifying key findings
- Translating meaning to patient language

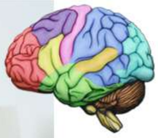
www.ChirosHub.com

124

Spine Talk Prone

- When checking the spine prone, talk spine, discuss paraspinal deep muscles and what occurs over time
- Do some 'did you know questions'

Brain talk supine/sitting



- When checking their neck either sitting or supine, talk brain, talk how the muscles from the spine impact the brain and that adjustments change the way the brain perceives what is going on inside them and even around them.
- Do some 'did you know questions'

HAAVIK RESEARCH

125

HAAVIK RESEARCH

Did you know…….

The latest science is showing us that more frequent adjustments early on when you start care leads to better outcomes up to a year later for people like you with these kinds of headaches that come from your neck

Science is showing us that regular adjustments means less days in pain for you, as opposed to letting it build back up and you only come back in when it hurts

126

HAAVIK RESEARCH

PA28: How Often should I see my chiropractor

ARE YOU A CONFIDANT COMMUNICATOR?

ChirosHub

127

HAAVIK RESEARCH

128

HAAVIK RESEARCH

Did you know.......

The latest science is showing us that more frequent adjustments early on when you start care leads to better outcomes up to a year later for people like you with these kinds of headaches that come from your neck

Science is showing us that regular adjustments means less days in pain for you, as opposed to letting it build back up and you only come back in when it hurts

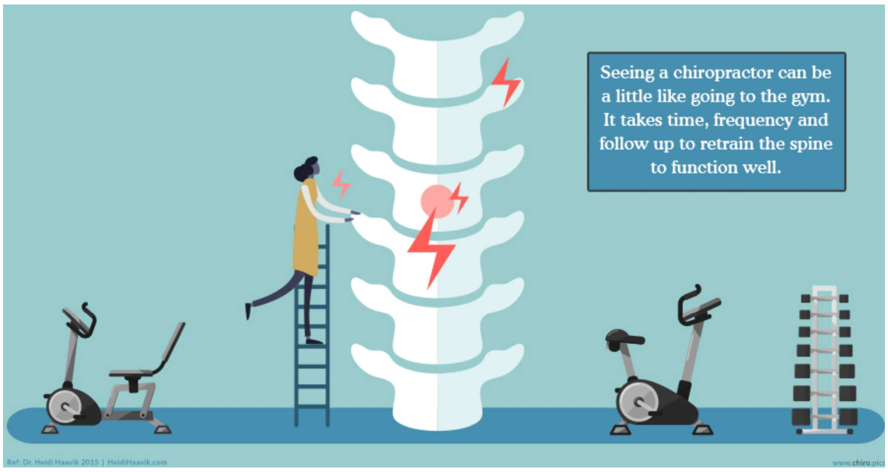
129

130

How long have you been regularly adjusted?

HAAVIK RESEARCH

131



Print and digital resources

HAAVIK RESEARCH

132


Chiropractic & Pregnancy
How often should you visit a Chiropractor?
Chiropractic Care and Breastfeeding
Chiropractic Care & Reaction Times
Effects of an Adjustment
Chiropractic Care and Golf
Infantile Colic
Healthy Ageing
What is a subluxation?

133


Neck Pain
Pain is Created in the Brain
Understanding Pain
Lower Back Pain
The Opioid Epidemic
Keep your Spine Moving
Maintenance Care
Did you know that even the ancient Greeks knew that movement and physical exercise was good for your brain?
Why is spinal movement important?
Did you know that 50% of patients visit a chiropractor simply to maintain their health and well-being!
What is maintenance care?
© Haavik Research 2023

134

Exploring the neurophysiological effects of chiropractic care on preterm infants

- Dr Jenna Duher's PhD project at Auckland University
- Baby RCT
- Infant babies
- 3 months care
- EEG
- Movement measures at 6 months

Jenna Duehr

NEW ZEALAND COLLEGE OF CHIROPRACTIC graduating hands, hearts & minds

AUSTRALIAN spinal research FOUNDATION

THE KID'S SUMMIT

135

HAAVIK RESEARCH

As seen on YouTube in Russell Brand Interview

https://www.youtube.com/watch?v=tgwXAzTqJVU

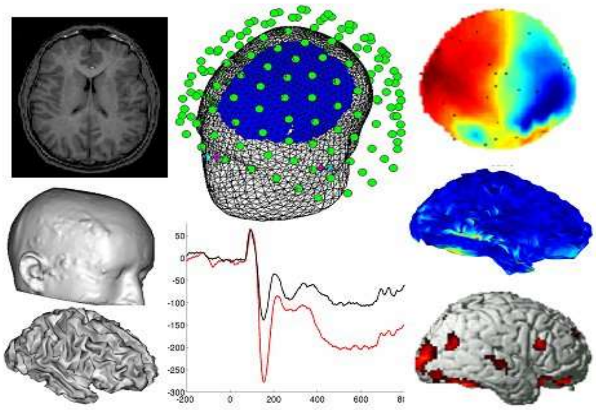
136

NEW ZEALAND COLLEGE OF CHIROPRACTIC

Electroencephalography (EEG)

HAAVIK RESEARCH

- Resting State (5 minutes)
- Source localization analysis (both)



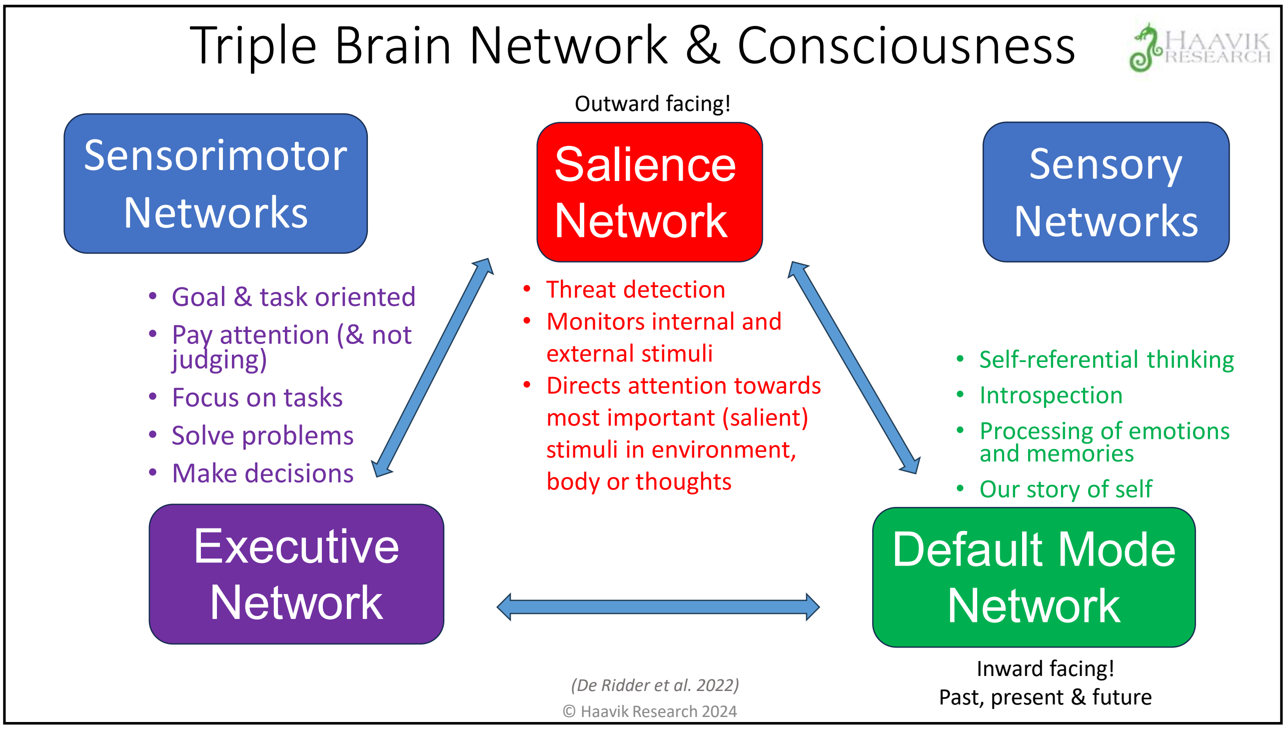
137

NEW ZEALAND COLLEGE OF CHIROPRACTIC

HAAVIK RESEARCH

138

139



Triple Brain Network & Consciousness
HAAVIK RESEARCH
Outward facing!
Sensorimotor Networks
Salience Network
Sensory Networks
• Goal & task oriented
• Pay attention (& not judging)
• Focus on tasks
• Solve problems
• Make decisions
• Threat detection
• Monitors internal and external stimuli
• Directs attention towards most important (salient) stimuli in environment, body or thoughts
• Self-referential thinking
• Introspection
• Processing of emotions and memories
• Our story of self
Executive Network
Default Mode Network
Inward facing!
Past, present & future
(De Ridder et al. 2022)
© Haavik Research 2024

