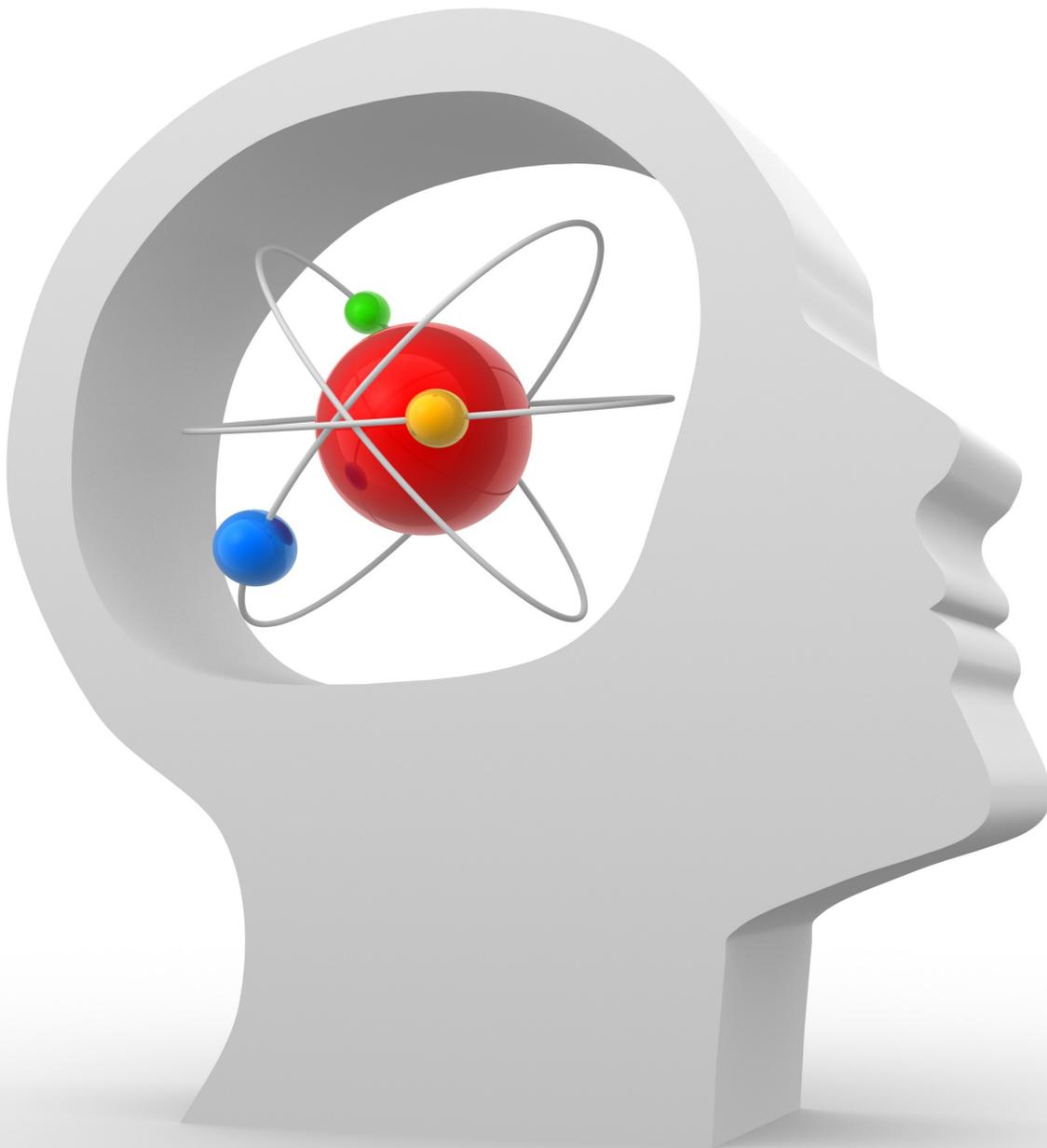


# CRANIAL OSTEOPATHY MYTH OR REALITY

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## ARTICLES REFUTING CRANIAL OSTEOPATHY

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### KEY

- › LR = Literature Review.
- › CC = Clinical Case Study.
- › BRCT = Blinded Randomised Controlled Trial.
- › PS = Pilot Study.
- › AS = Anatomical Study.
- › OS = Observational Study.
- › PS = Physiological Study.
- › ES = Epidemiological Study.

**Sommerfeld P, Kaider A, Klein P. *Inter- and interexaminador reliability in palpation of the "primary respiratory mechanism" within the "cranial concept"*. Man Ther. 2004 Feb; 9(1):22-9. [BRCT](#)**

Inevitable subjectivity makes interexaminer reliability of manual assessment procedures a special matter of concern. The cranial concept (CC), one aspect of osteopathy, deals with very subtle changes that have to be palpated. One of the main principles of the CC is the primary respiratory mechanism (PRM), which is hypothesized to be a palpable physiological phenomenon that occurs in rhythmic cycles, called flexion- and extension-phase, which are independent from cardiac and respiratory rates.

Palpation of the PRM is one of the first steps in assessment within the CC. An inter- and intraexaminer reliability study design for repeated measures was used in this study.

Forty nine healthy subjects were palpated simultaneously twice, once at the head and once at the pelvis. PRM-frequency (f), the mean duration of the flexion phase and the mean ratio of flexion- to extension-phase were used as the main outcome measures. Inter- and intraexaminer reliability and correlations to the respiratory rates were analysed for all three parameters.

Inter- as well as intraexaminer agreement could not be described beyond chance agreement, as the range within the 95% limits of agreement (e.g. for  $f=6.6$  cycles/90 s) for all cases resembled the total range of values (e.g. for  $f=7$  cycles/90 s) that were produced. A significant effect of the examiners' respiration was found for both examiners at the pelvis ( $P=0.004$  for one examiner,  $P < 0.0001$  for the other examiner), and for one examiner only at the head ( $P=0.0017$ ).

No correlation could be found for the subjects' respiratory rates.

In conclusion, PRM-rates could not be palpated reliably and under certain conditions were influenced by the examiners' respiratory rates.



These results do not support the hypotheses behind the PRM. The role of PRM palpation for clinical decision making and the models explaining the PRM should therefore be rethought.

**Moran RW, Gibbons P. *Intraexaminer and interexaminer reliability for palpation of the cranial rhythmic impulse at the head and sacrum.* J Manipulative Physiol Ther. 2001 Mar-Apr; 24(3):183-90. [OS](#)**

A range of health care practitioners use cranial techniques. Palpation of a cranial rhythmic impulse (CRI) is a fundamental clinical skill used in diagnosis and treatment with these techniques.

There has been little research establishing the reliability of CRI rate palpation.

This study aimed to establish the intraexaminer and interexaminer reliability of CRI rate palpation and to investigate the “core-link” hypothesis of craniosacral interaction that is used to explain simultaneous motion at the cranium and sacrum.

Two registered osteopaths, both with postgraduate training in diagnosis and treatment, using cranial techniques, palpated 11 normal healthy subjects.

Examiners simultaneously palpated for the CRI at the head and the sacrum of each subject. Examiners indicated the “full flexion” phase of the CRI by activating silent foot switches that were interfaced with a computer. Subject arousal was monitored using heart rate. Examiners were blind to each other’s results and could not communicate during data collection.

Reliability was estimated from calculation of intraclass correlation coefficients. Intrarater reliability for examiners at either the head or the sacrum was fair to good, significant intraclass correlation coefficients ranging from +0.52 to +0.73.

Interexaminer reliability for simultaneous palpation at the head and the sacrum was poor to non-existent, ICCs ranging from –0.09 to +0.31. There were significant differences between rates of CRI palpated simultaneously at the head and the sacrum.

The results fail to support the construct validity of the “core-link” hypothesis as it is traditionally held by proponents of craniosacral therapy and osteopathy in the cranial field.

**Rogers JS, Witt PL, Gross MT, Hacke JD, Genova PA. *Simultaneous palpation of the craniosacral rate at the head and feet: intrarater and interrater reliability and rate comparisons.* Phys Ther. 1998 Nov; 78(11):1175-85. [OS](#)**

The main purpose of this study was to determine the interrater and intrarater reliability of measurements obtained during palpation of the craniosacral rate at the head and feet. Palpated craniosacral rates of head and feet measured simultaneously were also compared.

Twenty-eight adult subjects and 2 craniosacral examiners participated in the study.

A within-subjects repeated-measures design was used. A standard cubicle privacy curtain, hung over the subject’s waist, was used to prevent the examiners from seeing each other.



Interrater intraclass correlation coefficients (ICCs) were .08 at the head and .19 at the feet.

Intrarater ICCs ranged from 0.18 to 0.30. Craniosacral rates simultaneously palpated at the head and feet were different.

The results did not support the theories that underlie craniosacral therapy or claims that craniosacral motion can be palpated reliably.

**Wirth-Pattullo V, Hayes KW. *Interrater reliability of craniosacral rate measurements and their relationship with subjects' and examiners' heart and respiratory rate measurements.* Phys Ther. 1994 Oct; 74(10):908-16; discussion 917-20. [OS](#)**

The evaluation of craniosacral motion is an approach used by physical therapists and other health professionals to assess the causes of pain and dysfunction, but evidence for the existence of this motion is lacking and the reproducibility of the results of this palpatory technique has not been studied.

This study examined the interexaminer reliability of craniosacral rate and the relationships among craniosacral rate and subjects' and examiners' heart and respiratory rates.

Participants were 12 children and adults with histories of physical trauma, surgery, or learning disabilities. Three physical therapists with expertise in craniosacral therapy were the examiners.

One of three nurses recorded heart and respiratory rates of both subject and examiner. The examiner then palpated the subject to determine craniosacral rate and reported the findings to the nurse. Each subject was examined by each of the three examiners.

Reliability was estimated using a repeated-measures analysis of variance and the intraclass correlation coefficient. Significant differences among examiners and the scatter plot of rates showed lack of agreement among examiners. The ICC was -.02. The correlations between subject craniosacral rate and subject and examiner heart and respiratory rates were analyzed with Pearson correlation coefficients and were low and not statistically significant.

Measurements of craniosacral motion did not appear to be related to measurements of heart and respiratory rates, and therapists were not able to measure it reliably. Measurement error may be sufficiently large to render many clinical decisions potentially erroneous. Further studies are needed to verify whether craniosacral motion exists, examine the interpretations of craniosacral assessment, determine the reliability of all aspects of the assessment, and examine whether craniosacral therapy is an effective treatment.



**Hanten WP, Dawson DD, Iwata M, Seiden M, Whitten FG, Zink T. *Craniosacral rhythm: reliability and relationships with cardiac and respiratory rates.* J Orthop Sports Phys Ther. 1998 Mar; 27(3):213-8. [OS](#)**

Craniosacral rhythm (CSR) has long been the subject of debate, both over its existence and its use as a therapeutic tool in evaluation and treatment. Origins of this rhythm are unknown, and palpatory findings lack scientific support.

The purpose of this study was to determine the intra- and inter-examiner reliabilities of the palpation of the rate of the CSR and the relationship between the rate of the CSR and the heart or respiratory rates of subjects and examiners.

The rates of the CSR of 40 healthy adults were palpated twice by each of two examiners.

The heart and respiratory rates of the examiners and the subjects were recorded while the rates of the subjects' CSR were palpated by the examiners.

Intraclass correlation coefficients were calculated to determine the intra- and inter-examiner reliabilities of the palpation. Two multiple regression analyses, one for each examiner, were conducted to analyze the relationships between the rate of the CSR and the heart and respiratory rates of the subjects and the examiners.

The intraexaminer reliability coefficients were 0.78 for examiner A and 0.83 for examiner B, and the interexaminer reliability coefficient was 0.22.

The result of the multiple regression analysis for examiner A was  $R = 0.46$  and adjusted  $R^2 = 0.12$  ( $p = 0.078$ ) and for examiner B was  $R = 0.63$  and adjusted  $R^2 = 0.32$  ( $p = 0.001$ ).

The highest bivariate correlation was found between the CSR and the subject's heart rate ( $r = 0.30$ ) for examiner A and between the CSR and the examiner's heart rate ( $r = 0.42$ ) for examiner B.

The results indicated that a single examiner may be able to palpate the rate of the CSR consistently, if that is what we truly measured. It is possible that the perception of CSR is illusory.

**Jäkel A, von Hauenschild P. *Therapeutic effects of cranial osteopathic manipulative medicine: a systematic review.* J Am Osteopath Assoc. 2011 Dec; 111(12):685-93. [LR](#)**

Cranial osteopathic manipulative medicine (OMM) involves the manipulation of the primary respiratory mechanism to improve structure and function in children and adults.

The objective of the study was to identify and critically evaluate the literature regarding the clinical efficacy of cranial OMM.

The clinical keywords "cranial manipulation" OR "osteopathy in the cranial field" OR "cranial osteopathy" OR "craniosacral technique" were searched in the following electronic databases:



EMBASE, MEDLINE In-Process & Other Non-Indexed Citations, The Cochrane Central Register of Controlled Trials, CINAHL (Cumulative Index to Nursing and Allied Health Literature), and AMED (Alternative Medicine). Searches were conducted in April 2011 with no date restriction for when the studies were completed.

Randomized controlled trials and observational studies that measured the effectiveness of cranial OMM on humans were included in the study.

Exclusion criteria included non-English language articles, studies not relevant to cranial OMM, animal studies, and studies in which there was no clear indication of the use of cranial OMM.

Studies that described the use of cranial OMM with other treatment modalities and that did not perform subgroup analysis were also excluded.

The present study did not have criteria regarding type of disease.

Outcome measures on pain, sleep, quality of life, motor function, and autonomic nervous system function were extracted. The methodological quality of the trials was assessed using the Downs and Black checklist.

Of the 8 studies that met the inclusion criteria, 7 were randomized controlled trials and 1 was an observational study. A range of cranial OMM techniques used for the management of a variety of conditions were identified in the included studies.

Positive clinical outcomes were reported for pain reduction, change in autonomic nervous system function, and improvement of sleeping patterns. Methodological Downs and Black quality scores ranged from 14 to 23 points out of a maximum of 27 points (overall median score, 16).

The currently available evidence on the clinical efficacy of cranial OMM is heterogeneous and insufficient to draw definitive conclusions. Because of the moderate methodological quality of the studies and scarcity of available data, further research into this area is needed.

**Cardoso-de-Mello-Ribeiro AP, Rodríguez-Blanco C, Riquelme-Agulló I, Heredia-Rizo AM, Ricard F, Oliva-Pascual-Vaca Á. *Effects of the Fourth Ventricle Compression in the Regulation of the Autonomic Nervous System: A Randomized Control Trial.* Evid Based Complement Alternat Med. 2015; 2015:148285. [BRCT\\*](#)**

Dysfunction of the autonomic nervous system is an important factor in the development of chronic pain. Fourth ventricle compression (CV-4) has been shown to influence autonomic activity. Nevertheless, the physiological mechanisms behind these effects remain unclear.

This study is aimed at evaluating the effects of fourth ventricle compression on the autonomic nervous system.

Forty healthy adults were randomly assigned to an intervention group, on whom CV-4 was performed, or to a control group, who received a placebo intervention (non-therapeutic touch



on the occipital bone). In both groups, plasmatic catecholamine levels, blood pressure, and heart rate were measured before and immediately after the intervention.

No effects related to the intervention were found. Although a reduction of norepinephrine, systolic blood pressure, and heart rate was found after the intervention, it was not exclusive to the intervention group. In fact, only the control group showed an increment of dopamine levels after intervention.

Fourth ventricle compression seems not to have any effect in plasmatic catecholamine levels, blood pressure, or heart rate. Further studies are needed to clarify the CV-4 physiologic mechanisms and clinical efficacy in autonomic regulation and pain treatment.

**Rogers JS, Witt PL. *The controversy of cranial bone motion*. J Orthop Sports Phys Ther. 1997 Aug; 26(2):95-103. [LR](#)**

Cranial bone motion continues to stimulate controversy. This controversy affects the general acceptance of some intervention methods used by physical therapists, namely, cranial osteopathic and craniosacral therapy techniques. Core to these intervention techniques is the belief that cranial bone mobility provides a compliant system where somatic dysfunction can occur and therapeutic techniques can be applied.

Diversity of opinion over the truth of this concept characterizes differing viewpoints on the anatomy and physiology of the cranial complex.

Literature on cranial bone motion was reviewed for the purpose of better understanding this topic.

Published research overall was scant and inconclusive. Animal and human studies demonstrate a potential for small magnitude motion.

Physical therapists should carefully scrutinize the literature presented as evidence for cranial bone motion.

Further research is needed to resolve this controversy. Outcomes research, however, is needed to validate cranial bone mobilization as an effective treatment.

**Green C, Martin CW, Bassett K, Kazanjian A. *A systematic review of craniosacral therapy: biological plausibility, assessment reliability and clinical effectiveness*. Complement Ther Med. 1999 Dec; 7(4):201-7. [LR](#)**

The objective of this research was to review critically the scientific basis of craniosacral therapy as a therapeutic intervention.

A systematic search for and critical appraisal of research on craniosacral therapy was conducted. Medline, Embase, Healthstar, Mantis, Allied and Alternative Medicine, Scisearch and Biosis were searched from their start date to February 1999.



A three-dimensional evaluative framework with related appraisal criteria:

- › Craniosacral interventions and health outcomes;
- › validity of craniosacral assessment; and
- › pathophysiology of the craniosacral system.

The available research on craniosacral treatment effectiveness constitutes low-grade evidence conducted using inadequate research protocols. One study reported negative side effects in outpatients with traumatic brain injury. Low inter-rater reliability ratings were found.

This systematic review and critical appraisal found insufficient evidence to support craniosacral therapy. Research methods that could conclusively evaluate effectiveness have not been applied to date.

**Guillaud A, Darbois N, Monvoisin R, Pinsault N. *Reliability of Diagnosis and Clinical Efficacy of Cranial Osteopathy: A Systematic Review*. PLoS One. 2016 Dec 9; 11(12):e0167823. [LR](#)**

In 2010, the World Health Organization released benchmarks for training in osteopathy in which they considered cranial osteopathy as an important osteopathic skill. However, the evidence supporting the reliability of diagnosis and the efficacy of treatment in this field appears scientifically weak and inconsistent.

The objective of this study was to identify and critically evaluate the scientific literature dealing with the reliability of diagnosis and the clinical efficacy of techniques and therapeutic strategies used in cranial osteopathy.

Relevant keywords were used to search the electronic databases MEDLINE, PEDro, OSTMED, DR, Cochrane Library, and in Google Scholar, Journal of American Osteopathy Association and International Journal of Osteopathic Medicine websites. Searches were conducted up to end June 2016 with no date restriction as to when the studies were completed. As a complementary approach we explored the bibliography of included articles and consulted available previous reviews dealing with this topic.

Regarding diagnostic processes in cranial osteopathy, we analyzed studies that compared the results obtained by at least two examiners or by the same examiner on at least two occasions. For efficacy studies, only randomized-controlled-trials or crossover-studies were eligible.

We excluded articles that were not in English or French, and for which the full-text version was not openly available. We also excluded studies with unsuitable study design, in which there was no clear indication of the use of techniques or therapeutic strategies concerning the cranial field, looked at combined treatments, used a non-human examiner and subjects or used healthy subjects for efficacy studies. There was no restriction regarding the type of disease.

In our electronic search we found 1280 references concerning reliability of diagnosis studies plus four references via our complementary strategy. Based on the title 18 articles were



selected for analysis. Nine were retained after applying our exclusion criteria. Regarding efficacy, we extracted 556 references from the databases plus 14 references through our complementary strategy. Based on the title 46 articles were selected. Thirty two articles were not retained on the grounds of our exclusion criteria.

Risk of bias in reliability studies was assessed using a modified version of the quality appraisal tool for studies of diagnostic reliability. The methodological quality of the efficacy studies was assessed using the Cochrane risk of bias tool. Two screeners conducted these analyses.

For reliability studies, our analysis leads us to conclude that the diagnostic procedures used in cranial osteopathy are unreliable in many ways. For efficacy studies, the Cochrane risk of bias tool we used shows that 2 studies had a high risk of bias, 9 were rated as having major doubt regarding risk of bias and 3 had a low risk of bias. In the 3 studies with a low risk of bias alternative interpretations of the results, such as a non-specific effect of treatment, were not considered.

Our results demonstrate, consistently with those of previous reviews, that methodologically strong evidence on the reliability of diagnostic procedures and the efficacy of techniques and therapeutic strategies in cranial osteopathy is almost non-existent.

**Zegarra-Parodi R, de Chauvigny de Blot P, Rickards LD, Renard EO. *Cranial palpation pressures used by osteopathy students: effects of standardized protocol training. J Am Osteopath Assoc. 2009 Feb; 109(2):79-85. [BRCT](#)***

Descriptions of subtle palpatory perceptions in osteopathic cranial palpation can be misperceived by students. Thus, adequate dissemination and replication of cranial palpatory techniques is challenging for osteopathy students.

The objective of the study was to evaluate the effects of standardized protocol training on cranial palpation of the frontomalar suture.

Fourth-year osteopathy students from the European Center for Osteopathic Higher Education in Paris, France, were recruited and randomly divided into three groups.

