Heidi's Platinum RoundTable Dec 2025

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

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Welcome to New Platinum Members!!

- Online Classes for DCs and CAs
- Live Zoom Workshops every 8 weeks
- Level 1 The Brain Model
- Level 2 Pain, the Brain and Chiropractic care
- Level 3 Stress, Disease and Chiropractic care

- Your resources:
  - ChirosHub – for patients
  - ChirosAcademy – for chiros
  - LearningHub – for CAs

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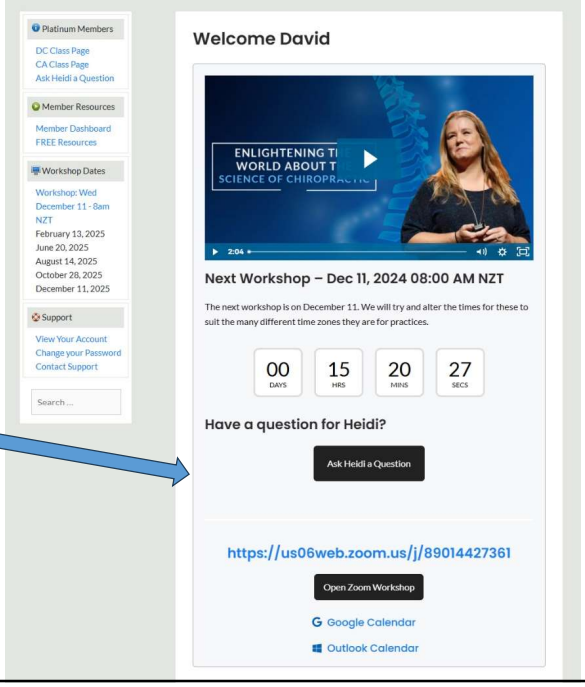
Platinum Member on ChirosHub

- The Platinum Member also has a dedicated platinum member site on ChirosHub.com
- Next life workshop countdown
- Question for Heidi
- Next workshop link
- Prefrontal cortex poster
- Cerebellum poster



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Outline

- https://chirosacademy.com/the-new-brain-model-2024/

Dec 2024 Topic
How I present this latest science to other health care providers

Feb 2025 Topic
How I present this latest science to the lay public

April 2025 Topic is how to explain the chiro-neuro-immune connection according to the brain model

June 2025 How, according to brain model, can chiro care impact organ function

Aug 2025 How, according to brain model, can chiro care impact anxiety & depression

Oct 2025 Chiropractic and Sports Performance

Recorded Live Zoom Sessions

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Outline Level 1

ALL ONLINE

- 20 Steps for chiros
  - https://chirosacademy.com/the-new-brain-model-2024/
- 13 Steps for CAs
  - https://chiroslearninghub.com/enlighten-practice-members-2024/

Plus LIVE DC workshops roughly every second months
- covers live Q&A plus a topic

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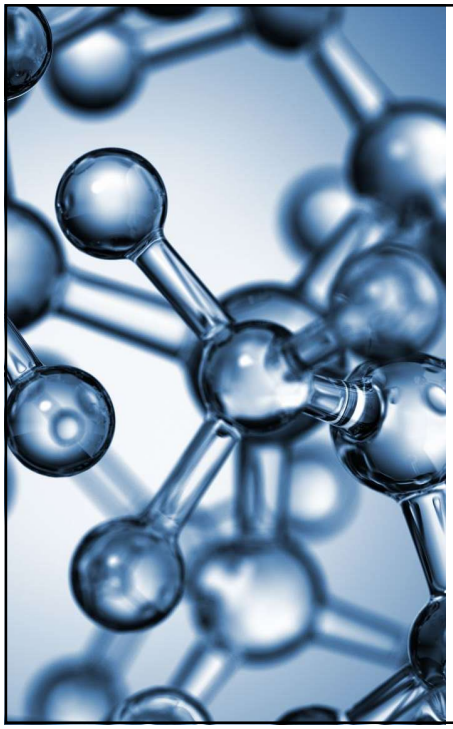

Today's Topic: A hot-off-the-press update on the Chiropractic and Immune Connection

February: How might chiropractic care enhance sports performance?

April: Does chiropractic care prevent sports injuries, and if so how can it do this?

These workshops will also be recorded and appear on your ChirosHub membership page and on the course outline page along with the handout and PowerPoints if you want them.

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Chiropractic Assistants

- 14 online classes for CAs
- Happy to book a practice CA live zoom session also
- Reward your staff for their effort!!!
  - Voucher
  - Pay rise

https://chiroslearninghub.com/enlighten-practice-members-2024/

https://chiroslearninghub.com/platinum-level-1

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Any Questions Regarding Membership?

Dave Woodard

support@chiroshub.com

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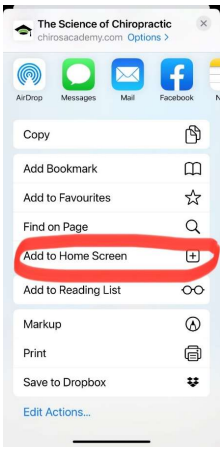
On your smart phone click on Safari and type in ChirosAcademy.com

2

Click on the up arrow

3



Click on 'Add to Home Screen'

4

ChirosAcademy will now appear as an App on your phone!

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If anyone requires USA CE credits

- Go to Palmer College Continuing Education Online Courses
- https://palmerce.learningexpressce.com/index.cfm?eventTypeID=0&categoryIDs=&q=Haavik

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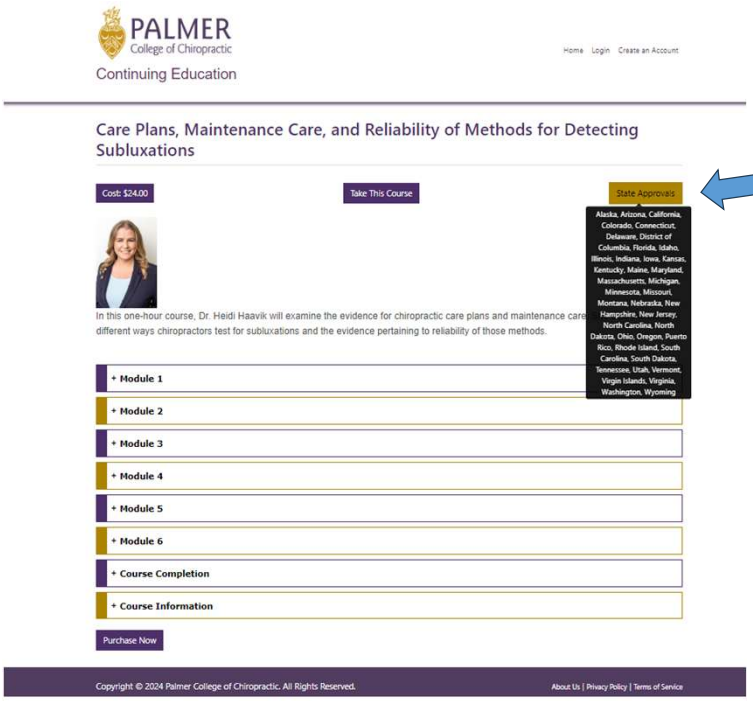

Check here for which states have approved each class

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Questions

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The Latest Research about Chiropractic care & Immune function

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

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Key Reference

medicina

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

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 Amjad, Imran Khan Niazi, Nitika Kumari, Usman Ghani, Usman Rashid, Felipe Duarte, Federico For-tuna, Diego Gonzalez, Alex Sumich, Bibiana Fabre, Kelly Holt, Heidi Haavik. The effects of 12 weeks of chiropractic spinal adjustments on Physiological biomarkers in adults: A pragmatic randomized controlled trial. *PLOS ONE. Accepted for publication Nov 2025* 5-year impact factor of 3.2

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Check out the April 2025 Platinum RoundTable talk

It is recorded and covers the background information!

Today I will recap briefly what I covered in April and then

Cover our latest publication – accepted for publication a few days ago

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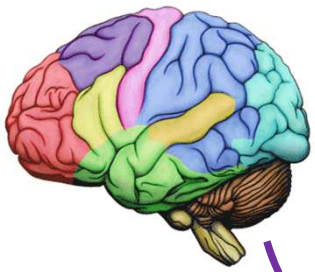
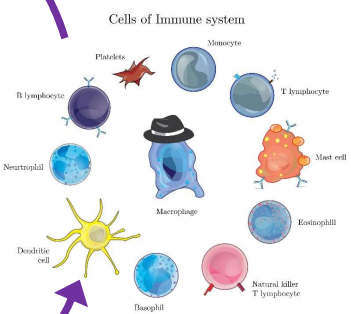
HAAVIK RESEARCH

