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The Effectiveness of CV-4 and Resting Position Techniques on Subjects with Tension-Type Headaches

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Abstract: Tension-type headache (TTH) is a common reason for consulting a clinician. Manual therapies are being used in clinical settings to treat TTH with no documented research to validate their efficacy. This study investigated the effectiveness of CV-4 and resting position techniques on TTH sufferers. Sixty adults between the ages of 21 and 65 ($\bar{x}$=36, SD=12) who were experiencing a TTH were randomly assigned to groups. Subjects in the first group received a 10-minute session wherein multiple still points were induced using the CV-4 craniosacral technique. Subjects in the second group were placed supine in a resting position with the head and neck positioned for ten minutes in the most comfortable points in the ranges of protraction-retraction and flexion-extension. Subjects in the third group received no treatment; they lay quietly for 10 minutes. Pain intensity and the affective component of pain were measured before and after the treatments using visual analog scales. To determine if significant differences existed between the groups, a one-way multivariate analysis of covariance (MANCOVA) was used, followed by univariate tests and post-hoc tests. The MANCOVA was significant ($F=3.59$; $df=4,108$; $p<0.05$). Analyses of covariance for the variables of pain intensity and affect revealed significant differences among the groups ($F=5.38$; $df=2,56$; $p<0.05$ for intensity and $F=4.45$; $df=2,56$; $p<0.05$ for affect). Tukey tests revealed a significant improvement, in both intensity and affect scores, between the group receiving the CV-4 treatment and the no-treatment group and no significant difference between the group using only the resting position and the group receiving no treatment. The CV-4 technique is an effective technique for treating patients with TTH. Additional investigation is warranted to examine the duration of relief and to address the effectiveness of multiple treatment sessions utilizing the CV-4 and resting position techniques.

Key Words: CV-4, Resting Position, Tension-Type Headaches, Manual Therapy

In its 1998 classification the International Headache Society designated the term tension-type headache to describe the condition previously known as a tension muscle-contraction headache[1]. Rasmussen et al[2] discovered in a random population that this was the most common type of headache with a lifetime incidence of 69% in men and 88% in women. They also stated that headache disorders are extremely prevalent and represent a major health problem that merits increased attention[2].

Very little is known about the etiology of tension headaches. Kidd and Nelson[3] believe that causes may include genetics, emotional stress, fatigue, abnormal factors, weather, and food sensitivities. Carlsson et al[4] have stressed the importance of physical factors such as faulty posture, monotonous work, and dysfunctional mastication. Tension headaches may also be caused by contraction of the musculature of the head, face, and cervical regions and may, according to Sturgis et al[5], be accompanied by muscle ischemia. In description, tension headaches may appear almost daily as a constant tight pressing or band-

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like sensation in the occipital, temporal, and/or frontal areas; pain is bilateral but not necessarily symmetrical[4].

Traditional treatment has been restricted to medications that treat symptoms: tranquilizers, muscle relaxants, analgesics, or individual psychotherapy[6]. Much research has been done regarding the use of oral medications on tension-headaches. Kumar and Cooney[7] found that simple analgesics such as acetaminophen, aspirin, and other nonsteroidals have been useful in relieving or decreasing the severity. Clifford[8] found that of the various pharmacological agents administered to patients with tension headaches, amitryptyline and imipramine (Tofranil) were found to be most effective. Solomon et al[9] have explained that the benefits of pharmacological treatment for patients with tension headaches cannot be doubted; however, complications from overuse of medication is a major problem. This overuse might cause some patients to have an analgesic rebound headache, which is a self-sustaining rhythmic headache occurring daily or nearly daily, with an irresistible and predictable use of pain medication as the only means of relieving the headache attacks[10]. Many headache sufferers cannot take medications because of the side effects[11], which may include nausea, weakness, fatigue, upset stomach, vertigo, drowsiness, dry mouth, diarrhea, and insomnia[12]. Some headache sufferers want a chemical-free alternative. Certain manual therapies such as soft tissue manipulation, massage, manual traction, joint manipulation, and joint mobilization have been shown to benefit these patients[13]. The use of manual therapy, according to Di Fabio[13], may apply to the therapeutic management of pain, limited motion, and poor posture. Schoensee et al[14] have reported the effectiveness of manipulation and mobilization in reducing headache pain, but little research on manipulative therapies used to treat tension headaches has been published.