Students in the study group received instruction in a standardized protocol for palpatory assessment of the frontomalar suture; students in the control group did not receive instruction; and the remaining students acted as subjects. A specialized force sensor was placed on the skin covering the left frontomalar suture of each subject. Student practitioners were instructed to palpate subjects' left frontomalar suture using the customary pressure described for evaluation and treatment of somatic dysfunction of the cranium. Pressure measurements were exported to a laptop computer.

Twelve students were in each group. Student practitioners' palpation pressures ranged from 0.19 to 1.12 N/cm<sup>2</sup>, while mean palpation pressures for each test ranged from 0.27 to 0.98 N/cm<sup>2</sup>.



The mean (SD) palpation pressure in the study group and control group was 0.55 N/cm<sup>2</sup> (0.16 N/cm<sup>2</sup>) and 0.53 N/cm<sup>2</sup> (0.15 N/cm<sup>2</sup>), respectively. There was no statistically significant difference in mean palpation pressures used by the two groups. Substantial variation in test performance was noted in both groups.

Palpatory training was ineffective in improving student practitioners' precision of cranial palpation performance. Quantitative feedback of palpation pressures during training may improve outcomes.

To our knowledge, data on palpation pressures used during osteopathic cranial manipulation have not been reported previously in the medical literature.

**Ferré JC, Chevalier C, Lumineau JP, Barbin JY. *Cranial osteopathy, delusion or reality? Actual Odontostomatol (Paris). 1990 Sep; 44(171):481-94. [CNS](#)***

After having outlined the theories of cranial osteopathy (SUTHERLAND, KARNI, UPLEDGER, and, more recently, CLAUZADE and DARRAILLANS), the authors refute the latter point by point. "Primary respiration" is in fact a way of thinking, and the various bones making up the calvaria and base of the skull, which are solidly synostosed in the adult, are clearly incapable of the pretended rhythmic displacements "described" by the osteopaths.

Moreover, the C.R.L., like any liquid, is incompressible and mildly pulsatile. Conversely, although the brain clearly shows rhythmic pulsations, which every neuro-surgeon notes every day, the latter are exclusively connected to the vascular system.

**Wyatt K, Edwards V, Franck L, Britten N, Creanor S, Maddick A, Logan S. *Cranial osteopathy for children with cerebral palsy: a randomized controlled trial. Arch Dis Child. 2011 Jun; 96(6):505-12. [BRCT](#)***

The objective of the study was to estimate the effect of cranial osteopathy on the general health and wellbeing, including physical functioning, of children with cerebral palsy.

A pragmatic randomised controlled trial was carried out.

The participants of the study were 142 children from Greater London and the South West of England, aged 5-12 years with cerebral palsy.

Participants were randomised to six sessions of cranial osteopathy with a registered osteopath or a waiting list with partial attention control (parents invited to participate in two semistructured interviews).

Blind assessment of motor function by physiotherapists using the Gross Motor Function Measure-66 (GMFM-66) and quality of life using the Child Health Questionnaire (CHQ) PF50 at 6 months.



Parents' assessment of global health and sleep at 6 months, pain and sleep diaries at 10 weeks and 6 months, CHQ PF50 at 10 weeks and quality of life of main carer (Short Form 36) at 10 weeks and 6 months.

Compared with children in the control group, children in the osteopathy group demonstrated no statistically significant differences in GMFM-66 (mean difference 4.9, 95% CI -4.4 to 14.1), CHQ Physical Summary Score (mean difference 2.2, 95% CI -3.5 to 8.0) or CHQ Psychological Summary Score (mean difference 3.4, 95% CI -0.8 to 7.7). There were no significant differences between groups with respect to pain; sleep (either 'time asleep' or 'time to sleep'); or main carer's quality of life. Compared with children in the control group, carers of children receiving cranial osteopathy were nearly twice as likely to report that their child's global health had 'improved' at 6 months rather than 'decreased' or 'remained the same' (38% vs 18%; odds ratio 2.8, 95% CI 1.1 to 6.9).

This trial found no statistically significant evidence that cranial osteopathy leads to sustained improvement in motor function, pain, sleep or quality of life in children aged 5-12 years with cerebral palsy nor in quality of life of their carers.



## ARTICLES SUPPORTING CRANIAL OSTEOPATHY

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### KEY

- › LR = Literature Review.
- › CC = Clinical Case Study.
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- › OS = Observational Study
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- › ES = Epidemiological Study.

### ANATOMICAL TESTS

**Retzlaff EW, Michael D, Roppel R, Mitchell F. *Proceedings: The structures of cranial bone sutures.* J Am Osteopath Assoc. 1976 Feb; 75(6):607-8. [AS](#)**

This study, carried out in 1976, attributed the sensory innervation of the cranial bone and sutures to V1 and V2, as well as the cervical branches of C2 and C3. It described the mechanoreceptors in the sutures.

**Schueler M, Neuhuber WL, De Col R, Messlinger K. *Innervation of rat and human dura mater and pericranial tissues in the parieto-temporal region by meningeal afferents.* Headache. 2014 Jun; 54(6):996-1009. [AS](#)**

The objective of the study was to reinvestigate the innervation pattern of the dura mater of rat and human middle cranial fossa, the morpho-functional substrate of headache generation, and adjacent extracranial tissues with neuronal in vitro tracing.

Anterograde and retrograde neuronal in vitro tracing was made in formaldehyde fixed hemisected rat and human skulls. The fluorescent tracer Dil was applied to proximally cut meningeal nerves in rat and to distal branches of the spinosus nerve in human calvaria lined by dura mater. After several weeks, the dura mater and deep extracranial tissues were examined with fluorescence microscopy.

In addition to a network of meningeal nerve fibers, several fiber bundles were observed, leaving the skull through emissary canals and fissures to innervate the pericranial temporal, parietal, and occipital periosteum. Traced fibers were seen spreading into deep layers of the temporal and upper neck muscles. Retrograde neuronal tracing revealed labeled cell bodies exclusively in the mandibular and maxillary division of the rat trigeminal ganglion, and centrally projecting fibers were identified in the spinal trigeminal tract. Electron microscopy of



the cross-sectioned spinous nerve showed myelinated and unmyelinated axons with similar numbers in human and rat.

We conclude that a proportion of meningeal afferents innervates extracranial tissues like periosteum and pericranial muscles via collaterals projecting through the skull. These afferents may be nociceptive, some may subservise proprioceptive functions. The finding of extracranial projections of meningeal afferents may be important for our understanding of extracranial impacts on headache generation and therapy.

In order to assess whether or not the trigeminal afferents which innervate the specific periosteal receptive field originate from the extracranial nerves which innervate the epicranium, Schueler et al. administered a local injection of lidocaine 2% ( $\mu\text{l} \sim 5$ ) near to one of the three nerves V1/V2, which innervate the epicranial region and which can also innervate the periosteum, which covers the frontal and temporal bones, namely the supraorbital (V1), supratrochlear (V1) and zygomaticotemporal (V2) nerves. To determine whether or not a given neuron in an intracranial periosteal receptive field in the units in which the electrical and mechanical responses evoked were not blocked by extracranial administration of lidocaine, gradual incisions were made in order to separate as much extracranial innervation as possible from the periosteal receptive field, leaving a small periosteal "island" ( $\sim 2 \text{ mm}^2$ ) with a response receptive field in the middle. It was found that the innervation of these neurons began at an intracranial point, probably the meninges. To further explore the origin of the sensory innervation of these neurons, the periosteum was removed and a craniotomy was performed to look for the presence of a dural receptive field, using mechanical and electrical stimulation of the dura mater.

**Bigal ME, Ashina S, Burstein R, Reed ML, Buse D, Serrano D, Lipton RB. *Prevalence and characteristics of allodynia in headache sufferers: a population study*. *Neurology*. 2008 Apr 22; 70(17):1525-33. [AS](#)**

Trigeminal afferents that innervate the calvarial periosteum have slow conduction velocities, slowly adapting responses to mechanical stimuli, and were activated and sensitized following administration of pro-inflammatory mediators to their RF, which supports their involvement in nociception. Inflammatory stimulation of periosteal afferents promotes the development of periorbital tactile hypersensitivity, a sensory change that accompanies primary headaches including migraines.

Extracranial anesthetic blockade of neural traffic in peripheral afferent nerves that innervate extracranial structures as well as less invasive manipulations such as manual therapies thought to decrease afferent input have been suggested to provide headache relief.

**Upledger J, Vredevoogd J. *Craniosacral therapy*. Seattle: Eastland Press. 1983. [AS](#)**

Upledger and Vredevoogd describe tracing single nerve axons from the sagittal suture centralward through the meningeal membranes, to the wall of the 3rd ventricle in monkeys. They search for a 'telegraph system' connecting the cranial suture and the ventricular system of



the brain, hypothesizing that an increase in intra-ventricular pressure corresponds to stretch reflex activity in the connective and intersutural elastic fibers and neurovascular plexuses.

## Conclusion

Cranial sutures contain nerve fibers and mechanoreceptors, which respond to pressure changes. There are axons inside the sutures that transport sensory information to the cranium, which is nociceptive.

Meningeal fibers ensure a very good nerve supply to the posterior part of the falx cerebri, the tentorium cerebelli and the dura mater of the base of the cranium in the middle cranial fossa.

The trigeminal nerve (V1 and V2) and the cervical branches of C2 and C3 are responsible for the sensory innervation of the cranium and the cranial sutures.

Meningeal afferents innervate extracranial tissues such as the periosteum and pericranial muscles via collaterals projecting through the skull. These afferents may be nociceptive, some may subserve proprioceptive functions. It has been suggested that these afferents have a double-size innervation area which seems to innervate the periosteum and the cranial dura mater.

Activating this nociceptive innervation of the periosteum leads to the development of nerve hypersensitivity or allodynia with headaches.

Manual osteopathic therapy manipulations can reduce afferent activity in cases of nerve hypersensitivity.

*The V and X nerves appear to have main afferent pathways in the cranial structures, associated with IX and its cervical roots C1-C2-C3. The anterior part of the cranium is innervated by the trigeminal nerve and the posterior part is innervated by the X nerve and the C1 nerve root.*

## MOVEMENTS AND PALPATION

**Retzlaff EW, Michael DK. *A preliminary study of cranial bone movement in the squirrel monkey.* J Am Osteopath Assoc. 1975 May;74(9):866-9. [AS](#)**

Retzlaff et al., describe experiments designed to test the hypothesis that the cranial bones in adult monkeys move. Movement patterns were recorded in the parietal bones. One of these patterns corresponded with the monkey's breathing rate; another which occurred 5-7 cycles/minute did not correspond to heart rate or to changes in central venous pressure. Cranial bone movement in anesthetized squirrel monkeys was recorded alongside breathing and cardiac activity. The results obtained support the idea that when the animal's head is not firmly fixed, respiratory and cardiac activity corresponds to the bone movements recorded. When the head is firmly fixed using a stereotactic device, which holds the temporal and facial bones in place, a slower movement pattern can be recorded, as well as the movements of the parietal bones. This movement does not correspond to respiratory or cardiac activity.



It was also proven that flexion and extension of the spine produces cranial bone movement, when there is a linear relationship with the movement produced. We propose that this third slower movement may be caused by changes in cerebrospinal fluid pressure and may occur under normal physiological circumstances. These experimental results support the idea that there is more than one type of spontaneous cranial bone movement in adult squirrel monkeys. One movement pattern is directly linked to respiratory and cardiac activity. This activity is characterized by a slow wave, which synchronizes with each respiratory cycle. Alongside this wave is a more rapid, oscillating wave, which is directly correlated to cardiac activity.

One pattern of cranial bone movement was seen when the monkey's head was allowed to move freely from the stereotactic device.

When the head was partially fixed, allowing for limited movement, each of the parietal bones adopted its own frequency of movement. This observation supports the theory that the different cranial bones move independently of each other. In that case, the rapid oscillating wave does not occur at the same rate as the cardiac system. When the head is firmly fixed by a stereotactic device, holding the temporal and facial bones in place, the left and right parietal bones move independently of each other. Flexion and extension of the spine correspond to movements of the left and right parietal bones. When the movement is stopped, the parietal bones resume their rhythmic pattern of motion.

When the head is completely immobilized by fixing the temporal and facial bones, as previously described, the parietal bone pattern of motion is independent of the respiratory and cardiac systems.

Each side has its own frequency of motion, which suggests that the bones move independently of each other and that this type of force produces changes in cerebrospinal fluid pressure, which causes the parietal bones to move. Changes in cerebrospinal fluid pressure produce cranial bone movement in flexion-extension of the spine in monkeys. These movements increase the range of the slow wave and the rapid oscillating wave.

The linear relationship between movements of the spine and movements of the parietal bones indicated that changes in cerebrospinal fluid pressure are responsible for parietal bone movement.

When flexion-extension movements were stopped, the parietal bones assumed their previous rhythmic spontaneous pattern of activity. They concluded that Sutherland's theory was corroborated by these experimental results on cranial bone movement and the belief that changes in cerebrospinal fluid pressure are responsible for spontaneous movement of the bones.

**Retzlaff I, Upledger J, Mitchell F JR et al. *Possible functional significance of cranial bone sutures*. Report, 88th Session Am. Assn. of Anatomists. 1975. [AS](#)**

Several studies were carried out in 1975, analyzing the histology of the sutures, observing the contents of the sutures, noting the presence of nerve fibers and blood vessels.



A study on the mobility of the parietal bones in monkeys demonstrated movement of the parietal bones that was not related to cardiac or respiratory activity.

**Adams T, Heisey RS, Smith MC, Briner BJ. *Parietal bone mobility in the anesthetized cat.* J Am Osteopath Assoc. 1992 May;92(5):599-600, 603-10, 615-22. [AS](#)**

To quantify parietal bone motion in reference to the medial sagittal suture, a newly developed instrument was attached to the surgically exposed skull of anesthetized adult cats. The instrument differentiated between lateral and rotational parietal bone movements around the fulcrum of the suture. Bone movement was produced by external forces applied to the skull and by changes in intracranial pressure associated with induced hypercapnia, intravenous injections of norepinephrine, and controlled injections of artificial cerebrospinal fluid into the lateral cerebral ventricle.

Responses varied considerably among test animals. Generally, lateral head compression caused sagittal suture closure, small inward rotation of the parietal bones, increased intraventricular pressure, transient apnea, and unstable systemic arterial blood pressure.

Graded increases in intracranial volume produced stepped increases in pressure, lateral expansion at the sagittal suture, and outward rotation of the parietal bones. We attribute variations in animal response largely to differences in intracranial and suture compliance among them.

Cranial suture compliance may be an important factor in defining total cranial compliance.

**Herniou JC. *Movilidad de los huesos del cráneo.* Revista Osteopatía. Junio 1999; 10. [PS](#)**

A study of the dynamic modulus of elasticity and the deformability coefficient of the cranium, applying a weak force (500g) to a harmonic cranial suture.

- › Deformation of the suture: 41.65 micrometres.
- › Deformation of the bone: 25 micrometres.

Estimated movement of "beveled" sutures was:

- › Deformation of the suture: 25 micrometres (force applied to the external bevelled border).
- › Deformation of the bone: 6.49 micrometres (force applied to the internal bevelled border).

Estimated movement of "serrated" sutures was:

- › Deformation of the suture: 22.44 micrometres.

The cerebrospinal fluid (CSF) pressure was 0.4 N, equivalent to 40g. This is a negligible force, the CSF cannot be the motor of the system. It moves at a very slow velocity (1 cm/ hour).



**Rommeveaux L. *La Mobilité des Os du Crâne: Une vérité scientifiquement démontrée.* Journal Ostéopathie. Février 1993;(26), 15-18. [ES](#)**

Mechanical captors were placed on the glabella and the bones in the nose to measure the pressure. Oscillations from 0.08 Hz to 0.2 Hz were seen, i.e. 5 to 10 cycles per minute.

**Kostopoulos D, Keramides G. *Changes in magnitude of relative elongation of falx cerebri during application of external forces on frontal bone of embalmed cadaver.* Cranio. 1992 Jan;10(1):9-12. [PS](#)**

The objective of this study, carried out by Kostopoulos and Keramides was to observe “piezo-electric” changes in order to measure the possible elongation of falx cerebri during the application of anterior traction for the frontal lift: an elastic response appears from 140g of traction. With a traction of 642 g, the falx cerebri is elongated by 1.097 mm.

**Lewandoski MA, Drasby E, Morgan M, Zanakis MF. *Kinematic system demonstrates cranial bone movement about the cranial sutures.* JAOA. September 1996. 96,(9): 551; PO1. [PS](#)**

Lewandoski et al. used infra-red markers and a kinematic system, formed of acupuncture needles inserted into the sagittal and parieto-frontal sutures to show a range of motion in the cranial sutures from 245 - 285 micrometres, not just in relation to the malleability of the bone. These rhythmic movements occur at a rate of between 2.25/minute to 1/3 or 4 minutes.

**Lecoq M. *Etude des modifications des pressions et de certains composants biochimiques du liquide céphalo rachidien en rapport avec la mobilisation des os du crâne chez le chien.* Thèse de doctorat de 3<sup>o</sup> cycle, agronomie, physiologie animale appliquée. Université de Rennes. Novembre 1980. [PS](#)**

The theory developed by Lecoq in his study is that it is the meningeal and interosseous membrane elements that cause the cranial bones to turn in internal rotation. External rotation is caused by an increase in cerebrospinal fluid pressure. Fluctuations in cerebrospinal fluid are essentially caused by thoracic respiration, taking into account the frequency and range of motion. He concludes that cranial bone mobility is affected by rhythmic variations in cerebrospinal fluid pressure, mainly caused by diaphragmatic breathing.



## CSF PULSATIONS

**Levy LM, Di Chiro G. *MR phase imaging and cerebrospinal fluid flow in the head and spine. Neuroradiology. 1990; 32(5):399-406. PS***

Motion of the cerebrospinal fluid (CSF) in and around the brain and spinal cord was examined in healthy subjects and in a number of patients with abnormalities of the CSF circulation.

The pulsatile motion of the CSF was determined by spin echo phase (velocity) imaging, sometimes in combination with gradient echo phase contrast cine. Differences in flow patterns across CSF spaces were observed: flow reversal in the cerebellomedullary cistern and lumbar area relative to cervical CSF, and in the posterior versus the anterior subarachnoid space in the spinal canal.

Flow communication was demonstrated in known communicating cysts or cavities. Differences in flow were also noted across spinal narrowing or block, and across the walls of a variety of cystic lesions in the brain and spinal cord. MR phase imaging of CSF flow provides pathophysiological information of potential clinical importance for the assessment of diseases affecting the CSF circulation.

**Quencer RM, Post MJ, Hinks RS. *Cine MR in the evaluation of normal and abnormal cerebrospinal fluid flow: intracranial and intraspinal studies. Neuroradiology. 1990; 32(5):371-91. PS***

Evaluation of intracranial and intraspinal CSF flow was accomplished by the use of cardiac gated gradient echo magnetic resonance (MR) technique. Normal patterns of pulsatile flow within the ventricles, cisterns and cervical subarachnoid space were established by this technique and these observations were compared to prior description of CSF flow. With systole there is downward (caudal) flow of CSF in the aqueduct of Sylvius, the foramen of Magendie, the basal cisterns and the dorsal and ventral subarachnoid spaces while during diastole, upward (cranial) flow of CSF in these same structures is seen. The relationships between the cardiac cycle and the CSF pulsations are demonstrated on both magnitude reconstruction and phase reconstruction MR images. Calculations of actual fluid velocity within CSF containing spaces can be obtained from the phase reconstruction images and holds promise for a more accurate analysis of CSF flow. In conditions which result in alterations of flow, cine MR dramatically shows either obstruction or excessively turbulent flow within the CSF pathways. The site of obstructed flow whether in the third ventricle, aqueduct, fourth ventricle, or subarachnoid space can be appreciated by changes in or absence of the normal hypointense signal.

The use of cine MR for the analysis of CSF flow is useful in a wide range of pathological conditions including, but not limited to, conditions resulting in hydrocephalus or cystic cord lesions.



**Greitz D, Wirestam R, Franck A, Nordell B, Thomsen C, Ståhlberg F. *Pulsatile brain movement and associated hydrodynamics studied by magnetic resonance phase imaging. The Monro-Kellie doctrine revisited. Neuroradiology. 1992; 34(5):370-80. [PS](#)***

In 1992, brain tissue movements were studied in axial, sagittal and coronal planes in 15 healthy volunteers, using a gated spin echo MRI sequence. All movements had characteristics different from those of perfusion and diffusion. The highest velocities occurred during systole in the basal ganglia (maximum 1.0 mm/s) and brain stem (maximum 1.5 mm/s). The movements were directed caudally, medially and posteriorly in the basal ganglia, and caudally-anteriorly in the pons. Caudal and anterior motion increased towards the foramen magnum and towards the midline. The resultant movement occurred in a funnel-shaped fashion as if the brain were pulled by the spinal cord. This may be explained by venting of brain and cerebrospinal fluid (CSF) through the tentorial notch and foramen magnum. The intracranial volume is assumed to be always constant by the Monro-Kellie doctrine.

The intracranial dynamics can be viewed as an interplay between the spatial requirements of four main components: arterial blood, capillary blood (brain volume), venous blood and CSF.