Vagus nerve and circulation



CNS Immune Link



ANS & HPA axis

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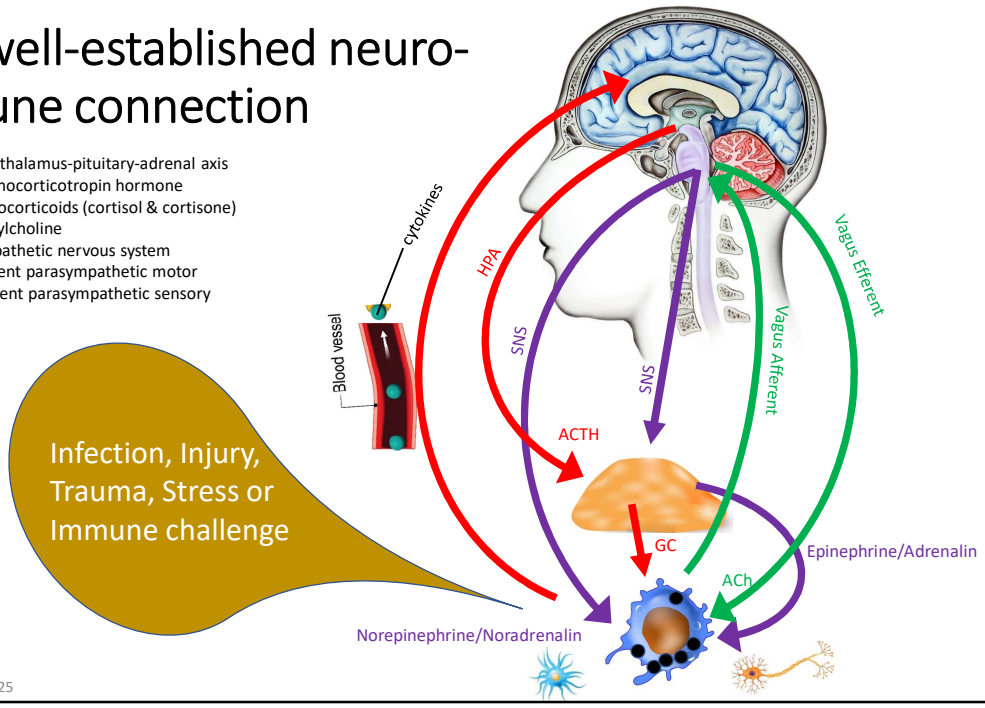
The well-established neuro-immune connection

HPA	hypothalamus-pituitary-adrenal axis
ACTH	adrenocorticotropin hormone
GC	glucocorticoids (cortisol & cortisone)
Ach	Acetylcholine
SNS	sympathetic nervous system
Vagus	Efferent parasympathetic motor
Vagus	Afferent parasympathetic sensory



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STRESS

- Reduces Immunity
- Activates SNS
- Activates HPA
- Shuts down prefrontal cortex function
- Increased levels of cortisol, adrenaline/ epinephrine and noradrenaline / norepinephrine
- Higher inflammation

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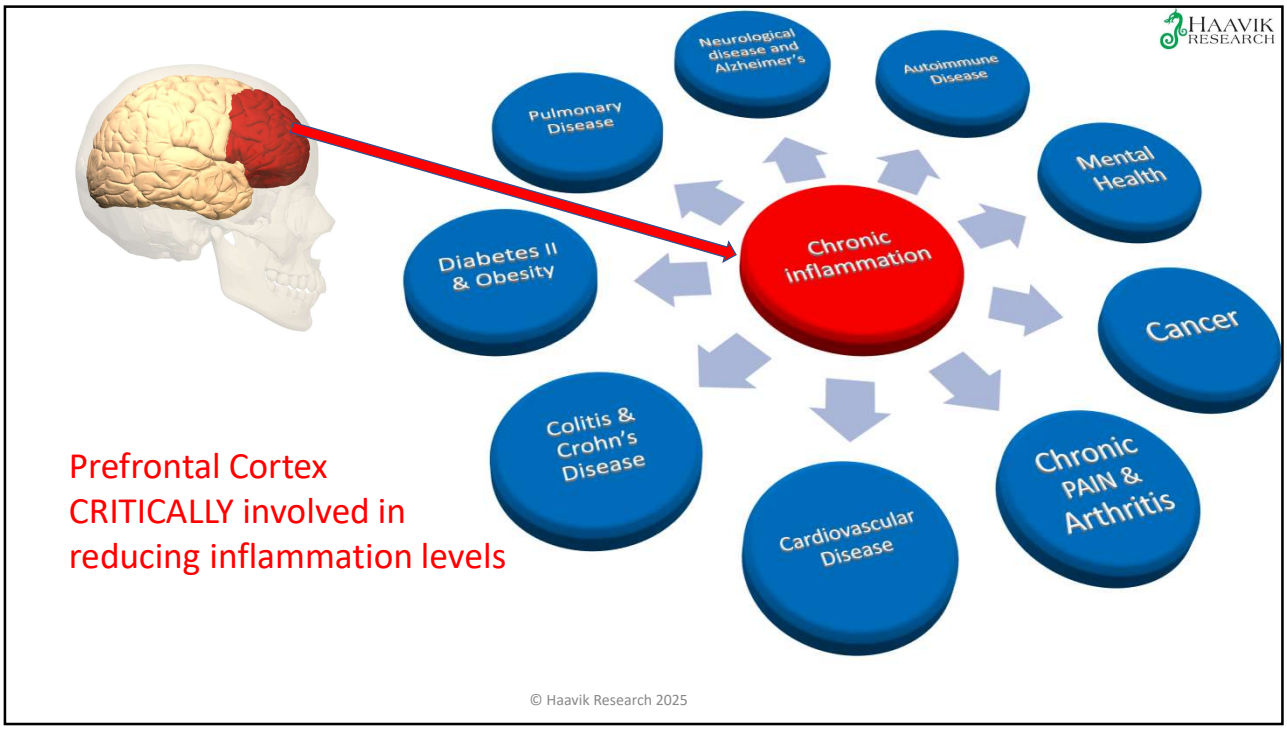
HAAVIK RESEARCH
Neurological disease and Alzheimer's
Autoimmune Disease
Pulmonary Disease
Mental Health
Diabetes II & Obesity
Chronic inflammation
Cancer
Colitis & Crohn's Disease
Chronic PAIN & Arthritis
Cardiovascular Disease
Prefrontal Cortex
CRITICALLY involved in
reducing inflammation levels
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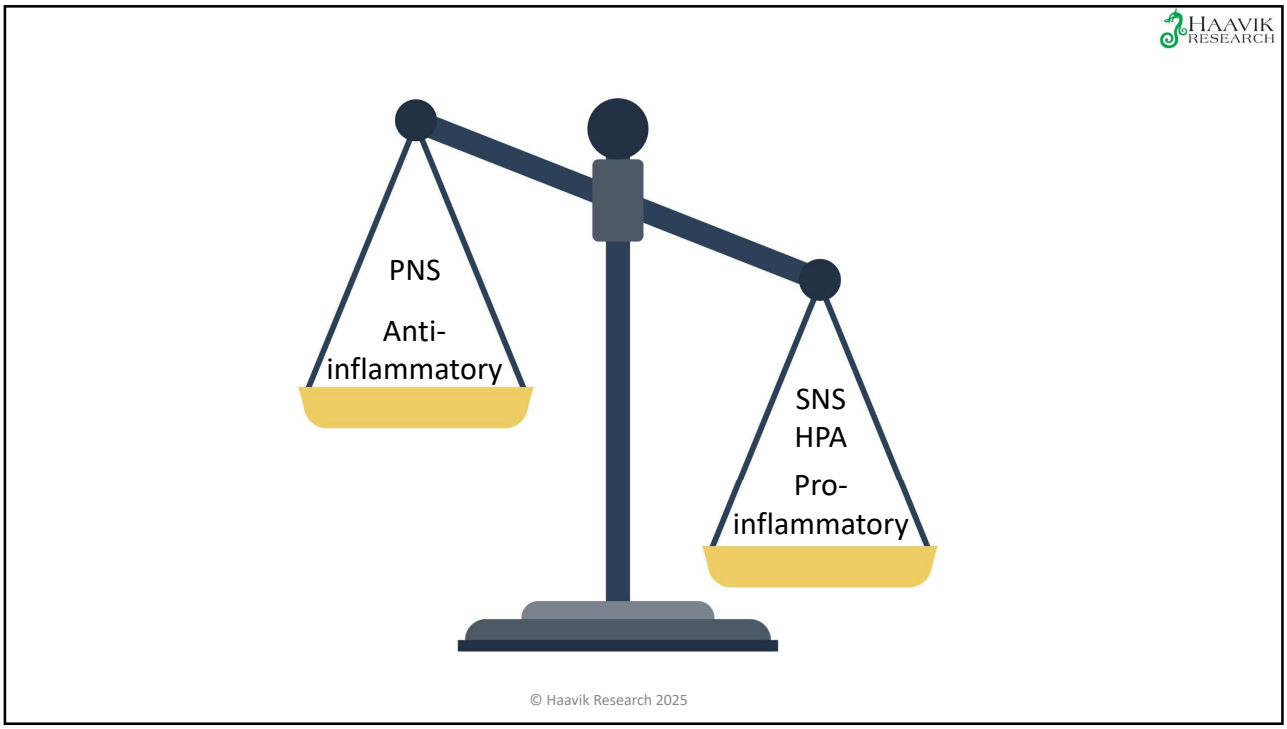
HAAVIK RESEARCH
PNS
Anti-
inflammatory
SNS
HPA
Pro-
inflammatory
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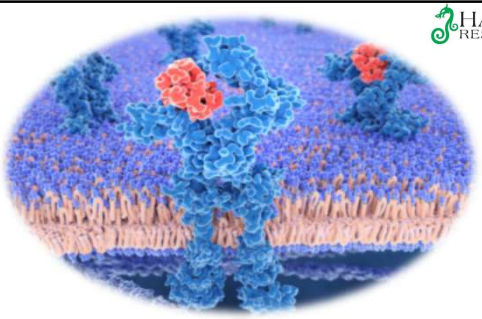
Summary



- CNS – Immune Closely linked
- Bi-directional communication
- Rely on accurate perception of situation
- Appropriate / balanced response required (not too much or too little)
- Neuro-immune Cell Units around the body perceive immune threat
- Vagus afferents and blood convey inflammation levels to the brain
- Brain modulates immune response via HPA and ANS by releasing glucocorticoids and catecholamines which regulate immune cell function
- Stress impairs immune response

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Take Home Messages

"There is substantial evidence that tells us the nervous system, the hormonal system and the immune system communicate with one another and are intimately linked in their functions. Stress affects our immune response and makes us more susceptible to infections such as respiratory diseases. And a part of the brain called the prefrontal cortex is critically involved in regulating the autonomic nervous system, the endocrine system and the immune system".