140

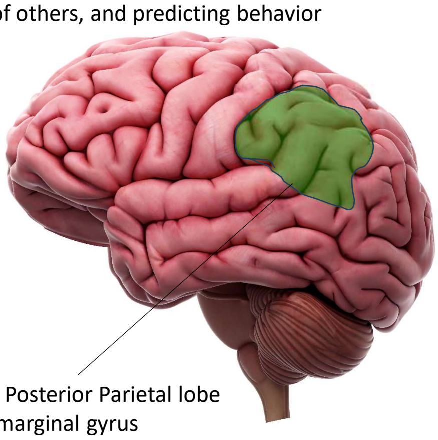
Tripple Brain Network and Psychopathology

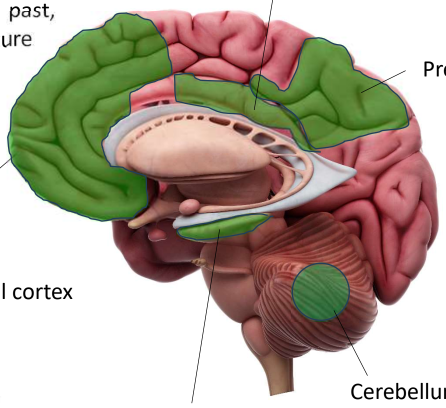
The science of large-scale brain networks offers a powerful paradigm for investigating cognitive and affective dysfunction in psychiatric and neurological disorders. This review examines recent conceptual and methodological developments which are contributing to a paradigm shift in the study of psychopathology. I summarize methods for characterizing aberrant brain networks and demonstrate how network analysis provides novel insights into dysfunctional brain architecture. Deficits in access, engagement and disengagement of large-scale neurocognitive networks are shown to play a prominent role in several disorders including schizophrenia, depression, anxiety, dementia and autism. Synthesizing recent research, I propose a triple network model of aberrant saliency mapping and cognitive dysfunction in psychopathology, emphasizing the surprising parallels that are beginning to emerge across psychiatric and neurological disorders.

(Menon 2011)

141

Default Mode Network





(Dumas et al 2014)

142

Questionnaire Study Results

Control Group

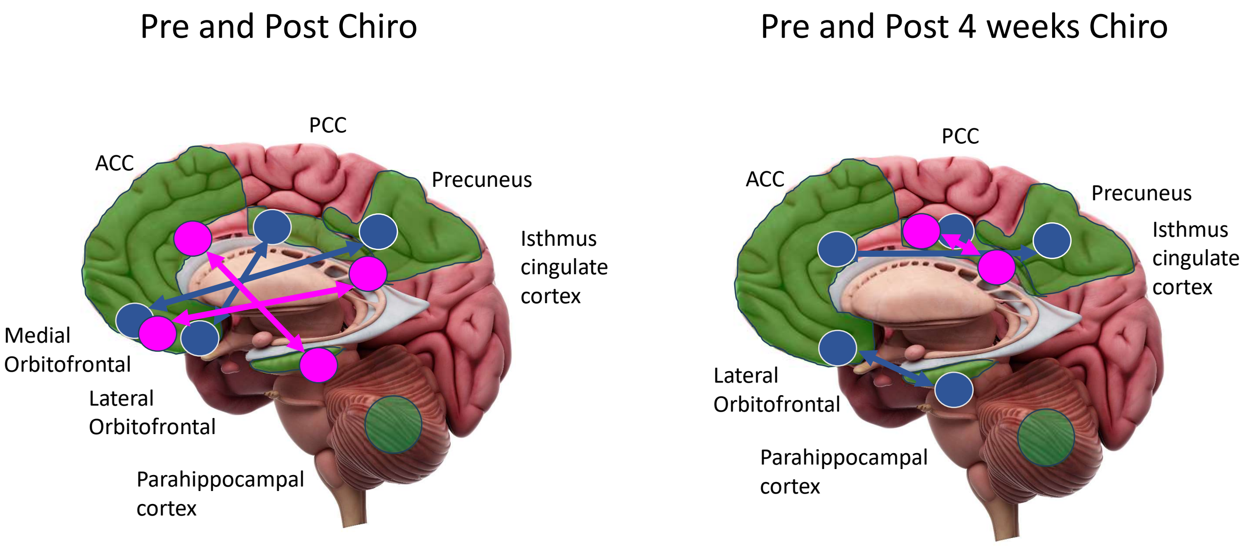
NO significant changes at all

Chiropractic Group

- Improved QOL overall
- Improved Physical function
- Less Depression
- Less anxiety
- Less Fatigue
- Less pain interference
- Less pain intensity

143

SEPs DMN changes



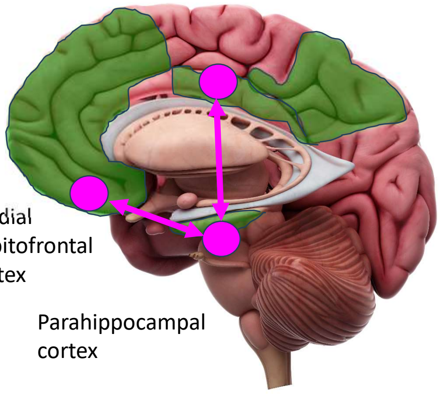
(Haavik et al 2024 submitted)

144

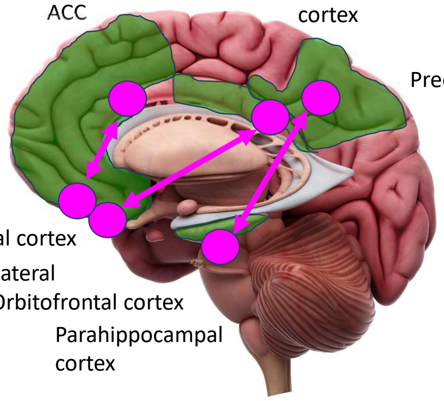
NEW ZEALAND COLLEGE OF CHIROPRACTIC

Resting EEG DMN changes

Pre and Post Chiro



Pre and Post 4 weeks Chiro



(Haavik et al 2024 submitted)

145

NEW ZEALAND COLLEGE OF CHIROPRACTIC

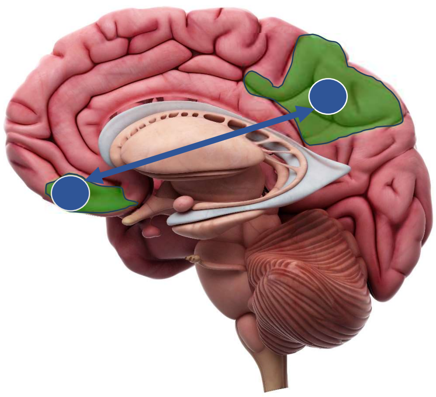
PRE vs POST First Adjustment Session

SEPs Beta ↓ R Medial-orbitofrontal - L Precuneus

May reflect the changes in body schema (and external world schema) from the spinal adjustments also altering the participants mental states, introspection and their constructed sense of self