**Greitz D. *Cerebrospinal fluid circulation and associated intracranial dynamics. A radiologic investigation using MR imaging and radionuclide cisternography. Acta Radiol Suppl. 1993; 386:1-23. [PS](#)***

CSF flow and associated hemodynamics were studied using gated MR imaging, in 26 healthy volunteers. The subarachnoid space (SAS) was divided into 5 compartments depending on the magnitude of the pulsatile CSF flows: a high velocity compartment in the area of the brain stem and spinal cord, 2 slow ones at the upper and lower extremes of the SAS, and finally 2 intermediate velocity compartments in between. The main pulsatile spinal flow channel had a meandering pattern. The extraventricular CSF-circulation can be explained by pulsatile CSF flow without the necessity of assuming existence of a net flow. A successive time offset during the cardiac cycle has been found in the fronto-occipital direction of the interplay between the arterial expansion, brain expansion, and volume changes of the CSF spaces and of the veins. It is proposed to name this time offset the intracranial "volume wave" (VoW).

**Henry-Feugeas MC, Idy-Peretti I, Blanchet B, Hassine D, Zannoli G, Schouman-Claeys E. *Temporal and spatial assessment of normal cerebrospinal fluid dynamics with MR imaging. Magn Reson Imaging. 1993; 11(8):1107-18. [PS](#)***

Cerebrospinal fluid (CSF) pulsations result from change of blood volume in the closed craniospinal cavity. We used cine phase contrast MR analysis to determine whether spinal CSF pulsations result from spinal vascular pulsations or intracranial subarachnoid pulsations, whether intracranial CSF pulsations result from intracranial large arteries pulsations or cerebrovascular bed changes.



We performed a quantified physiological mapping of CSF velocity waveforms along the craniospinal axis. Thirty six volunteers participated in the study. MR acquisitions were obtained at the intracranial level, the upper, midcervical, cervicothoracic, mid thoracic, and/or the thoracolumbar levels.

The temporal velocity information were plotted as wave form and key temporal parameters were determined and analyzed; intervals from the R wave to the onset of CSF systole, to CSF systolic peak, to the end of systole, as well as duration of systole.

Three kinds of dynamic channels could be differentiated along the spinal axis, the lateral, medioventral and mediodorsal channels. Lateral spinal CSF pulse waves show significant craniocaudal propagation. No such significant progression was detected through the medial channels along the spine.

Through the medial channels, a cephalic progression was observed from the upper cervical level to the intracranial level. At the craniocervical junction, mediodorsal CSF systole appeared the earliest one whereas in the anterior intracranial basal cistern, CSF systole appeared delayed.

In conclusion, spinal CSF pulsations seem to result mainly from intracranial pulsations in the lateral channels, whereas local vascular pulsations could modify CSF pulse wave mainly in the medial channels. At the craniocervical junction, our results suggest that blood volume change in the richly vascularised cerebellar tonsils is the main initiating factor of CSF systole; and that spinal vascular pulsations could be considered as an additional early and variable CSF pump.

**Moskalenko Y. *On the cerebral pulsation in the closed cranial cavity.* Akademiia Nauk SSR Izvestiia Serii Biolog. 1961; 2:620–629. [PS](#)**

We can conclude from human and animal studies that, in normal conditions, there are continuous and complex changes in the volume of cerebrospinal fluid in the hermetic cavity of the skull.

Displacements of cerebrospinal fluid between the cavities of the cranium and the spine are periodic (corresponding to respiration and the waves of the 3<sup>rd</sup> ventricle and non-periodic (linked to slow changes in the volume of blood in the cranial cavity). These displacements of cerebrospinal fluid are generally associated with small changes in intracranial pressure. Due to the velocity of the displacement of cerebrospinal fluid between the brain and the spine, space in the cavities is limited. Redistribution of cerebrospinal fluid and venous blood in the cranial cavity compensate for rapid changes to blood supply in the cranial cavity.

This is associated with significant variations in intracranial pressure and this phenomenon is known as “cerebral pulsation”. Pulsation actually occurs in the hermetic cavity of the skull and is caused by periodic variations in intracranial pressure and the pressure in the cerebral blood vessels, caused by the displacement of cerebrospinal fluid between the various regions of the cranial cavity, as well as venous outflow from the cranium.

The velocity of the distribution of blood flow within the hermetic cavity of the cranium is twenty times greater than the velocity of the cerebral circulatory system in general. The close



link between intracranial pressure and venous blood pressure indicates a direct transmission of the arterial pulse wave to the venous system through the capillary bed.

This marries two sets of appealingly conflicting data: the presence of cerebral pulsation and uninterrupted circulation in the cerebral capillaries. All of these facts point to anomalies, which can be found in the Monroe-Kelly doctrine. All of this data allows us to conclude that one of the basic characteristics of the hemodynamics of cerebral circulation is the diversion of uninterrupted fluctuations of cerebrospinal fluid, which appears to serve as an active mechanism to maintain an essential level of cerebral circulation. The diversion of cerebrospinal fluid forms the basis of the mechanism that permits the neurohumeral regulation of cerebral circulation within a hermetic, non-expandable cranial cavity.

The limitation of the velocity at which cerebrospinal fluid is displaced plays an essential role in protecting the tissue in the central nervous system against mechanical damage because it reduces the impact of rapid, unexpected shocks.

The participation of cerebrospinal fluid in the direct transmission of the arterial pulse wave to the venous system creates the optimum conditions for utilizing the oxygen in the capillary bed in the brain because it allows for regular, uninterrupted blood flow.

The correct functioning of the most important organ in humans and animals- the brain- is largely determined by its blood supply, which ensures a constant supply of sufficient nutritional material to the brain whilst removing its waste products.

## Conclusion

Spinal CSF pulsations seem to result mainly from intracranial pulsations in the lateral channels, whereas local vascular pulsations could modify CSF pulse wave mainly in the medial channels.

Three successively initiated phenomena may explain the temporal course of CSF motion: the systolic expansion of the main arteries at the base of the brain, the systolic expansion of the cerebrospinal axis and, finally the systolic expansion of the choroid plexuses.

Lateral spinal CSF pulse waves show significant craniocaudal propagation. No such significant progression was detected through the medial channels along the spine, which contradicts the theory that CSF travels from the skull to the end of the spinal dural sac 10-12 times per minute.

During a moderate increase in intracranial pressure, when the regulation mechanisms in the brain are functioning efficiently, Doppler flow velocity is not affected by changes in intracranial pressure.

**Sabini RC, Elkowitz DE. *Significance of differences in patency among cranial sutures.* J Am Osteopath Assoc. 2006 Oct; 106(10):600-4. [AS](#)**

The objective was to evaluate the gross external characteristics of the coronal, lambdoid, and sagittal sutures in human cadaver skulls and determine if a difference exists in terms of patency, sex, and age.



The coronal, lambdoid, and sagittal sutures were described using a modified grading scale to quantify sutural patency.

An open suture was graded as 0, a fused suture as 1, and an obliterated suture as 2, 3, or 4, depending on the extent of obliteration.

Thirty-six skulls were examined, including 17 female and 19 male (age range, 56-101 y).

When compared with the sagittal suture, the lambdoid suture was significantly more likely to be patent and least likely to be obliterated. No significant difference in suture grades was found between female and male skulls, and no significant difference was found between age and suture grade.

The prolonged patency of the lambdoid suture may be due to external forces, such as the greater number of muscles affecting the lambdoid suture when compared with the sagittal suture.

## OSTEOPATHIC AND CRANIAL RHYTHMIC IMPULSES

The rate of the CSR palpated by two examiners is not consistent. The results of the regression analysis of one examiner offered no validation to those of the other.

It appears that a subject's CSR is not related to the heart or respiratory rates of the subject or the examiner.

**Gard G. *An investigation into the regulation of intra-cranial pressure and its influence upon the surrounding cranial bones.* J Bodyw Mov Ther. 2009 Jul; 13(3):246-54. [PS](#)**

The aim of this study is to present a rational coherent hypothesis to explain the palpable involuntary movements of the cranium.

The arterial and venous anatomy inside and around the skull and spinal column presents a complete vascular system with the capacity to regulate intra-cranial pressure to a level of equilibrium slightly higher than atmospheric pressure.

Variations in cerebrospinal fluid (csf) pressure control the volume of blood draining through the cavernous sinus and hence into the inter-vertebral venous plexus in relation to the jugular vein.

Stable intra-cranial pressure is maintained by a controlled release of venous blood through the inter-vertebral venous plexus (slow) and the jugular vein (fast) in the cavernous sinus. Any distortion of the skull from its healthy state will lead to reduced intra-cranial volume.

The process of release from the state of compression has been interpreted as "cranial rhythm" but may be a mechanical adjustment increasing the internal volume of the skull, aided by the continual maintenance of stable intracranial pressure.

This involuntary movement is capable of being assisted manually.



**McPartland JM, Mein EA. *Entrainment and the cranial rhythmic impulse. Altern Ther Health Med.* 1997 Jan; 3(1):40-5. [PS](#)**

All organisms pulsate with myriad electrical and mechanical rhythms. Many of these rhythms emanate from synchronized pulsating cells (e.g., pacemaker cells, cortical neurons).

The cranial rhythmic impulse is an oscillation recognized by many bodywork practitioners, but the functional origin of this impulse remains uncertain.

We propose that the cranial rhythmic impulse is the palpable perception of entrainment, a harmonic frequency that incorporates the rhythms of multiple biological oscillators. It is derived primarily from signals between the sympathetic and parasympathetic nervous systems. Entrainment also arises between organisms.

The harmonizing of coupled oscillators into a single, dominant frequency is called frequency-selective entrainment.

We propose that this phenomenon is the modus operandi of practitioners who use the cranial rhythmic impulse in craniosacral treatment.

**Norton JM. *A tissue pressure model for palpatory perception of the cranial rhythmic impulse. J Am Osteopath Assoc.* 1991 Oct; 91(10):975-7, 980, 983-4 passim. [PS](#)**

A tissue pressure model was developed to provide a possible physiologic basis for the manifestation of the cranial rhythmic impulse (CRI).

The model assumes that the sensation described as the CRI is related to activation of slowly adapting cutaneous mechanoreceptors by tissue pressures of both the examiner and the subject, and that the sources of change in these tissue pressures are the combined respiratory and cardiovascular rhythms of both examiner and subject.

The model generates rhythmic impulses with patterns similar to those reported for the CRI.

Also, a significant correlation was found between frequencies calculated from the model and published values for CRI obtained by palpation.

These comparisons suggest that the CRI may arise in soft tissues and represents a complex interaction of at least four different physiologic rhythms.

**Chikly B, Quaghebeur J. *Reassessing cerebrospinal fluid hydrodynamics: a literature review presenting a novel hypothesis for cerebrospinal fluid physiology. J Bodyw Mov Ther.* 2013 Jul; 17(3):344-54. [LR](#)**

The traditional model of cerebrospinal fluid (CSF) hydrodynamics is being increasingly challenged in view of recent scientific evidences. The established model presumes that CSF is primarily produced in the choroid plexuses (CP), then flows from the ventricles to the subarachnoid spaces, and is mainly reabsorbed into arachnoid villi (AV). This model is seemingly based on



faulty research and misinterpretations. This literature review presents numerous evidence for a new hypothesis of CSF physiology, namely, CSF is produced and reabsorbed throughout the entire CSF-Interstitial fluid (IF) functional unit.

IF and CSF are mainly formed and reabsorbed across the walls of CNS blood capillaries. CP, AV and lymphatics become minor sites for CSF hydrodynamics. The lymphatics may play a more significant role in CSF absorption when CSF-IF pressure increases.

The consequences of this complete reformulation of CSF hydrodynamics may influence applications in research, publications, including osteopathic manual treatments.

**Farasyn A, Vanderschueren F. *The decrease of the cranial rhythmic impulse during maximal physical exertion: ¿an argument for the hypothesis of venomotion?* Journal of Bodywork and Movement Therapies. January 2001. (5); 1,56-69. [PS](#)**

In this study we will attempt to discover whether a brief physical peak effort has an influence on the CRI. We will assume that there is, in the case of maximal exertion, a brief shift of the  $\text{CO}_2/\text{O}_2$  volume ratio (RER), which serves as a measure for the energy consumption within the blood vessels. In analogy with this physiological phenomenon we would expect a decrease of the CRI. Three examiners (twice) palpated the cranium and the sacrum for the CRI as well as the vena femoralis for local vasomotion (LVMvf) on a group of healthy subjects (n=15). The examiners changed places during the examination both before and after the exertion test performed by the subject. The study showed that the reproducibility of all measurements is exceptionally high and that there are no significant differences with respect to rhythm between the three measured locations on the body.

The physical effort was determined by measuring the supplied physical strain within a certain time.

The respiratory ratio (RER) was determined as the  $\text{CO}_2$  in the bloodstream. Together with the values of lactic acid  $\text{O}_2$  concentration these data were used as explanatory variables and compared to the outcome variables, i.e. the CRI of the cranium (CRI cranium), the CRI of the sacrum (CRI sacrum), cardiac pulse (CAP) and local vasomotion of the vena femoralis (LVMvf). It was found that for each of these research variables there was a significantly high difference associated with the exertion test. The experiment demonstrated that 20 min post-test, a maximal exertion test yields a significant decrease of the three measured rhythms of the CRI cranium, CRI sacrum and LVMvf, with an average reduction of 30%. This suggests that the common decrease probably points to a relation between 'CRI' and the decrease of  $\text{O}_2$  concentration in the bloodstream. The CRI decreases after effort as a result of the simultaneously occurring reduced vasomotricity and does not show a proportional increase due to increased cardiac rhythm. As the three rhythms, CRI cranium, CRI sacrum and LVMvf, which were measured simultaneously, correspond both before and after the exertion test, and since all three rhythms decreased markedly following exertion, it is possible to hypothesize that venous vasomotricity is probably one of the forces behind CRI.



A correlation has been established between the Traube-Hering-Mayer oscillation in blood-flow velocity, and the cranial rhythmic impulse.

Statistical comparisons demonstrated that the CRI is palpably concomitant with the low-frequency fluctuations of the THM oscillation.

Cranial manipulation affects the blood-flow velocity oscillation in its low-frequency Traube-Hering-Mayer components. Because these low-frequency oscillations are mediated through parasympathetic and sympathetic activity, it is concluded that cranial manipulation affects the autonomic nervous system.

Osteopaths tend to palpate the cranial rhythmic impulse and Traube-Hering oscillation.

CRI is related to activation of slowly adapting cutaneous mechanoreceptors by tissue pressures of both the examiner and the subject, and that the sources of change in these tissue pressures are the combined respiratory and cardiovascular rhythms of both examiner and subject.

Palpatory training was ineffective in improving student practitioners' precision of cranial palpation performance.

Stasis of the cerebrospinal fluid (CSF) in the spinal canal is detrimental to health. A disruption to CSF flow may be associated with adverse mechanical cord tension, vertebral subluxation syndrome, reduced cranial rhythmic impulse, and restricted respiratory function.

CSF is produced and reabsorbed throughout the entire CSF-Interstitial fluid (IF) functional unit. The lymphatics may play a more significant role in CSF absorption when CSF-IF pressure increases.

This complete reformulation of CSF hydrodynamics may influence osteopathic manual treatments.

The palpatory perception of CRI or PRM is associated with the activation of cutaneous mechanoreceptors in the hand. Changes in these tissue pressures are associated with respiratory, cardiovascular and lymphatic rhythm. This would also explain palpation of the PRM in the skull.

**Nelson KE, Sergueef N, Lipinski CM, Chapman AR, Glonek T. *Cranial rhythmic impulse related to the Traube-Hering-Mayer oscillation: comparing laser-Doppler flowmetry and palpation.* J Am Osteopath Assoc. 2001 Mar; 101(3):163-73. [OS](#)**

The primary respiratory mechanism (PRM) as manifested by the cranial rhythmic impulse (CRI), a fundamental concept to cranial osteopathy, and the Traube-Hering-Mayer (THM) oscillation bear a striking resemblance to one another. Because of this, the authors developed a protocol to simultaneously measure both phenomena.

Statistical comparisons demonstrated that the CRI is palpably concomitant with the low-frequency fluctuations of the THM oscillation as measured with the Transonic Systems BLF 21 Perfusion Monitor laser-Doppler flowmeter.



This opens new potential explanations for the basic theoretical concepts of the physiologic mechanism of the PRM/CRI and cranial therapy.

Comparison of the PRM/CRI with current understanding of the physiology of the THM oscillation is therefore warranted.

Additionally, the recognition that these phenomena can be simultaneously monitored and recorded creates a new opportunity for further research into what is distinctive about the science and practice of osteopathic medicine.

**Nelson KE, Sergueef N, Glonek T. *Recording the rate of the cranial rhythmic impulse.* J Am Osteopath Assoc. 2006 Jun; 106(6):337-41. [OS](#)**

The rate of the cranial rhythmic impulse can be obtained by both palpation and instrumentation.

However, the literature has reported higher rates obtained by instrumentation compared with palpation.

The cranial rhythmic impulse has been demonstrated to be synchronous with the Traube-Hering oscillation, measured in blood flow velocity.

The current study demonstrates that physicians tend to palpate the cranial rhythmic impulse and Traube-Hering oscillation in a 1:2 ratio.

This finding provides an explanation for the difference between palpated and instrumentally recorded rates for the cranial rhythmic impulse.

**Crow WT, King HH, Patterson RM, Giuliano V. *Assessment of calvarium structure motion by MRI.* Osteopath Med Prim Care. 2009 Sep 4; 3:8. [PS](#)**

Practitioners of manual medicine/manual therapy (MM/MT) who utilize techniques thought to have some impact upon and move the solid structures of the human head have been criticized for lack of evidence of cranial bone motion. The present study utilized magnetic resonance imagery (MRI) technology to address the question of whether or not inherent (non-operator initiated) calvarial structure motion can be assessed.

Twenty healthcare professionals, (physicians, nurses, medical students, pharmacists) between the ages of 24 and 52 were recruited. Seven females (ages 25-47, mean age 36.7) and 13 males (ages 25-53, mean age 31.2) volunteered. MRI scans were acquired at 450 ms per slice, in a 1.5 Tesla Signa Excite HD closed MRI system. The same scan prescription was repeated serially every 45 seconds to obtain eight serial slices for each subject.

Image analysis was accomplished using ImageJ software (ImageJ 1.33 u National Institutes of Health, USA). Data from all eight images for each of the 20 subjects were analyzed to determine the two images with the largest differences in the parameters measured.



Difference values for the measures of area, width, height, major axis, and feret were statistically different whereas the measures for perimeter and minor axis were not. However, only the difference values for area were both statistically different ( $p < 0.003$ ) and exceeded the resolution threshold of 0.898 mm/pixel.

The statistically significant difference value for area is suggestive of inherent motion in calvarial structures, and adds to the body of evidence supportive of biomechanically measurable calvarial structure motion in general. That the total intracranial area appeared to expand and recede was consistent with theory and prior studies suggestive of calvarial structure motion due to intracranial fluid volume changes.

The use of MRI technology was able to demonstrate calvarial structure motion at a level exceeding the resolution threshold, and provides a means for further research on phenomena related to the cranial concept. It may be just a matter of time until increased resolution of MRI technology and image analysis provide the ability to examine more detailed areas of specific cranial bone motion.

**Oleski SL, Smith GH, Crow WT. *Radiographic evidence of cranial bone mobility.* Cranio. 2002 Jan; 20(1):34-8. [LR](#)**

The purpose of this retrospective chart review was to determine if external manipulation of the cranium alters selected parameters of the cranial vault and base that can be visualized and measured on X-ray.

Twelve adult patient charts were randomly selected to include patients who had received cranial vault manipulation treatment with a pre- and post-treatment x-ray taken with the head in a fixed positioning device.

The degree of change in angle between various specified cranial landmarks as visualized on x-ray was measured.

The mean angle of change measured at the atlas was 2.58 degrees, at the mastoid was 1.66 degrees, at the malar line was 1.25 degrees, at the sphenoid was 2.42 degrees, and at the temporal line was 1.75 degrees. 91.6% of patients exhibited differences in measurement at 3 or more sites.

This study concludes that cranial bone mobility can be documented and measured on x-ray.

**Halma HD, Degenhardt BF, Snider KT Johnson JC, Flaim MS, Bradshaw D. *Intraobserver reliability of cranial strain patterns as evaluated by osteopathic physicians: a pilot study.* J Am Osteopath Assoc 2008 Sep; 108(9):493-502. [OS](#)**

Few studies of inter- or intraobserver reliability have focused on evaluations of cranial strain patterns.



The objective of this study was to determine whether substantial intraobserver reliability can be achieved by osteopathic physicians (DOs) using common palpatory tests to diagnose cranial dysfunction.

Forty-eight subjects were divided into three diagnostic groups, categorized as those with asthma, headaches, or neither asthma nor headaches (ie, healthy control group). Two blinded DO examiners separately evaluated approximately 8 subjects from each group (4 subjects per session), conducting diagnostic tests for cranial rhythmic impulse (CRI) rate, cranial strain patterns, and quadrants of restriction.

Overall, among the three diagnostic procedures, cranial strain patterns showed the highest intraobserver reliability ( $\kappa=0.67$ ). The highest intraobserver reliability was achieved in cranial strain patterns for the control group ( $\kappa=0.82$ ), followed by the headache ( $\kappa=0.67$ ) and asthma ( $\kappa=0.52$ ) groups.

Diagnoses of the left anterior quadrant of restriction also showed substantial intraobserver reliability for the headache and control groups ( $\kappa=0.60$  and  $0.61$ , respectively).

Diagnoses of three quadrants of restriction showed moderate overall intraobserver reliability ( $\kappa=0.44-0.52$ ), while the left posterior quadrant had only fair overall intraobserver reliability ( $\kappa=0.33$ ).