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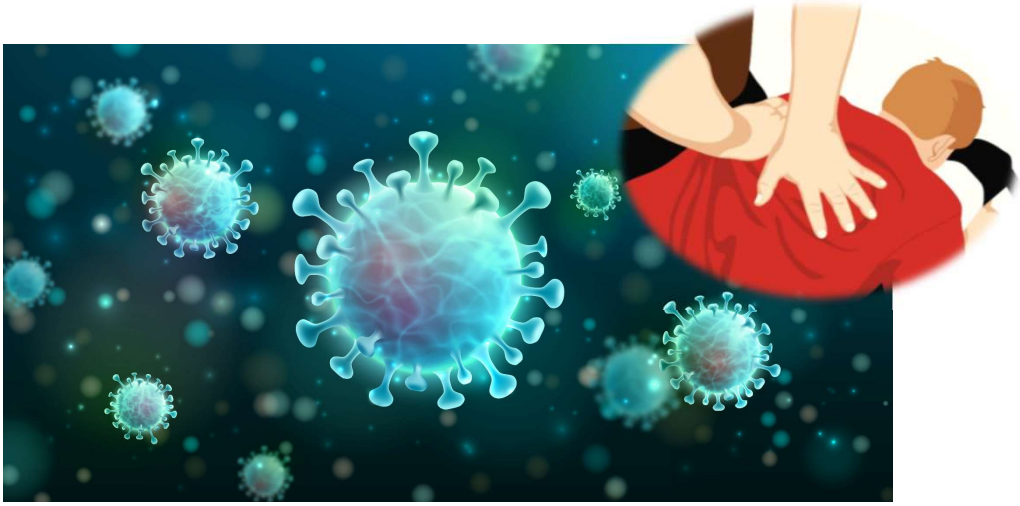
Chiropractic and the Immune System



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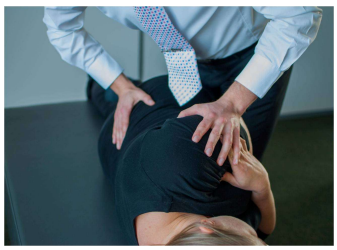
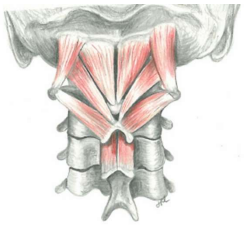
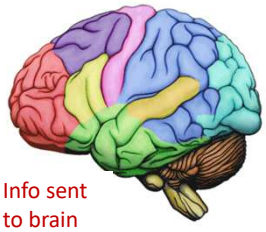