Medial orbitofrontal

- Processing information about own mental states, beliefs, intentions and desires
- Introspection
- Construction of the narrative sense of self
- Is activated by rewarding and subjectively pleasant stimuli
- Has reduced functional connectivity in depression
- Imagines future events



Precuneus

- Self-awareness, self-referential processing and self-reflection
- Constructing sense of self
- Visuospatial integration
- Anterior Precuneus = THE HUB of Body Schema
- INCREASED in disc herniations
- Decreased following SM in disc herniation patients (Du et al 2024)

(Haavik et al 2024 submitted)

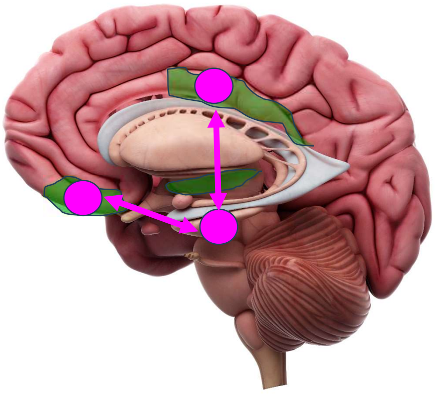
146

PRE vs POST First Adjustment Session

rEEG Alpha ↑ R Parahipp – R PCC   Alpha ↑ L Parahipp – R mOFC

Most likely reflects a state of heightened introspection, emotional and spatial awareness or internally directed cognition, and improved mood after the adjustment.

- Medial Orbitofrontal cortex
  - Processing info about own mental state, beliefs, intentions & desires
  - Introspection and sense of self
  - REDUCED in depression
  - REDUCED in disc herniations
- **Parahippocampus**
  - Memory formation & retrieval
  - Emotional modulation of memories
  - Spatial navigation, object recognition & scene perception.



- Posterior Cingulate Cortex
  - Navigation & spatial memory
  - Emotional awareness and regulation
  - Construction of narrative sense of self
  - Internal, self-referencing thoughts

(Haavik et al 2024 submitted)

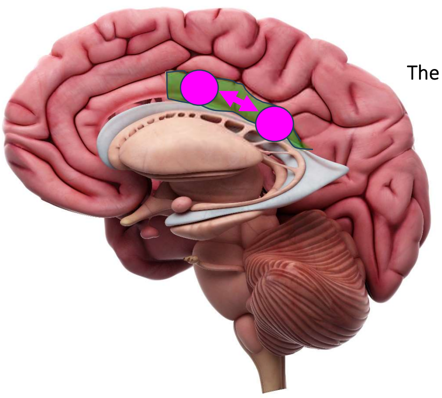
147

PRE vs POST 4 weeks of chiropractic care

SEPs Alpha ↑ L isthmus-cingulate- R PCC   SEPs Alpha ↓ L PCC – R PCC

Thus, may reflect altered narrative sense of self in a manner that is reducing symptoms of depression and improvements in fatigue

- The Posterior Cingulate Cortex
  - internally focused, self-referential processing
  - implicated in depression
- In depression there is asymmetry in the thickness of PCC (↑ cortical thickness in left vs right)
- Depressed individuals with higher somatic symptoms (e.g. sleep disturbance, appetite disturbance, and fatigue or loss of energy) have greater asymmetry in PCC thickness



The isthmus cingulate
- introspection and self-referential processing
- construction of the narrative sense of self, including autobiographical memories

(Haavik et al 2024 submitted)

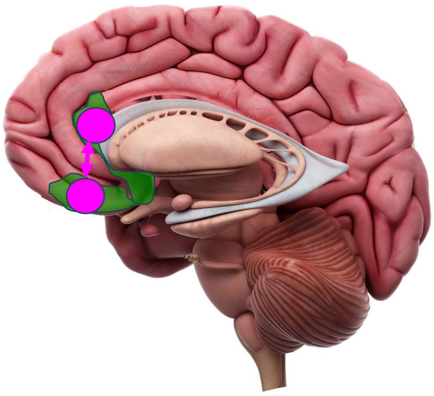
148

PRE vs POST 4 weeks of Chiropractic care

rEEG Alpha ↑ L rostral ACC – R Medial-orbitofrontal Alpha ↑ L rostral ACC - L Medial-orbitofrontal

Most likely reflects the reduction in pain and improved cognition about their own mental states and improved mood.

- Medial orbitofrontal cortex
  - Processing information about own mental states, beliefs, intentions and desires
  - Introspection
  - Construction of the narrative sense of self
  - Is activated by rewarding and subjectively pleasant stimuli
  - Has reduced functional connectivity in depression
  - Imagines future events
  - REDUCED in depression
  - REDUCED in disc herniations

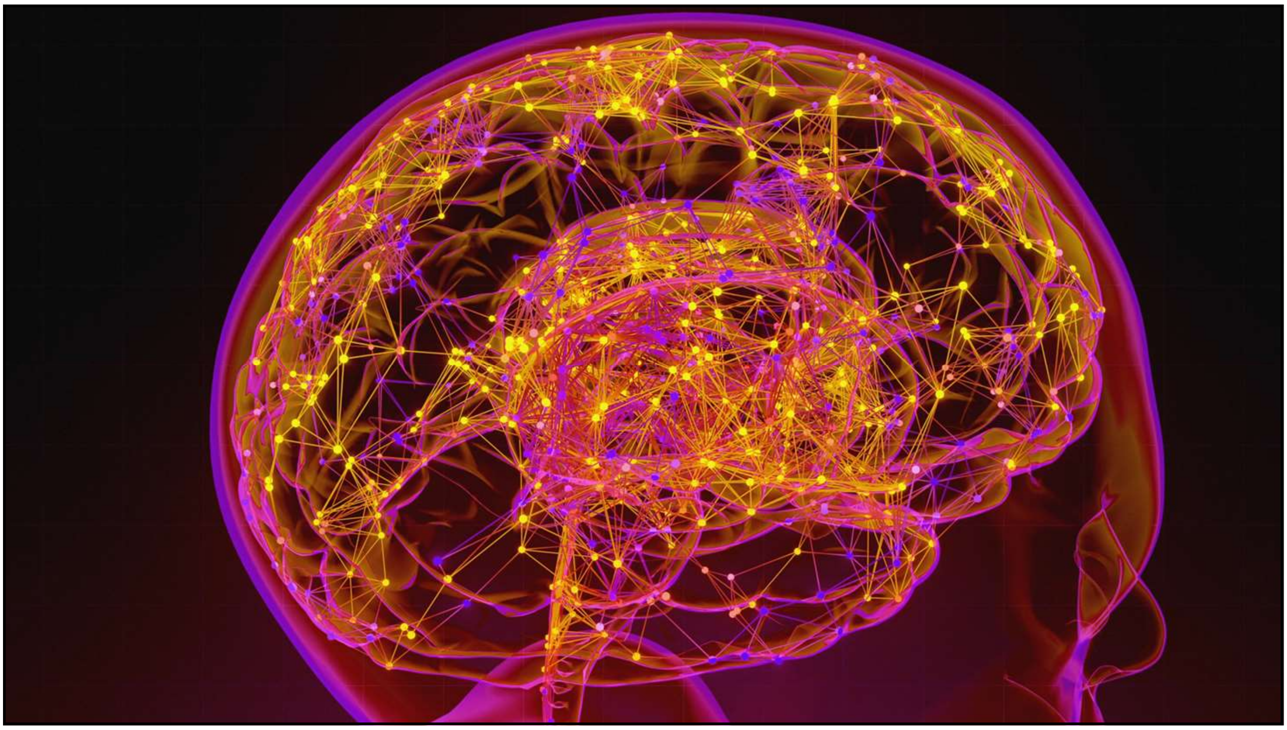


(Haavik et al 2024 submitted)

- Rostral Anterior Cingulate Cortex
  - Recognizing, understanding and regulating own emotions
  - Appraising Interoceptive signals (visceral, emotions, pain sensations)
  - Driving physical arousal
  - Descending pain inhibitory pathway

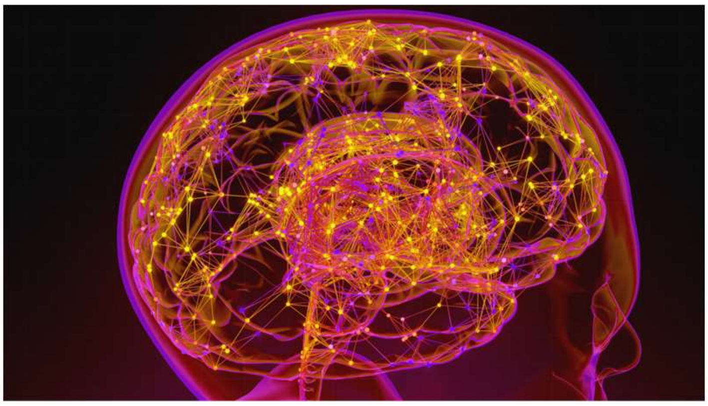
- ACC involved in both the Salience and DMN and they have abnormal functional connectivity in people with chronic pain, depression and anxiety.