The CV-4 technique is a type of manual therapy purported to enhance tissue and fluid motion and restore flexibility of the autonomic response through manipulating the sutures of the skull[15]. Traditionally, it has been thought that the sutures of the skull are fused and hence immovable, but Adams et al[16] demonstrated in anesthetized cats that forces applied externally to the head evoke both lateral and rotational movements of the parietal bones around the sagittal suture. They also suggested that although there are large differences among animals, increasing the intracranial pressure and inward lateral compressive forces on temporal bones will have a general effect, causing the parietal bones to change their position relative to one another. Heisey and Adams[17] state that the flexible, innervated, and vascularized cartilaginous sutures between the rigid bony plate of the skull will move and therefore affect skull geometry and intra-cranial volume; they used a motion-detecting instrument in their study and were able to detect lateral movements of the parietal bones, again in anesthetized cats. Upledger and Retzlaff[18] explained that if the physiological state of the temporo-parietal suture has been disrupted by a previous event, a simple mobilizing procedure may temporarily relieve head pain.

Many clinicians skilled in palpatory diagnosis profess that it is possible to detect manually the movements of cranial bones in humans. These clinicians make use of this ability when they apply certain cranial manipulative techniques[19,20]. According to Morey[21], the immobility of cranial sutures has long been disproved although the belief persists. Sutherland was first to introduce the theory and application of the cranial concept of manipulation of the head; he explained that the effects of manipulating the cranial bones can be directly achieved on the sutural joints themselves through pulling or releasing the various membranes such as the dura, tentori, or falx cerebri[22].

The procedure in the CV-4 technique is to move with the narrowing and widening of the skull, also known as the subject's cranial rhythm. As the subject's occiput begins to widen, an attempt is made to resist the widening and bring the subject to a still point. At this point, the cranial rhythm ceases for a few seconds to a few minutes, until the occiput once again tries to widen[15]. Wales[23] theorizes that the tissues in the floor of the fourth ventricle must be working efficiently for the body to function, because the physiological centers that regulate the vital processes of the body are located in the floor of the fourth ventricle. The basis of the CV-4 technique is the compression of the fourth ventricle. Wales[23] also explained that the fluctuation of the CSF and the motility of the brain and spinal cord constitute the functional demands that require mobile cranial bones. These observations support the theory that the cranial sutures and their component structures are movable and that they move at a particular rhythm; however, the craniosacral rhythm theory has long been a subject of discussion and controversy. Many support the theory, but others adamantly disagree because of the lack of confirming research[24].

The connective tissue matrix that binds the parietal bones together contains myelinated and unmyelinated nerve fibers that terminate as free nerve endings and that may be sources of pain from certain traumas to the skull[25]. Some of the myelinated fibers terminate as branched free-endings along the inner periosteal covering of the free ends of the skull bones; these nerve endings are said to be sensitive to pressure change and may produce pain sensations under excessive force. According to Retzlaff et al[26], if the stimulus is excessive, all of the sensory-type receptors in the suture may produce poorly localized pain perception.

Other studies have been done on physical dysfunctions of the cranial sutures that manifest as head pain. Miller[27] found that the cerebral dura mater and the cranial sutures are highly vascularized. The unmyelinated afferents appear to arise as branched free-endings in close approximation to the venous vessels. These vessels in

the dura mater extend into the sutures and the cranial bones. Much of the venous drainage is done by vessels that empty into venous sinuses within the cranium. The unmyelinated autonomic fibers that innervate these vessels are considered neurosecretory in function and to cause vascular constriction. These free sensory endings are seen in the walls of venous sinuses[27]. The nerve endings described are considered to be sensitive to the excessive pressure exerted by the sutural compression[25]. These findings are significant because the human cranial suture may be dysfunctional when various stresses are exerted on the skull, such as excessive pressure, resulting in pain: relief of this pressure will alleviate the pain.