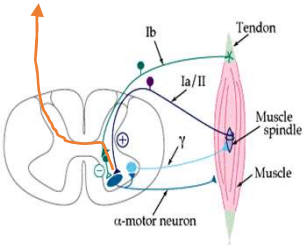
Adjustment

Stretches small muscles closest to spine and scull





Info sent to brain



Bombards brain with mechanoreceptor input

Effects of Adjustment

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

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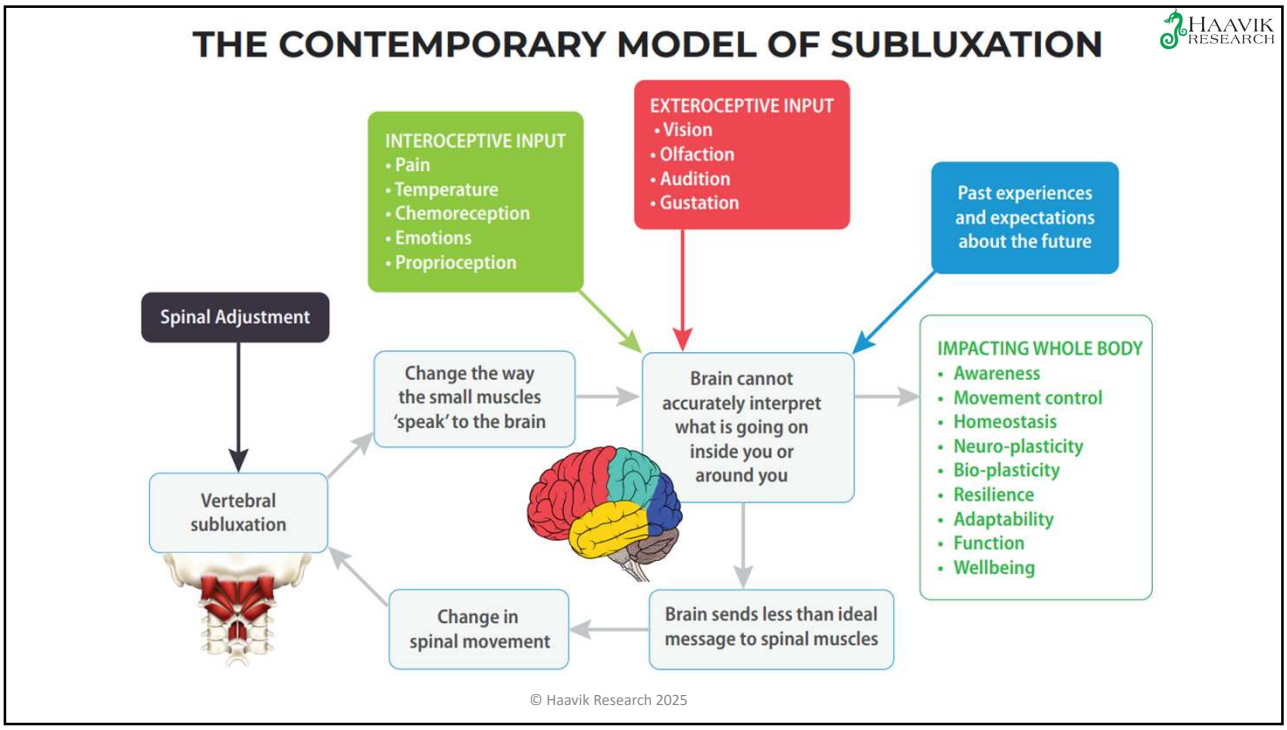
THE CONTEMPORARY MODEL OF SUBLUXATION
HAAVIK RESEARCH
INTEROCEPTIVE INPUT
• Pain
• Temperature
• Chemoreception
• Emotions
• Proprioception
EXTEROCEPTIVE INPUT
• Vision
• Olfaction
• Audition
• Gustation
Past experiences and expectations about the future
Spinal Adjustment
Change the way the small muscles 'speak' to the brain
Brain cannot accurately interpret what is going on inside you or around you
IMPACTING WHOLE BODY
• Awareness
• Movement control
• Homeostasis
• Neuro-plasticity
• Bio-plasticity
• Resilience
• Adaptability
• Function
• Wellbeing
Vertebral subluxation
Change in spinal movement
Brain sends less than ideal message to spinal muscles
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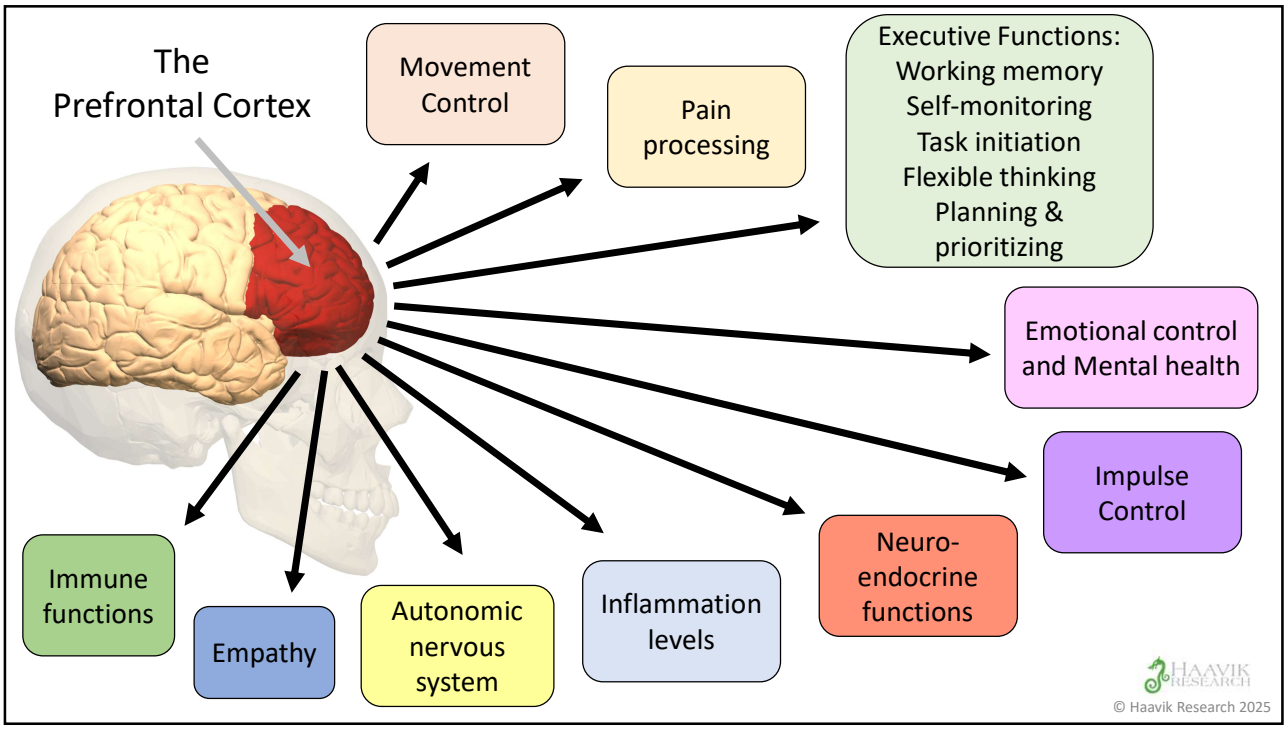
The Prefrontal Cortex
Movement Control
Pain processing
Executive Functions:
Working memory
Self-monitoring
Task initiation
Flexible thinking
Planning & prioritizing
Emotional control and Mental health
Impulse Control
Neuro-endocrine functions
Inflammation levels
Autonomic nervous system
Empathy
Immune functions
HAAVIK RESEARCH
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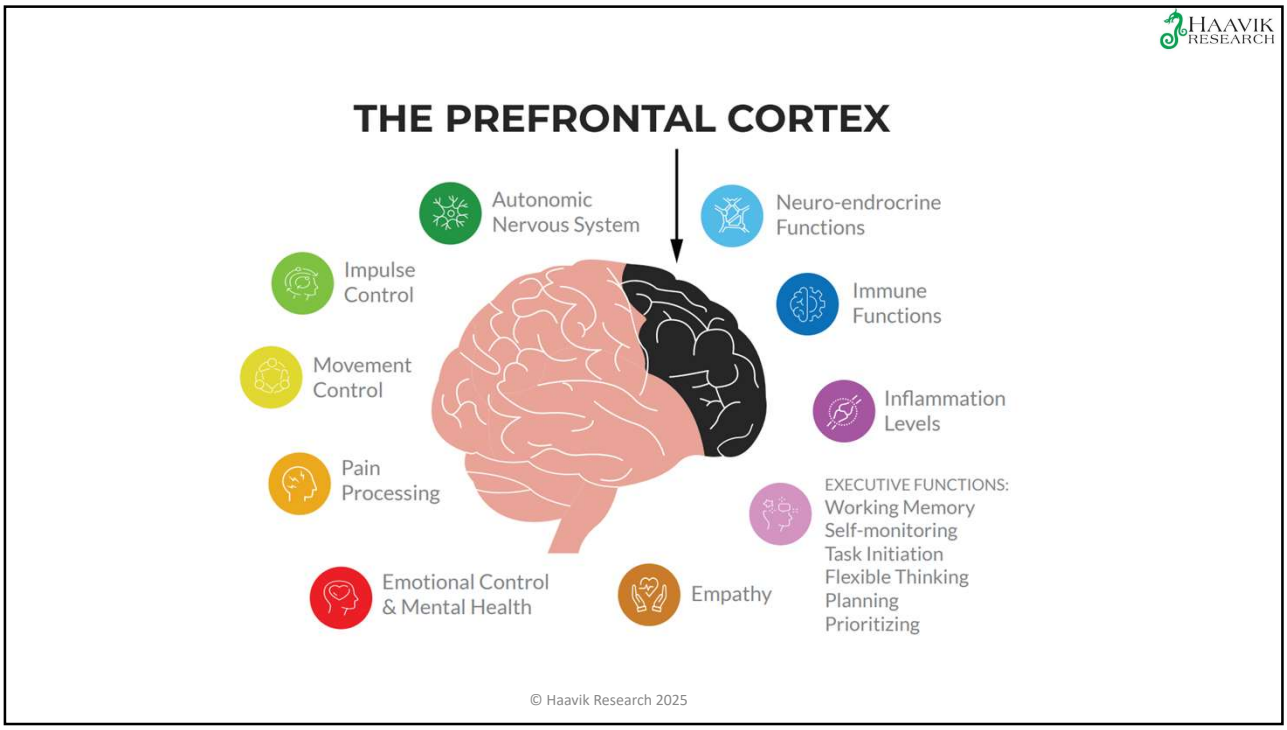
HAAVIK RESEARCH
THE PREFRONTAL CORTEX
Autonomic Nervous System
Neuro-endrocrine Functions
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EXECUTIVE FUNCTIONS:
Working Memory
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Planning
Prioritizing
Emotional Control & Mental Health
Empathy
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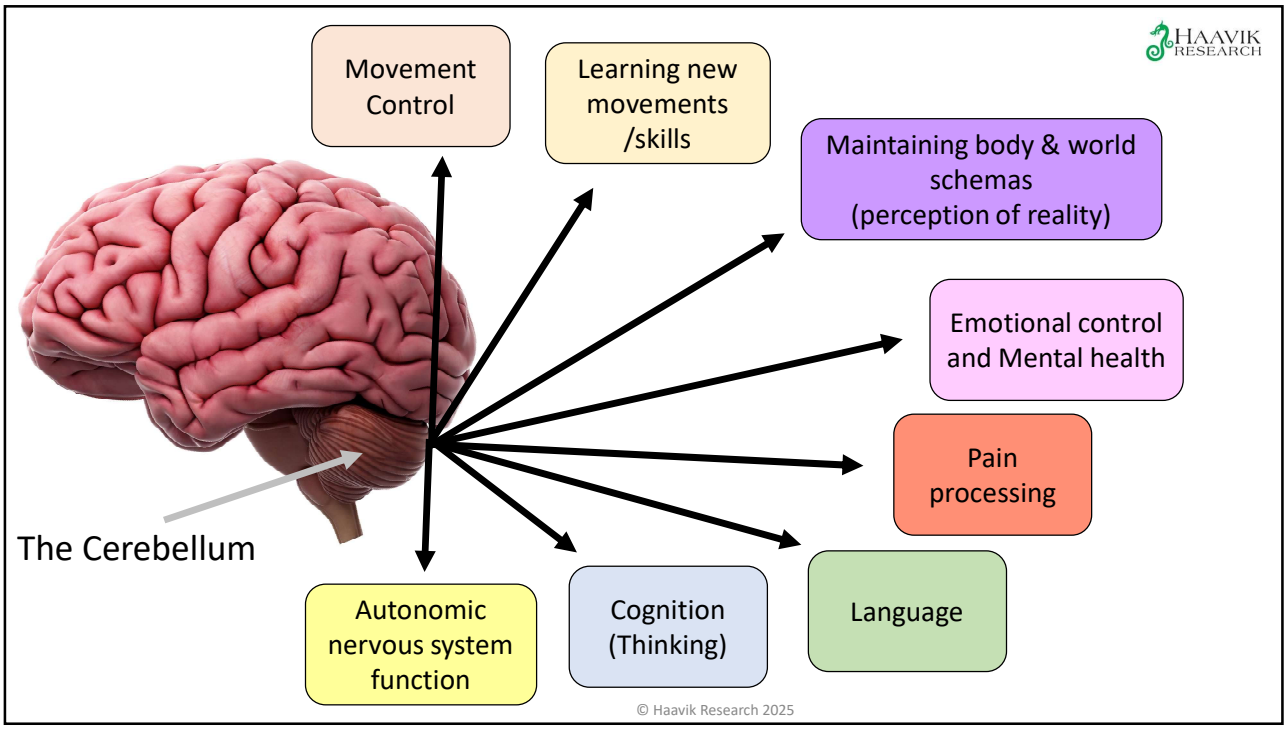
HAAVIK RESEARCH
Movement Control
Learning new movements /skills
Maintaining body & world schemas (perception of reality)
Emotional control and Mental health
Pain processing
Language
Cognition (Thinking)
Autonomic nervous system function
The Cerebellum
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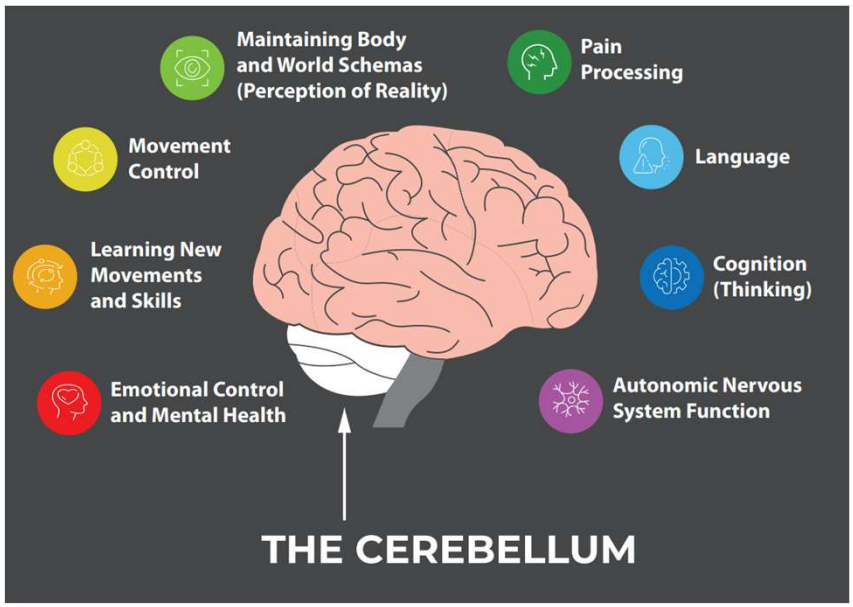

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The Brain Model – What evidence do we have?