149



150

Want to learn more about the Triple Brain Network and Chiropractic Care?



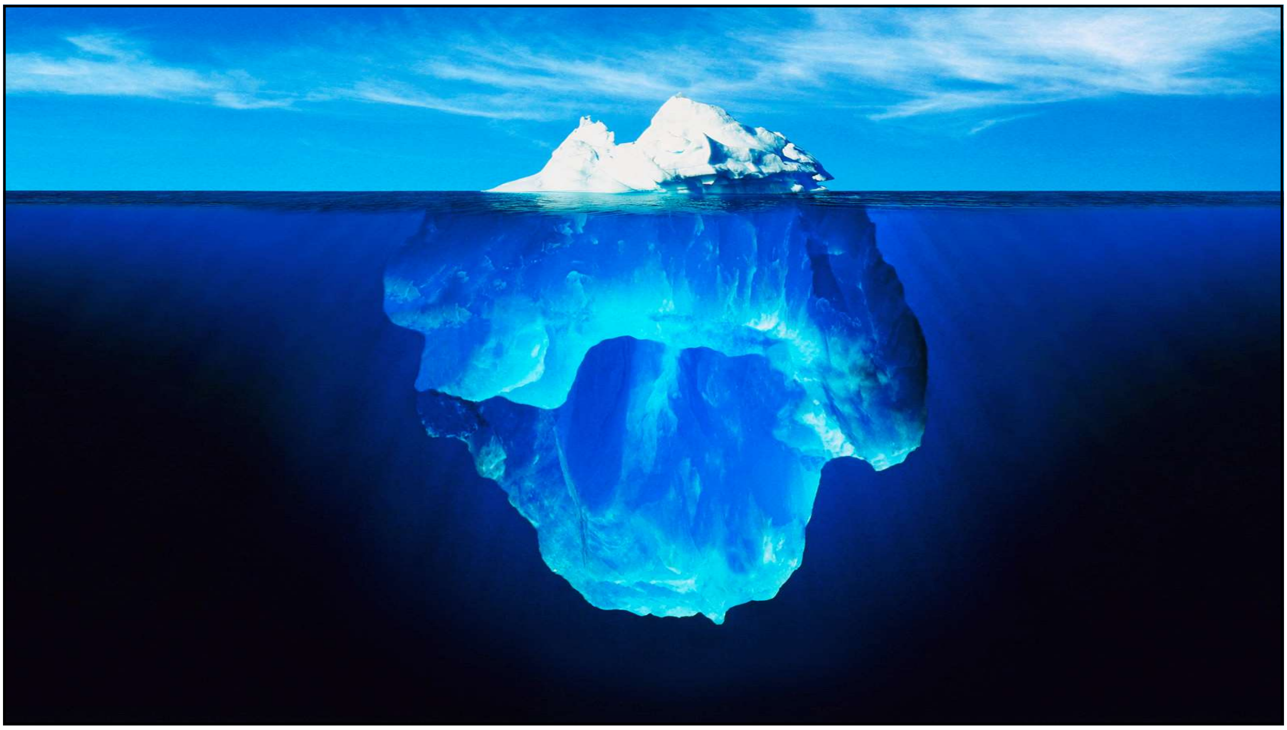
https://chiroshub.com/implementing-the-latest-science-october-2024/?__s=xxxxxxx

151

Symptoms don't just appear out of thin air

HAAVIK RESEARCH

152



153

HAAVIK RESEARCH

PA 4 Symptoms

ARE YOU A CONFIDANT COMMUNICATOR?

ChirosHub

154

155

Another example of faulty inner body schema/maps and maladaptive neural plastic changes

(Caused by subluxations if you look at the literature!!!)

Chronic Pain

HAAVIK RESEARCH

Apkarian AV, Hashmi JA, Baliki MN. Pain and the brain: specificity and plasticity of the brain in clinical chronic pain. Pain. 2011;152(3 Suppl):S49; May A. Chronic pain may change the structure of the brain. PAIN®. 2008/06/30/ 2008;137(1):7-15; Costigan M, Scholz J, Woolf CJ. Neuropathic Pain: A Maladaptive Response of the Nervous System to Damage. Annual Review of Neuroscience. 2009;32(1):1-32.

156

HAAVIK RESEARCH

PA18: Pain is our alarm system

ARE YOU A CONFIDANT COMMUNICATOR?

ChirosHub

157

158

SYSTEMATIC REVIEW

The Effect of Neuroscience Education on Pain, Disability, Anxiety, and Stress in Chronic Musculoskeletal Pain

Adriaan Louw, PT, MAppSc, Ina Diener, PT, PhD, David S. Butler, PT, EdD, Emilio J. Puentedura, PT, DPT

ABSTRACT. Louw A, Diener I, Butler DS, Puentedura EJ. The effect of neuroscience education on pain, disability, anxiety, and stress in chronic musculoskeletal pain. Arch Phys Med Rehabil 2011;92:2041-56.

Objective: To evaluate the evidence for the effectiveness of neuroscience education (NE) for pain, disability, anxiety, and stress in chronic musculoskeletal (MSK) pain.

Data Sources: Systematic searches were conducted on Biomed Central, BMJ.com, CINAHL, the Cochrane Library, NLM Central Gateway, OVID, ProQuest (Digital Dissertations), PsycInfo, PubMed/Medline, ScienceDirect, and Web of Science. Secondary searching (PEARLing) was undertaken, whereby reference lists of the selected articles were reviewed for additional references not identified in the primary search.

Study Selection: All experimental studies including randomized controlled trials (RCTs), nonrandomized clinical trials, and case series evaluating the effect of NE on pain, disability, anxiety, and stress for chronic MSK pain were considered for inclusion. Additional limitations: studies published in English, published within the last 10 years, and patients older than 18 years. No limitations were set on specific outcome measures of pain, disability, anxiety, and stress.

Data Extraction: Data were extracted using the participants, interventions, comparison, and outcomes (PICO) approach.

Data Synthesis: Methodological quality was assessed by 2 reviewers using the Critical Review Form–Quantitative Studies. This review includes 8 studies comprising 6 high-quality RCTs, 1 pseudo-RCT, and 1 comparative study involving 401 subjects. Most articles were of good quality, with no studies rated as poor or fair. Heterogeneity across the studies with respect to participants, interventions evaluated, and outcome measures used prevented meta-analyses. Narrative synthesis of results, based on effect size, established compelling evidence that NE may be effective in reducing pain ratings, increasing function, addressing catastrophization, and improving movement in chronic MSK pain.

Conclusions: For chronic MSK pain disorders, there is compelling evidence that an educational strategy addressing neurophysiology and neurobiology of pain can have a positive effect on pain, disability, catastrophization, and physical performance.

Key Words: Education; Musculoskeletal System; Neurophysiology; Neurosciences; Pain; Rehabilitation.

