Section One: Neck Exercises for Cervicogenic Headache

<table>
<thead>
<tr>
<th>Study Title:</th>
<th>Effect of neck exercises on cervicogenic headache: a randomized controlled trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors:</td>
<td>Ylinen J et al.</td>
</tr>
<tr>
<td>Author's Affiliations:</td>
<td>Department of Physical Medicine and Rehabilitation, Central Hospital of Central Finland</td>
</tr>
<tr>
<td>Background Information:</td>
<td>Headaches of a cervical origin are common (cited by the authors as affecting 2.5% of the adult population and accounting for 15-20% of chronic and recurrent headaches). There is ongoing controversy regarding the classification and etiology of cervicogenic headaches, particularly as to whether it is a separate clinical entity, rather than a form of, tension type headache. Regardless, those with neck pain do more frequently experience headaches than those with symptoms in other anatomical areas. The authors reason that if neck exercise can be effective for chronic neck pain, then it may also prove useful for cervicogenic headaches; however there is minimal research to support this assertion. This study had three major aims with the first indicated as the primary aim of the study:</td>
</tr>
<tr>
<td></td>
<td>1. “to determine whether exercise therapy relieves headache and arm pain associated with neck pain”;</td>
</tr>
<tr>
<td></td>
<td>2. “to analyze whether the presence of headache indicates a more</td>
</tr>
</tbody>
</table>
severe condition, with consequent negative effects on the outcome of exercise therapy in patients with chronic neck pain”; and
3. “to analyze the dose-response relationship of the specific strength and endurance training regimens for the cervical muscles to reduce cervicogenic headache.”

This was to be done by comparing the efficacy of 3 different 12-month training programs.

<table>
<thead>
<tr>
<th>Pertinent Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The groups did not differ in demographic data at baseline.</td>
</tr>
<tr>
<td>• <strong>Strength Group:</strong> At 1 year, the strength group had a decrease in headache intensity VAS of 69%, significantly different from baseline and significantly different than the Control Group. Upper extremity pain was decreased by 58% - also significantly different than baseline and significantly different from the Control Group. Neck pain decreased by 69%, the most significant decrease in neck pain in all groups was for those subjects in the Strength Group with severe headaches.</td>
</tr>
<tr>
<td>• <strong>Endurance Group:</strong> At 1 year the endurance group had a decrease in headache intensity (measured by VAS) of 58%, significantly different from baseline. Upper extremity pain was decreased by 70%, significantly different than baseline and significantly different from the Control Group, while neck pain decreased by 61%.</td>
</tr>
<tr>
<td>• <strong>Control Group:</strong> At 1 year the control group had a decreased headache intensity of 37%, significantly different from baseline. Upper extremity pain decreased by 21%, significantly different than baseline, while neck pain decreased by 28%.</td>
</tr>
<tr>
<td>• Energy expenditure training was negatively correlated with pain scores, accounting for 12% of the total variation predicted in the dose-analysis model.</td>
</tr>
<tr>
<td>• Subjects with the highest pain scores initially showed the most benefit from the training programs, regardless of intervention groups as both training groups (strength and endurance) had significant decreases in headache intensity.</td>
</tr>
<tr>
<td>• The dose analysis indicated that for every hour of training performed per week that a 0.6mm decrease in headache intensity on the VAS was observed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinical Application &amp; Conclusions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The authors concluded that both strength and endurance exercises (combined with stretching) are effective for neck pain with associated headache and arm pain. Stretching alone was less effective than when combined with muscle endurance and strength training. They also</td>
</tr>
</tbody>
</table>
noted that headache does not have a negative effect on the results of exercise therapy and does not hinder one from performing strength training which may be recommended for patients with severe headache associated with neck pain.

The results of this study are useful to clinicians as it provides evidence that may be helpful in recommending exercises for these patients, whether as in-clinic or at-home exercise programs. It also shows that the traditional model of stretching exercises only for patients with cervicogenic headache may be insufficient.