Basic Science
Link chiro-neuro
Link chiro-immune

compromised (spinal) movement patterns

NO LONGER NOTHING!!!!
We now have a clinical trial!!!!

compromised adaptability and awareness

compromised neurophysiology

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HAAVIK RESEARCH

Basic Science vs Clinical Science

- Is there a link between spinal function and neural function?
- Is there a link between spinal function and immune function?
- Can an adjustment impact neural function?
- Can an adjustment impact immune function?

- Can chiropractic care improve immune function by reducing susceptibility to getting sick
- Can chiropractic care improve immune function by improving outcomes if you do get sick (reduced symptoms, shorter recovery times, etc)

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HAAVIK RESEARCH

Conclusion

"spinal manipulation can increase substance-p, neurotensin, oxytocin and interleukin levels and may influence cortisol levels post-intervention"

"more research needs to be done to understand the clinical relevance of such changes"

Musculoskeletal Science and Practice

Review article

Changes in biochemical markers following spinal manipulation-a systematic review and meta-analysis

Kesava Kovanur-Sampath, M.Ost, Ramakrishnan Mani, PhD, Jim Cotter, PhD, Angela Spontelli Gisselman, PT, Steve Tumilty, PhD

Kovanur-Sampath, et al. 2017. Musculoskeletal Science and Practice 29: 120-131

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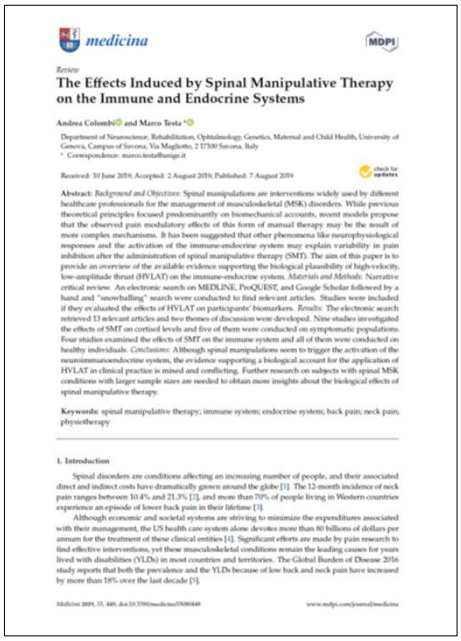
Conclusion

"Although spinal manipulations seem to trigger the activation of the neuro-immuno-endocrine system, the evidence supporting a biological account for the application of HVLAT in clinical practice is mixed and conflicting.

Further research on subjects with spinal MSK conditions with larger sample sizes are needed to obtain more insights about the biological effects of spinal manipulative therapy."



medicina

MDPI

Review

The Effects Induced by Spinal Manipulative Therapy on the Immune and Endocrine Systems

Andrea Colombi and Marco Testa

Department of Neuroscience, Rehabilitation, Ophtalmology, Genetics, Maternal and Child Health, University of Genova, Campus of Savona, Via Magliotto, 2 17100 Savona, Italy

* Correspondence: marco.testa@unige.it

Received: 10 June 2019; Accepted: 2 August 2019; Published: 7 August 2019

Abstract: *Background and Objectives:* Spinal manipulations are interventions widely used by different healthcare professionals for the management of musculoskeletal (MSK) disorders. While previous theoretical principles focused predominantly on biomechanical accounts, recent models propose that the observed pain modulatory effects of this form of manual therapy may be the result of more complex mechanisms. It has been suggested that other phenomena like neurophysiological responses and the activation of the immune-endocrine system may explain variability in pain inhibition after the administration of spinal manipulative therapy (SMT). The aim of this paper is to provide an overview of the available evidence supporting the biological plausibility of high-velocity, low-amplitude thrust (HVLAT) on the immune-endocrine system. *Materials and Methods:* Narrative critical review. An electronic search on MEDLINE, ProQUEST, and Google Scholar followed by a hand and "snowballing" search were conducted to find relevant articles. Studies were included if they evaluated the effects of HVLAT on participants' biomarkers. *Results:* The electronic search retrieved 13 relevant articles and two themes of discussion were developed. Nine studies investigated the effects of SMT on cortisol levels and five of them were conducted on symptomatic populations. Four studies examined the effects of SMT on the immune system and all of them were conducted on healthy individuals. *Conclusions:* Although spinal manipulations seem to trigger the activation of the neuroimmunoendocrine system, the evidence supporting a biological account for the application of HVLAT in clinical practice is mixed and conflicting. Further research on subjects with spinal MSK conditions with larger sample sizes are needed to obtain more insights about the biological effects of spinal manipulative therapy.

Keywords: spinal manipulative therapy; immune system; endocrine system; back pain; neck pain; physiotherapy

1. Introduction

Spinal disorders are conditions affecting an increasing number of people, and their associated direct and indirect costs have dramatically grown around the globe [1]. The 12-month incidence of neck pain ranges between 10.4% and 21.3% [2], and more than 70% of people living in Western countries experience an episode of lower back pain in their lifetime [3].

Although economic and societal systems are striving to minimize the expenditures associated with their management, the US health care system alone devotes more than 80 billions of dollars per annum for the treatment of these clinical entities [4]. Significant efforts are made by pain research to find effective interventions, yet these musculoskeletal conditions remain the leading causes for years lived with disabilities (YLDs) in most countries and territories. The Global Burden of Disease 2016 study reports that both the prevalence and the YLDs because of low back and neck pain have increased by more than 18% over the last decade [5].

Medicina 2019, 55, 448; doi:10.3390/medicina55080448 www.mdpi.com/journal/medicina

Colombi and Testa 2019. Medicina 55(8): 448.

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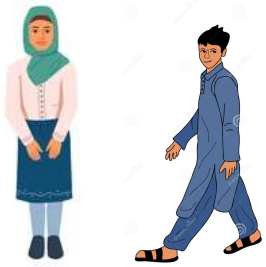
HOT OFF THE PRESS PUBLICATION

- 106 SCSP participants
- 12 weeks of chiro care
- 4 week follow up
- EEG + Lots of clinical outcomes related to PFC
  - Immune
  - Emotions
  - Sleep
  - executive functions
  - Etc



So measurements taken at baseline, at 12 weeks and at 16 weeks

Amjad, Niazi, Kumari, Ghani, Rashid, Duarte, For-tuna, Gonzalez, Sumich, Fabre, Holt & Haavik. The effects of 12 weeks of chiropractic spinal adjustments on Physiological biomarkers in adults: A pragmatic randomized controlled trial. *PLOS ONE. Accepted for publication Nov 2025* 5-year impact factor of 3.2

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Study Design & Participants

- **Pragmatic parallel-group RCT (Pakistan, 2022)**
- **Adults 20–60 with *subclinical spinal pain***
- **106 randomized → 88 completed 12 weeks → 73 completed follow-up**
- **Groups:** 12 weeks chiropractic care vs sham care
- **Frequency:** ~3 sessions/week, 15–20 min each
- **Blinding:** Participants, assessors, and data analyst blinded
- **Blinding success:** 94% believed they received real chiropractic care
- **Outcomes measured at:** baseline, 12 weeks, 16-week follow-up

Amjad et al 2025 *PLOS ONE*

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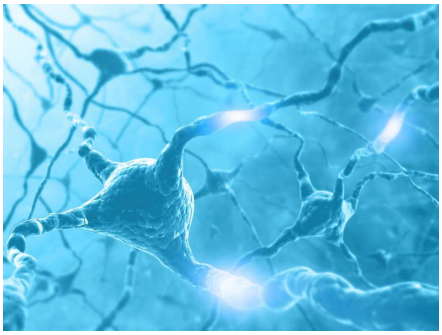
Interventions & Biomarker Measures

- **Chiropractic care:** 12 weeks of adjusting vertebral subluxations
- **Sham care:** identical setup, positioning, and clicks with an activator — but *no thrusts* delivered
- **Primary outcome: Blood BDNF**
- **Secondary outcomes:**
  Cortisol: saliva, blood, hair
  Cytokines: IL-6, TNF-α, IFN-γ, CRP
  Immune cells: CD4, CD8, CD19, CD56
- **Samples:** blood, saliva, hair (validated ELISA + chemiluminescent assays)
- **Analysis:** linear mixed-effects models with baseline adjustment



Amjad et al 2025 *PLOS ONE*

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16-week RCT

Immune results published!

