Immunity- Chiropractic Reviews and Theory

The Effects Induced by Spinal Manipulative Therapy on the Immune and Endocrine Systems
Colombi A, Testa M,
Medicina
2019
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

Changes in biochemical markers following spinal manipulation-a systematic review and meta-analysis
Kovanur-Sampath K, Mani R, Cotter J, Gisselman AS, Tumilty S
Musculoskeletal Science and Practice
2017
The aim of this meta-analysis was to determine the effectiveness of spinal manipulation in influencing various biochemical markers in healthy and or symptomatic population.
Electronic databases (n ¼ 10) were searched (from inception till September 2016) and eight trials (325 participants) that met the inclusion criteria were included in the meta-analysis. Two authors independently extracted and assessed the risk of bias in included studies. Standardised mean differences for outcome measures were used to calculate effect sizes. The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) tool was used for assessing the quality of the body of evidence for each outcome of interest.
There was moderate quality evidence that spinal manipulation influenced biochemical markers. There was moderate quality evidence of significant difference that spinal manipulation is better (SMD -0.46, 95% CI - 0.93 to 0) than control in eliciting changes in cortisol levels immediately after intervention. There was also a low quality evidence that spinal manipulation is better than control at post-intervention in increasing substance-P (SMD -0.48,95%CI-0.87 to _0.1), neurotensin (SMD -1.8,95%CI-

2.56 to _1.04) and oxytocin levels (SMD -2.61,95%CI-3.5to-1.72). However, low quality evidence indicated that spinal manipulation did not influence epinephrine (SMD 0.1,95%CI- 0.56to0.75) or nor-epinephrine levels (SMD -0.06,95%CI-0.71to0.6).
The current review found that spinal manipulation can increase substance-p, neurotensin, oxytocin and interleukin levels and may influence cortisol levels post-intervention. However, future trials targeting symptomatic populations are required to understand the clinical importance of such changes.

The Physiological Role of Tumor Necrosis Factor in Human Immunity and Its Potential Implications in Spinal Manipulative Therapy: A Narrative Literature Review
Zhang L and Y CH
Journal of Chiropractic Medicine
2016
Objective: Although tumor necrosis factor (TNF) is a well-known inflammatory cytokine in the pathological development of various human diseases, its physiological roles are not widely understood nor appreciated. The molecular mechanisms underlying spinal manipulation therapy (SMT) remain elusive. The relationship between TNF and SMT is unclear. Thus, we performed this literature review to better understand TNF physiology and its potential relationship with SMT, and we propose a novel mechanism by which SMT may achieve clinical benefits by using certain beneficial features of TNF.
Methods: We searched several databases for relevant articles published between 1975 and 2015 and then reexamined the studies from current immunophysiological perspectives.
Results: The history and recent progresses in TNF physiology research were explored. Conflicting reports on the relationship between TNF and SMT were identified. Based on the newly discovered interaction between TNF and regulatory T cells, we proposed a putative biphasic TNF response to SMT, which may resolve the conflicts in the reported observations and interpretations.
Conclusion: The current literature about TNF informed our discussion of new physiological roles for TNF, which may help to better understand the physiological effects of SMT.

Basic science research related to chiropractic spinal adjusting: The state of the art and recommendations revisited
Cramer G, Budgell B, Henderson C, Khalsa P, Pickar J
Journal of Manipulative and Physiological Therapeutics
2006
Objective: The objectives of this white paper are to review and summarize the basic science literature relevant to spinal fixation (subluxation) and spinal adjusting procedures and to make specific recommendations for future research.
Methods: PubMed, CINAHL, ICL, OSTMED, and MANTIS databases were searched by a multidisciplinary team for reports of basic science research (since 1995) related to spinal fixation (subluxation) and spinal adjusting (spinal manipulation). In addition, hand searches of the reference sections of studies judged to be important by the authors were also obtained. Each author used key words they determined to be most important to their field in designing their individual search strategy. Both animal and human studies were included in the literature searches, summaries, and recommendations for future research produced in this project.
Discussion: The following topic areas were identified: anatomy, biomechanics, somatic nervous system, animal models, immune system, and human studies related to the autonomic nervous system. A relevant summary of each topic area and specific recommendations for future research in each area were the primary objectives of this project.