PAIN IS A POWERFUL motivating force that guides treatment-seeking behaviors in patients.[1-3] Patient education has long been explored in the management of pain, anxiety, and stress associated with low back pain (LBP).[4-7] In the orthopedic domain, there are a number of studies on the effect of patient education on pain, with outcomes ranging from "excellent"[8] to "poor."[9,10] The study by Udermann et al[8] demonstrated that introduction of an individualized educational booklet on back biomechanics can result in decreased pain and frequency of LBP episodes in patients with chronic LBP (CLBP). In contrast to those findings, 2 systematic reviews[9,10] on the effect of individualized and/or group education for LBP and mechanical neck pain showed little efficacy for such education.

Most education programs for orthopedic patient populations have used anatomic and biomechanical models for addressing pain,[4,11-14] which not only have shown limited efficacy,[4,11,12,15,16] but may even have increased patient fears, anxiety, and stress, thus negatively impacting their outcomes.[11,17-19] Several educational strategies are advocated for patients with LBP, including biomechanical/back school type of education, evidence-based guideline education (ie, *The Back Book*[20]), cognitive behavioral therapy, and recently, neuroscience education (NE).

NE can be best described as an educational session or sessions describing the neurobiology and neurophysiology of pain, and pain processing by the nervous system. Instead of a

List of Abbreviations

BPPT	brachial plexus provocation test
CFS	chronic fatigue syndrome
CLBP	chronic low back pain
CONSORT	Consolidated Standards of Reporting Trials
LBP	low back pain
MSK	musculoskeletal
NE	neuroscience education

HAAVIK RESEARCH

Neuroscience education about pain helps on its own!!

Conclusions: For chronic MSK pain disorders, there is compelling evidence that an educational strategy addressing neurophysiology and neurobiology of pain can have a positive effect on pain, disability, catastrophization, and physical performance.

Louw, A., Diener, I., Butler, D. S., & Puentedura, E. J. (2011). The effect of neuroscience education on pain, disability, anxiety, and stress in chronic musculoskeletal pain. *Archives of Physical Medicine and Rehabilitation, 92*(12), 2041-2056.

159

HAAVIK RESEARCH

PA: Understanding Chronic Pain

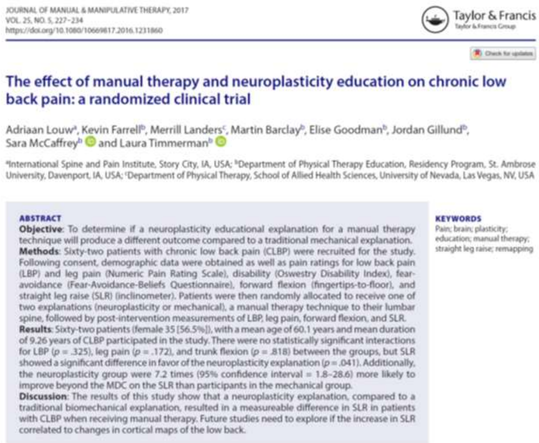
ARE YOU A CONFIDANT COMMUNICATOR?

ChirosHub

160

161

What you tell your patient matters!



JOURNAL OF MANUAL & MANIPULATIVE THERAPY, 2017
VOL. 25, NO. 5, 227–234
https://doi.org/10.1080/10669817.2016.1231860

Taylor & Francis
Taylor & Francis Group

Check for updates

The effect of manual therapy and neuroplasticity education on chronic low back pain: a randomized clinical trial

Adriaan Louw[a], Kevin Farrell[b], Merrill Landers[c], Martin Barclay[b], Elise Goodman[b], Jordan Gillund[b], Sara McCaffrey[b] and Laura Timmerman[b]

[a]International Spine and Pain Institute, Story City, IA, USA; [b]Department of Physical Therapy Education, Residency Program, St. Ambrose University, Davenport, IA, USA; [c]Department of Physical Therapy, School of Allied Health Sciences, University of Nevada, Las Vegas, NV, USA

ABSTRACT

Objective: To determine if a neuroplasticity educational explanation for a manual therapy technique will produce a different outcome compared to a traditional mechanical explanation. **Methods**: Sixty-two patients with chronic low back pain (CLBP) were recruited for the study. Following consent, demographic data were obtained as well as pain ratings for low back pain (LBP) and leg pain (Numeric Pain Rating Scale), disability (Oswestry Disability Index), fear-avoidance (Fear-Avoidance-Beliefs Questionnaire), forward flexion (fingertips-to-floor), and straight leg raise (SLR) (inclinometer). Patients were then randomly allocated to receive one of two explanations (neuroplasticity or mechanical), a manual therapy technique to their lumbar spine, followed by post-intervention measurements of LBP, leg pain, forward flexion, and SLR. **Results**: Sixty-two patients (female 35 [56.5%]), with a mean age of 60.1 years and mean duration of 9.26 years of CLBP participated in the study. There were no statistically significant interactions for LBP ($p = .325$), leg pain ($p = .172$), and trunk flexion ($p = .818$) between the groups, but SLR showed a significant difference in favor of the neuroplasticity explanation ($p = .041$). Additionally, the neuroplasticity group were 7.2 times (95% confidence interval = 1.8–28.6) more likely to improve beyond the MDC on the SLR than participants in the mechanical group. **Discussion**: The results of this study show that a neuroplasticity explanation, compared to a traditional biomechanical explanation, resulted in a measureable difference in SLR in patients with CLBP when receiving manual therapy. Future studies need to explore if the increase in SLR correlated to changes in cortical maps of the low back.

KEYWORDS
Pain; brain; plasticity; education; manual therapy; straight leg raise; remapping

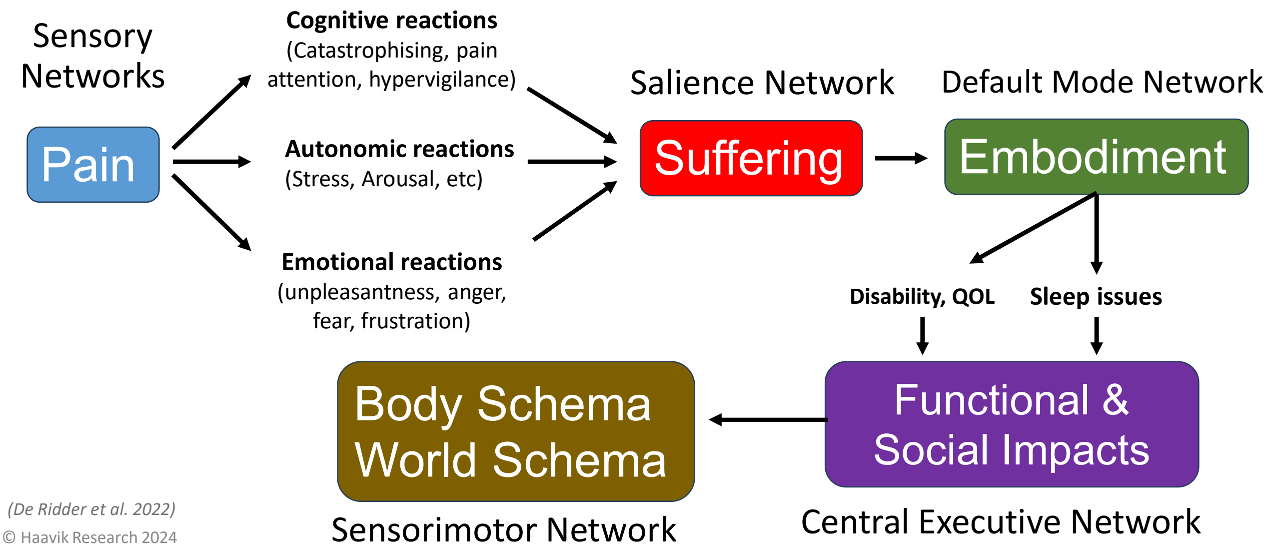
Discussion: The results of this study show that a **neuroplasticity explanation**, compared to **a traditional biomechanical explanation**, resulted in a measureable difference in SLR in patients with CLBP when receiving manual therapy.