BDNF

IL-6

TNF-alpha

INF-gamma

Serum and saliva cortisol

Amjad et al 2025 *PLOS ONE*

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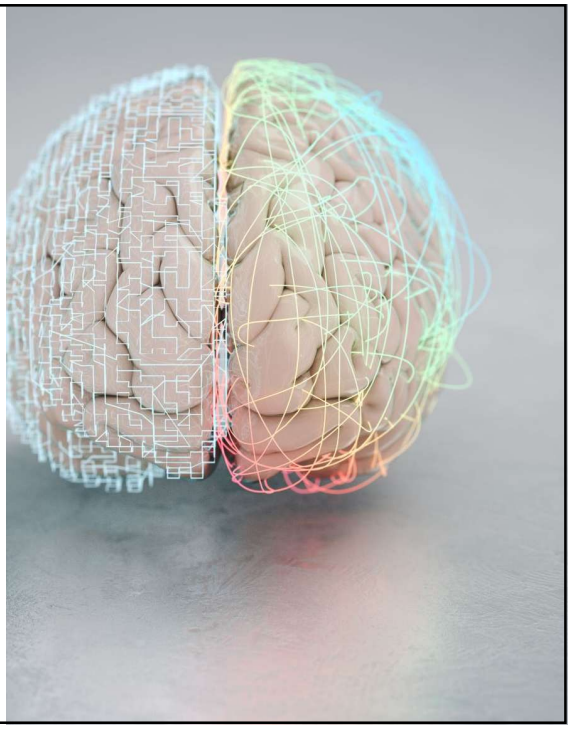
HAAVIK RESEARCH

BDNF

- Brain-Derived Neurotrophic Factor (BDNF)
- Key supporter of neuroplasticity
- Helps neurons survive, grow, and adapt
- Linked to learning, memory, mood, and pain modulation



Amjad et al 2025 *PLOS ONE*

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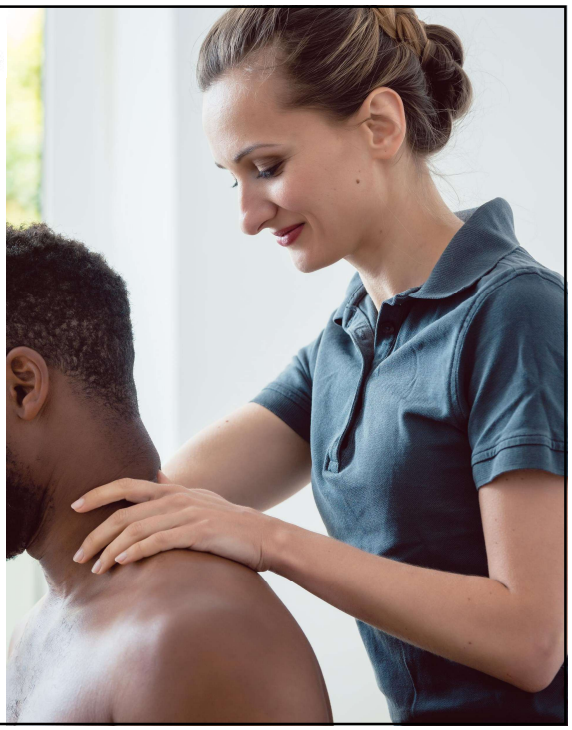
BDNF changes with chiropractic care

- Primary outcome of the trial = blood BDNF at 12 weeks of chiropractic vs sham
- Higher BDNF in chiropractic group at 12 weeks+150 ± 60 (95% CI: 40 to 270), p = 0.009
- Trend for higher BDNF still at 16 weeks
- Suggests enhanced neuroplastic activity in chiropractic group

Amjad et al 2025 *PLOS ONE*



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What does this mean to us chiropractors?

- Adds biological weight to the "brain-based" chiropractic model
- 12 weeks of care → systemic neuroplasticity signal
- Potential relevance for:
  - Chronic pain
  - Stress resilience & healthy ageing
- Early evidence – effect sizes modest, needs replication
- Message: "*There is emerging evidence that regularly caring for the spine appears to also support the brain's capacity to adapt and reorganize, not just reduce symptoms.*"

Amjad et al 2025 *PLOS ONE*

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Cortisol

(Stress System – Hair, Blood, Saliva)

- Cortisol = main stress hormone (HPA axis)
- Short term: helps manage acute stress & inflammation
- Long term: chronically high cortisol can be harmful
- Measured in:
  - Blood & saliva → acute/short-term levels
  - Hair → longer-term, chronic stress load

Amjad et al 2025 *PLOS ONE*

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Cortisol Changes with Chiropractic Care

- **12 weeks:**
  - Blood cortisol: ↑ in **both** groups (no between-group difference)
  - Salivary cortisol: **higher in chiropractic** vs sham
    - +5 ± 2, $p = 0.045$
  - Hair cortisol: **non-significant trend down** in chiropractic group
- **16 weeks (4 weeks after care stopped):**
  - Blood cortisol **lower in chiropractic vs sham**
    - −9 ± 4 (95% CI: −17 to −1), $p = 0.024$

Amjad et al 2025 *PLOS ONE*

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What does this mean for us chiropractors?

- Care may **engage** the stress system acutely (like exercise)
- Over time, chiropractic care may support **better regulation**
- Lower blood cortisol at 16 weeks = possible **reduce systemic stress load**
- Fits with a **neuroimmunomodulation / HPA axis** story
- "*There is emerging evidence that chiropractic care may help support healthier regulation of the stress system over time, not just symptom relief in the spine.*"

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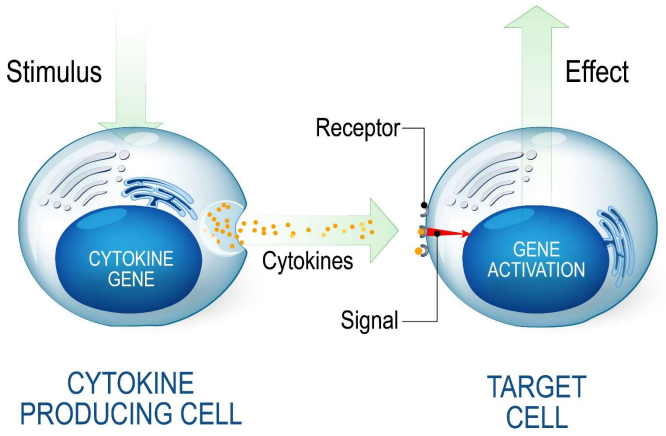
Cytokines

- Proteins that are important in cell signaling.
- They are released by cells and affect the behavior of other cells.
- Cytokines include interferons, interleukins, lymphokines and other.
- Cytokines are produced by a broad range of cells, including immune cells: macrophages, B lymphocytes, T lymphocytes and mast cells.



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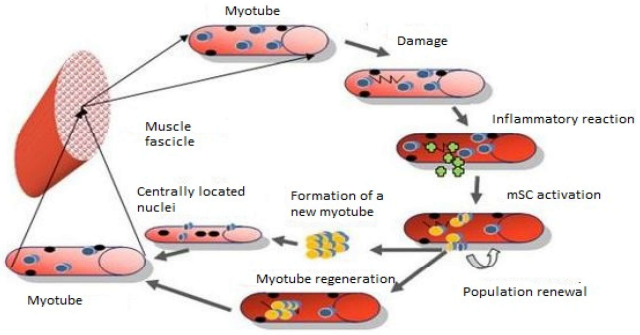
IL-6 (Inflammation & Myokine)

- Interleukin-6 (IL-6) = **dual role** cytokine
- In disease: often **pro-inflammatory** (infection, autoimmunity)
- In muscle: acts as a **myokine** released during exercise
- Can support:
  - **Local tissue repair & regeneration**
  - Regulation of **acute phase response** (e.g., CRP)



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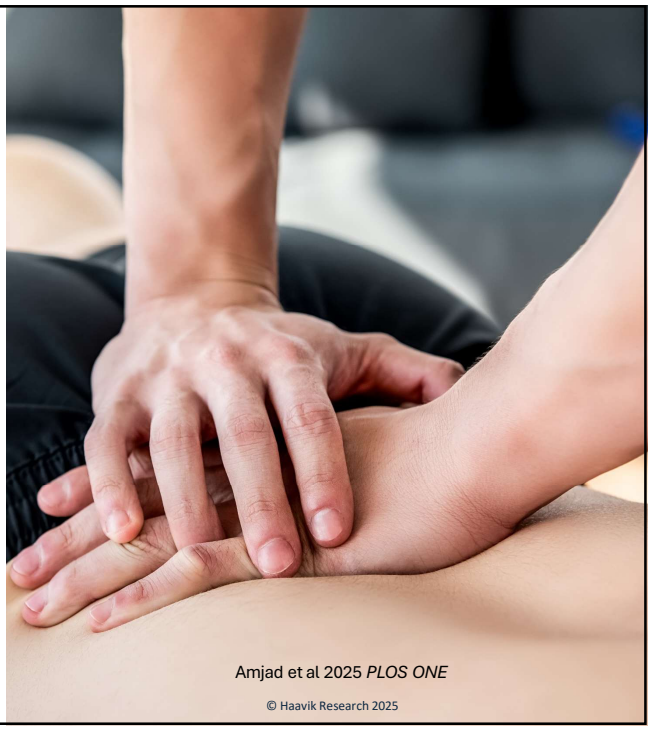
IL-6 Changes with Chiropractic Care

- **Higher IL-6 in chiropractic group at 12 weeks**
  - +1.0 ± 0.3 (95% CI: 0.5 to 1.5), $p < 0.001$
- Within chiropractic group:
  - IL-6 ↑ at 12 and still ↑ at 16 weeks
- No IL-6 change in sham at 12 weeks
- **CRP did NOT increase** in chiropractic group
- TNF-α actually **lower** in chiropractic group (see TNF slides)



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What does this mean for us chiropractors?