Osteopathic physicians can obtain substantial intraobserver reliability when diagnosing cranial strain patterns in healthy subjects as well as those with asthma or headache.

However, results are less promising for diagnoses of CRI and quadrants of restriction.

### General conclusion

There is no doubt that there is micro-mobility at the facial and cranial sutures: there is significant clinical evidence.

Alterations to the rhythmic pressure in the bones of the skull are accompanied by rhythmic fluid fluctuations.

Changes to the formation of sutures correspond to the elasticity of the skull and the intersutural tissue.

The sagittal suture is displaced by mm, while the parietal bones are displaced in internal-external rotation.

Sutural mobility ranges from 25 to 41  $\mu$  and bone elasticity ranges from 6 to 25  $\mu$ .

The bone elasticity of the maxilla produces a rhythmic intermaxillary movement (9 cycles/minute) with a range of 1.5 mm.

The existence of a primary respiratory mechanism is called into question as there is no motor for the mechanism. Dilation of the cerebral ventricles cannot be responsible and the cerebrospinal fluid (CSF) pressure is 0.4 N, equivalent to 40g. The pressure is negligible so CSF



cannot be the motor of the system. Displacement velocity is very slow (1 cm/ hour): the most reasonable, straight-forward explanation is that diaphragmatic breathing is the motor of the mechanism.

We might put forward the following explanation:

- › Diaphragmatic inhalation is accompanied by an increase in the anteroposterior and transverse diameter of the ribcage, which can reduce physiological thoracic kyphosis, which affects the lumbar and cervical spine, reducing spinal curvature.
- › This mechanism produces sacral FLEXION, synchronous with diaphragmatic inhalation.
- › A decrease in spinal curvature increases the distance between the occiput and the cervicothoracic junction, which stretches the posterior and anterior cervical aponeuroses (sternocleidomastoid, upper trapezius etc.) and produces occipital FLEXION and a relative elevation of the sphenobasilar synchondrosis. From this point onwards, the classic mechanical descriptions explain each movement of each bone in the skull correctly.

## THE EFFECTS ON VARIOUS PATHOLOGIES

### Ophthalmology

**Sánchez Jorge S, Palomeque del Cerro L. *Influencia de la técnica de bombeo del globo ocular en la presión intraocular en sujetos hipertensos sometidos a medicación. Osteopatía Científica 2010;5:17-24. [BRCT\\*](#)***

Intraocular hypertension is a commonly occurring pathology and its prevalence increases with age.

High intraocular pressure over a period of several years is a risk factor for developing glaucoma.

The main objective of this study is to evaluate the effect of the pump technique applied to the eyeball on intraocular pressure in patients with ocular hypertension, controlled by medication.

The study also seeks to analyze the relationship between intraocular pressure (IOP), systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR).

A randomized clinical trial. 60 patients were selected with ocular hypertension- men and women, aged between 18 and 65, taking medication to treat the hypertension (beta-blockers). They were randomly divided into two groups: an intervention group and a control group. The IOP, SBP, DBP and HR were measured in all of the subjects in the same conditions before applying the technique, immediately afterwards and 15 minutes afterwards.

The IOP was measured using a portable applanation tonometer (Kowa tonometer HA-2).

The IOP level in subjects with hypertension taking medication measured immediately after applying the pump technique to the eyeball was statistically significantly lower ( $p < 0.001$ ) than before applying the technique and after applying the placebo. The results were the same after 15 minutes ( $p < 0.001$ ). There was a strong correlation between the IOP and SBP each



time they were measured ( $p < 0,05$ ) and it was a positive correlation i.e. when one increases, so does the other.

**Pérez Navarro Vicent Capó i Giner JV. *Eficacia de la técnica osteopática de liberación del hueso lagrimal en la obstrucción congénita del conducto nasolagrimal. Osteopatía Científica 2009;4:79-85. [BRCT](#)\****

The objective of the study was to analyse the effectiveness of the lacrimal bone release technique in children with congenital nasolacrimal duct obstruction (CNLDO).

A randomized, simple blind experimental study with a placebo group. In order to carry out this study, a sample of 30 subjects was taken from both sexes, aged between 2 weeks and 9 months, diagnosed with CNLDO. 36 eyes were studied in total. The subjects were randomly divided into two groups: an intervention group, which received the treatment once and a placebo group, which received a placebo technique. The indicators used to evaluate the effectiveness of the technique were the fluorescein dye disappearance test (FDDT) and the modified Jones Test. The FDDT and Jones tests were carried out in both groups before the treatment (FDDT1/Jones1), immediately after the treatment (FDDT2/Jones2) and 14 days after the treatment (FDDT3/Jones3).

In the intervention group, the FDDT2 results ( $1.68 \pm 0.58$ ) and Jones2 results were significantly lower than in the placebo group ( $p < 0.05$ ). There was no statistically significant difference between the FDDT3 results ( $1.474 \pm 0.513$ ) and Jones3 results in the intervention group and the placebo group ( $p > 0.05$ ).

The osteopathic lacrimal bone release technique produced lower FDDT results and higher Jones test results in the intervention group immediately after the treatment. It can therefore be concluded that this technique is an effective short term treatment for CNLDO.

**Sandhouse ME, Shecht man D, Sorkin R, Drowns JL, Cabin-Martinez AJ 3rd, Patterson MM, Shallow-Hoffmann J, Cardigan P, Snyder A. *Effect of osteopathy in the cranial field on visual function--a pilot study. J Am Osteopath Assoc. 2010 Apr; 110(4):239-43. [BRCT](#)***

The effects of osteopathy in the cranial field on visual function-particularly on changes in the visual field and on the binocular alignment of the eyes-have been poorly characterized in the literature.

The authors examined whether osteopathy in the cranial field resulted in an immediate, measurable change in visual function among a sample of adults with cranial asymmetry.

Randomized controlled double-blinded pilot clinical trial.

40 adult volunteers between ages 18 and 35 years who were free of strabismus or active ocular or systemic disease were recruited. Inclusion criteria were refractive error ranging



between six diopters of myopia and five diopters of hyperopia, regular astigmatism of any amount, and cranial somatic dysfunction.

All subjects were randomly assigned to the treatment or control group. The treatment group received a single intervention of osteopathy in the cranial field to correct cranial dysfunction.

The control group received light pressure of a few ounces of force applied to the cranium without osteopathic manipulative treatment.

Preintervention and postintervention optometric examinations consisted of distant visual acuity testing, Donder push-up (i.e., accommodative system) testing, local stereoacuity testing, pupillary size measurements, and vergence system (i.e., cover test with prism neutralization, near point of convergence) testing.

Global stereoacuity testing and retinoscopy were performed only in preintervention to determine whether subjects met inclusion criteria.

Analysis of variance (ANOVA) was performed for all ocular measures. Twenty-nine subjects completed the trial-15 in the treatment group and 14 in the control group. A hierarchical ANOVA revealed statistically significant effects within the treatment group and within the control group ( $P < .05$ ) in distance visual acuity of the right eye (OD) and left eye (OS), local stereoacuity, pupillary size measured under dim illumination OD and OS, and near point of convergence break and recovery.

For the treatment group vs the control group, a statistically significant effect was observed in pupillary size measured under bright illumination OS ( $P < .05$ ).

The present study suggests that osteopathy in the cranial field may result in beneficial effects on visual function in adults with cranial asymmetry. However, this finding requires additional investigation with a larger sample size and longer intervention and follow-up periods.

**Sandhouse ME, Shechtman D, Fecho G, Timoshkin EM. *Effect of Osteopathic Cranial Manipulative Medicine on Visual Function.* J Am Osteopath Assoc. 2016 Nov 1; 116(11):706-714. [BRCT](#)**

Effect of Osteopathic Cranial Manipulative Medicine on Visual Function. Based on a pilot study conducted by their research group, the authors conducted a study that examined whether OCMM produced a measurable change in visual function in adults with cranial asymmetry.

Randomized, controlled, double-blinded clinical trial. The intervention and control (sham therapy) were applied during 8 weekly visits, and participants in both groups received 8 weekly follow-up visits.

Adult volunteers aged between 18 and 35 years with unremarkable systemic or ocular history were recruited. Inclusion criteria were refractive error between 6 diopters of myopia and 5 diopters of hyperopia, regular astigmatism of any amount, and cranial somatic dysfunction.



All participants were evaluated for cranial asymmetry and randomly assigned to the treatment or sham therapy group. The treatment group received OCMM to correct cranial dysfunctions, and the sham therapy group received light pressure applied to the cranium.

Preintervention and postintervention ophthalmic examinations consisted of distance visual acuity testing, accommodative system testing, local stereoacuity testing, pupillary size measurements, and vergence system testing. A x2 analysis was performed to determine participant masking.

Analysis of variance was performed for all ophthalmic measures.

Eighty-nine participants completed the trial, with 47 in the treatment group and 42 in the sham therapy group. A hierarchical analysis of variance revealed statistically significant within-groups effects ( $P < .05$ ) from before the intervention to visit 16 in distance visual acuity of both eyes, local stereoacuity, Donder pushup in both eyes, and near point of convergence break and recovery.

For treatment group vs sham therapy group, a statistically significant effect ( $P < .05$ ) was observed from before the intervention to visit 16 in pupillary size under bright light in the left eye and in near point of convergence break.

Osteopathic cranial manipulative medicine may affect visual function in adults with cranial asymmetry. Active motion testing of the cranium for somatic dysfunction may affect the cranial system to a measurable level and explain interrater reliability issues in cranial studies.

## MIGRAINES AND HEADACHES

**Voigt K, Liebnitzkv J, Burmeister U, Sihvonen-Riemenschneider H, Beck M, Voigt R, Bergmann A. *Efficacy of osteopathic manipulative treatment of female patients with migraine: results of a randomized controlled trial. J Altern Complement Med. 2011 Mar;17(3):225-30. [BRCT](#)***

Migraine is one of the most prevalent neurological disorders in Europe, severely affecting ability to work and quality of life. Medical therapies are considered to be the “gold standard” of treatment.

This study addresses osteopathic treatment for acute therapy or prophylactic therapy as an alternative to traditional therapies.

Forty-two (42) female patients with migraine were randomized into an intervention group ( $n = 21$ ) and a control group ( $n = 21$ ). Outcomes were evaluated with three questionnaires before the treatment ( $t_1$ ) and 6 months later ( $t_2$ ).

The intervention group received five 50-minute osteopathic manipulative treatments (OMT) over a 10-week period. The control group did not receive OMT, sham treatment, or physical therapy.



Patients of this group only filled the questionnaires. Both groups continued with previously prescribed medication.

The Migraine Disability Assessment (MIDAS) and Short Form-36 (SF-36) questionnaires as well as a German "pain questionnaire" were used to assess pain intensity, the impact of migraine on daily life and health-related quality of life (HRQoL), and the number of days subjects suffered from migraine.

Three (3) of the eight HRQoL domains of the SF-36 form in the intervention group showed significant improvement (from t1 to t2), with a general betterment exhibited in the other domains. The total MIDAS score, pain intensity, and disturbance in occupation due to migraine as well as number of days of disablements were also significantly reduced. The control group showed insignificant differences in these areas.

This study affirms the effects of OMT on migraine headache in regard to decreased pain intensity and the reduction of number of days with migraine as well as working disability, and partly on improvement of HRQoL. Future studies with a larger sample size should reproduce the results with a control group receiving placebo treatment in a long-term follow-up.

**Schabert E, Crow WT. *Impact of osteopathic manipulative treatment on cost of care for patients with migraine headache: a retrospective review of patient records.* J Am Osteopath Assoc 2009 Aug; 109(8):403-7. [Community RCT](#)**

Migraine headache is highly prevalent in the United States, resulting in large healthcare expenditures.

The objective of this study was to determine whether the use of osteopathic manipulative treatment (OMT) affected the cost of treating patients with migraine headache, compared with non-OMT care.

A retrospective review of electronic medical records from patients treated for migraine at two residency clinics within the Florida Hospital organization from July 1, 2002, to June 30, 2007. One of the clinics was osteopathic and offered OMT services, and the other clinic was allopathic and did not offer OMT. All costs compiled during the office visits and costs of prescribed medications were tabulated for each patient.

Patients' pain-severity ratings, as reported in office visits in 2006 and 2007, were also tabulated.

Electronic medical records from 631 patients, representing 1427 migraine-related office visits, were analyzed. Average cost per patient visit was approximately 50% less at the osteopathic clinic than at the allopathic clinic (\$195.63 vs \$363.84, respectively;  $p < 0.001$ ).

This observed difference was entirely attributable to the difference in the average number of medications prescribed per visit at the two clinics, with 0.696 prescriptions at the osteopathic clinic and 1.285 prescriptions at the allopathic clinic ( $P < 0.001$ ).



This difference in prescription number resulted in a lower average medication cost per visit at the osteopathic clinic than at the allopathic clinic (\$106.94 vs \$284.93, respectively;  $P < 0.001$ ). Patients at the osteopathic clinic were 5 years younger on average than at the allopathic clinic ( $P < 0.001$ ).

The inclusion of OMT in a treatment regimen for patients with migraine headache may lower the cost of the treatment regimen. However, further study is needed to confirm these results.

**Cerritelli F, Lacorte E, Ruffini N, Vanacore N. *Osteopathy for primary headache patients: a systematic review.* J Pain Res. 2017 Mar 14; 10:601-611. [LR](#)**

This systematic review aimed to assess the efficacy, effectiveness, safety, and tolerability of osteopathic manipulative treatment (OMT) in patients with headache.

Migraine is one of the most common and disabling medical conditions. It affects more than 15% of the general population, causing high global socioeconomic costs, and the currently available treatment options are inadequate.

We systematically reviewed all available studies investigating the use of OMT in patients with migraine and other forms of headache.

The search of literature produced six studies, five of which were eligible for review.

OMT could most likely reduce the number of episodes per month as well as drug use.

None of the included studies, however, was classified as low risk of bias according to the Cochrane Collaboration's tool for assessing risk of bias.

The results from this systematic review show a preliminary low level of evidence that OMT is effective in the management of headache.

However, studies with more rigorous designs and methodology are needed to strengthen this evidence. Moreover, this review suggests that new manual interventions for the treatment of acute migraine are available and developing.

**Rolle V, Tremolizzo L, Somalvico F, Ferrarese C, Bressan LC. *Pilot trial of osteopathic manipulative therapy for patients with frequent episodic tension-type headache.* J Am Osteopath Assoc. 2014 Sep; 114(9):678-85. [BRCT](#)**

Osteopathic manipulative therapy (OMTh; manipulative care provided by foreign-trained osteopaths) may be used for managing headache pain and related disability, but there is a need for high-quality randomized controlled trials to assess the effectiveness of this intervention.

The objective of this study was to explore the efficacy of OMTh for pain management in frequent episodic tension-type headache (TTH).

Single-blind randomized placebo-controlled pilot study.



Forty-four patients who were affected by frequent episodic TTH and not taking any drugs for prophylactic management of episodic TTH were recruited.

Patients were randomly allocated to an experimental or control group. The experimental group received corrective OMTh techniques, tailored for each patient; the control group received assessment of the cranial rhythmic impulse (sham therapy). The study included a 1-month baseline period, a 1-month treatment period, and a 3-month follow-up period.

The primary outcome was the change in patient-reported headache frequency, and secondary outcomes included changes in headache pain intensity (discrete score, 1 [lowest perceived pain] to 5 [worst perceived pain]), over-the-counter medication use, and Headache Disability Inventory score.

Forty patients completed the study (OMTh, n=21; control, n=19). The OMTh group had a significant reduction in headache frequency over time that persisted 1 month (approximate reduction, 40%;  $P<.001$ ) and 3 months (approximate reduction, 50%;  $P<.001$ ) after the end of treatment. Moreover, there was an absolute difference between the 2 treatment groups at the end of the study, with a 33% lower frequency of headache in the OMTh group ( $P<.001$ ).

This feasibility study demonstrated the efficacy of OMTh in the management of frequent episodic TTH, compared with sham therapy in a control group. Osteopathic manipulative therapy may be preferred over other treatment modalities and may benefit patients who have adverse effects to medications or who have difficulty complying with pharmacologic regimens. This protocol may serve as a model for future studies.

**Mann JD, Faurot KR, Wilkinson L, Curtis P, Coeytaux RR, Suchindran C, Gaylord SA. *Craniosacral therapy for migraine: protocol development for an exploratory controlled clinical trial.* BMC Complement Altern Med. 2008 Jun 9; 8:28. [BRCT](#)**

Migraine affects approximately 20% of the population. Conventional care for migraine is suboptimal; overuse of medications for the treatment of episodic migraines is a risk factor for developing chronic daily headache. The study of non-pharmaceutical approaches for prevention of migraine headaches is therefore warranted.

Craniosacral therapy (CST) is a popular non-pharmacological approach to the treatment or prevention of migraine headaches for which there is limited evidence of safety and efficacy.

In this paper, we describe an ongoing feasibility study to assess the safety and efficacy of CST in the treatment of migraine, using a rigorous and innovative randomized controlled study design involving low-strength static magnets (LSSM) as an attention control intervention.

The trial is designed to test the hypothesis that, compared to those receiving usual care plus a treatment with low-strength static magnets (attention-control complementary therapy), subjects receiving usual medical care plus CST will demonstrate significant improvement in: quality-of-life as measured by the Headache Impact Test (HIT-6); reduced frequency of migraine; and a perception of clinical benefit. Criteria for inclusion are either gender, age > 11, English or Spanish speaking, meeting the International Classification of Headache Disorders



(ICHD) criteria for migraine with or without aura, a headache frequency of 5 to 15 per month over at least two years.

After an 8 week baseline phase, eligible subjects are randomized to either CST or an attention control intervention, low strength static magnets (LSSM). To evaluate possible therapist bias, videotaped encounters are analyzed to assess for any systematic group differences in interactions with subjects.

169 individuals have been screened for eligibility, of which 109 were eligible for the study. Five did not qualify during the baseline phase because of inadequate headache frequency. Nineteen have withdrawn from the study after giving consent.

This report endorses the feasibility of undertaking a rigorous randomized clinical trial of CST for migraine using a standardized CST protocol and an innovative control protocol developed for the study. Subjects are able and willing to complete detailed headache diaries during an 8-week baseline period, with few dropouts during the study period, indicating the acceptability of both interventions.

**Anderson RE, Seniscal C. *A comparison of selected osteopathic treatment and relaxation for tension-type headaches*. Headache. 2006 Sep; 46(8):1273-80. [BRCT](#)**

The objective of this study was to compare the effects of osteopathic treatment and progressive muscular relaxation (PMR) exercises on patients with tension-type headache (TTH).

Relaxation is generally accepted as a treatment for TTH. Osteopathy is considered by some practitioners to be useful for headache management but there is limited scientific evidence regarding the effectiveness. This study compares relaxation and relaxation plus selected osteopathic techniques in the treatment of people with TTH.

This was a single-blind, randomized, clinical study using an experimental design.

Twenty-nine patients with TTH according to the International Headache Classification Subcommittee, 2004, were recruited for this study and randomly placed in either a control or experimental group. Both groups practiced PMR exercises at home while the experimental group also received 3 osteopathic treatments.

All participants recorded headache frequency and intensity in a headache diary (HD) for 2 weeks pretreatment, and continued recording during the treatment period until reassessment for a total of 6 to 7 weeks. All tests of significance were set at  $P < 0.05$ .

Twenty-six people completed the study. Results indicated that the number of Headache Free Days Per Week was significantly improved ( $P = 0.016$ ) in the experimental group. Two other measures, the Headache Degree of Improvement ( $P = 0.075$ ) and the HD rating ( $P = 0.059$ ), which combine headache frequency and intensity, did not meet our criteria for statistical significance but both scores are  $< 10$  indicating a trend toward improvement in the experimental group that is clinically significant.



The HD Rating also showed that the experimental group improved 57.5%, while the control group improved 15.6%. The intensity of headache did not show a significant improvement ( $P = 0.264$ ).

The people in this study who did relaxation exercises and received 3 osteopathy treatments had significantly more days per week without headache than those who did only relaxation exercises.

**Cerritelli F, Ginevri L, Messi G, Caprari E, Di Vincenzo M, Renzetti C, Cozzolino V, Barlafante G, Foschi N, Provinciali L. *Clinical effectiveness of osteopathic treatment in chronic migraine: 3-Armed randomized controlled trial. Complement Ther Med. 2015 Apr; 23(2):149-56. [BRCT](#)***

The objective of this study was to assess the effectiveness of OMT on chronic migraineurs using HIT-6 questionnaire, drug consumption, days of migraine, pain intensity and functional disability.

3-Armed randomized controlled trial setting: all patients admitted in the Department of Neurology of Ancona's United Hospitals, Italy, with a diagnosis of migraine and without chronic illness, were considered eligible for the study.

Patients were randomly divided into three groups:

- › OMT+medication therapy,
- › sham+medication therapy and
- › medication therapy only.

Patients received 8 treatments in a study period of 6 months and the results were measured using the HIT-6 score.