Louw, A., Farrell, K., Landers, M., Barclay, M., Goodman, E., Gillund, J., . . . Timmerman, L. (2017). The effect of manual therapy and neuroplasticity education on chronic low back pain: a randomized clinical trial. Journal of Manual & Manipulative Therapy, 25(5), 227-234.

162

The Chronicity of Pain

HAAVIK RESEARCH



(De Ridder et al. 2022)

163

HAAVIK RESEARCH

Rheumatology 2005;44:509–516 doi:10.1093/rheumatology/keh529
Advance Access publication 11 January 2005

Simulating sensory–motor incongruence in healthy volunteers: implications for a cortical model of pain

C. S. McCabe, R. C. Haigh[1], P. W. Halligan[2] and D. R. Blake

Objectives. Conflict between motor–sensory central nervous processing has been suggested as one cause of pain in those conditions where a demonstrable or local nociceptive aetiology cannot be convincingly established (e.g. complex regional pain syndrome type 1, repetitive strain injury, phantom limb pain and focal hand dystonia). The purpose of this study was to discover whether pain could be induced in pain-free healthy volunteers when this conflict was generated transiently in a laboratory setting.

Methods. Forty-one consecutively recruited healthy adult volunteers without a history of motor or proprioceptive disorders performed a series of bilateral upper and lower limb movements whilst viewing a mirror/whiteboard, which created varied degrees of sensory–motor conflict during congruent/incongruent limb movements. A qualitative method recorded any changes in sensory experience.

Results. Twenty-seven subjects (66%) reported at least one anomalous sensory symptom at some stage in the protocol despite no peripheral nociceptive input. The most frequent symptoms occurred when incongruent movement was performed whilst viewing the reflected limb in the mirror condition, the time of maximum sensory–motor conflict. Symptoms of pain were described as numbness, pins and needles, moderate aching and/or a definite pain. Other sensations included perceived changes in temperature, limb weight, altered body image and disorientation. There were indications that some individuals were more susceptible to symptom generation than others.

Conclusions. Our findings support the hypothesis that motor–sensory conflict can induce pain and sensory disturbances in some normal individuals. We propose that prolonged sensory–motor conflict may induce long-term symptoms in some vulnerable subjects.

© Haavik Research 2024

McCabe, C. S., Haigh, R. C., Halligan, P. W., & Blake, D. R. (2005). Simulating sensory–motor incongruence in healthy volunteers: implications for a cortical model of pain. Rheumatology, 44(4), 509-516. doi:10.1093/rheumatology/keh529

164

165

Did you know…….

Pain that you have had for more than 3 months means that your brain has learnt to be in pain, and my job is to retrain your brain out of pain. Because we know that the dysfunction of the spine plays a major role in both causing and maintaining these brain changes.

166

Why is all this important to understand?

HAAVIK RESEARCH

Review

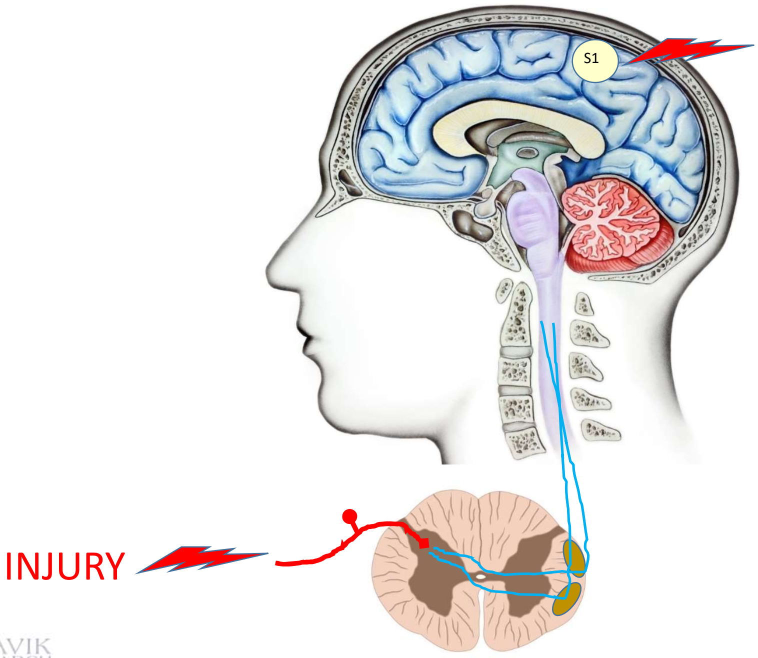
The Neuroscientist 1–14

Abstract

Motor control, which relies on constant communication between motor and sensory systems, is crucial for spine posture, stability and movement. Adaptions of motor control occur in low back pain (LBP) while different motor adaption strategies exist across individuals, probably to reduce LBP and risk of injury. However, in some individuals with LBP, adapted motor control strategies might have long-term consequences, such as increased spinal loading that has been linked with degeneration of intervertebral discs and other tissues, potentially maintaining recurrent or chronic LBP. Factors contributing to motor control adaptations in LBP have been extensively studied on the motor output side, but less attention has been paid to changes in sensory input, specifically proprioception. Furthermore, motor cortex reorganization has been linked with chronic and recurrent LBP, but underlying factors are poorly understood. Here, we review current research on behavioral and neural effects of motor control adaptions in LBP. We conclude that back pain-induced disrupted or reduced proprioceptive signaling likely plays a pivotal role in driving long-term changes in the top-down control of the motor system via motor *and* sensory cortical reorganization. In the outlook of this review, we explore whether motor control adaptations are also important for other (musculoskeletal) pain conditions.

Meier, M. L., Vrana, A., & Schweinhardt, P. (2018). Low Back Pain: The Potential Contribution of Supraspinal Motor Control and Proprioception. The Neuroscientist, 1073858418809074. doi:10.1177/1073858418809074

167



This was the old 'structural pathology model' of pain. However, the latest research shows this is far too simplistic

HAAVIK RESEARCH

168

Systemic inflammation

Stress autonomic sympathetic activation

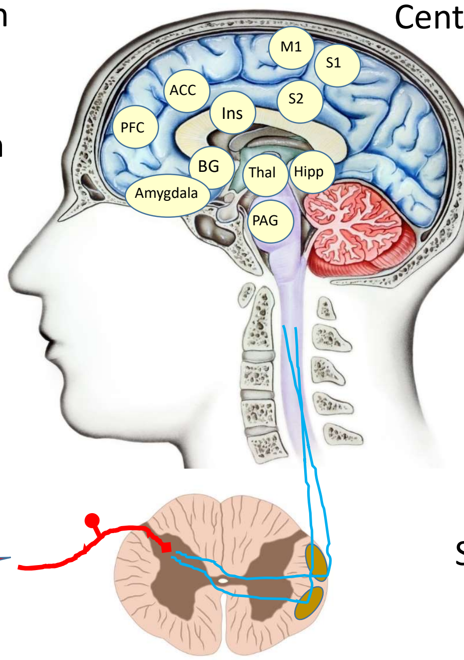
Poverty

Mental health issues

Expectations

Diet

INJURY



Central neuroimmune Influences

Stress HPA activation

Attitudes & Personality

Social problems

Learning effects

Thoughts

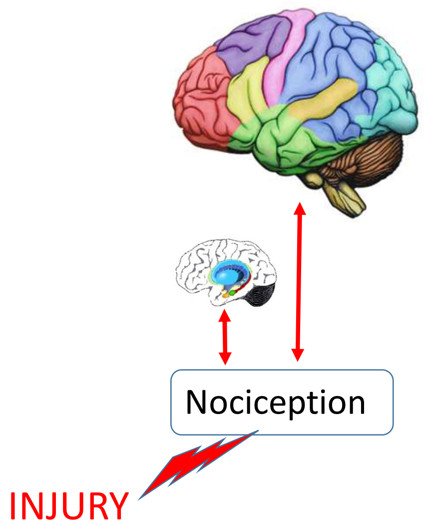
Sleep

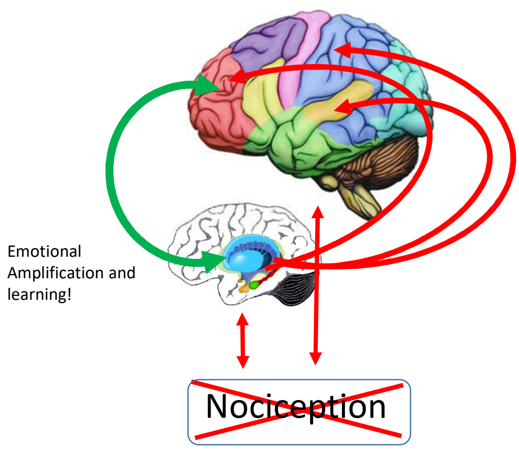
Microbiome

169

3 months +

Acute Pain vs Chronic Pain





170

HAAVIK RESEARCH

Did you know…

Current scientific understanding is showing us that how your spine "talks" to your brain is vitally important to enable your brain to control and accurately move your head, neck and back properly.