- HVLA adjustments may act like **“exercise” for deep paraspinal muscles**
- Repeated loading → **IL-6 myokine release** → muscle **repair & adaptation**
- No CRP rise + lower TNF-α → **not a harmful inflammatory spike**
- Supports model: adjusting dysfunctional segments = **mechanotherapy**
- Message: We may be **rehabilitating paraspinal tissues**, not just “putting bones back”

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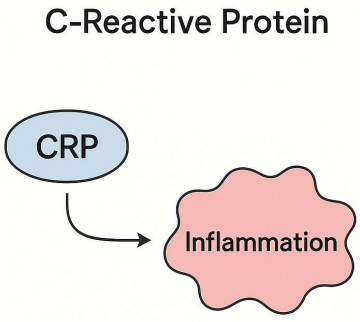
CRP (Systemic Inflammation Marker)

- C-reactive protein (CRP)
- Produced by the liver in response to IL-6
- Widely used marker of **systemic inflammation**
- High CRP linked to:
  - Cardiometabolic risk
  - Chronic inflammatory states



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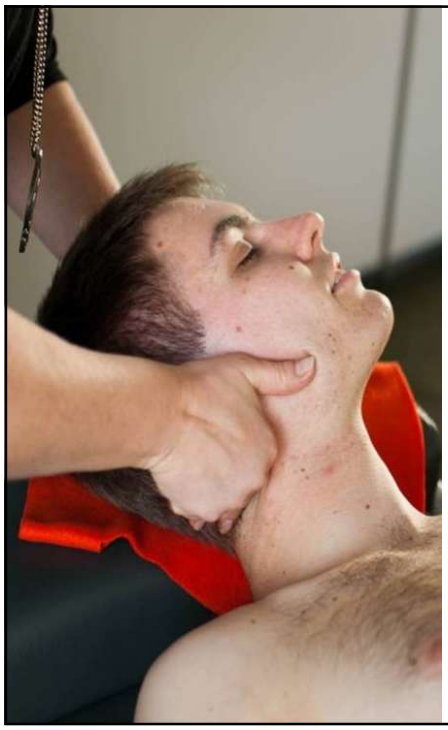

CRP Changes with Chiropractic Care

- **No significant between-group differences** at 12 or 16 weeks
- Within chiropractic:
  - Small increase at 12 weeks (borderline)
  - No sustained change at 16 weeks
- Within sham:
  - Similar small transient changes only
- Overall: **no clear CRP signal** favoring either group

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What does this mean for us chiropractors?

- Reassuring: no evidence of **harmful systemic inflammation** from care
- Supports the idea that IL-6 increase is **local muscle / myokine**, not systemic flare
- Chiropractic care appears **safe at the biomarker level** in this cohort
- Important message for:
  - **Interprofessional discussions**
  - Reassuring **patients** about safety

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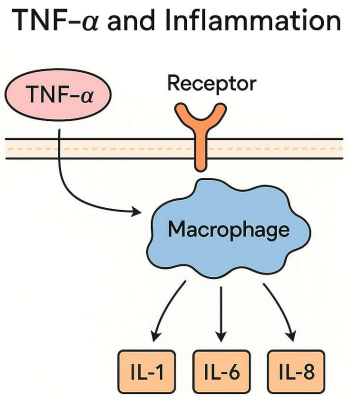
TNF-alpha (Key Pro-Inflammatory Cytokine)

- Tumor Necrosis Factor-alpha (TNF-α)
- Major **pro-inflammatory cytokine**
- Helps initiate and propagate **acute inflammation**
- Chronically high TNF-α linked to:
  - **Chronic pain**
  - Autoimmunity
  - Tissue damage & degeneration



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TNF-α Changes with Chiropractic Care

- **Lower TNF-α in chiropractic vs sham** at:
  - 12 weeks: −2 ± 1; $p = 0.023$
  - 16 weeks: −2 ± 1; $p = 0.028$
- Within-group:
  - Sham group: TNF-α **increased significantly** over time
  - Chiropractic group: only modest, non-significant increase
- Overall: sham group became **more inflamed**, chiropractic group **less so**

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What does this mean for us chiropractors?

- 12 weeks of care → **favorable shift in a key inflammatory driver**
- Supports idea that chiropractic care may help **dampen chronic inflammation**
- Aligns with other work showing reduced TNF-α after manual therapies
- Potential relevance for:
  - **Chronic spinal pain**
  - **Multi-system inflammatory burden**
- *"There is preliminary evidence that regular chiropractic care may help support a more balanced inflammatory profile, including lower TNF-alpha."*

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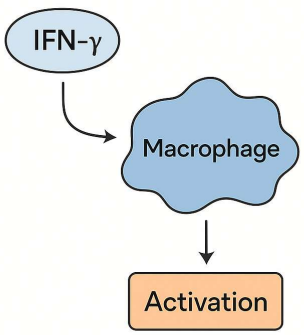
INF-γ (gamma - Immune Activation & Defence)

- Interferon-gamma (IFN-γ)
- Produced by T cells, NK cells, macrophages
- Activates cells that **kill infected or damaged cells**
- Important for **host defense**, but chronically high = **immune over-activation**



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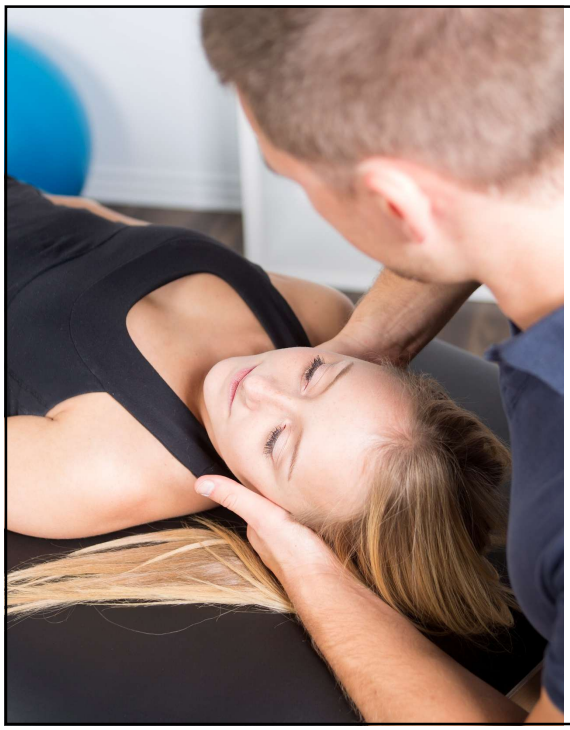

IFN-γ Changes with Chiropractic Care

- 12 weeks:
  - No significant between-group difference
  - Chiropractic group: **modest IFN-γ increase**
- 16 weeks:
  - IFN-γ **significantly higher in sham** vs chiropractic
    - −22 ± 7; $p = 0.001$ (chiro < sham)
  - Driven by **big increase in sham group** between 12 and 16 weeks
- Chiropractic group did **not** show this late rise

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What does this mean for us chiropractors?

- If we put this together with the TNF-alpha and cortisol findings, a pattern emerges:
- The sham group progressively shows **more signs of immune activation and inflammation** – higher TNF-alpha, higher IFN-gamma, and higher cortisol at 16 weeks.
- The chiropractic group looks more like a system that has been challenged in a controlled way and has then **settled into a more regulated state**.
- That's exactly what we'd hope for if chiropractic care is supporting neuro-immune balance rather than simply being a placebo for pain.
- We're not 'suppressing' the immune system – we may be helping it to stay responsive but not over-reactive."

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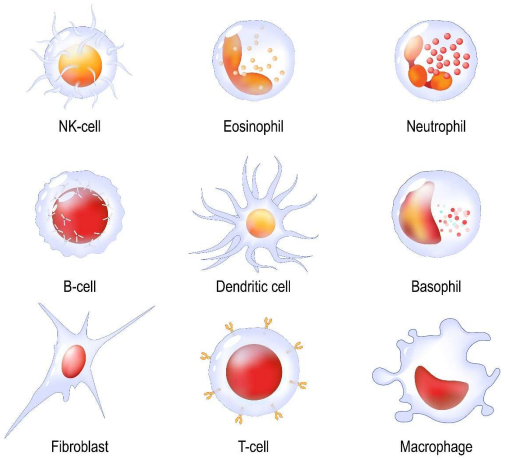
Immune Cells:

- **CD19** – B-lymphocytes (antibody-producing cells)
- **CD4** – T-helper cells (coordinate immune responses)
- **CD8** – Cytotoxic T cells (kill infected/damaged cells)
- **CD56** – Natural killer (NK) cells (innate defence)



- CD4:CD8 ratio = indicator of **immune system activation/balance**

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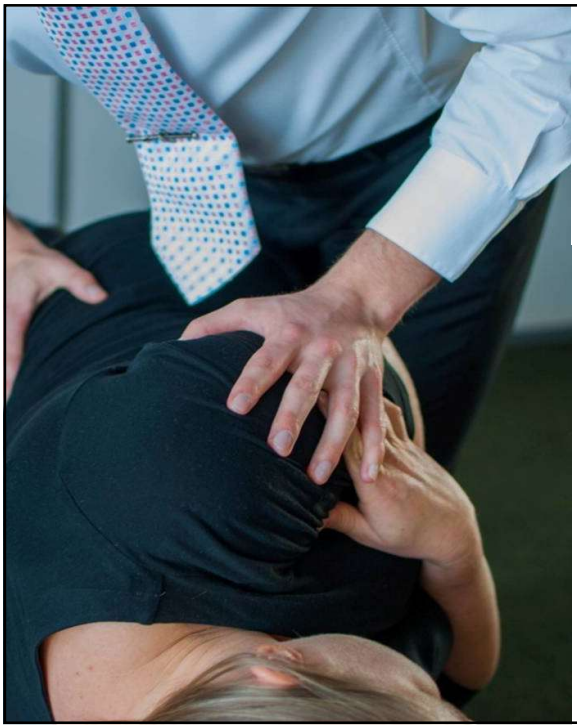

Immune Cerll Changes with Chiropractic Care

- **No significant between-group differences** (CD19, CD4, CD8, CD56) at 12 or 16 weeks
- **Within chiropractic group at 12 weeks:**
  - CD19 ↑ significantly
  - CD4 ↑ significantly
  - CD8 ↑ trend (non-significant)
  - CD56 ↑ (non-significant)
- Changes not sustained at 16 weeks

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What does this mean for us chiropractors?