105 subjects were included. At the end of the study, ANOVA showed that OMT significantly reduced HIT-6 score (mean change scores OMT-conventional care: -8.74; 95% confidence interval (CI) -12.96 to -4.52;  $p < 0.001$  and OMT-sham: -6.62; 95% CI -10.85 to -2.41;  $p < 0.001$ ), drug consumption (OMT-sham: RR=0.22, 95% CI 0.11-0.40; OMT-control: RR=0.20, 95% CI 0.10-0.36), days of migraine (OMT-conventional care: M=-21.06; 95% CI -23.19 to -18.92;  $p < 0.001$  and OMT-sham: -17.43; 95% CI -19.57 to -15.29;  $p < 0.001$ ), pain intensity (OMT-sham: RR=0.42, 95% CI 0.24-0.69; OMT-control: RR=0.31, 95% CI 0.19-0.49) and functional disability ( $p < 0.001$ ).

## PLAGIOCEPHALY

**Amiel-Tison C, Soyez-Papiernik E. *Cranial osteopathy as a complementary treatment of postural plagiocephaly. Arch Pediatr. 2008 Jun; 15 Suppl 1:S24-30. [LR](#)***

For the majority of neonates and young infants, appropriate postures and standard physiotherapy succeed in preventing or correcting acquired cranial deformations (fetal due to restricted mobility in utero or postnatal secondary to exclusive dorsal decubitus). However



in some cases, when postural management is not efficient, pediatricians will be asked by the parents about the potential benefits of osteopathy. What is osteopathic treatment?

At first, diagnostic palpation will identify which suture is normally mobile with the respiratory cycle, and which has limited or absent mobility secondary to abnormal postures. Later on, the goal of the therapeutic phase is to mobilise impaired sutures, by various gentle maneuvers depending on the topography of the impairment.

The treatment is not restricted to the skull but extended to the spine, pelvis and lower extremities which contribute to the deformative sequence.

The scientific value of osteopathic treatment has been shown and favorable results have been provided. Based on randomized studies, the answer is yes, it significantly decreases the degree of asymmetry.

**Lessard S, Gagnon I, Trottier N. *Exploring the impact of osteopathic treatment on cranial asymmetries associated with nonsynostotic plagiocephaly in infants.* Complement Ther Clin Pract. 2011 Nov; 17(4):193-8. [PS](#)**

The objective of this study was to document the evolution of cranial asymmetries in infants with signs of nonsynostotic occipital plagiocephaly (NSOP) who were to undergo a course of four osteopathic treatments (in addition to the standard positioning recommendations) as well as to determine the feasibility of using this methodology to conduct a randomized clinical trial investigating the impact of osteopathic intervention for infants with NSOP.

Pilot clinical standardization project using pre-post design in which 12 infants participated.

Ten infants presented an initial Oblique Diameter Difference Index (ODDI) over 104% and five of them had an initial moderate to severe Cranial Vault Asymmetry (CVA) (over 12mm).

Infants received four osteopathic treatments at 2-week intervals.

Anthropometric, plagiocephalometric as well as qualitative measures were administered pre-intervention (T1), during the third treatment (T2) and two weeks after the fourth treatment (T3).

Participants showed a significant decrease in CVA ( $p=0.02$ ), Skull Base Asymmetry (SBA) ( $p=0.01$ ), Trans-Cranial Vault Asymmetry (TCVA) ( $p<0.003$ ) between the first and third evaluations.

These clinical findings support the hypothesis that osteopathic treatments contribute to the improvement of cranial asymmetries in infants younger than 6.5 months old presenting with NSOP characteristics.



**Billi M, Greco A, Colonnelli P, Volpi G, Valente D, Galeoto G. *The functional manual therapy intervention in infants with nonsynostotic plagiocephaly: a pilot study.* Minerva Pediatr. 2017 Oct 25. doi: 10.23736/S0026-4946.17.04838-1. [Epub ahead of print]. [BRCT](#)**

The objective of this study was to document the evolution of cranial asymmetries in infants with signs of nonsynostotic occipital plagiocephaly (NSOP) who were undergo to many functional manual therapy treatments (in addition to the standard positioning recommendations) as well as to determine the feasibility of this methodology to conduct an outcome research investigating the impact of this intervention for infants with NSOP.

Pilot clinical standardization project using pre-post design in which 10 infants participated.

Nine infants presented an initial Oblique Diameter Difference Index (ODDI) over 104%, three an initial Ear Deviation Index (EDI) over 4%, and three a Cranial Proportional Index (CPI) over 90%.

Infants received three functional manual therapy treatments for week during the first month of intervention and two ones for week during the second month.

Plagiocephalometric measurements were administered at the first assessment pre-intervention (T0), after 30 days (+/-5) (T1) and at a third time after 60 days (+/5) of treatment (T2).

9/10 participants showed a significant decrease in ODDI under 104% between T0 and T2 assessments.

5/10 infants showed an EDI under 4%, and 3/10 showed a value about 0%. 3/10 maintained their CPI over 90% with a considerable decrease.

These clinical findings support the hypothesis that functional manual therapy treatments contribute to the improvement of cranial asymmetries in infants younger than 6.5 months old presenting with NSOP.

**Sergueef N, Nelson KE, Glonek T. *Palpatory diagnosis of plagiocephaly.* Complement Ther Clin Pract. 2006 May; 12(2):101-10. [ES](#)**

The term plagiocephaly, from the Greek plagios (oblique) and kephalê (head), means distortion of the head, and refers clinically to cranial asymmetry. Cranial Osteopathy, since it was first proposed, has focussed upon the diagnosis and treatment of birth trauma and cranial asymmetries, and consequently specific therapy for plagiocephalic deformities has been described. Osteopathic manipulation also has been proposed as a treatment for torticollis, a condition associated with plagiocephaly.

For these reasons, we decided to look at the mechanics of the occipital bone and the adjacent atlas and bones of the cranial base, in relation to functional plagiocephaly. The records of 649 children seen in an osteopathic practice in Lyon, France, were reviewed retrospectively, in compliance with the legal requirements of the Commission Nationale de l'Informatique



et des Libertés (CRIL) and the Helsinki accord, for gender, age at presentation, birth history, obstetrical data (breech presentation, vacuum extraction, forceps delivery or Caesarean section), presenting complaint, side of posterior plagiocephaly, side of frontal plagiocephaly, torticollis, motion pattern of the occipital bone upon the atlas, and motion pattern of the spheno-occipital synchondrosis.

We found significant correlations between plagiocephaly (right/left) and primipara ( $P=0.024$ ), use of forceps ( $P=0.055$ ) and extractor suction ( $P=0.055$ ).

Correlations were also found between flattening of the occiput (right/left) and lateral strain of the spheno-occipital synchondrosis ( $P=0.002$ ) and between plagiocephaly (right/left) and occipito-atlantal motion ( $P=0.000$ ).

We found a significant correlation between the lateral strain pattern of the spheno-occipital synchondrosis and plagiocephaly and between rotational dysfunction of the occiput upon the atlas and the side of posterior plagiocephaly. We suggest that thorough neonatal osteopathic examination can identify individuals predisposed to develop posterior plagiocephaly.

## DENTISTRY

**Brantingham JW, Cassa TK, Bonnefin D, Pribicevic M, Robb A, Pollard H, Tong V, Korporaal C. *Manipulative and multimodal therapy for upper extremity and temporomandibular disorders: a systematic review.* J Manipulative Physiol Ther. 2013 Mar-Apr; 36(3):143-201. [LR](#)**

The purpose of this study was to complete a systematic review of manual and manipulative therapy (MMT) for common upper extremity pain and disorders including the temporomandibular joint (TMJ).

A literature search was conducted using the Cumulative Index of Nursing Allied Health Literature, PubMed, Manual, Alternative, and Natural Therapy Index System (MANTIS), Physiotherapy Evidence Database (PEDro), Index to Chiropractic Literature, Google Scholar, and hand search inclusive of literature from January 1983 to March 5, 2012.

Search limits included the English language and human studies along with MeSH terms such as manipulation, chiropractic, osteopathic, orthopedic, and physical therapies. Inclusion criteria required an extremity peripheral diagnosis (for upper extremity problems including the elbow, wrist, hand, finger and the (upper quadrant) temporomandibular joint) and MMT with or without multimodal therapy.

Studies were assessed using the PEDro scale in conjunction with modified guidelines and systems.

After synthesis and considered judgment scoring was complete, evidence grades of "A, B, C and I" were applied.



Out of 764 citations reviewed, 129 studies were deemed possibly to probably useful and/or relevant to develop expert consensus. Out of 81 randomized controlled or clinical trials, 35 were included.

Five controlled or clinical trials were located and 4 were included. Fifty case series, reports and/or single-group pre-test post-test prospective case series were located with 32 included.

There is Fair (B) level of evidence for MMT to specific joints and the full kinetic chain combined generally with exercise and/or multimodal therapy for lateral epicondylopathy, carpal tunnel syndrome, and temporomandibular joint disorders, in the short term.

**Meyer PM, Gustowski SM. *Osteopathic manipulative treatment to resolve head and neck pain after tooth extraction.* J Am Osteopath Assoc. 2012 Jul; 112(7):457-60. [CC](#)**

Pain is a common occurrence after tooth extraction and is usually localized to the extraction site.

However, clinical experience shows that patients may also have pain in the head or neck in the weeks after this procedure.

The authors present a case representative of these findings. In the case, cranial and cervical somatic dysfunction in a patient who had undergone tooth extraction was resolved through the use of osteopathic manipulative treatment.

This case emphasizes the need to include a dental history when evaluating head and neck pain as part of comprehensive osteopathic medical care.

The case can also serve as a foundation for a detailed discussion regarding how to effectively incorporate osteopathic manipulative treatment into primary care practice for patients who present with head or neck pain after tooth extraction.

**Walter C, Lechner KH, Karl M. *A pilot study on spatial changes in the maxilla caused by osteopathic therapy.* Quintessence Int. 2015 Jan; 46(1):81-6. [PS](#)**

A variety of theories on the pathogenesis of temporomandibular disorders (TMD) exists resulting in treatment approaches ranging from the fabrication of occlusal splints to alternative treatment modalities such as osteopathy. The goal of this pilot study was to investigate whether osteopathic treatment causes spatial changes in the maxilla.

Following ethics commission approval and informed patient consent, three patients diagnosed with TMD participated in this investigation. In addition to regular treatment, an individualized mandibular occlusal splint was fabricated and a maxillary silicone impression was made.

Following osteopathic treatment, the splint was adapted intraorally and another maxillary impression was made. Before and after treatment, the splint and the impressions were



scanned three-dimensionally. The resulting images were superimposed using best-fit matching algorithms.

Inconsistent spatial changes in the posterior areas were observed both in the maxillary impressions as well as in the mandibular splints reaching maximum absolute values of 0.50mm.

Based on this pilot study, it appears that osteopathic treatment may be capable of inducing spatial changes in the maxilla due to sutural movement thereby validating the fundamental principles of osteopathic treatment.

Although, based on the study conducted, it cannot be concluded that osteopathy constitutes a successful treatment alternative in TMD patients, practitioners should be aware of this treatment modality.

**Cuccia AM, Caradonna C, Caradonna D. *Manual therapy of the mandibular accessory ligaments for the management of temporomandibular joint disorders.* J Am Osteopath Assoc. 2011 Feb; 111(2):102-12. [LR](#)**

Temporomandibular joint disorders are characterized by chronic or acute musculoskeletal or myofascial pain with dysfunction of the masticatory system. Treatment modalities include occlusal splints, patient education, activity modification, muscle and joint exercises, myofascial therapy, acupuncture, and manipulative therapy.

In the physiology of the temporomandibular joint, accessory ligaments limit the movement of the mandible. A thorough knowledge of the anatomy of accessory ligaments is necessary for good clinical management of temporomandibular joint disorders.

Although general principles regarding the anatomy of the ligaments are relatively clear, very little substantiated information on the dimension, orientation, and function of the ligaments has been published, to the authors' knowledge.

The authors review the literature concerning the accessory ligaments of the temporomandibular joint and describe treatment options, including manual techniques for mobilizing the accessory ligaments.

**Fournier R, Aknin JJ, Bourcier S, Gebeile-Chauty S. *Dento-facial orthopedics and osteopathy.* Orthod Fr. 2011 Dec; 82(4):331-40. [LR](#)**

Osteopathy has grown rapidly. Given their common action on children and adolescents, the collaboration between dentofacial orthopedics and osteopathy is increasingly common.

It therefore becomes necessary and urgent to investigate whether, based on data acquired from science, there is evidence of possible interrelations between the two disciplines.

After reviewing the literature, very few scientific publications demonstrate the utility of osteopathy and its relationships with other disciplines.



However, the relationship between occlusion and posture seem relatively proven, especially in the sagittal direction. On the other hand, although the mobility of the cranial bones is established, the primary respiratory motion is still subject to controversy, even among osteopaths. This, even as orthodontics has long been accused of countering the primary respiratory motion of cranial bones (PRM).

Today osteopaths do not reject orthodontics anymore, because the return to a physiological bite situation is considered beneficial. According to expert opinion (without proof, however), some orthodontic devices (like headgears) which block the sutures are still to be avoided and require appropriate monitoring osteopathy.

The controversy over the adverse effects of orthodontic treatment is becoming more nuanced by osteopaths, and modern orthodontics claiming a «global» approach of patient, collaboration may be possible in future year.

**Gesslbauer C, Vavti N, Keilani M, Mickel M, Crevenna R. *Effectiveness of osteopathic manipulative treatment versus osteopathy in the cranial field in temporomandibular disorders - a pilot study.* Disabil Rehabil. 2016 Dec 28:1-6. [BRCT](#)**

Temporomandibular disorders are a common musculoskeletal condition causing severe pain, physical and psychological disability. The effect and evidence of osteopathic manipulative treatment and osteopathy in the cranial field is scarce and their use are controversial. The purpose of this pilot study was to evaluate the effectiveness of osteopathic manipulative treatment and osteopathy in the cranial field in temporomandibular disorders.

A randomized clinical trial in patients with temporomandibular disorders was performed.

Forty female subjects with long-term temporomandibular disorders (>3 months) were included.

At enrollment, subjects were randomly assigned into two groups:

- › osteopathic manipulative treatment group (20 female patients) and
- › osteopathy in the cranial field group (20 female patients).

Examination was performed at baseline (E0) and at the end of the last treatment (E1), consisting of subjective pain intensity with the Visual Analog Scale, Helkimo Index and SF-36 Health Survey.

Subjects had five treatments, once a week. 36 subjects completed the study ( $33.7 \pm 10.3$  y).

Patients in both groups showed significant reduction in Visual Analog Scale score (osteopathic manipulative treatment group:  $p=0.001$ ; osteopathy in the cranial field group:  $p<0.001$ ), Helkimo Index (osteopathic manipulative treatment group:  $p=0.02$ ; osteopathy in the cranial field group:  $p=0.003$ ) and a significant improvement in the SF-36 Health Survey - subscale "Bodily Pain" (osteopathic manipulative treatment group:  $p=0.04$ ; osteopathy in the cranial field group:  $p=0.007$ ) after five treatments (E1).

All subjects ( $n=36$ ) also showed significant improvements in the above named parameters after five treatments (E1): Visual Analog Scale score ( $p<0.001$ ), Helkimo Index ( $p<0.001$ ), SF-



36 Health Survey - subscale "Bodily Pain" ( $p=0.001$ ). The differences between the two groups were not statistically significant for any of the three target parameters.

Both therapeutic modalities had similar clinical results. The findings of this pilot trial support the use of osteopathic manipulative treatment and osteopathy in the cranial field as an effective treatment modality in patients with temporomandibular disorders. The positive results in both treatment groups should encourage further research on osteopathic manipulative treatment and osteopathy in the cranial field and support the importance of an interdisciplinary collaboration in patients with temporomandibular disorders.

This pilot study demonstrates the reduction of pain, the improvement of temporomandibular joint dysfunction and the positive impact on quality of life after osteopathic manipulative treatment and osteopathy in the cranial field.

Our findings support the use of osteopathic manipulative treatment and osteopathy in the cranial field and should encourage further research on osteopathic manipulative treatment and osteopathy in the cranial field in patients with temporomandibular disorders. Rehabilitation experts should consider osteopathic manipulative treatment and osteopathy in the cranial field as a beneficial treatment option for temporomandibular disorders.

**Monaco A, Cozzolino V, Cattaneo R, Cutilli T, Spadaro A. *Osteopathic manipulative treatment effects on mandibular kinetics: kinesiographic study.* Eur J Paediatr Dent. 2008 Mar; 9(1):37-42. [BRCT](#)**

The aim of this study was to evaluate the effects of Osteopathic Manipulative Treatment (OMT) on mandibular kinematics in TMD patients.

The study was conducted on 28 children with non-specific TMD symptoms, limited mouth opening, history of trauma (delivery trauma, accident trauma).

Patients were randomly divided into two groups: an OMT group (study group) and a no-intervention group (control group). All subjects underwent a first kinesiographic recording to evaluate the amplitude and velocity of maximal opening-closing movements.

Study group patients underwent a second kinesiographic recording 2 months after OMT.

Control group patients were submitted to a control kinesiographic recording six months after the first one. Kinesiographic tracings were acquired using the K7I system.

The kinesiographic data of the study group showed a moderate statistically significant difference ( $p<.07$ ) of maximal mouth opening (MO) parameter and a high statistically significant difference ( $p<.03$ ) of maximal mouth opening velocity (MOV) parameter. No statistically significant difference (null hypothesis confirmed) of kinesiographic parameters in the control group was observed.

The results of this study suggest that OMT can induce changes in the stomatognathic dynamics, offering a valid support in the clinical approach to TMD. Multifactorial genesis of chronic disorders is also confirmed. Multifactorial genesis of chronic disorders is also confirmed.



## OTHERS

**Haller H, Lauche R, Cramer H, Rampp T, Saha FJ, Ostermann T, Dobos G. *Craniosacral Therapy for the Treatment of Chronic Neck Pain: A Randomized Sham-controlled Trial*. Clin J Pain. 2016 May; 32(5):441-9. [BRCT](#)**

With growing evidence for the effectiveness of craniosacral therapy (CST) for pain management, the efficacy of CST remains unclear. This study therefore aimed at investigating CST in comparison with sham treatment in chronic nonspecific neck pain patients.

A total of 54 blinded patients were randomized into either 8 weekly units of CST or light-touch sham treatment. Outcomes were assessed before and after treatment (week 8) and again 3 months later (week 20).

The primary outcome was the pain intensity on a visual analog scale at week 8; secondary outcomes included pain on movement, pressure pain sensitivity, functional disability, health-related quality of life, well-being, anxiety, depression, stress perception, pain acceptance, body awareness, patients' global impression of improvement, and safety.

In comparison with sham, CST patients reported significant and clinically relevant effects on pain intensity at week 8 (-21 mm group difference; 95% confidence interval, -32.6 to -9.4;  $P=0.001$ ;  $d=1.02$ ) and at week 20 (-16.8 mm group difference; 95% confidence interval, -27.5 to -6.1;  $P=0.003$ ;  $d=0.88$ ). Minimal clinically important differences in pain intensity at week 20 were reported by 78% within the CST group, whereas 48% even had substantial clinical benefit.

Significant between-group differences at week 20 were also found for pain on movement, functional disability, physical quality of life, anxiety and patients' global improvement.

Pressure pain sensitivity and body awareness were significantly improved only at week 8. No serious adverse events were reported.

CST was both specifically effective and safe in reducing neck pain intensity and may improve functional disability and the quality of life up to 3 months after intervention.

**Martins WR, Diniz LR, Blasczyk JC, Lagoa KF, Thomaz S, Rodrigues ME, de Oliveira RJ, Bonini-Rocha AC. *Immediate changes in electroencephalography activity in individuals with nonspecific chronic low back pain after cranial osteopathic manipulative treatment: study protocol of a randomized, controlled crossover trial*. BMC Complement Altern Med. 2015 Jul 13;15:223. [BRCT](#)**

Osteopathic medicine is based on a diagnostic and therapeutic system to treat tissue mobility/motility dysfunctions in general, using different approaches (depending on the target tissue) known as osteopathic manipulative treatment.



Among the available techniques those ones addressed to the cranial field are the most questioned because of the lack of scientific evidence; but the compression of the 4th ventricle technique has been largely studied in clinical trials.

Studies have shown that the technique may affect both central and autonomous nervous system, modulating some reflexes (Traube-Hering baro signal), and modifying brain cortex electrical activity through central sensitization in subjects with chronic low back pain. Thus, investigators hypothesize that the compression of the 4th ventricle may modulate peak alpha frequency (electroencephalographic assessment) and promote physical relaxation in subjects in vigil.

A randomized, controlled crossover trial with blinded assessor was designed to test the hypothesis.

A total of 81 participants will be assigned to three treatment conditions, with seven days of washout:

- compression of the 4th ventricle;
- › sham compression of the fourth ventricle;
- › control (no intervention).

The (I) power amplitude and the (II) frequencies of the dominant peak in the alpha band will be the primary outcome measures of the study. All participants will be recruited at the Out-patient Rehabilitation Service of the University Hospital of Brasília-University of Brasília. All the electroencephalographic exams will be conducted by a blinded assessor.

The investigators hypothesize that patients with chronic low back pain submitted to the technique would have the peak alpha frequency modulated and, thus, would experience physical relaxation.

**Shi X, Rehrer S, Praiaoti P, Stoll ST, Gamber RG, Downey HF. *Effect of cranial osteopathic manipulative medicine on cerebral tissue oxygenation. J Am Osteopath Assoc* 2011 Dec; 111(12):660-6. [BRCT](#)**

The goal of this study was to determine whether the use of cranial osteopathic manipulative medicine (OMM) can alter cerebral tissue oxygen saturation and could play a role in the maintenance of cerebral homeostasis.