Conclusions: The summaries of the literature for the 6 topic sections (anatomy, biomechanics, somatic nervous system, animal models, immune system, and human studies related to the autonomic nervous system) indicated that a significant body of basic science research evaluating chiropractic spinal adjusting has been completed and published since the 1997 basic science white paper. Much more basic science research in these fields needs to be accomplished, and the recommendations at the end of each topic section should help researchers, funding agencies, and other decision makers develop specific research priorities

Mechanisms and effects of spinal high velocity, low amplitude trust manipulation: Previous theories
Evans DW
Journal of Manipulative and Physiological Therapeutics
2002
Objectives: When the clinical efficacy of spinal manipulative treatment for spinal pain has been assessed, high-velocity low-amplitude thrust (HVL.AT) manipulation and mobilization have been regarded as clinical interventions giving identical and equivalent biologic effects. The objective of this review is to critically discuss previous theories and research of spinal HVL.AT manipulation, highlighting reported neurophysiologic effects that seem to be uniquely associated with cavitation of synovial fluid.
Data Source: The biomedical literature was searched for research and reviews on spinal manipulation. MEDLINE and FMBASE databases were used to help find relevant articles.
Study Selection: All articles relevant to the objectives were selected.
Data Extraction: .Ml available data were used.
Data Synthesis: The main hypotheses for lesions that respond to HVLAT manipulation were critically discussed: (1) release o\' entrapped synovial folds or plica, (2) relaxation of hypertonic muscle by sudden stretching, (3) disruption of articular or periarticular adhesions, and (4) unbuckling of motion segments that have undergone disproportionate displacements.
Results: There appear to be 2 separate modes of action from zygapophyseal HVLAT manipulation. intraarticular "mechanical" effects of zygapophyseal HYLAT manipulation seem to be absolutely separate from and irrelevant to the occurrence of reported "neurophysiologic" effects. Cavitation should not be an absolute requirement for the mechanical effects to occur but may be a reliable indicator for successful joint gapping.
Conclusions: It is hoped that identification of these unique neurophysiologic effects will provide enough theoretical reason for HVLAT manipulation and mobilization lo be assessed independently as individual clinical interventions.

Neurophysiological effects of spinal manipulation
Pickar JG
The Spine Journal
2002
Background context: Despite clinical evidence for the benefits of spinal manipulation and the apparent wide usage of it, the biological mechanisms underlying the effects of spinal manipulation are not known. Although this does not negate the clinical effects of spinal manipulation, it hinders acceptance by the wider scientific and health-care communities and hinders rational strategies for improving the delivery of spinal manipulation.
Purpose: The purpose of this review article is to examine the neurophysiological basis for the effects of spinal manipulation.
Study design: A review article discussing primarily basic science literature and clinically oriented basic science studies.