<table>
<thead>
<tr>
<th>Study Methods:</th>
<th>This was a three arm examiner-blinded randomized controlled trial. 180 patients with long-standing neck pain were admitted into the study. They had to be currently employed female office workers between 25 and 53 years old with constant or frequent neck pain for at least 6 months. Exclusion criteria included:</th>
</tr>
</thead>
<tbody>
<tr>
<td>disc prolapsed</td>
<td></td>
</tr>
<tr>
<td>stenosis</td>
<td></td>
</tr>
<tr>
<td>post-operative conditions</td>
<td></td>
</tr>
<tr>
<td>a history of severe trauma</td>
<td></td>
</tr>
<tr>
<td>instability</td>
<td></td>
</tr>
<tr>
<td>spasmodic torticollis</td>
<td></td>
</tr>
<tr>
<td>frequent migraine (more than 2x monthly)</td>
<td></td>
</tr>
<tr>
<td>peripheral nerve entrapment</td>
<td></td>
</tr>
<tr>
<td>Fibromyalgia</td>
<td></td>
</tr>
<tr>
<td>shoulder disease</td>
<td></td>
</tr>
<tr>
<td>inflammatory arthropathies</td>
<td></td>
</tr>
<tr>
<td>pregnancy</td>
<td></td>
</tr>
<tr>
<td>severe psychiatric illness</td>
<td></td>
</tr>
<tr>
<td>any other conditions that may limit their ability to participate in physical activity</td>
<td></td>
</tr>
</tbody>
</table>

A computer driven block randomization method was employed, to divide the patients into 3 groups – a strength training group, an endurance training group, and a control group. Outcome measurements were taken at baseline and after 12 months. Visual analogue scales and the Neck Disability Index were employed and subgroups of headache severity were established as per headache VAS scores into minor, moderate, and severe headache groups. Maximal neck isometric strength and ranges of motion were assessed, as was maximal oxygen uptake. Physical activity was assessed using a 4-week recall questionnaire and a training diary. Each group completed a 12-day institutional rehabilitation program and given a home exercise program.
The strength group completed five 45 minute sessions per week with every other session at a lower (50%) intensity. Exercises were performed as 1 set of 15 repetitions. Sessions finished with stretching and included elements of a neck school as well as 4 physical therapy sessions (consisting of mobilizations and massage).

The endurance training group completed five 45 minutes sessions per week with every other session at a lower (50%) intensity. Exercises were generally performed as 3 sets of 20 repetitions. Sessions finished with stretching and included elements of a neck school, as well as 4 physical therapy sessions (again consisting of mobilizations and massage).

The control group was advised to perform 30 minutes of aerobic activity 3 times per week as well as stretches at home for 20 minutes, but did not receive any treatments.

All groups were encouraged to exercise at home regularly 3 times per week at home. All of the groups completed their allocated programs for 12 months. An intention-to-treat analysis was employed as was a correlation analysis with a forced entry model, with the alpha level set at 0.05 for all statistical tests.

### Study Strengths/Weaknesses:

- **The division of the study into three groups, two comparison groups and a control group are an important strength of this study.** Having the control group complete a protocol that was part of the other two interventions was also of benefit.

- The authors point to the small size of the subgroups employed as a possible weakness. They also comment that the headaches were not sub-typed (although subcategories in terms of headache intensity were created). It is also questionable as to how realistic the exercise programs described in this study might be for many clinicians and patients. To ask patients to complete neck exercises for 45 minutes, five times per week may not be feasible for many clinicians or achievable for many patients. In addition, the physical therapy treatments received by the two exercise groups were not well described (mainly massage and mobilizations but types and amounts not specified) and while the authors reasoned that they were intended to enable those with severe neck pain to perform their exercises, the control group did not receive any such treatments to allow them to perform their activities. It is possible that the difference between the control group results and those of the treatment groups could be partially explained by this difference in physical therapy treatments received. To truly see the impact of the exercise interventions, the physical therapy treatments either should have been added to the
control group or else should have been omitted completely. Finally, the inclusion criteria of this study were fairly limiting, and the external validity of results may be questionable.

Additional References:


Section Two: Manual Therapy for Migraine: Systematic Review

<table>
<thead>
<tr>
<th>Study Title:</th>
<th>Manual therapies for migraine: A systematic review</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authors:</td>
<td>Chaibi A, Tuchin PJ &amp; Russell MB</td>
</tr>
<tr>
<td>Author's Affiliations:</td>
<td>Head and Neck Research Group &amp; Institute of Clinical Medicine, Akershus University Hospital, Norway; Department of Chiropractic, Macquarie University, Australia.</td>
</tr>
<tr>
<td>Background Information:</td>
<td>Migraine is a common form of primary headache syndrome, affecting nearly 15% of the general population. Although normally managed by medication or modification of dietary or lifestyle triggers, some patients seek more conservative treatment in an effort to avoid medication side effects or unwanted drug interactions if they have comorbidities. Non-pharmacological management of migraine can take many forms including massage therapy, trigger point therapy, myofascial release, joint mobilization/manipulation, exercise and rehabilitation, relaxation, biofeedback, and so on. The goal of this paper was to systematically review the randomized, controlled trial literature assessing manual therapies for migraine.</td>
</tr>
<tr>
<td>Pertinent Results:</td>
<td>The literature search yielded 7 RCTs on migraine that met the inclusion criteria: 2 looking at massage therapy (1, 2), 1 on physiotherapy (3) and 4 on chiropractic (4-7, with two of these papers</td>
</tr>
</tbody>
</table>
discussing the same dataset). No studies were found on spinal mobilization or osteopathic manipulation as an intervention for migraine. Methodological quality of the 7 trials was as follows:

- 4 of the included studies had a good methodological score (≥50) [2, 3, 6] and 3 had a low score [1, 4, 5, 7 – NOTE: two papers represent the same study/dataset – the second one was a 20 month follow-up survey]

Pertinent results of these studies include:

**Massage Therapy:**

- One study from the USA included 26 participants with chronic migraine diagnosed via questionnaire (1). The massage therapy group (30 minute treatment, 2x/week for 5 weeks, focusing on the neck musculature) had statistically significant improvement in pain (71% reduction) compared to the control group (no treatment). This study had no follow-up past the 5th week of treatment.
- The second study was from New Zealand and included 48 subjects with migraine also diagnosed via questionnaire (2). This study was conducted over 13 weeks – a 4 week baseline period, 6 weeks of treatment and 3 weeks of follow-up. Migraine frequency was reduced in the massage group (45 minute treatment, 1x/week for 6 weeks, focusing on neuromuscular and trigger point areas of the back, neck and shoulders) after treatment (by 34%) and at follow-up (by 30%) compared to the control group (kept a headache diary – values were 7% and 2% respectively). Interestingly, intensity of migraine attacks remained unchanged in both groups and sleep quality was improved in the massage group.

**Physiotherapy:**

- This American study (n=73) that compared physical therapy (2 home sessions/day of 30 minutes duration for 4 weeks) to relaxation therapy (2 home sessions/day of 30 minutes duration for 4 weeks – muscle relaxation, breathing techniques and thermal biofeedback) included female migraine patients with frequent attacks diagnosed by a neurologist (3). This study was conducted over 13.5 months – 2 weeks baseline, 4 weeks of treatment and a 1-year follow-up. The relaxation group had significantly more people with a 50% reduction in headaches severity (51%) compared to the physical therapy group (13%). Treatment effect was maintained in both groups at 12 month
follow-up. They then did a cross-over portion where those who did not have a successful outcome could try the other treatment. In this phase, the physical therapy was more successful than the relaxation group (55% vs. 47%). This phase had a high number of drop-outs and unfortunately, the physical therapy intervention was poorly described for the entire project and no control group was utilized.

Chiropractic Manipulation:

- An Australian study included patients (n=85) with frequent migraine diagnosed by a neurologist (4, 5). Participants were divided into three groups: cervical manipulation administered by a chiropractor, cervical manipulation administered by a physiotherapist or physician, or cervical mobilization administered by a physiotherapist or physician (designated as the control group). A notable significant difference at baseline was that those patients in the chiropractic group had migraines that lasted much longer (30.5 hours) than the other two groups (12.2 and 14.9 hours, respectively). Overall, no statistically significant differences were seen between groups but all three groups improved with 2 months of treatment (2x/week maximum). The second paper (5) was a 20 month follow-up to the first paper that demonstrated further improvement in all three groups. No control group was included in this project (the authors labeled the mobilization group as the control, but as we now know this designation is likely not appropriate as manipulation and mobilization have similar clinical efficacy).

- An American study (6) involving 218 subjects with migraine (at least 4 episodes per month) diagnosed by chiropractors using the IHS criteria compared outcomes in three treatment groups (no control group was used) over a 4 month period consisting of 1 month baseline, 2 months treatment and 1 month follow-up:
  1. Chiropractic cervical manipulation – 14 treatments over an 8 week period
  2. Amitriptyline – initial dose of 25mg was increased by 25mg/week up to 100mg/day. Patients were seen 3 times in the 3 month study period
  3. Combined SMT + Amitriptyline

Average intensity was reduced from baseline to the last 4 weeks treatment and 4 weeks post-treatment by 40% and 42% respectively in the SMT group, 49% and 24% in the Amitriptyline group, and 41% and 25% in the combined group. Corresponding intensity reductions are as follows: 32% and
33% in the SMT group, 48% and 22% in the Amitriptyline group and 39% and 22% in the combined group. Dropouts were high in this study (n=59).