- Suggests chiropractic care may **subtly tune immune cell activity**
- Patterns fit with:
  - Increased **immune competence**, not immune suppression
  - Balanced inflammatory picture alongside lower TNF-α & IFN-γ
- Very **early days** – hypothesis-generating, not definitive
- Message: another hint that chiropractic care interacts with the **neuro-immune network**

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Previous Research Also shown that HVLA thrusts alter:

medicina

MDPI

Review

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

Heidi Haavik [1,2], Imran Khan Niazi [1,2,3,4,*], Nitika Kumari [1,2], Imran Amjad [1,4,5], Jenna Duehr [1] and Kelly Holt [1,4,*]

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Abstract: The current COVID-19 pandemic has necessitated the need to find healthcare solutions that boost or support immunity. There is some evidence that high-velocity, low-amplitude (HVLA) controlled vertebral thrusts have the potential to modulate immune mediators. However, the mechanisms of the link between HVLA controlled vertebral thrusts and neuroimmune function and the associated potential clinical implications are less clear. This review aims to elucidate the underlying mechanisms that can explain the HVLA controlled vertebral thrust–neuroimmune link and discuss what this link implies for clinical practice and future research needs. A search for relevant articles published up until April 2021 was undertaken. Twenty-three published papers were found that explored the impact of HVLA controlled vertebral thrusts on neuroimmune markers, of which eighteen found a significant effect. These basic science studies show that HVLA controlled vertebral thrust influence the levels of immune mediators in the body, including neuropeptides, inflammatory markers, and endocrine markers. This narrative review discusses the most likely mechanisms for how HVLA controlled vertebral thrusts could impact these immune markers. The mechanisms are most likely due to the known changes in proprioceptive processing that occur within the central nervous system (CNS), in particular within the prefrontal cortex, following HVLA spinal thrusts. The prefrontal cortex is involved in the regulation of the autonomic nervous system, the hypothalamic–pituitary–adrenal axis and the immune system. Bi-directional links between these structures are affected by emotional or pain related stress. Stress-induced sympathetic nervous system activity also alters vertebral motor control. Therefore, there are biologically plausible direct and indirect mechanisms that link HVLA controlled vertebral thrusts to the immune system, suggesting HVLA controlled vertebral thrusts have the potential to modulate immune function. However, it is not yet known whether HVLA controlled vertebral thrusts have a clinically relevant impact on immunity. Further research is needed to explore the clinical impact of HVLA controlled vertebral thrusts on immune function.

Keywords: high-velocity low-amplitude thrust; HVLA; chiropractic; spinal manipulation; central nervous system; prefrontal cortex; immune system; endocrine system

1. Introduction

The COVID-19 pandemic has resulted in significant global morbidity and mortality [1,2], especially amongst individuals who are immunocompromised, such as older people and those with underlying medical conditions [2,3]. The current pandemic and

Medicine 2021, 57, 536. https://doi.org/10.3390/medicina57060536 https://www.mdpi.com/journal/medicina

Single thrust session studies mainly:

Neuropeptides
- Neurotensin ↑
- Oxytocin ↑
- Substance P ↑ (short-term)

These molecules influence:
- Inflammation
- Stress responses
- Neuroendocrine regulation
- Pain modulation

Cytokines & Inflammatory Markers
- Pro-inflammatory cytokines ↓
- IL-1β ↓
- TNF-α ↓

Anti-inflammatory cytokines ↑
- IL-2 ↑
- IL-10 ↑ (in some studies)

Endocrine Markers
- Cortisol responses are inconsistent, with some studies showing changes and others not.

Haavik et al. 2021. Medicina 2021, 57, 536.

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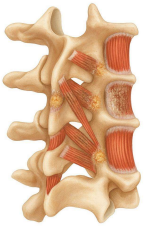
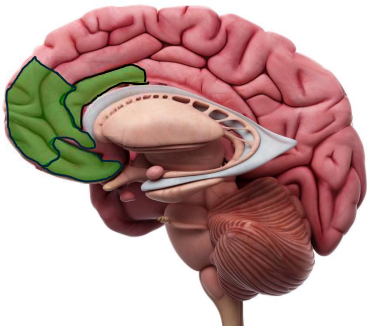
Mechanisms from 2021 Review

HVLA adjustments

Increase proprioceptive input from deep paraspinal muscles that are stretched rapidly during adjustments

Affect PFC activity





PFC regulates ANS, HPA axis, Immune system, Stress response, Emotions and pain modulation

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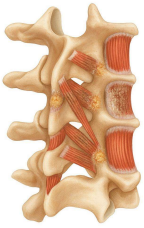
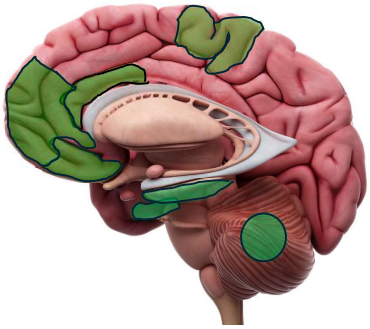
Mechanisms from 2025 RCT

HVLA adjustments

Increase proprioceptive input from deep paraspinal muscles that are stretched rapidly during adjustments

Affect PFC, DMN activity, Cerebellum and SMI





PFC, DMN, Cerebellum and SMI impacts and regulates ANS, HPA axis, Immune system, Stress response, Emotions and pain modulation

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What you CANNOT say based on current science

- Cannot claim chiropractic care **treats, cures, or prevents** any inflammatory, immune, or neurological disease
- Cannot claim chiropractic care **directly boosts immunity**
- Cannot claim biomarker changes = **clinical outcomes** yet
- Cannot generalize beyond this **specific population** (subclinical spinal pain)
- Cannot infer long-term effects beyond **16 weeks**
- Cannot claim effects are large — current results show **modest effect sizes**
- Single RCT → requires **replication** before making broad clinical claims

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Take Home Messages from this latest publication

- First-ever **longer-term RCT** showing neuroplasticity + immune biomarker changes with chiropractic care
- **BDNF increased** → suggests enhanced neuroplastic activity
- **IL-6 increased** without CRP rise → consistent with **myokine / muscle repair response**, not harmful inflammation
- **TNF-α lower** in chiropractic group → potentially reduced systemic inflammatory load
- **Cortisol better regulated** over time (lower at 16 weeks)
- Sham group showed **worsening inflammatory/immune profile** (↑ TNF-α, ↑ IFN-γ, ↑ cortisol)
- No evidence of biomarker **harm** from chiropractic care
- Supports the **contemporary brain–immune–stress model** of chiropractic care

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What we CAN claim based on this research

- Chiropractic care **modulated** key biomarkers (BDNF, IL-6, TNF-α, cortisol)
- Patterns suggest **neuroplastic, stress-regulatory, and immune-balancing** effects
- Changes occurred **over 12 weeks**, not just acutely
- Biomarker shifts were generally **favorable** (↑ BDNF, ↓ TNF-α, ↓ cortisol at follow-up)
- No evidence of **increased systemic inflammation or tissue damage**
- Findings **support**, but do not yet *prove*, broader health benefits
- More research needed → larger sample, longer follow-up, integration with outcomes
- Safe, evidence-aligned message:
  "Chiropractic care may influence neuroplasticity, stress physiology, and immune function."

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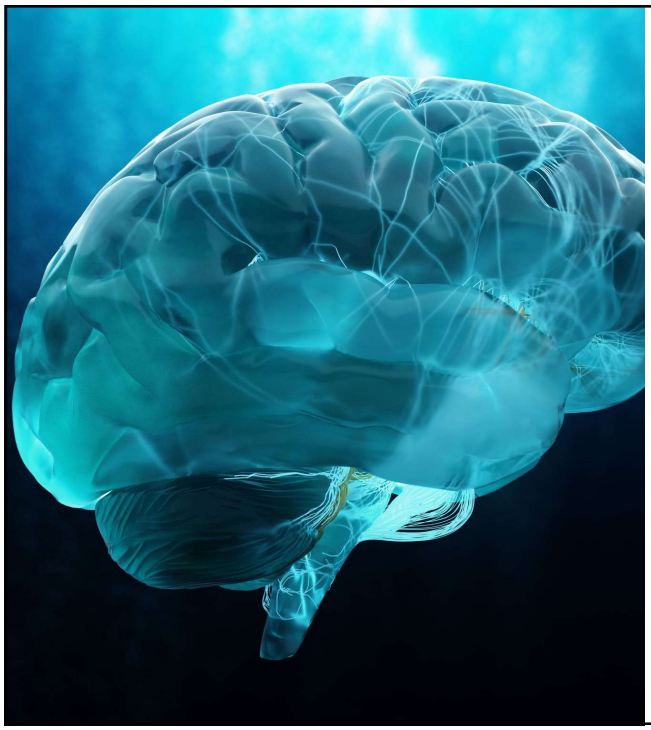

What is yet to come from this RCT

- Patient reported outcome measures (quality of life, stress, emotions)
- Sleep outcomes
- Executive functions outcomes
- Tripple Brain Network changes

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Questions?

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