Methods: This review article draws primarily from the peer-reviewed literature available on Medline. Several textbook publications and reports are referenced. A theoretical model is presented describing the relationships between spinal manipulation, segmental biomechanics, the nervous system and end-organ physiology. Experimental data for these relationships are presented.
Results: Biomechanical changes caused by spinal manipulation are thought to have physiological consequences by means of their effects on the inflow of sensory information to the central nervous system. Muscle spindle afferents and Golgi tendon organ afferents are stimulated by spinal manipulation. Smaller-diameter sensory nerve fibers are likely activated, although this has not been demonstrated directly. Mechanical and chemical changes in the intervertebral foramen caused by a herniated intervertebral disc can affect the dorsal roots and dorsal root ganglia, but it is not known if spinal manipulation directly affects these changes. Individuals with herniated lumbar discs have shown clinical improvement in response to spinal manipulation. The phenomenon of central facilitation is known to increase the receptive field of central neurons, enabling either subthreshold or innocuous stimuli access to central pain pathways. Numerous studies show that spinal manipulation increases pain tolerance or its threshold. One mechanism underlying the effects of spinal manipulation may, therefore, be the manipulation's ability to alter central sensory processing by removing subthreshold mechanical or chemical stimuli from paraspinal tissues. Spinal manipulation is also thought to affect reflex neural outputs to both muscle and visceral organs. Substantial evidence demonstrates that spinal manipulation evokes paraspinal muscle reflexes and alters motoneuron excitability. The effects of spinal manipulation on these somatosomatic reflexes may be quite complex, producing excitatory and inhibitory effects. Whereas substantial information also shows that sensory input, especially noxious input, from paraspinal tissues can reflexively elicit sympathetic nerve activity, knowledge about spinal manipulation's effects on these reflexes and on end-organ function is more limited.
Conclusions: A theoretical framework exists from which hypotheses about the neurophysiological effects of spinal manipulation can be developed. An experimental body of evidence exists indicating that spinal manipulation impacts primary afferent neurons from paraspinal tissues, the motor control system and pain processing. Experimental work in this area is warranted and should be encouraged to help better understand mechanisms underlying the therapeutic scope of spinal manipulation.

Basic science research in chiropractic: the state of the art and recommendations for a research agenda
Brennan PC, Cramer GD, Kirstukas SJ, Cullum ME
Journal of Manipulative and Physiological Therapeutics
1997
A position paper was prepared as background information for participants in the National Workshop to Develop the Chiropractic Workshop Agenda conducted by the Palmer Center for Chiropractic Research, Davenport, Iowa. The paper was revised in light of comments and suggestions at the workshop by participants and by a workgroup composed of basic scientists from within and outside of chiropractic. This final article documents the history of basic science research in chiropractic, and the current state of the art of basic science research conducted since 1975 by chiropractors or investigators at chiropractic institutions in North America. Seed recommendations contained in the working paper for the development of an adequate infrastructure needed to conduct future research and seed recommendations for a future basic science research agenda were also modified and revised by the workgroup participants through a modified nominal group process. The final recommendations contained in this article represent a synthesis of these recommendations and those of the authors.

The Effects of Chiropractic on the Immune System: A Review of the Literature
Allen JM

Chiropractic Journal of Australia
1993
This paper outlines the many components of the mammalian immune system and the anatomical and physiological connections suggesting that the nervous system plays a role in the modulation of immune response. The few studies attempting to measure the effect of chiropractic or manipulative treatment on the immune system are reviewed. Their results suggest that chiropractic or manipulative treatment may influence T and B lymphocyte numbers, NK cell numbers, antibody levels, phagocytic activity and plasma beta-endorphin levels. The influence of these effects on the outcome of host resistance is unknown. There is now a need for large, well-planned clinical trials using some of, the more sophisticated measures of immune function to establish whether chiropractic treatment can influence the immune response in a clinically significant manner.

An overview of neuroimmunomodulation and a possible correlation with musculoskeletal system function
Fidelibus JC
Journal of Manipulative and Physiological Therapeutics
1989
There is an increasing body of evidence that the nervous system is capable of modulating the immune response. Receptors for neuromodulators and neuro-hormones have been found on human T lymphocytes. Activation of these receptors can be stimulatory or inhibitory depending on the neuroactive substance. The immune system may be able to communicate with the nervous system using neuromodulators and neuro-hormones secreted by lymphocytes. Sympathetic innervation of lymphoid tissues is not restricted to blood vessels and smooth muscle, but directly supplies lymphocytes and blood precursor cells. It is theorized that spinal fixations may adversely affect the immune response through somatosympathetic reflexes. Spinal manipulation can correct the spinal fixations and may eliminate the adverse effects of somatosympathetic reflexes.