Pain has been defined as the sensation resulting from stimulation of specialized nerve endings[27]. Pain may result directly from factors originating outside of the body, from changes within the body, or from abnormally mediated psychological factors through an autonomic response. Ray and Wolff[28] studied the probable causes of head pain in relation to the dura mater; they found that pain resulted primarily from inflammation, traction, displacement, and distention of pain-sensitive structures, of which cranial vascular structures are the most frequent and most widely distributed[28]. Jones et al[25] found that movement of the sacrum increases or decreases the pressure within the system; this pressure increase is reflected in increased brain volume that, in turn, causes slight separation of the parietal bones, relieving the sutural compression and thereby alleviating the pain[25]. These factors encourage the belief that some type of manipulation of the sutures of the skull may reduce pressure and therefore reduce pain as well. Because of these findings, it is thought that the cranial sutures and their component structures are capable of responding to external stimuli.

Healthy tissue is not usually tender; tenderness has been found in pericranial tissue of patients with tension-type headaches but the mechanism responsible for this tenderness is unknown[29]. One may postulate that putting the patient in the position of most comfort may reduce the tension and tenderness of the pericranial tissue. This resting position technique has been formally taught,[30] but no research has been published. The treatment calls for a patient who is lying in supine to have his/her head put into a position of no pain or reduced pain and supported in that position. A more relaxed position will reduce the contraction of the musculature of the head, face, and cervical region which may present itself as a tension-type headache. Relaxation, traction, massage to the neck and occipital area, and correction of faulty posture are other treatments similar to the resting position technique that have been proven to be effective[7]. Electromyographic (EMG) biofeedback is another form of relaxation treatment that has been used successfully to train headache victims to relax relevant muscular structures to prevent muscle-contraction headaches. Cox[6] found that EMG feedback and relaxation were equally superior to medication placebo in decreasing headache pain and frontalis EMG activity.

Manual therapy is considered by many therapists to be an important component in evaluating and treating musculoskeletal disorders. Fitzgerald et al[31] believe that there is a need for continued investigation of the effectiveness of manual therapy. The CV-4 and resting position techniques are being readily used in clinics and other treatment facilities, but no research has been done to validate these treatments. Therefore, the purpose of this study was to investigate the effectiveness of these techniques, following a single treatment, on tension-type headache sufferers. The null hypothesis was that there would be no significant difference in the intensity or affect of headache pain, as measured by visual analog scale (VAS) scores, between subjects receiving treatment of CV-4 or resting position, and subjects who received no treatment.

Methods

Subjects

Sixty volunteer subjects, 17 males and 43 females, between the ages of 18 and 70 ($\bar{x}$=36, SD=12), participated in the study. Subjects had to meet the diagnostic criteria for episodic or chronic tension-type headache (TTH) as defined by the 1988 guidelines of the International Headache Society1. The diagnostic guidelines were as follows: (1) Episodic TTH: at least 10 previous episodes of headache, but less than 15 per month, lasting 30 minutes to 7 days, and fulfilling Nos. 3-4 below. (2) Chronic TTH: average headache frequency of at least 15 days/month for at least 6 months, and fulfilling Nos. 3-4 below. (3) At least two of the following pain characteristics: (a) a pressing, tightening quality; (b) mild or moderate intensity (may inhibit, but not prohibit, activities); (c) bilateral location; (d) no aggravation from climbing stairs or doing similar routine physical activity. (4) Both of the following: (a) no vomiting, (b) photophobia and phonophobia are both absent or only one is present. In addition, accepted subjects reported no organic or neurological disease that might have contributed to their headache[15], no history of migraine, no use of analgesics in the 24 hours preceding the study[32], and no alteration in their usual caffeine intake[33]. Informed consent was obtained from all subjects.

Equipment

A visual analog scale (VAS) was used to measure headache intensity before and after treatment. It consisted of a 10-cm line marked at the extremes with "no headache pain" and "worst headache pain ever"[34]. A second VAS measured the affective component of headache pain; it was also 10 cm long, with extremes labeled "tolerable" and "intolerable"[35].

Procedure

Each of three investigators treated twenty subjects, who were randomly assigned to one of three treatment groups. Just prior to treatment, all subjects indicated the intensity of their headache pain using a VAS as described above. An identical VAS was administered immediately post-treatment. In addition, similar pre- and post-treatment VASs were completed, indicating each subject's affective status.

For all treatments, the subjects lay supine on a padded table with their arms at their sides and a pillow under their knees. The subjects were asked to close their eyes but were told that they could leave them open, if preferred. The room was dimly lit and quiet.