The effects of cranial OMM on cerebral tissue oxygen saturation SCTO2 and cardiac autonomic function were examined in healthy adults.

Cranial OMM augmentation and suppression techniques and sham therapy were randomly applied to healthy adults. During cranial OMM and sham therapy, SCTO2 of the prefrontal cortex was determined bilaterally by using near-infrared spectroscopy. Heart rate, blood pressure, and systemic arterial blood oxygen saturation SaO2 were also measured. Power spectral analysis was applied to continuous 4-minute R-R intervals. Measurements were made



during 2-minute baseline periods, during 4-minute applications of the techniques, and during 5-minute recovery periods.

Twenty-one adults (age range, 23-32 y) participated in the present study. Differences in mean baseline measurements for the augmentation technique, suppression technique, and sham therapy were not statistically significant for heart rate, blood pressure, SaO<sub>2</sub>, left SCTO<sub>2</sub>, or right SCTO<sub>2</sub>.

During the suppression technique, there was a statistically significant decrease in both left (slope [standard deviation]= -0.33 [0.08] %/min, R(2)=0.85, P=.026) and right (slope [standard deviation]= -0.37 [0.06] %/min, R(2)=0.94, P=.007) SCTO<sub>2</sub> with increased cranial OMM time.

However, neither the augmentation technique nor the sham therapy had a statistically significant effect on SCTO<sub>2</sub>. Decreases in normalized low-frequency power of R-R interval variability and enhancements of its high-frequency power were statistically significant (P=0.05) during cranial OMM and sham therapy, indicating a decrease in cardiac sympathetic influence and an enhanced parasympathetic modulation.

The cranial OMM suppression technique effectively and progressively reduced SCTO<sub>2</sub> in both prefrontal lobes with the treatment time.

**Duncan B, McDonough-Means S, Worden K, Schnyer R, Andrews J, Meaney FJ. *Effectiveness of osteopathy in the cranial field and myofascial release versus acupuncture as complementary treatment for children with spastic cerebral palsy: a pilot study.* J Am Osteopath Assoc. 2008 Oct; 108(10):559-70. [BRCT](#)**

Case reports and clinical trials have indicated that osteopathic manipulative treatment (OMT) may improve motor function and quality of life for children with cerebral palsy.

The objective of the study was to assess the effectiveness of osteopathy in the cranial field, myofascial release, or both versus acupuncture in children with moderate to severe spastic cerebral palsy, as measured by several outcomes instruments in a randomized controlled trial.

Children between the ages of 20 months and 12 years with moderate to severe spastic cerebral palsy were enrolled in a single-blind, randomized wait-list control pilot study.

There were three arms in the study:

- › OMT (i.e., osteopathy in the cranial field,
- › myofascial release,
- › or both, using direct or indirect methods), acupuncture, and control (i.e., nontherapeutic attention).

Children who were initially randomly assigned to the control arm were subsequently randomly reassigned to the intervention arms, increasing the sample size. Outcome measures included standard instruments used in the evaluation of children with cerebral palsy.



Less traditional measures were also used, including serial evaluations by an independent blind osteopathic physician and visual analog scale assessments by an independent osteopathic physician and the parents or guardians. A total of 11 outcome variables were analyzed.

Fifty-five patients were included in the study. Individual analyses of the 11 outcome variables revealed statistically significant improvement in two mobility measures for patients who received OMT—the total score of Gross Motor Function Measurement and the mobility domain of Functional Independence Measure for Children ( $P < .05$ ). No statistically significant improvements were seen among patients in the acupuncture treatment arm.

A series of treatments using osteopathy in the cranial field, myofascial release, or both improved motor function in children with moderate to severe spastic cerebral palsy. These results can be used to guide future research into the effectiveness of OMT or acupuncture in treating children with spastic cerebral palsy.

**Shanahan LK, Raines SG, Coggins RL, Moore T, Carnes M, Griffin L. *Osteopathic Manipulative Treatment in the Management of Isaacs Syndrome*. *J Am Osteopath Assoc*. 2017 Mar 1; 117(3):194-198. [CC](#)**

Isaac's syndrome is a rare neuromuscular disorder characterized by chronic muscle stiffness, cramping, fasciculations, myokymia, and hyperhidrosis. Pathogenesis includes autoimmunity, paraneoplastic disorders, genetic predisposition, or toxin exposure. There is no known cure for Isaac's syndrome.

This case report describes a patient who had been given the diagnosis of Isaac's syndrome and received osteopathic manipulative treatment to manage fascial and cranial dysfunctions and reduce nervous system hyperexcitability. Long-term decrease of myokymia and reduction of severity and frequency of exacerbations resulted.

**Whedon JM, Glassey D. *Cerebrospinal fluid stase and its clinical significance*. *Altern Ther Health Med*. 2009 May-Jun;15(3):54-60. [RB](#)**

Stasis of the cerebrospinal fluid (CSF) is detrimental to health. Physiologic factors affecting the normal circulation of CSF include cardiovascular, respiratory, and vasomotor influences.

The CSF maintains the electrolytic environment of the central nervous system (CNS), influences systemic acid-base balance, serves as a medium for the supply of nutrients to neuronal and glial cells, functions as a lymphatic system for the CNS by removing the waste products of cellular metabolism, and transports hormones, neurotransmitters, releasing factors, and other neuropeptides throughout the CNS.

Physiologic impedance or cessation of CSF flow may occur commonly in the absence of degenerative changes or pathology and may compromise the normal physiologic functions of the CSF. CSF appears to be particularly prone to stasis within the spinal canal. CSF stasis may



be associated with adverse mechanical cord tension, vertebral subluxation syndrome, reduced cranial rhythmic impulse, and restricted respiratory function.

Increased sympathetic tone, facilitated spinal segments, dural tension, and decreased CSF flow have been described as closely related aspects of an overall pattern of structural and energetic dysfunction in the axial skeleton and CNS.

Therapies directed at affecting CSF flow include osteopathic care (especially cranial manipulation), craniosacral therapy, chiropractic adjustment of the spine and cranium, Network Care (formerly Network Chiropractic), massage therapy (including lymphatic drainage techniques), yoga, therapeutic breath work, and cerebrospinal fluid technique. Further investigation into the nature and causation of CSF stasis, its potential effects upon human health, and effective therapies for its correction is warranted.

**Mulcahy J, Vaughan B. *Sensations experienced and patients' perceptions of osteopathy in the cranial field treatment.* J Evid Based Complementary Altern Med. 2014 Oct; 19(4):235-46. [PS](#)**

Osteopathy in the cranial field is an approach used by manual and physical therapists. However, there is minimal information in the literature about patient experiences of this treatment.

The present study was undertaken to explore patients' experiences of osteopathy in the cranial field.

Patients completed the Patient Perception Measure-Osteopathy in the Cranial Field and identified sensations they experienced during treatment. Additional measures of anxiety, depression, Satisfaction With Life, and Meaningfulness of Daily Activity were completed.

The Patient Perception Measure-Osteopathy in the Cranial Field was internally consistent (Cronbach's  $\alpha = .85$ ). The most frequently experienced sensations of osteopathy in the cranial field patients were "relaxed", "releasing", and "unwinding".

Satisfaction With Life and Meaningfulness of Daily Activity were positively associated with Patient Perception Measure-Osteopathy in the Cranial Field scores.

Negative associations were observed between the Patient Perception Measure-Osteopathy in the Cranial Field and depression.

Psychometric properties of the Patient Perception Measure-Osteopathy in the Cranial Field require further testing.

The observed associations of Satisfaction With Life and depression with patients' perceptions of osteopathy in the cranial field treatment needs to be tested in larger clinical manual therapy cohorts.



**Rivera-Martinez S, Wells MR, Capobianco JD. *A retrospective study of cranial strain patterns in patients with idiopathic Parkinson's disease.* J Am Osteopath Assoc. 2002 Aug; 102(8):417-22. [EE](#)**

While providing osteopathic manipulative treatment to patients with Parkinson's disease at the clinic of the New York College of Osteopathic Medicine of New York Institute of Technology, physicians noted that these patients may exhibit particular cranial findings as a result of the disease.

The purpose of this study was to compare the recorded observations of cranial strain patterns of patients with Parkinson's disease for the detection of common cranial findings.

Records of cranial strain patterns from physician-recorded observations of 30 patients with idiopathic Parkinson's disease and 20 age-matched normal controls were compiled. This information was used to determine whether different physicians observed particular strain patterns in greater frequency between Parkinson's patients and controls.

Patients with Parkinson's disease had a significantly higher frequency of bilateral occipitoatlantal compression (87% vs. 50%;  $P < .02$ ) and bilateral occipitomastoid compression (40% vs. 10%;  $P < .05$ ) compared with normal controls.

Over subsequent visits and treatments, the frequency of both strain patterns were reduced significantly (occipitoatlantal compression,  $P < .01$ ; occipitomastoid compression,  $P < .05$ ) to levels found in the control group.

## AOM

**Mills MV, Henley CE, Bames LL, Carreiro JE, Degenhardt BF. *The use of osteopathic manipulative treatment as adjuvant therapy in children with recurrent acute otitis media.* Arch Pediatr Adolesc Med. 2003 Sep; 157(9):861-6. [BRCT](#)**

The objective of this study was to study effects of osteopathic manipulative treatment as an adjuvant therapy to routine pediatric care in children with recurrent acute otitis media (AOM).

Patients 6 months to 6 years old with 3 episodes of AOM in the previous 6 months, or 4 in the previous year, who were not already surgical candidates were placed randomly into 2 groups: one receiving routine pediatric care, the other receiving routine care plus osteopathic manipulative treatment.

Both groups received an equal number of study encounters to monitor behavior and obtain tympanograms. Clinical status was monitored with review of pediatric records. The pediatrician was blinded to patient group and study outcomes, and the osteopathic physician was blinded to patient clinical course.

We monitored frequency of episodes of AOM, antibiotic use, surgical interventions, various behaviors, and tympanometric and audiometric performance.



A total of 57 patients, 25 intervention patients and 32 control patients, met criteria and completed the study. Adjusting for the baseline frequency before study entry, intervention patients had fewer episodes of AOM (mean group difference per month, -0.14 [95% confidence interval, -0.27 to 0.00];  $P=0.04$ ), fewer surgical procedures (intervention patients, 1; control patients, 8;  $P=0.03$ ), and more mean surgery-free months (intervention patients, 6.00; control patients, 5.25;  $P=0.01$ ).

Baseline and final tympanograms obtained by the audiologist showed an increased frequency of more normal tympanogram types in the intervention group, with an adjusted mean group difference of 0.55 (95% confidence interval, 0.08 to 1.02;  $P=.02$ ). No adverse reactions were reported. No adverse reactions were reported.

The results of this study suggest a potential benefit of osteopathic manipulative treatment as adjuvant therapy in children with recurrent AOM; it may prevent or decrease surgical intervention or antibiotic overuse.

**Steele KM, Carreiro JE, Viola JH, Conte JA, Ridpath LC. *Effect of osteopathic manipulative treatment on middle ear effusion following acute otitis media in young children: a pilot study.* J Am Osteopath Assoc. 2014 Jun; 114(6):436-47. [BRCT](#)**

Childhood acute otitis media (AOM) is highly prevalent. Its usual sequela of middle ear effusion (MEE) can lead to conductive hearing loss, for which surgery is commonly used.

The objective of this study was to evaluate the efficacy of an osteopathic manipulative treatment (OMT) protocol on MEE resolution following an episode of AOM. The authors hypothesized that OMT provided adjunctively to standard care for young children with AOM would reduce the duration of MEE following the onset of AOM.

We compared standard care only (SCO) and standard care plus OMT (SC+OMT) for the duration of MEE following AOM. Patients were aged 6 months to 2 years. The SC+OMT group received OMT during 3 weekly visits.

Weekly tympanometric and acoustic reflectometer (AR) readings were obtained from all patients.

There were 52 patients enrolled, with 43 completing the study and 9 dropping out. No demographic differences were noted. Only ears from each patient with abnormal tympanograms at entry were included.

There were 76 ears in the tympanogram analysis (38 from SCO; 38 from SC+OMT) and 61 ears in the AR data analysis (31 from SCO; 30 from SC+OMT). Dependence of bilateral ear disease noted in AR readings was accounted for in statistical analysis. Tympanogram data demonstrated a statistically significant improvement in MEE at visit 3 in patients in the SC+OMT group (odds ratio, 2.98; 95% confidence interval, 1.16, 7.62;  $\chi^2$  (2) test for independence,  $P=0.02$ ).



The AR data analysis showed statistically significant improvement at visit 3 for the SC+OMT group ( $z=2.05$ ;  $P=.02$ ). There was no statistically significant change in MEE before or immediately after the OMT protocol in MEE before or immediately after the OMT protocol.

A standardized OMT protocol administered adjunctively with standard care for patients with AOM may result in faster resolution of MEE following AOM than standard treatment alone.

**Méndez Sánchez R. *Eficacia del tratamiento osteopático en la rinosinusitis crónica del adulto*. *Osteopatía Científica* 2008;3:125-34. [PS\\*](#)**

Chronic rhinosinusitis is one of the most commonly occurring conditions in the general population; in recent years, efforts have been made to describe the clinical criteria for diagnosing the condition, as well as its impact on patients' quality of life.

The objective of this study was to demonstrate the effectiveness of osteopathic treatment in adult subjects with chronic rhinosinusitis.

3 subjects (women) (corrected age  $\pm$  standard deviation  $28.17 \pm 3.06$  years) with craniofacial pain and diagnosed with chronic rhinosinusitis were included in this study. The parameters analyzed were: two diagnosis and quality of life questionnaires, specific to rhinosinusitis (SNAQ-11 and RTF), the Visual Analogue Scale (VAS) for craniofacial pain and pressure algometry in the frontal and maxillary sinuses. This case series study followed a multiple baseline design BAABAB (B = no treatment and A = treatment). All subjects were assessed 7 times and each received osteopathic treatment sessions (preceding the A periods). The Friedman test for repeated measures in related samples was carried out.

There were significant differences ( $p < 0.05$ ) in all of the variables analyzed before and after applying the osteopathic treatment. The results of the rhinosinusitis-specific questionnaires showed a significant decrease in the presence of symptoms and a significant improvement in quality of life (SNAQ-11 (61.97 %) ( $p = 0.008$ ); RTF (66.80 %) ( $p = 0.007$ )). The VAS for craniofacial pain decreased by 70.21% ( $p = 0.008$ ). Finally, there were significant differences in the pressure algometry in all of the sinuses. Pressure Pain Threshold increased by between 25.52% (left frontal) and 68.38% (left maxillary).

The use of osteopathic treatment has been proven to be effective in treating chronic rhinosinusitis, using both local and remote techniques. It was shown to be significantly effective from the first treatment session. The results demonstrate a significant reduction in craniofacial pain after applying global osteopathic treatment to the patients suffering with chronic rhinosinusitis. The results remained positive up to two weeks after the third treatment session. Osteopathic treatment preceded by and in line with a comprehensive diagnosis, improved quality of life in patients with chronic rhinosinusitis, measured using two disease-specific questionnaires (SNAQ-11 and RTF).

Osteopathic treatment can be used as an alternative treatment prior to surgery and in some cases could even remove the need for surgery. These findings should be analyzed further in future studies.



## TECHNIQUES

**Żurowska A, Malak R, Kołcz-Trzęsicka A, Samborski W, Paprocka-Borowicz M. *Compression of the Fourth Ventricle Using a Craniosacral Osteopathic Technique: A Systematic Review of the Clinical Evidence*. Evid Based Complement Alternat Med. 2017; 2017:2974962. [LR](#)**

Compression of the fourth ventricle (CV4) is a well-known osteopathic procedure, utilized by osteopaths, osteopathic physicians, craniosacral therapists, physical therapists, and manual therapists as part of their healthcare practice based on some evidence suggesting impact on nervous system functions.

The main objective of the study was to identify randomized controlled trials (RCTs) assessing the clinical benefits of CV4 and to show the evidence supporting clinical prescriptions, guides, and advice in treating.

A computerized search of the PubMed, CINAHL Complete, Scopus, Web of Science, and Science-Direct databases was performed. Two filters were used (article type: RCTs; species: humans).

The methodological quality of the trials was assessed using the Downs and Black quality checklist for healthcare intervention studies.

Only six studies met the inclusion criteria, of which four were RCTs and two were observational studies. The Downs and Black score ranged from 17 to 24 points out of a maximum of 27 points.

The present review revealed the paucity of CV4 research in patients with different clinical problems, as five out of six included studies investigated healthy adults.

According to the results of the included studies, CV4 may be beneficial for patients with different functional problems.

**Miana L, Bastos VH, Machado S, Arias-Carrión O, Nardi AE, Almeida L, Ribeiro P, Machado D, King H, Silva JG. *Changes in alpha band activity associated with application of the compression of fourth ventricular (CV-4) osteopathic procedure: a quantitative electroencephalography pilot study*. J Bodyw Mov Ther. 2013 Jul; 17(3):291-6. [BRCT](#)**

The compression of the fourth ventricle (CV-4) is one of the more well-known procedures in the cranial manipulation curriculum and practice.

Cranial manipulation has received criticism because of the subtle, difficult to learn techniques, controversy over whether or not cranial bone structures move, and what if any clinical effects have been shown.



The aim of this study was to measure the effects of CV-4 in 10 healthy subjects through quantitative electroencephalography (qEEG), specifically in alpha band. Participants were randomly distributed in control, sham-CV4 and CV4 conditions using a cross-over design.

qEEG activity was recorded for each of the 10 subjects in each of the 3 conditions. There was a significant increase in the alpha absolute power between pre and post in the CV-4 condition. There appears to be potential for understanding the effect of the CV-4 if these findings are replicated in further clinical trials.

**Cutler MJ, Holland BS, Stupski BA, Gamber RG, Smith ML. *Cranial manipulation can alter sleep latency and sympathetic nerve activity in humans: a pilot study.* J Altern Complement Med. 2005 Feb; 11(1):103-8. [BRCT](#)**

The objective of this study was to determine if cranial manipulation is associated with altered sleep latency. Furthermore, we investigated the effects of cranial manipulation on muscle sympathetic nerve activity (MSNA) as a potential mechanism for altered sleep latency.

Randomized block design with repeated measures.

The Integrative Physiology and Manipulative Medicine Departments, University of North Texas Health Science Center, Fort Worth, TX.

Twenty (20) healthy volunteers (12 male, 8 female; age range, 22-35 years) participated in this investigation.

Subjects were exposed to 3 randomly ordered treatments: compression of the fourth ventricle (CV4), CV4 sham (simple touch), and control (no treatment).

Sleep latency was assessed during each of the treatments in 11 subjects, using the standard Multiple Sleep Latency Test protocol. Conversely, directly recorded efferent MSNA was measured during each of the treatments in the remaining 9 subjects, using standard micro-neurographic technique.

Sleep latency during the CV4 trial was decreased when compared to both the CV4 sham or control trials ( $p < 0.05$ ). MSNA during the CV4-induced temporary halt of the cranial rhythmic impulse (still point) was decreased when compared to pre still-point MSNA ( $p < 0.01$ ).

However, these changes in MSNA were similar between the CV4 sham and control trials ( $p > 0.80$ ).

During the CV4 sham and control trials MSNA was not different between CV4 time-matched measurements ( $p > 0.05$ ). Moreover, the change in MSNA pre still-point to still point during the CV4 trial was different compared to the CV4 sham and control trials ( $p < 0.05$ ). However, this change in MSNA was similar between the CV4 sham and control trials ( $p > 0.80$ ).

The current study is the first to demonstrate that cranial manipulation, specifically the CV4 technique, can alter sleep latency and directly measured MSNA in healthy humans. These find-



ings provide important insight into the possible physiologic effects of cranial manipulation. However, the mechanisms behind these changes remain unclear.

## OTHERS

**Hayden C, Mullinger B. *A preliminary assessment of the impact of cranial osteopathy for the relief of infantile colic.* Complement Ther Clin Pract. 2009 Nov, 15(4):198-203. [BRCT](#)**

In this open, controlled, prospective study, 28 infants with colic were randomized to either cranial osteopathic manipulation or no treatment; all were seen once weekly for 4 weeks.

Treatment was according to individual findings, and administered by the same practitioner.

Parents recorded time spent crying, sleeping and being held/rocked on a 24-hour diary.

A progressive, highly significant reduction between weeks 1 and 4 in crying (hours/24h) was detected ( $P < 0.001$ ) in treated infants; similarly, there was a significant improvement in time spent sleeping ( $P < 0.002$ ).

By contrast, no significant differences were detected in these variables for the control group.

Overall decline in crying was 63% and 23%, respectively, for treated and controls; improvement in sleeping was 11% and 2%.

Treated infants also required less parental attention than the untreated group. In conclusion, this preliminary study suggests that cranial osteopathic treatment can benefit infants with colic; a larger, double-blind study is warranted.

**Haller H, Lauche R, Cramer H, Rampp T, Saha FJ, Ostermann T, Dobos G. *Craniosacral Therapy for the Treatment of Chronic Neck Pain: A Randomized Sham-controlled Trial.* Clin J Pain. 2016 May; 32(5):441-9. [BRCT](#)**

With growing evidence for the effectiveness of craniosacral therapy (CST) for pain management, the efficacy of CST remains unclear. This study therefore aimed at investigating CST in comparison with sham treatment in chronic nonspecific neck pain patients.