If your spine is not working properly, it does not "talk" to the brain properly, and this is known to both cause and maintain neck and back pain.

My job as a chiropractor is to train your spine back into proper function, so it can "talk" to you brain properly.

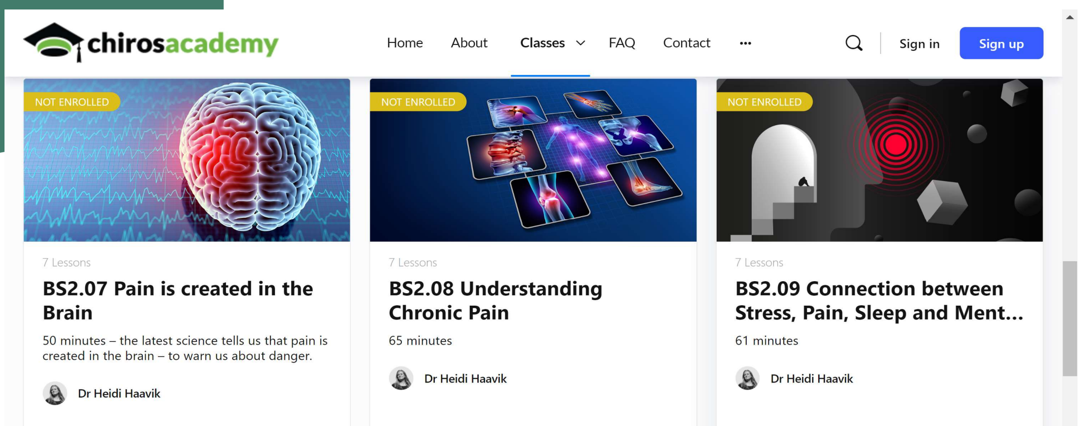
NEW ZEALAND COLLEGE OF CHIROPRACTIC

171

Understanding Pain Campaign

Are you concerned you do not know enough to answer Questions?

ChirosAcademy.com
The science of chiropractic



172

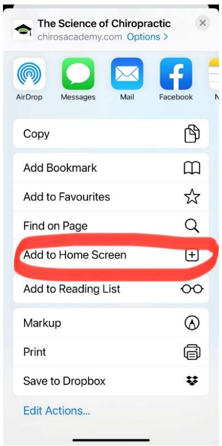
1

On your smart phone click on Safari and type in ChirosAcademy.com

2

Click on the up arrow

3



Click on 'Add to Home Screen'

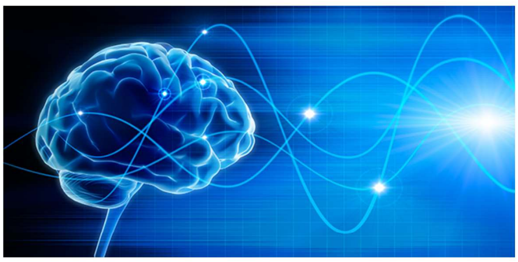
4

ChirosAcademy will now appear as an App on your phone!

173

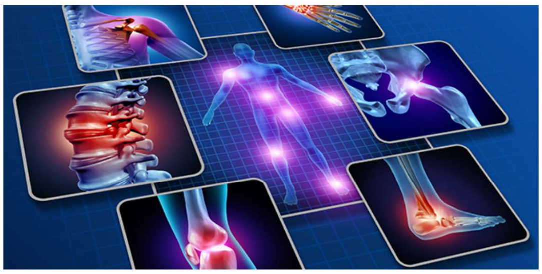
Chiropractic Health Talks

Dr. Haavik shares her renowned chiropractic health talks for you to customize and use. We encourage you to download them and customize them to be about you and your chiropractic story.



Communicating the Science

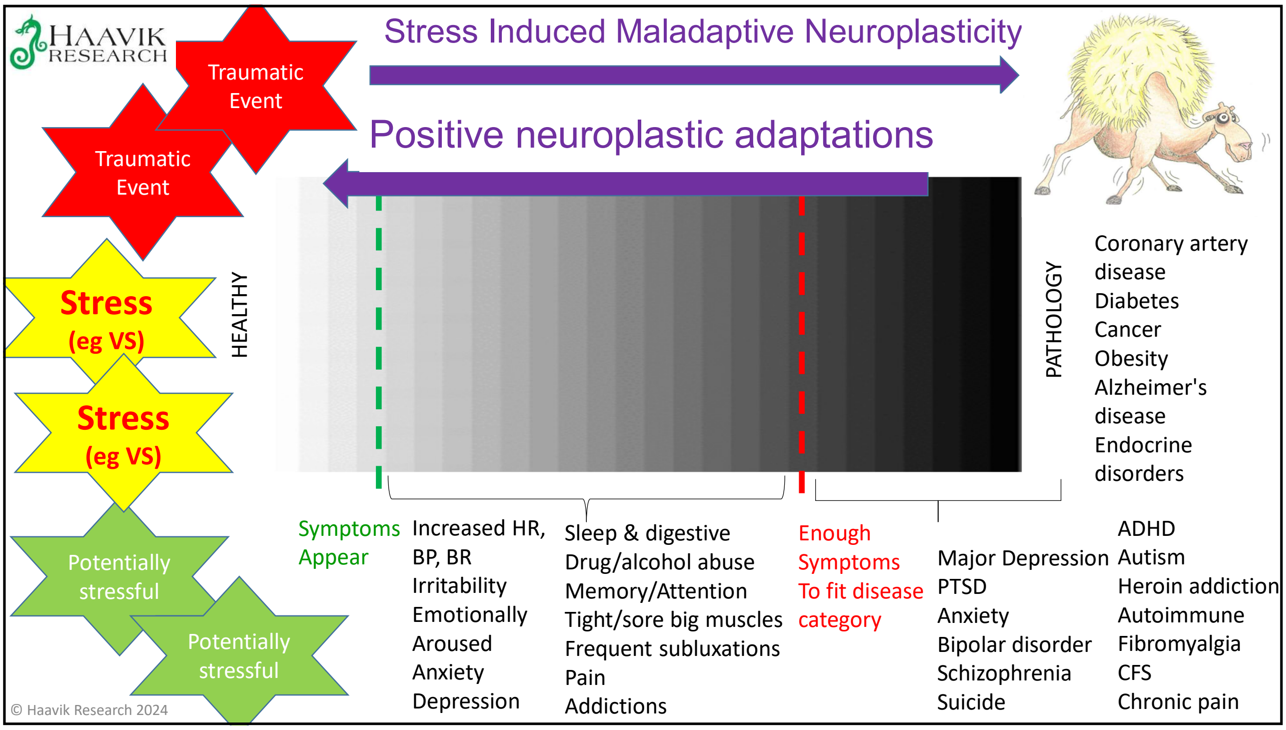
The first of our health talk templates for you to customize. It