Treatment One was the control. The twenty subjects assigned to this treatment group received no manual therapy. They lay quietly for 10 minutes.

Treatment Two consisted of the resting position technique[30]. Each of these twenty subjects had a pillow placed under the head. A cervical roll was available for use depending on the subject's preference. The investigator moved each subject's head into protraction or retraction and asked the subject to indicate the most comfortable position. When this position was achieved, objects such as towels or magazines were placed under the subject's pillow to maintain the position. From this position, the investigator gently moved the subject's head into flexion or extension until the most comfortable point in this range was achieved. The subject then rested in this position for 10 minutes. The subject was repositioned during the treatment if he or she so desired.

The third treatment was the CV-4 technique as described by Upledger and Vredevoogd[15]. Each of the twenty subjects received the following protocol. The investigator rested one of his/her hands in the other with palms up so that the tips of the thumbs were lined up with the volar-radial aspects of the pads touching. The thenar eminences were placed under the subject's occiput, avoiding the occipito-mastoid sutures, with the tips of the thumbs at the level of the second or third cervical vertebra. The craniosacral rhythm was then palpated by following the widening of the occiput, due to flexion at the sphenobasilar synchondrosis, then its narrowing due to extension of the same joint. After two cycles, the rhythm was followed to its greatest excursion in the direction of narrowing, and widening was prevented by statically resisting the movement with the thenar eminences. With each subsequent cycle, any movement going further in the direction of narrowing was followed and that position held, resisting efforts to widen. Attempts to widen eventually ceased, indicating that a still point had been reached. In a short time, varying from seconds to minutes, the craniosacral rhythm would resume. This process of bringing the subject to a still point was repeated as many times as a 10-minute treatment allowed. (The 10-minute treatment time began when the investigator's hands were placed under the subject's head.)

Data Analysis

For each subject, the distance between "no pain" or "tolerable" and the subject's mark on all visual analog scales were measured and recorded to the nearest tenth of a centimeter.

Means and standard deviations of the VAS values of each group for each dependent variable (intensity and affect) were calculated for pretest, posttest, and difference scores. In order to determine if there were significant differences ($p<0.05$) among the three treatment groups, a multivariate analysis of covariance (MANCOVA), with the pretests as the covariates, was conducted. Because this analysis was significant, two analyses of covariance (ANCOVA) were conducted, one for each dependent variable. Because these were in turn significant, Tukey post-hoc tests were used to determine where the treatment groups differed.

Results

Pretest, posttest, and difference means and standard deviations of the VAS values of each group for each dependent variable (intensity and affect) are recorded in Table 1. The MANCOVA for the variables of intensity and affect was found to be significant ($F=3.59$; $df=4,108$; $p<.05$) by the Wilks' Lambda Criterion.

The ANCOVA for the variable of intensity revealed a significant difference ($F=5.38$;$df=2,56$;$p<.05$) between the groups (Table 2). Tukey post-hoc tests revealed that the group treated with CV-4 showed a significant improvement compared to the group receiving no treatment, while no significant difference existed between the group treated with the resting position and the group receiving no treatment.

The ANCOVA for the variable of affect revealed a significant difference ($F=4.45$;$df=2,56$, $p<.05$) between the groups (Table 3). Tukey post-hoc tests revealed that the group treated with CV-4 showed a significant improvement compared to the group receiving no treatment, while no significant difference existed between the group treated with the resting position and the group receiving no treatment.

Discussion

We hypothesized that there would be no significant difference in intensity or affect of headache pain, as measured by visual analog scale scores, between subjects receiving CV-4 or resting position technique treatment and subjects receiving no treatment. The null hypothesis was rejected regarding the CV-4 technique. In comparison

Table 1. Means and Standard Deviations of Pretest and Posttest Pain Intensity and Affect (in mm) for Each Group

Groups	Pretest	Posttest	Difference
Pain Intensity			
Control	33.7(13.9)	26.1(17.3)	7.8(10.1)
Rest Position	37.9(19.4)	26.7(23.3)	11.2(9.6)
CV-4	41.0(17.0)	21.6(18.1)	19.3(13.1)
Pain Affect			
Control	21.1(19.4)	18.3(20.4)	2.9(8.0)
Rest position	20.6(14.8)	13.0(13.5)	7.6(7.4)
CV-4	31.8(20.2)	16.9(20.1)	14.9(15.4)

to the resting-position group and the no-treatment group, those who received CV-4 showed a significant improvement in both intensity and affect while no significant difference occurred between the resting-position group and the no-treatment group.

