

Phase contrast magnetic resonance measured changes in migraine subject following chiropractic care

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BACKGROUND

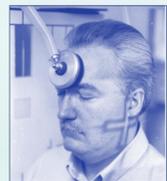
Reports of blood pressure normalization using the National Upper Cervical Chiropractic Association (NUCCA) atlas alignment procedure suggest a relation to changes in cerebral circulation. Phase Contrast Magnetic Resonance Imaging (PCMR) is a noninvasive method to investigate changes in cerebral hemodynamics and hydrodynamics. A male subject, with neurologist diagnosed migraine headaches, was studied with PCMR before and after the NUCCA intervention to explore changes in cerebral flow dynamics.

METHODS

A 61-year old male subject signed a consent form for an Institutional Review Board approved Phase Contrast MR imaging procedure after diagnosis of migraine without aura by a neurologist. Evaluation by NUCCA protocol followed. SF-36 and Headache Disability Index (HDI) were completed before doctor interaction. Reimaging occurred five and thirty days following atlas procedure. Weekly visits ensured maintenance of atlas alignment while assessing migraine symptoms. Repeat administration of SF-36 and HDI preceded reimaging at thirty days.

NUCCA RADIOGRAPHIC PROCEDURE

A total of three (3) x-rays of the head and neck are taken for pre-correction analysis. After the atlas misalignment is corrected, two (2) radiographs are obtained to determine if the atlas has returned to subject's 'normal.'



LATERAL



VERTEX

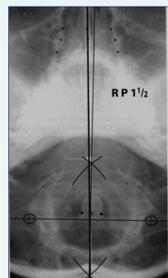


NASIUM

NUCCA ATLAS DIAGNOSTIC RADIOGRAPHS



LATERAL



VERTEX



NASIUM

NUCCA INTERVENTION PROCEDURE

SUPINE LEG CHECK SCREENING TEST



POSTURAL ASSESSMENT WITH ANATOMETER™



BEFORE INTERVENTION

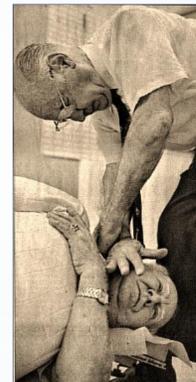


AFTER INTERVENTION

A finding of an unequal ilium level in the frontal plane and/or a pelvic twist in the transverse plane is indicative of an atlas misalignment. An important measurement is determining if the base of the cervical spine is in the vertical axis.

NUCCA INTERVENTION

Post films reveal the atlas, skull and subjacent cervical vertebrae all proportionately returned to normal orthogonal alignment in the frontal and transverse planes. These findings coincide with the return of normal posture and weight bearing in the neutral standing position as measured by the Anatometer.

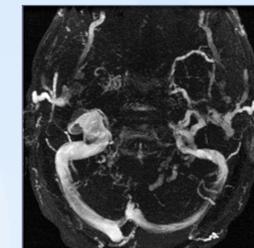


RESULTS

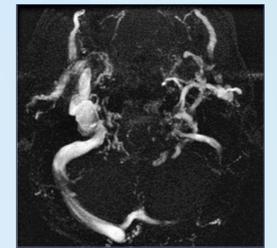
The subject remained free of migraine symptoms contingent on atlas alignment. SF-36 scores increased an average of five points across the eight scales. Headache Disability Index (HDI) scores decreased accordingly with the absence of migraine symptoms. Cranial arterial inflow remained constant throughout the imaging studies. Venous outflow was less pulsatile with outflow patterns changing to the vertebral venous plexus from the internal jugular veins in the supine position. Measurements of the intracranial compliance index (ICCI) increased following the atlas intervention. ICCI baseline measured 9.4. The subject measured an increase in ICCI, at day five, 11.5, up to 17.3 by four weeks.

MIP IMAGES OF VENOUS DRAINAGE

Internal Jugular Vein



BASELINE



30 DAYS AFTER INTERVENTION

A noticeable change in venous outflow pattern on the post image; less flow through the internal jugulars and more through the paravertebral venous plexus.

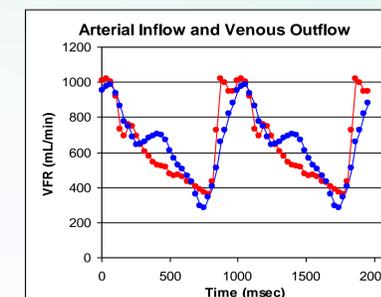
INTRACRANIAL COMPLIANCE INDEX

Parameter	Baseline	5-Day Post Intervention	30-Day Post Intervention
ICVC (mL)	0.58	0.57	0.76
ICCI	9.4	11.5	17.3

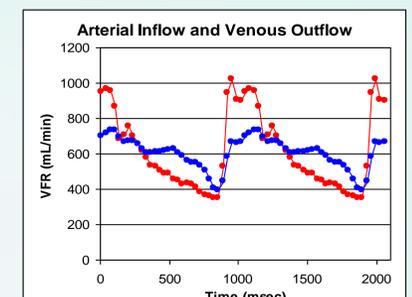
The intra-cranial compliance measure shows improvement at week 4 (ICC = intracranial compliance; ICVC = intracranial volume change)

Intracranial Volume Change Waveforms

The waveforms were derived from the cine phase contrast scans of the arterial and venous trans-cranial volumetric flow rate. They show total transcranial arterial inflow rates (Red) and venous outflow rates (Blue) during the cardiac cycle of the subject. The venous outflow is considerably less pulsatile (lower amplitude) in the post intervention intervention.



BASELINE



30 DAYS AFTER INTERVENTION