A total of 54 blinded patients were randomized into either 8 weekly units of CST or light-touch sham treatment. Outcomes were assessed before and after treatment (week 8) and again 3 months later (week 20).

The primary outcome was the pain intensity on a visual analog scale at week 8; secondary outcomes included pain on movement, pressure pain sensitivity, functional disability, health-related quality of life, well-being, anxiety, depression, stress perception, pain acceptance, body awareness, patients' global impression of improvement, and safety.



In comparison with sham, CST patients reported significant and clinically relevant effects on pain intensity at week 8 (-21 mm group difference; 95% confidence interval, -32.6 to -9.4;  $P=0.001$ ;  $d=1.02$ ) and at week 20 (-16.8 mm group difference; 95% confidence interval, -27.5 to -6.1;  $P=0.003$ ;  $d=0.88$ ). Minimal clinically important differences in pain intensity at week 20 were reported by 78% within the CST group, whereas 48% even had substantial clinical benefit.

Significant between-group differences at week 20 were also found for pain on movement, functional disability, physical quality of life, anxiety and patients' global improvement.

Pressure pain sensitivity and body awareness were significantly improved only at week 8. No serious adverse events were reported.

CST was both specifically effective and safe in reducing neck pain intensity and may improve functional disability and the quality of life up to 3 months after intervention.

**Feely RA, Kapraun HE. *Progressive Infantile Scoliosis Managed With Osteopathic Manipulative Treatment.* J Am Osteopath Assoc. 2017 Sep 1; 117(9):595-599. [CC](#)**

Infantile idiopathic scoliosis is a compensatory result of cranial and sacral intraosseous dysfunction associated with asymmetric developmental deformation of the occiput, leading to dysfunction of the sphenobasilar synchondrosis.

A female infant with progressive infantile idiopathic scoliosis diagnosed at age 12 months (46.9° left scoliotic curve) initially received standard orthopedic care, including casting.

The patient presented for osteopathic evaluation at age 14 months, at which time her scoliotic curve was 52°.

The patient wore a Risser cast extending from T1-L5 at her first osteopathic manipulative treatment (OMT) visit, which included osteopathic cranial manipulative medicine. Her parents chose to have the cast removed at age 17 months, with a 23° curve remaining. For approximately 12 months, OMT was the only continued, consistent treatment, which occurred once per month. By 28 months of age, radiographs measured 0° of scoliosis.

This case demonstrates that OMT can dramatically improve infantile idiopathic scoliosis and prevent its progression.

**Martins WR, Diniz LR, Blasczyk JC, Lagoa KF, Thomaz S, Rodrigues ME, de Oliveira RJ, Bonini-Rocha AC. *Immediate changes in electroencephalography activity in individuals with nonspecific chronic low back pain after cranial osteopathic manipulative treatment: study protocol of a randomized, controlled crossover trial.* BMC Complement Altern Med. 2015 Jul 13;15:223. [BRCT](#)**

Osteopathic medicine is based on a diagnostic and therapeutic system to treat tissue mobility/motility dysfunctions in general, using different approaches (depending on the target tissue) known as osteopathic manipulative treatment.



Among the available techniques those ones addressed to the cranial field are the most questioned because of the lack of scientific evidence; but the compression of the 4th ventricle technique has been largely studied in clinical trials.

Studies have shown that the technique may affect both central and autonomous nervous system, modulating some reflexes (Traube-Hering baro signal), and modifying brain cortex electrical activity through central sensitization in subjects with chronic low back pain. Thus, investigators hypothesize that the compression of the 4th ventricle may modulate peak alpha frequency (electroencephalographic assessment) and promote physical relaxation in subjects in vigil.

A randomized, controlled crossover trial with blinded assessor was designed to test the hypothesis.

A total of 81 participants will be assigned to three treatment conditions, with seven days of washout:

- › compression of the 4th ventricle;
- › sham compression of the fourth ventricle;
- › control (no intervention).

The (I) power amplitude and the (II) frequencies of the dominant peak in the alpha band will be the primary outcome measures of the study.

All participants will be recruited at the Outpatient Rehabilitation Service of the University Hospital of Brasília-University of Brasília.

All the electroencephalographic exams will be conducted by a blinded assessor. The investigators hypothesize that patients with chronic low back pain submitted to the technique would have the peak alpha frequency modulated and, thus, would experience physical relaxation.

**Shi X, Rehrer S, Praiaoti P, Stoll ST, Gamber RG, Downey HF. *Effect of cranial osteopathic manipulative medicine on cerebral tissue oxygenation. J Am Osteopath Assoc* 2011 Dec; 111(12):660-6. [BRCT](#)**

The goal of this study was to determine whether the use of cranial osteopathic manipulative medicine (OMM) can alter cerebral tissue oxygen saturation and could play a role in the maintenance of cerebral homeostasis.

The effects of cranial OMM on cerebral tissue oxygen saturation SCTO<sub>2</sub> and cardiac autonomic function in healthy adults.

Cranial OMM augmentation and suppression techniques and sham therapy were randomly applied to healthy adults. During cranial OMM and sham therapy, SCTO<sub>2</sub> of the prefrontal cortex was determined bilaterally by using near-infrared spectroscopy. Heart rate, blood pressure, and systemic arterial blood oxygen saturation SaO<sub>2</sub> were also measured. Power spectral analysis was applied to continuous 4-minute R-R intervals. Measurements were made



during 2-minute baseline periods, during 4-minute applications of the techniques, and during 5-minute recovery periods.

Twenty-one adults (age range, 23-32 years) participated in the present study. Differences in mean baseline measurements for the augmentation technique, suppression technique, and sham therapy were not statistically significant for heart rate, blood pressure, SaO<sub>2</sub>, left SCTO<sub>2</sub>, or right SCTO<sub>2</sub>.

During the suppression technique, there was a statistically significant decrease in both left (slope [standard deviation]= -0.33 [0.08] %/min, R(2)=0.85, P=.026) and right (slope [standard deviation]= -0.37 [0.06] %/min, R(2)=0.94, P=.007) SCTO<sub>2</sub> with increased cranial OMM time.

However, neither the augmentation technique nor the sham therapy had a statistically significant effect on SCTO<sub>2</sub>. Decreases in normalized low-frequency power of R-R interval variability and enhancements of its high-frequency power were statistically significant (P=.05) during cranial OMM and sham therapy, indicating a decrease in cardiac sympathetic influence and an enhanced parasympathetic modulation.

The cranial OMM suppression technique effectively and progressively reduced SCTO<sub>2</sub> in both prefrontal lobes with the treatment time.

**Fraix M, Gordon A, Graham V, Hurwitz E, Seffinger MA. Use of the SMART Balance Master to quantify the effects of osteopathic manipulative treatment in patients with dizziness. J Am Osteopath Assoc. 2013 May; 113(5):394-403. [BRCT](#)**

Dizziness is the third most common complaint among outpatients and the most common complaint in patients aged 75 years or older. It can be incapacitating for patients, affecting both productivity and quality of life.

The objective of this study was to evaluate the effect of osteopathic manipulative treatment (OMT) for spinal somatic dysfunction in patients with dizziness lasting longer than 3 months.

A prospective clinical cohort study that took place in 2011 in the Department of Physical Therapy laboratory at the Western University of Health Sciences College of Osteopathic Medicine in Pomona, California.

Sixteen participants (2 male, 14 female; mean [range] age, 49 [13-75] years) with dizziness lasting at least 3 months (mean duration of symptoms, 84 months) and spinal somatic dysfunction, but no history of known stroke or brain disease, were recruited from the local community and evaluated for postural balance control before, immediately after, and 1 week after OMT.

Four osteopathic physicians board certified in neuromusculoskeletal medicine/osteopathic manipulative medicine provided OMT, including muscle energy; high-velocity, low-amplitude; counterstrain; myofascial release; balanced ligamentous release; and cranial OMT techniques.

Outcomes were assessed with the SMART Balance Master (NeuroCom), a validated instrument that provides graphic and quantitative analyses of sway and balance, and the Dizziness Handicap



Inventory (DHI), a self-assessment inventory designed to assess precipitating physical factors associated with dizziness and functional and emotional consequences of vestibular disease.

Paired t tests, performed to assess changes in mean composite scores for all challenge tests, revealed that balance was significantly improved both immediately and 1 week after OMT (both  $P < .001$ ), with no significant difference between immediate and 1-week post-OMT scores ( $P = .20$ ).

The DHI scores, both total and subscale, improved significantly after OMT ( $P < .001$ ), and changes in composite and DHI scores were correlated with each other ( $P = .047$ ).

Osteopathic manipulative treatment for spinal somatic dysfunction improved balance in patients with dizziness lasting at least 3 months.

**Vecino Rodríguez A, Martínez Loza E. *Modificaciones inmediatas en la dinámica uterina tras la realización de la técnica de equilibración de la sincondrosis esfenobasilar según Upledger. Osteopatía Científica 2010;5:2-8. [BRCT\\*](#)***

The objective was to analyse and compare the presence or absence of uterine contractions in two groups, following the application of Upledger's technique for balancing the sphenobasilar synchondrosis. Hypothesis: Upledger's balancing manoeuvre for the sphenobasilar synchondrosis did not provoke any immediate uterine contractions in patients in the last three weeks of pregnancy.

A controlled, double-blinded, randomized clinical trial. Having confirmed that no uterine contractions had occurred before the intervention, post-intervention measurements were taken to check for the presence of contractions in 118 patients (with no known SEB disorders), divided into two equal groups: an intervention group and a control group, with 59 subjects in each. All measurements were taken using a foetal monitor.

There was a considerable difference ( $p < 0.05$ ) between the results of applying the balancing manoeuvre to the sphenobasilar synchondrosis and the results of the placebo study. The significance level was 95% (statistically significant) and the variables were dichotomous.

After applying the technique and completing the study, Upledger's balancing manoeuvre for the sphenobasilar synchondrosis was seen to provoke uterine contractions in the women in the last three weeks of pregnancy within 5 minutes of applying the technique.

## SCIENTIFIC ARTICLES

\* Articles published by the Madrid School of Osteopathy

### ARTICLES REFUTING CRANIAL AND CRANIOSACRAL OSTEOPATHY

#### Craniosacral and cranial palpation and PRM

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Sommerfeld et al. (2004)	BRCT	The existence of the PRM and poor interexaminer reliability.	49 patients
Moran et Gibbons (2011)	OS	Poor inter- and intraexaminer reliability when palpating the CSR.	11 patients
Rogers et al. (1998)	OS	Poor inter- and intraexaminer reliability when palpating the CSR.	28 patients
Wirth-Pattullo et al. (1994)	OS	Poor inter- and intraexaminer reliability when palpating the CSR and heart and respiratory rates.	12 patients
Hanten et al. (1998)	OS	Idem.	40 patients
Rogers and Witt (1997)	LR	The controversy of cranial bone motion.	
Guillaud et al. (2016)	LR	Poor reliability of diagnosis and the effects of cranial osteopathy.	14 articles
Zegarra-Parodi et al. (2009)	BRCT	The difficulty of teaching cranial palpation to osteopathy students.	24 students
Ferré et al. (1990)	NSC	The sutures in the cranial vault and the base of the skull are clearly incapable of the rhythmic movements "described" by osteopaths.	?

LR = Literature Review, BRCT = Blinded Randomised Controlled Trial, PS = Pilot Study, OS = Observational Study, NSC = Non Scientific Commentary.

#### Conclusions

The literature reviews and observational clinical studies published indicate poor interexaminer reliability when performing craniosacral palpation. There is a lack of evidence and the studies



published are of a poor scientific quality. The quality of the research on cranial osteopathy must be improved.

There is clearly no evidence for the existence of the craniosacral rhythm.

## THE EFFECTS OF CRANIAL AND CRANIOSACRAL OSTEOPATHY

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Jakel and Bonn Hauens-child (2011)	LR	The lack of evidence on the effects of cranial osteopathy.	8 studies
Cardoso de Mello Ribeiro et al. (2015)*	BRCT	The ineffectiveness of the CV4 technique on plasma catecholamines, blood pressure and heart rate.	40 patients
Green et al. (1999)	LR	The ineffectiveness of craniosacral osteopathy.	
Wyatt et al. (2011)	BRCT	The ineffectiveness of cranial osteopathy on children with cerebral palsy.	142 children

LR = Literature Review, BRCT = Blinded Randomised Controlled Trial.

### Conclusions

The literature reviews indicate a lack of evidence on the effects of cranial osteopathy, mostly owing to the poor scientific quality of the studies published. The quality of the research on cranial osteopathy must be improved.

The few blind controlled randomized studies published on cranial osteopathy indicate a lack of effective treatment for infant cerebral palsy, the secretion of plasma catecholamines, blood pressure and heart rate.



## SCIENTIFIC ARTICLES SUPPORTING CRANIAL OSTEOPATHY

### Anatomical Tests

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Retzlaff et al. (1976)	AS	The structure of cranial sutures.	Monkeys
Schueler et al. (1976)	AS	Innervation of the cranial dura mater and meninges: suture pain.	Rats
Bigal et al. (2008)	PS	The mechanisms of a headache and cranial soft tissue.	
Upledger et Vredevoogd (193)	Book	The existence of neurons from the sagittal suture, through the meningeal membranes, to the wall of the 3rd ventricle.	

AS = Anatomical Study, PS = Physiological Study.

### Conclusion

Cranial sutures contain nerve fibers and mechanoreceptors, which respond to pressure changes.

There are axons inside the sutures that transport sensory information to the cranium, which is nociceptive.

Meningeal fibers ensure a very good nerve supply to the posterior part of the falx cerebri, the tentorium cerebelli and the dura mater of the base of the cranium in the middle cranial fossa.

The trigeminal nerve (V1 and V2) and the cervical branches of C2 and C3 are responsible for the sensory innervation of the cranium and the cranial sutures.

Meningeal afferents innervate extracranial tissues such as the periosteum and pericranial muscles via collaterals projecting through the skull. These afferents may be nociceptive, some may subserve proprioceptive functions. It has been suggested that these afferents have a double-size innervation area which seems to innervate the periosteum and the cranial dura mater.

Activating this nociceptive innervation of the periosteum leads to the development of nerve hypersensitivity or allodynia with headaches.

Manual osteopathic therapy manipulations can reduce afferent activity in cases of nerve hypersensitivity.

## Movements and palpation

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Retzlaff and Michael (1975)	AS	Cranial bone mobility.	Monkeys
Retzlaff et al. (1975)	AS	The functional role of the opening and closing of the cranial sutures.	Monkeys
Adams et al. (1992)	AS	Parietal bone mobility.	Cats
Herniou (1999)	AS	Cranial bone mobility.	Sheep
Rommeveaux (1993)	PS	Cranial bone mobility.	Humans
Lecoq (1980)	PS	Cranial bone mobility.	Humans
Crow et al. (2009)	RS	MR Imaging of cranial mobility.	20 subjects
Oleski et al. (2002)	RS	Radiological evidence of cranial bone mobility.	12 patients

AS = Anatomical Study, PS = Physiological Study, RS= Radiological Study.

## CSF rhythmic pulsations

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Levy and Di Chiro (1990)	RS	The existence of cerebrospinal fluid displacement as seen in MR Images.	Humans
Quencer et al. (1990)	RS	The existence of normal and abnormal cerebrospinal fluid displacement as seen in Cine MR Images.	Humans
Greitz et al. (1992)	RS	Cerebral pulsations and hemodynamics as seen in MR Images.	15 patients
Greitz et al. (1993)	RS	Rhythmic CSF circulation and hemodynamics as seen in MR Images and cisternography.	24 patients
Henry-Feugeas et al. (1993)	RS	Normal and abnormal CSF dynamics as seen in MR Images.	Humans
Moskalenko (1961)	PS	Cerebral pulsations in the skull, ventricle and CSF pulsations.	Humans and animals
Sabini and Elkowitz (2006)	AS	The significance of the sutural patency.	36 craniums

AS = Anatomical Study, PS = Physiological Study, RS= Radiological Study.

## Osteopathic and cranial rhythmic impulses

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Gard (2009)	PS	The regulation of intracranial pressure and its effect on the cranial bones.	Humans
McPartland and Mein (1997)	PS	Cranial rhythmic impulse.	Theoretical
Norton (1991)	PS	The existence of PRM and cranial rhythmic impulses.	Humans
Chikly and Quaghebeur (2013)	LR	A review of the physiology of CSF hydrodynamics.	Humans
Farasyn and Vanderschueren (2001)	PS	Cranial rhythmic impulses and intravenous flow rate.	15 patients
Nelson et al. (2001)	PS	Cranial rhythmic impulses with palpation and doppler echocardiography.	Humans
Nelson (2006)	OS	Recording cranial rhythmic impulses and Traube-Hering oscillation.	Humans
Halma et al. (2008)	OS	Positive intraexaminer reliability of cranial palpation.	

AS = Anatomical Study, PS = Physiological Study.

### Conclusion

There is no doubt that there is micro-mobility at the facial and cranial sutures: there is significant clinical evidence.

Alterations to the rhythmic pressure in the bones of the skull are accompanied by rhythmic fluid fluctuations.

Changes to the formation of sutures correspond to the elasticity of the skull and the intersutural tissue.

The sagittal suture is displaced by mm, while the parietal bones are displaced in internal-external rotation.

Sutural mobility ranges from 25 to 41  $\mu$  and bone elasticity ranges from 6 to 25  $\mu$ .

The bone elasticity of the maxilla produces a rhythmic intermaxillary movement (9 cycles/minute) with a range of 1.5 mm.

The existence of a primary respiratory mechanism is called into question as there is no motor for the mechanism. Dilation of the cerebral ventricles cannot be responsible and the cerebrospinal fluid (CSF) pressure is 0.4 N, equivalent to 40g. The pressure is negligible so CSF cannot be the motor of the system. Displacement velocity is very slow (1cm/ hour): the most reasonable, straight-forward explanation is that diaphragmatic breathing is the motor of the mechanism.

### The effects of cranial osteopathy on ophthalmology

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Sánchez Jorgea and Palomeque del Cerro (2010)*	BRCT	The influence of the pump technique applied to the eyeball on intraocular pressure in patients with hypertension.	60 patients
Pérez Navarro and Capó i Giner (2009)*	BRCT	The effectiveness of the lacrimal bone release technique on congenital nasolacrimal duct obstruction.	30 patients
Sandhouse et al. (2010)	BRCT	The effects of cranial osteopathy on functional vision in adults with cranial asymmetry.	29 patients
Sandhouse et al. (2016)	BRCT	The effects of cranial osteopathy on functional vision in patients with cranial asymmetry.	89 patients

BRCT = Blinded Randomised Controlled Trial.

### The effects of cranial osteopathy on migraines and headaches

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Voigt et al. (2011)	BRCT	The effect of cranial osteopathy on migraines.	42 patients
Schabert and Crow (2009)	cBRCT	The cost benefits of the use of cranial osteopathy to treat migraines.	631 patients
Cerritelli et al. (2017)	LR	The effect of cranial osteopathy on migraines.	
Rolle et al. (2014)	BRCT	The effect of cranial osteopathy on tension headaches.	40 patients
Mann et al. (2008)	BRCT	Craniosacral therapy and cranial osteopathy for migraines.	109 patients
Anderson and Seniscal (2006)	BRCT	The effect of cranial osteopathy on tension headaches.	26 patients
Cerritelli et al. (2015)	BRCT	The effect of cranial osteopathy on migraines.	105 patients

LR = Literature Review, BRCT = Blinded Randomised Controlled Trial, cBRCT = Community-Based Blinded Randomised Controlled Trial.

### The effects of cranial osteopathy on plagiocephaly

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Amiel-Tison and Soyez-Papiernik (2008)	LR	Osteopathic manipulative treatment for plagiocephaly.	
Lessard et al. (2011)	PS	Osteopathic manipulative treatment for plagiocephaly.	
Billi et al. (2017)	BRCT	Osteopathic manipulative treatment for plagiocephaly.	10 patients
Sergueef et al. (2006)	EE	Significant correlation between the lateral strain pattern of the sphenoccipital synchondrosis and plagiocephaly and between rotational dysfunction of the occiput upon the atlas and the side of posterior plagiocephaly.	649 children

LR = Literature Review, BRCT = Blinded Randomised Controlled Trial, PS = Pilot Study ES = Epidemiological Study.

### The effects of cranial osteopathy on dentistry

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Brantingham et al. (2013)	LR	Osteopathic manipulative treatment and pain in the upper limb and temporomandibular joint.	71 studies
Meyer and Gustowski (2012)	CC	Osteopathic manipulative treatment for headaches or neck pain after a dental extraction.	1 patient
Walter et al. (2015)	PS	Osteopathic treatment causes spatial changes in the maxilla, as seen in 3D CT scans.	3 patients
Cuccia et al. (2011)	LR	Applying osteopathic manipulative treatment to the accessory ligaments of the temporomandibular joint in order to treat the joint.	
Fournier et al. (2011)	LR	Collaboration between orthodontics and osteopathy.	
Gesslbauer et al. (2016)	BRCT	Cranial and musculoskeletal osteopathic treatment for temporomandibular joint dysfunctions.	40 patients
Monaco et al. (2008)	BRCT	Cranial osteopathic treatment and kinesiographic recording for temporomandibular joint dysfunctions.	28 patients
Gesslbauer et al. (2016)	BRCT	Cranial vs musculoskeletal osteopathic treatment for temporomandibular joint dysfunctions.	40 patients

LR = Literature Review, CC = Clinical Case Study, BRCT = Blinded Randomised Controlled Trial, PS = Pilot Study.