The use of manual therapy, of which CV-4 is a technique, is considered by many therapists as an important component of treatment[31]. Certain manual therapies have been shown to be beneficial for headache-suffering patients: soft tissue manipulation, massage, manual traction, joint manipulation, and joint mobilization[13]. Schoensee et al[14] supported the effectiveness of manipulation and mobilization in reducing headache pain. Jones et al[25] explained that increasing brain volume with direct pressure in order to cause a slight separation of the parietal bones would relieve sutural compression and therefore alleviate pain. The premise behind the CV-4 technique is that by increasing or decreasing the pressure to the craniosacral system, the ventricles enlarge because of increased brain volume. Jones et al[25] also explained that within the cranial sutures, certain nerve endings are considered sensitive to excessive pressure; when the pressure is relieved the pain is eliminated. Tension-type headaches often occur secondarily to emotional stress or following trauma to the neck region[3]. Stresses or trauma can disrupt the physiological state of the temporoparietal suture, and a simple mobilizing procedure may provide temporary relief of head pain according to Upledger and Retzlaff[18].

The CV-4 technique is a manual therapy that enhances tissue and fluid motion and that restores flexibility of the autonomic response through manipulation of the skull sutures[15]. With the significant results of applying CV-4 to tension-type headache sufferers in this study, further support is given to the theory that the cranial suture dysfunction that may manifest as a headache can be relieved by cranial manipulation[14,18,25].

The results supported the null hypothesis concerning the resting-position technique. In absolute terms, the resting-position technique did appear to provide a slight improvement in the subjects' headache with respect to pain intensity and affect; however, the study results showed an insignificant difference from the control. Other treatments similar to the resting position have proven to be effective, such as relaxation and correcting faulty posture[7]. The resting position technique has been taught in courses as headache treatment, but the technique is meant to be used as part of a more comprehensive treatment plan in which the patient participates in the treatment[30]. The patients are taught how to position themselves in the "utopian position," that position that provides substantial relief for their symptoms. Consequently, the patient is in control and can obtain immediate relief of recurrent symptoms without a physical therapist. A "quick-fix" treatment approach was applied in this particular study, consisting of one 10-minute treatment session in which the patient was not an active participant. Suboccipital tightness is frequently a contributing cause of headaches, and since this tightness is considered mechanical in nature, symptoms may change with proper movement or positioning, thus enhancing the healing process[30]. Further research in the area of tension headaches focussing on a more comprehensive approach to

Table 2. Analysis of Covariance for the Variable of Pain Intensity Using the Pretest as the Covariate

	Sum of Squares	df	Mean Square	Fa
Main Effects Group	1327.9	2	663.9	5.38
Covariates Pre	14335.4	1	14335.4	116.25
Residual	6905.5	56	123.3	
Total	**22568.7**	**59**	**382.5**	

[a]p<0.05

Table 3. Analysis of Covariance for the Variable of Pain Affect Using the Pretest as the Covariate

	Sum of Squares	df	Mean Square	Fa
Main Effects Group	973.9	2	486.9	4.45
Covariates Pre	12199.7	1	12199.7	111.41
Residual	6132.4	56	109.5	
Total	**19305.9**	**59**	**327.2**	

[a]p<0.05

the resting position technique with the patient participating is warranted.

Continued investigation is also needed on the effectiveness of the CV-4 and resting-position techniques; for example, perhaps these techniques would be more effective with an increased length of treatment time and with multiple treatment sessions. Also, we did not distinguish between episodic and chronic forms of tension-type headaches. Future research could be more specific in this regard for the purpose of determining whether one form is more amenable to CV-4 than the other.

Conclusions

This study investigated the effectiveness of the resting-position and CV-4 techniques on tension-type headache sufferers. The results indicate that the intensity and affective component of pain significantly improved in the group receiving the CV-4 technique while no significant difference occurred between the group using the resting position and the control group. This study provides initial evidence that the CV-4 technique may be used successfully on patients who suffer from tension-type headaches. ■

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