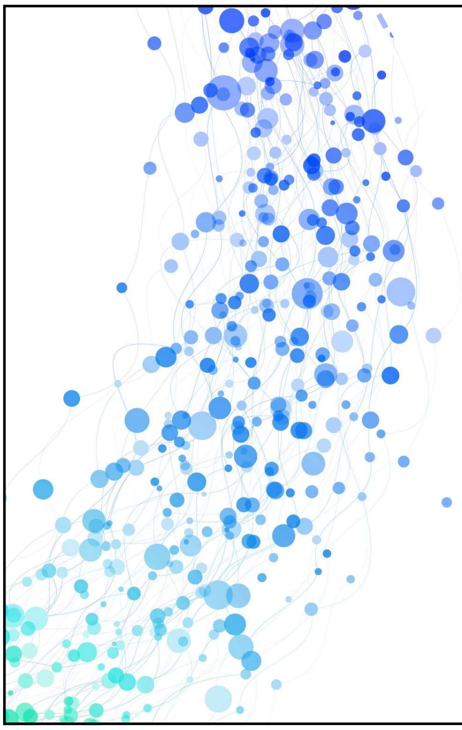
Pain and Plasticity

This is an overview presentation that is intended for the

174



175

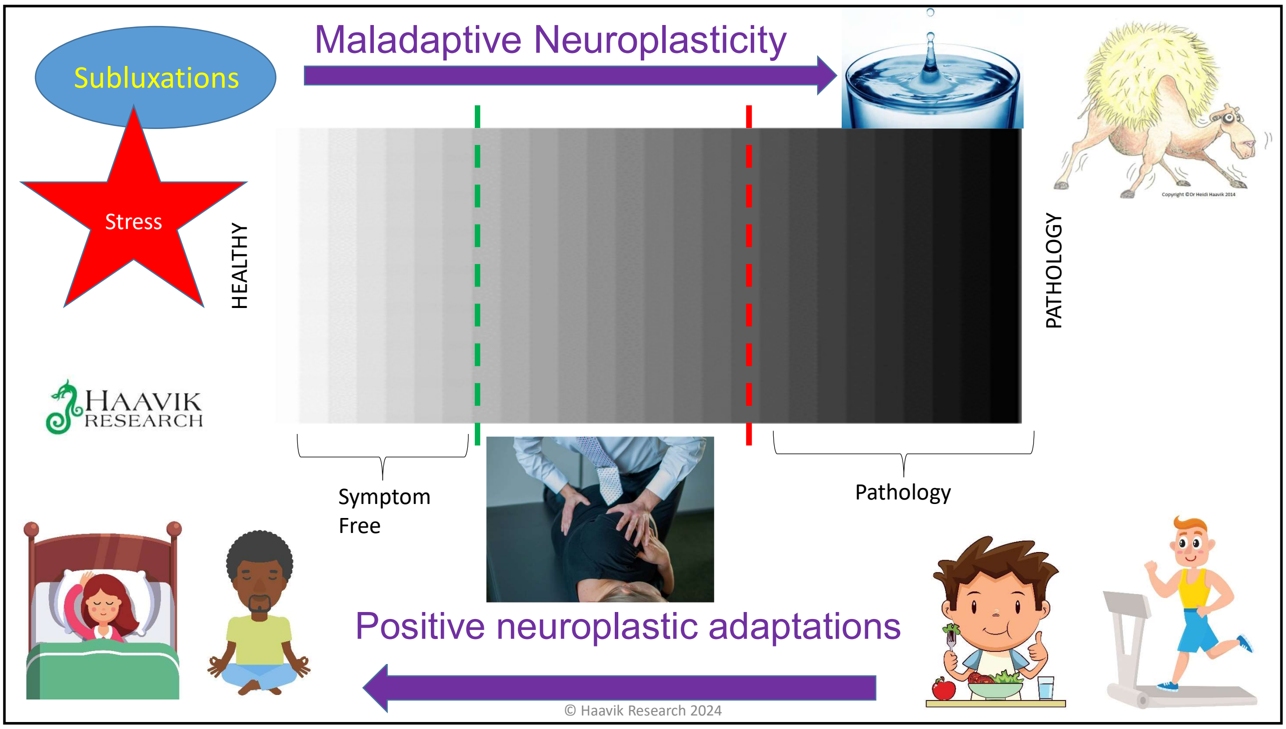


HAAVIK RESEARCH

Did you know…….

Science is showing us that stress is far more detrimental to your health (and spinal function) that we ever realised. There are things you can do to help what I'm doing to get you back towards much better health

176



177

HAAVIK RESEARCH

PA stress affects Brain

Are you a Confidant Communicator?

ChirosHub

178

179

Implications for question answers

- Chiropractors’ role is to exercise the spine back into proper function
- Science shows it’s better for you to see me more often early on in care, and this even gives you long term benefits (CGHAs and LBP)
- Science shows maintenance care gives you less days of pain compared to coming back only when it hurts

HAAVIK RESEARCH

180

Implications for question answers

- You do not need to adjust where they hurt, but instead where the subluxation is

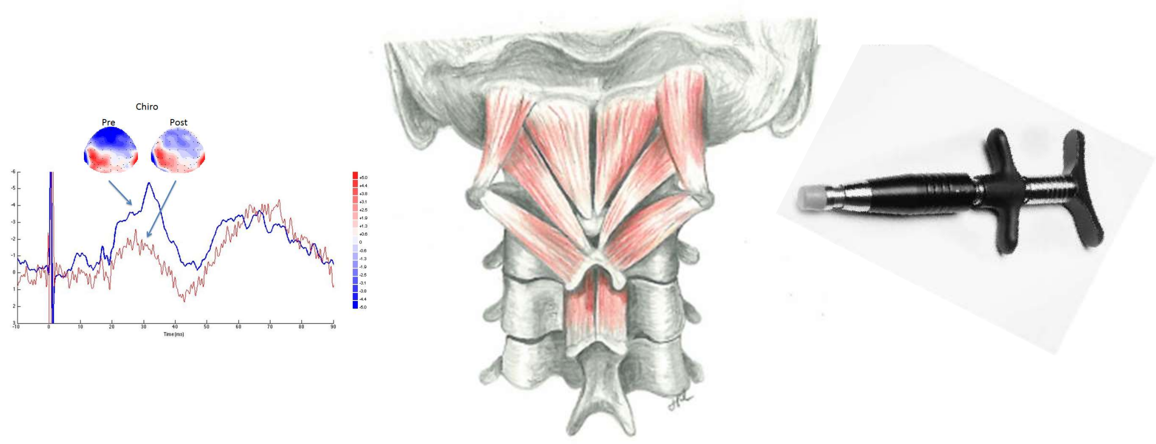
HAAVIK RESEARCH

181

NEW ZEALAND COLLEGE OF CHIROPRACTIC

HAAVIK RESEARCH

Does specificity matter?



Imran Khan Niazi, Muhammad Samran Navid, Christopher Merkle, Imran Amjad, Nitika Kumari, Robert J. Trager, Kelly Holt, Heidi Haavik. 2024 A randomized controlled trial comparing different sites of high-velocity low amplitude thrust on sensorimotor integration parameters. Scientific Report. 14(1), p.1159.

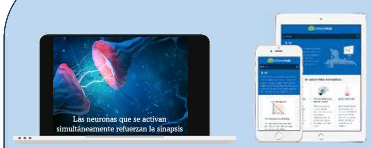
182

Implications for question answers

- Pain is a danger warning system, not necessarily reflective of where the problem is.

HAAVIK RESEARCH

183



ChirosHub

All the resources for your patients and the public!

Code heiditalk
Gives you 15% off

ChirosHub

ChirosAcademy

Over 70 online classes about the science of chiropractic for you!

LearningHub

Online classes for your chiropractic assistants!

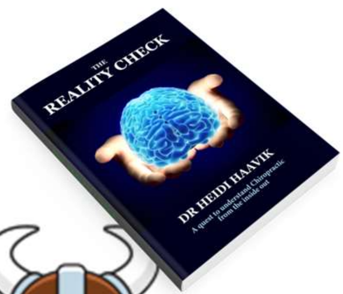
184

Enlighten the world about the science of the spine

185

TODAY'S HANDOUT & Gifts

www.heidihaavik.com



Enlightening the world about the science of chiropractic

186