### The effects of cranial osteopathy on AOM

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Mills et al. (2003)	BRCT	Cranial osteopathy and recurrent acute otitis media.	57 patients
Steele et al. (2014)	BRCT	Cranial osteopathy and acute otitis media.	43 patients
Méndez Sánchez (2008)*	PS	Cranial osteopathy and chronic rhinosinusitis.	3 patients

LR = Literature Review, PS = Pilot Study.

### The effects of cranial osteopathy

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Žurowska et al. (2017)	LR	Evidence of compression of the fourth ventricle (CV4).	6 articles
Miana et al. (2013)	BRCT	CV4 and a significant increase in the power of the alpha band with electroencephalography.	10 patients
Cutler et al. (2005)	BRCT	CV4 and changes to sleep latency and muscle sympathetic nerve activity.	20 patients
Vecino Rodríguez and Martínez Loza (2010)*	BRCT	Changes to labour progression and balancing the sphenobasilar synchondrosis.	118 patients
Kostopoulos and Keramides (1992)	AS	Elongation of falx cerebri during anterior traction of the frontal lift:	Humans

LR = Literature Review, BRCT = Blinded Randomised Controlled Trial.

## The effects of cranial osteopathy on various pathologies

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Haller et al. (2016)	BRCT	Cranial osteopathy for treating neck pain.	54 patients
Feely and Kapraun (2017)	CC	Cranial osteopathy in infant idiopathic scoliosis.	1 patient
Martins et al. (2015)	BRCT	CV4 and electroencephalography.	81 patients
Shi et al. (2011)	BRCT	Cranial osteopathy and changes to cerebral tissue oxygen saturation.	21 patients
Fraix et al. (2013)	BRCT	Cranial osteopathy and vertigo.	16 patients
Duncan et al. (2008)	BRCT	Cranial osteopathy and myofascial release versus acupuncture in patients with spastic cerebral palsy.	55 patients
Shanahan et al. (2017)	CC	Cranial osteopathy and Isaac's Syndrome.	1 patient
Whedon and Glassey (2009)	LR	Cranial osteopathy and stasis of the cerebrospinal fluid.	
Mulcahy and Vaughan (2014)	PS	Experiences of patients receiving cranial osteopathic treatment.	
Rivera-Martinez et al. (2002)	EE	Cranial osteopathy and Parkinson's disease.	50 patients
Hayden and Mullinger (2009)	BRCT	Cranial osteopathy and infantile colic	28 infants

LR = Literature Review, CC = Clinical Case Study, BRCT = Blinded Randomised Controlled Trial, PS = Pilot Study, OS = Observational Study, ES = Epidemiological Study.

## GENERAL CONCLUSIONS

We have presented 13 scientific articles describing the ineffectiveness of craniosacral and cranial osteopathy versus 69 articles with positive findings on osteopathy in relation to cranial palpation, the TMJ, plagiocephaly, otitis and sinusitis, migraines and headaches, ophthalmology and various other pathologies such as infantile colic, Parkinson's disease, cerebral Palsy, vertigo, gynaecology, neck pain...

It is clear that there is scientific evidence on the benefits of osteopathy and it is easy to find if you take the time to search for it on Pubmed.



However, the quality of the scientific studies on this subject should be improved. Blinded randomized controlled studies, case-control studies and literature reviews of those studies are recommended.

## THESES ON CRANIAL OSTEOPATHY

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### KEY

- › LR = Literature Review.
- › CC = Clinical Case Study.
- › BRCT = Blinded Randomised Controlled Trial.
- › PS = Pilot Study.
- › AS = Anatomical Study.
- › OS = Observational Study.
- › PS = Physiological Study.
- › ES = Epidemiological Study.

**Ibáñez García J. *Análisis comparativo entre la aplicación de la técnica de Jones y la técnica neuromuscular en los Puntos Gatillos latentes miofasciales de los maseteros.* Tesis de medicina osteopática, Escuela de Osteopatía de Madrid: Madrid.2007. BRCT**

The myofascial trigger points (MTrPs) of the muscles of mastication, specifically masseter muscle, are some of the most common causes of temporomandibular disorders. Treating these trigger points as part of current osteopathic practice is essential because of their involvement in stomatognathic and posture disorders. The subjects of this study, therefore, are the neuromuscular techniques that seek to treat these disorders.

### Objectives

To carry out a comparative analysis of the Jones technique and the Neuromuscular Technique using the thumb, applied to the latent myofascial trigger points (MTrPs) of the masseter muscle.

### Patients, Materials and Method

The study took place at the FITEMA Centre for Functional Rehabilitation and Physiotherapy (Centro de Recuperación Funcional y Fisioterapia Fitema) in Barcelona.

The subjects were randomly divided into three groups: Group 0 or the Control Group who underwent a placebo technique n = 24; Group 1 who underwent the neuromuscular technique n = 22 and Group 2 who underwent the Jones technique n = 25. Each treatment group received three sessions for 3 consecutive weeks. The following variables were evaluated before and after the intervention: Pressure pain threshold, measured using a pressure algometer in the MTrPs of the dysfunction masseter, pain using VAS elicited by the application of 1.5 Kg/cm<sup>2</sup> (pressure algometer) on the MTrPs of the dysfunctional masseter, active mouth opening and protrusion of the mouth.



The statistics programme used for this study was SPSS version 14.0, analysing a total of 28 variables.

The descriptive analysis used the mean and standard deviation in quantitative variables and frequencies in qualitative variables. In the comparative analyses, the Kolmogorov-Smirnov test, student's T-test (unpaired data),  $\chi^2$  test and ANOVA (paired measures - intra-subject: session; inter-subject: study group) were used.

The multiple analysis and general comparisons of the qualitative variables showed no significant differences among the three groups. Quantitative variables showed normal distribution. The multiple analysis and paired comparisons of the quantitative variables in the pre-intervention and post-intervention assessments across the three sessions showed significant differences in pressure pain threshold, active mouth opening and protrusion of the mouth. The Jones technique produced significant changes ( $p < 0.01$ ) in pressure pain threshold, measured using a pressure algometer and in active mouth opening ( $p = 0.02$ ). The NMT technique produced significant changes ( $p < 0.01$ ) in pressure pain threshold, measured using a pressure algometer and in active mouth opening ( $p = 0.009$ ). The VAS showed no significant differences in variable pressure pain, measured using a pressure algometer after applying either of the techniques.

## Conclusions

The Jones and NMT techniques are effective in the treatment of latent MTrPs in the masseter muscle producing significant changes in pressure pain threshold, active mouth opening and mouth protrusion.

**Caricote Armando S. *Aplicación de La Técnica de Jones en el músculo digástrico de pacientes con disfunción temporomandibular y tinnitus. Tesis de medicina osteopática, Escuela de Osteopatía de Madrid: Madrid. 2006. [BRCT](#)***

## Objective

To compare the effectiveness of conventional dentistry versus the Jones technique, applied to the digastric muscles in treating tinnitus in patients at the UNICRAM with temporomandibular disorders, tinnitus and limited mouth opening.

## Hypothesis

Applying the Jones technique to the digastric muscles with temporomandibular disorders, tinnitus and limited mouth opening will be more effective than conventional dentistry in improving the tinnitus.

## Materials and Methods

Experimental field study, Randomized controlled clinical trial with a comparative, longitudinal interexaminer Kappa coefficient. The sample group was made up of 42 patients with



temporomandibular disorders, tinnitus and limited mouth opening with no associated clinical pathologies from a population of 104 adult patients who came voluntarily to the Research Unit in Craniomandibular Disorders (UNICRAM) Faculty of Dentistry at the Universidad de Carabobo-Venezuela between October 2005 and June 2006, aged between 18 and 68 with no consideration of race, sex or religion.

A pretest posttest design analysing the trigger points of the digastric muscle, the tinnitus annoyance index (TAI) and active mouth opening in each group. The control group underwent dental treatment and the intervention group underwent the Jones technique. The statistical analyses used were the Kappa coefficient, the student's T-test, statistical inference, normality tests, the Wilcoxon signed-rank test, the null hypothesis test and a comparison of the treatment techniques applied.

### Results

Kappa Coefficient: 0.72 pretest and 0.87 posttest. Hypothesis testing: confidence interval is 99% of the intervention group, relative to the control group. Tinnitus improved in 100% of cases in the intervention group and disappeared in 4.76% of cases. In the control group, tinnitus did not improve in 76.19% of cases and did not disappear in any of the patients (0%). Active mouth opening increased in both groups.

### Conclusions

The Jones technique applied to the digastric muscle was significantly more effective in treating tinnitus than conventional dentistry.

**Garcia Garcia C. *Validación del test de movilidad mandibular comparado con tomografía computarizada*. Tesis de medicina osteopática, Escuela de Osteopatía de Madrid: Madrid. 2007. [OS](#)**

### Objectives

The aim of the present study was to ascertain whether the Active Mandibular Test (Test A) confirms the existence of temporomandibular joint dysfunction (TMD) by evaluating its validity and reliability in comparison with that of computed tomography (CT), the gold standard.

### Methods

We performed a double-blind, non-randomized, observational, descriptive, cross sectional study in 44 volunteers of both sexes who attended the clinic.

Three therapists acted as observers. Statistical analysis was performed with parametric tests according to the distribution of the variables.

## Results

CT confirmed that 33 volunteers (75%) had TMD, while 11 (25%) had no dysfunction.

The Kappa value was 0.534 among the three observers, revealing moderate concordance [0.41-0.60].

## Conclusions

The validity, reproducibility and reliability of the results of test A, with a 95% confidence interval and in comparison with results of CT, indicate that this test has a sensitivity of 97% and a specificity of 73%. These results indicate that test A is more accurate in diagnosing TMD than in excluding this disorder.

**García De Pereda Notario CM. *Evaluación de la eficacia de la técnica de bombeo para la trompa de Eustaquio en otitis media y su relación con la mejora de la hipoacusia.* Tesis de medicina osteopática, Escuela de Osteopatía de Madrid: Madrid. 2014. [BRCT](#)**

## Introduction

Otitis media is inflammation of the middle ear. The presence of discharge in this cavity instead of air affects the pressure in the middle ear and obstructs the Eustachian tube (ET). This affects the equipressive functioning of the tympanic cavity, diminishing the patient's ability to hear. One option in these cases is to apply osteopathic manipulative treatment (OMT), particularly the pump technique for the ET.

## Objectives

Having carried out a pilot study, the sample size was increased in order to obtain significant results on the effectiveness of the pump technique applied to the ET and its effectiveness in improving hypoacusis.

## Materials and Methods

An experimental, double-blinded clinical trial was carried out on 42 patients, aged between 10 and 95 months. The subjects were randomly divided into two groups: an experimental group (EG: n = 21) and a control group (CG: n = 21). The CG received the Galbreath technique and both the Galbreath technique and the pump technique for the ET were applied to the EG.

Changes in hearing were measured using pre and post-treatment audiometry.

## Results

We observed an improvement across all of the data obtained from the EG in the patients' ability to hear low-pitched sounds and conversational noise levels. The pre and post-treatment



difference in the patients' ability to hear low-pitched sounds exceeded 5dB in the right ear (RE) ( $5,333 \pm 3,653$ ) and in both ears (BE) ( $5,208 \pm 3,300$ ). In the CG, we observed an improvement in the ability to hear low-pitched sounds in the right ear and in both ears.

There were differences between the two groups studies (CG and EG). A difference of  $1,362 \pm 4,362$  dB ( $p > 0.7567$ ) was observed in the left ear (LE). A difference of  $2,601 \pm 5,700$  dB ( $p > 0.6553$ ) was observed in both groups' ability to hear conversation noise levels in the left ear. However, these differences were not statistically significant.

## Conclusions

This study indicates that, although the changes are not statistically significant, OMT does slightly affect the level of secretion found in the middle ear in patients suffering from otitis media.

The use of OMT did improve the patients' ability to hear low-pitched noises and conversational noise levels.

We should point out that the pump technique applied to the ET produced a greater clinical improvement to the hypoacusis that the Galbreath technique in the majority of cases.

**Muñoz Rodríguez J. *Efectos de la técnica con arcos botantes para la abertura de la sutura occipitomastoidea en pacientes con cervicalgia mecánica.* Tesis de medicina osteopática, Escuela de Osteopatía de Madrid: Madrid. 2012. [BRCT](#)**

## Introduction

Mechanical neck pain has an incidence rate of 45 - 54% in the general population.

There is a direct relationship between neck pain, disabilities and chronicity so neck pain does have a high psychosocial and economic impact.

## Objective

To determine the immediate effects of applying the structural buttresses technique to open the occipitomastoid suture bilaterally on the range of motion in the cervical spine, pressure pain threshold (sutural, muscular and sclerotome) and pain intensity in patients with chronic mechanical neck pain.

## Materials and Methods

A controlled, experimental, double-blinded, randomized clinical trial. Sixty two participants ( $n=62$ ) with mechanical neck pain were randomly distributed into two groups: an experimental group (31), which received the structural buttress technique on both sides and a control group (31), which received a placebo technique. In both groups, pre and post-intervention tests were carried out to measure the cervical range of motion, the pressure pain threshold in C2 and in the occipitomastoid suture bilaterally, the trigger points of the upper trapezius



and anterior scalene muscles (algometer) and the pain intensity when resting and with each movement of the cervical spine, using the numerical pain rating scale.

## Results

Statistically significant improvements were seen in the experimental group for the algometric values in the right upper trapezius ( $p = 0.002$ ), the left upper trapezius ( $p < 0.001$ ), the left occipitomastoid suture ( $p = 0.004$ ) the left scalene muscle ( $p = 0.004$ ) and for the range of motion in flexion ( $p = 0.019$ ). There was also a tendency towards statistical significance in the algometric value for the right occipitomastoid suture ( $p = 0.052$ ) as well as the range of motion when sidebending (right:  $p = 0.055$ , left:  $p = 0.05$ ).

There were no changes in pain intensity.

## Conclusions

The structural buttresses technique to open the occipitomastoid suture applied to patients with chronic mechanical neck pain increases pressure pain threshold in the upper trapezius and left scalene muscles and in the left occipitomastoid suture. It also increases the range of motion in the cervical spine in flexion.

**Pérez Navarro J. *Estudio de la eficacia de la técnica osteopática de liberación del hueso lagrimal sobre la obstrucción congénita del conducto nasolagrimal*. Tesis de medicina osteopática, Escuela de Osteopatía de Madrid: Madrid.2007. [BRCT](#)**

## Objectives

The objective of the study was to analyse the effectiveness of the lacrimal bone release technique in children with congenital nasolacrimal duct obstruction (CNLDO).

## Hypothesis

The osteopathic lacrimal bone release technique is an effective treatment for CNLDO.

## Materials and Method

A randomized, simple blind experimental study with a placebo group.

In order to carry out this study, a sample of 30 subjects was taken from both sexes, aged between 2 weeks and 9 months, diagnosed with CNLDO. A total of 36 eyes were studied. The subjects were randomly divided into two groups: an intervention group, which received the treatment once and a placebo group, which received a placebo technique. The indicators used to evaluate the effectiveness of the technique were the fluorescein dye disappearance test (FDDT) and the modified Jones Test. The FDDT and Jones tests were carried out in both groups before the treatment (FDDT1/Jones1), immediately after the treatment (FDDT2/Jones2) and 14 days after the treatment (FDDT3/Jones3).

## Results

In the intervention group, the FDDT2 results ( $1.68 \pm 0.58$ ) and Jones2 results were significantly lower than in the placebo group ( $p < 0.05$ ). There was no statistically significant difference between the FDDT3 results ( $1.474 \pm 0.513$ ) and Jones3 results in the intervention group and the placebo group ( $p > 0.05$ ).

## Conclusions

The osteopathic lacrimal bone release technique produced lower FDDT results and higher Jones test results in the intervention group immediately after the treatment.

It can therefore be concluded that this technique is an effective short term treatment for CNLDO.

Applying the technique more than once could increase its effectiveness further still.

**Sánchez Jorge S. *Influencia de la técnica de bombeo del globo ocular en la presión intraocular en sujetos con hipertensión intraocular sometidos a medicación. Tesis de medicina osteopática, Escuela de Osteopatía de Madrid: Madrid. 2006. [BRCT\\*](#)***

Intraocular hypertension is a commonly occurring pathology and its prevalence increases with age.

High intraocular pressure over a period of several years is a risk factor for developing glaucoma.

## Objectives

The objective of this study was to assess the effect of the pump technique applied to the eyeball on the IOP level in subjects with hypertension taking medication. A second objective was to analyze the relationship between intraocular pressure (IOP), systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR).

## Patients, Materials and Method

A randomized clinical trial. 60 patients were selected with ocular hypertension- men and women, aged between 18 and -65, taking medication to treat the hypertension (beta-blockers).

They were randomly divided into two groups: an intervention group and a control group.

The IOP, SBP, DBP and HR were measured in all of the subjects in the same conditions before applying the technique, immediately afterwards and 15 minutes afterwards.

The IOP was measured using a portable applanation tonometer (Kowa tonometer HA-2).

## Results and Conclusion

The IOP level in subjects with hypertension taking medication measured immediately after applying the pump technique to the eyeball was statistically significantly lower ( $p < 0.001$ ) than before applying the technique and after applying the placebo. The results were the same after 15 minutes ( $p < 0,001$ ).

There was a strong correlation between the IOP and SBP each time they were measured ( $p < 0,05$ ) and it was a positive correlation i.e. when one increases, so does the other.

**Mainenti Pagnez MA. *Efecto de la técnica craneal y de la terapia manipulativa Osteopática en el desvió ocular de pacientes con cervicalgia mecánica. Tesis de medicina osteopática, Escuela de Osteopatía de Madrid: Madrid. 2017. [BRCT](#)***

## Objective

To determine the short-term effect of the combination of cranial osteopathy and osteopathic manipulative treatment (OMT) on deviation of the visual axis (horizontal heterophoria- HH), Pressure Pain Threshold in the cranial and cervical regions and the Neck Disability Index in patients with mechanical neck pain.

Secondly, to compare the placebo effect with cranial osteopathy in the results of the study.

## Method

A randomized, experimental clinical trial with a placebo was carried out on patients with mechanical neck pain and oculomotor dysfunction. The tests carried out at the beginning of the study, before and after the intervention included the Maddox rod test for both eyes, algometry in the pterion region and the lateral mass of the atlas (bilateral) and the neck disability questionnaire.

Patients were randomly divided into two groups: (cranial osteopathy + OMT vs cranial osteopathy placebo + OMT) for 4 weeks.

The waiting list period was used as the control phase and the results were compared at three intervals. The effect of the interventions was also compared.

21 women and 8 men with an average age of 58 years participated in this study. The results obtained from the two groups (cranial osteopathy + OMT vs cranial osteopathy placebo + OMT) showed no significant differences (HH right eye  $p = 0.671$ , HH left eye  $p = 0.449$ , pain in the right pterion  $p = 0.307$ , pain in the Y pterion  $p = 0.727$ , pain in the right atlas  $p = 0.201$ , pain in the left atlas  $p = 0.142$ , NDI  $p = 0.134$ ). The difference in the values before and after intervention in the cranial osteopathy + OMT group was not statistically significant and presented no corrective response in HH. The average pressure pain threshold values decreased but NDI improved.



## Results

The results of the cranial osteopathy placebo + OMT group were significant in NDI ( $p = 0.005$ ), presented no corrective response in HH and there were signs of improved local Pressure Pain Threshold at the end of the intervention phase.

## Conclusion

The results in the cranial osteopathy + OMT group were not better than the cranial osteopathy placebo + OMT group in patients with mechanical neck pain and associated horizontal heterophoria.

The cranial osteopathy + OMT group presented slightly worse results in average local Pressure Pain Threshold. Signs of improvement were seen in the cranial osteopathy placebo + OMT group.

The final Neck Disability Index results in the cranial osteopathy placebo + OMT group were significant.

## THESES ON CRANIAL OSTEOPATHY IN TABLE FORMAT

AUTHOR	TYPE OF STUDY	SUBJECT	POPULATION
Ibáñez García J (2007)	BRCT	The effectiveness of the neuro-muscular technique applied to the latent myofascial trigger points of the masseter muscle.	71 patients
Caricote Armando S (2006)	BRCT	The Jones technique applied to the digastric muscle in patients with temporomandibular joint dysfunction and tinnitus.	42 patients
García García C (2007)	OS	A comparison of the mandibular mobility test and commuted tomography.	44 patients
García De Pereda Notario CM (2014)	BRCT	The effectiveness of the lacrimal bone release technique on congenital nasolacrimal duct obstruction.	30 patients
Sánchez Jorge S (2006)	BRCT	The influence of the pump technique applied to the eyeball on intraocular pressure in patients with hypertension.	60 patients
Mainenti Pagnez MA (2017)	BRCT	The effect of cranial osteopathy and osteopathic manipulative treatment on ocular deviation in patients with mechanical neck pain.	29 patients
Gasparini M. (2017)	ECAA	Effets de l'ostéopathie crânienne sur plagiocéphalie positionnelle non synostosique	70 sujets

BRCT = Blinded Randomised Controlled Trial, OS = Observational Study.