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INTRACRANIAL PRESSURE RESPONSES CRANIAL MANIPULATION

Changes in alpha band activity associated with application of the compression of fourth ventricular (CV-4) osteopathic procedure: A qEEG pilot study

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Summary 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 finding are replicated in further clinical trials.

Introduction

The procedure known as the compression of the fourth ventricle (CV-4) has been taught and practiced for over 80 years by students of the originator of osteopathy in the cranial field (OCF) William Garner Sutherland (King, 2011). In the last two decades the CV-4 has been adopted and become part of the curriculum of several manual therapy professions such as craniosacral therapy (Upledger and Vredevoogd, 1983), physical therapy (Hanten et al., 1999) and body workers (Chaitow, 2001). The CV-4 is possibly the most well-known of the cranial manipulation procedures originated by Sutherland (Magoun, 1966) and has been shown to reduce sleep latency (Cutler et al., 2005), reduce tension-headache symptoms (Hanten et al., 1999), change blood flow velocity (Nelson et al.,, 2006) and lower cerebral tissue oxygenation (Shi et al., 2011) A recent systematic review of clinical cranial manipulation results concluded that the results were mixed and more research was needed (Jäkel and von Hausenchild, 2011) The present study attempts increase the research base on clinical effects of OCF.

The 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, and controversy over whether or not cranial bone structures move in accordance the theory of the primary respiratory mechanism (PRM) postulated by Sutherland (Magoun, 1966). That cranial bones are capable of motion and do not necessarily fuse has been shown (Sabini and Elkowitz, 2006) and apparent calvarial structure position changes suggestive of motion have been shown (Ueno et al., 2003; Moskalenko et al., 1999; Crow et al., 2009). Besides the clinical benefits of the CV-4 described above, cranial manipulation has been shown to possibly benefit children with cerebral palsy (Wyatt et al., 2011), reduce the symptoms of infantile colic (Hayden and Mullinger, 2006), reduce the symptoms of otitis media in children (Mills et al., 2003), improve urinary tract function in patients with multiple sclerosis (Raviv et al., 2009), and improves balance and equilibrium in healthy elderly patients (Lopez et al., 2011).

The findings of Cutler et al. (2005), Nelson et al. (2006), Lopez et al. (2011), and Shi et al. (2011) suggest an impact on brain and cranial nerve function of the CV-4 cranial manipulation. One well known and commonly used clinical technology which might demonstrate effects of the CV-4 in monitoring changes in brain state is quantitative electroencephalography (qEEG). Since the invention of EEG, attempts have been made to assign a functional meaning of the brain's oscillatory neural activity. The recording of frequency spectrum of scalp EEG is a traditional method of analysis based on the frequency domain, and range among several frequency bands. Each band has been typically attributed to a certain brain state such as the level of consciousness or the degree of cognitive or perceptual activity, respectively. Thus, absolute power, defined as total energy intensity of an electrode on a certain region at different frequency bands (Machado et al., 2007), is a potential measure to investigate the influence of CV4 on qEEG activity. As contrasted with standard EEG assessment, the qEEG is a technique of analyzing the brain wave signal that allows a detailed two and three dimensional electrical picture of a subject's brain to be generated with the help of a sophisticated statistical computer program.

We choose alpha band because it is related to physical relaxation, awake and idle state (i.e., a standby state that allows the system to return more rapidly to goal oriented function when needed) (Niedermeyer and Lopes da Silva, 1999). The current study aims to directly measure the effects of CV-4 in absolute alpha power in the occipital areas in healthy subjects. Our hypothesis is that the CV-4 application will produce greater changes in absolute alpha power between pre and post qEEG assessment than in a sham a sham CV-4 or no-treat control conditions.

Methods

Sample

Ten healthy (6 male and 4 female; mean age: 28, SD: 3) subjects were recruited. These subjects were not familiar with cranial manipulation or the CV-4 technique. Inclusion criteria were: 1) absence of mental impairment determined by obtaining a score of $\geq$27 on the Mini Mental State Examination (MMSE) (Oskarsson et al., 2010; Williams et al., 2009) no history of psychoactive or psychotropic substance use (screened by a previous anamnesis and a clinical examination). Exclusion criteria were: 1) any local or systemic pain condition, 2) dizziness, 3) prior or current vascular disease, 4) no history of hypertension, 5) no history of recent headaches, 6) subjects were not included if they