- A second Australian study (7) including 127 patients diagnosed with migraine via questionnaire was conducted over 6 months – 2 months each for baseline, treatment and follow-up. Subjects received either cervical SMT (maximum of 16 sessions) or a control treatment (detuned interferential therapy). The average response was statistically significantly better in the SMT group than control for migraine frequency (35% vs. 17%), duration (40% vs. 20%), disability and reduction in medication use (all P < 0.05).

| Clinical Application & Conclusions: | Current evidence from randomized trials suggests that massage therapy, physiotherapy, relaxation therapy and chiropractic spinal manipulative therapy are all likely as efficient as propranolol and topiramate in the prophylactic management of migraine (the authors compared pain and frequency reduction rates with existing data from drug trials to reach this conclusion).

The massage trials had relatively small sample sizes but were promising, the physiotherapy trial was large but had no control group and did not describe the physiotherapy intervention and the chiropractic studies on manipulation were also plagued by lack of control groups (3 of 4 studies) despite showing promising results. These limitations should be considered when interpreting this literature and there are certainly some clear improvements that must be made in future studies.

For now, it is within reason to refer those patients who are not responding to, or tolerating, prescription drug management of migraines for manual therapy. However, firm conclusions and the development of clearer clinical treatment algorithms requires further research that addresses the methodological concerns that plague the existing literature on this topic. It is logical and supported at least by the existing evidence that assessing and treating cervical spine/shoulder musculature as well as cervical joint mechanics/motion is a reasonable clinical approach for migraine patients. |

| Study Methods: | The authors conducted a literature search utilizing CINAHL, Cochrane, Medline, Ovid and PubMed databases. All RCTs written in English evaluating a manual therapy for treating migraine were included. Migraine was defined preferentially using the criteria outlined by the International Headache Societies in 2004, although it
wasn’t an absolute requirement. The included studies had to include one migraine outcome such as frequency, duration, or intensity. Methodological quality of the studies was assessed using an instrument with a maximum score of 100 (8).

<table>
<thead>
<tr>
<th>Study Strengths/Weaknesses:</th>
<th>Rather than discuss specific strengths and weaknesses of this review, it may be more constructive to discuss the shortcomings of the literature on this topic in general:</th>
</tr>
</thead>
</table>
| **Areas for improvement:** | · 3/7 trials diagnosed migraine via questionnaire which does introduce some uncertainty into the exact nature of the patient populations. Therefore the possibility of co-occurrence of tension-type headache (TTH) remains high, which doesn’t necessarily mean the treatments were ineffective for migraine, but rather that they may also be effective for treating TTH.  
· 4 of the RCTs included no control group making interpretation more difficult.  
· Several of the studies had relatively small patient groups – a definite area that future studies could improve upon. |
| **Regarding this review in particular:** | · The authors presented summaries of the studies in chart form but did not include any information on critique/weaknesses of the included studies – this should have been included, particularly because one of the included studies was conducted by one of the authors of this review (7). |

Section Three: Manual Therapy for Chronic Tension-Type Headache

Study Title: Effectiveness of manual therapy for chronic tension-type headache: a pragmatic, randomized, clinical trial

Authors: Castien RF et al.

Author's Affiliations: Institute for Health and Care Research, VU University Medical Centre, Amsterdam

Publication Information: Cephalalgia 2011; 31(2): 133-43.

Background Information: Tension type headache (TTH) is a benign primary headache. The International Headache Society divides tension type headache into two categories; episodic and chronic (CTTH going forward). The IHS definition of CTTH includes the following:

- occurring on 15 or more days per month for at least 3 months
- episodes last for several hours or are continuous
- is pressing/tightening in quality
- mild-moderate in pain intensity
- bilateral in region
- not aggravated by physical activity/exertion
- is not associated with photo- or phono-phobia or associated with nausea or vomiting (1)

CTTH is frequently encountered in musculoskeletal practices. The point prevalence of CTTH is estimated at 3% in adults (2). Despite the fact that tension type headaches account for more than 60% of headaches (3), a low consultation rate is correlated with the disorder, as only 20% of sufferers seek medical care. (4-6).
Castien et al. report that the Dutch national general practice guideline for CTTH asserts that treatment should mainly consist of reassurance, lifestyle advice and medication; though no evidence investigates the effectiveness of this regime.

Recently, many studies have been published by Fernandez-des-las-Penas with respect to CTTH and musculoskeletal dysfunction in the craniocervical region. Castien et al. point out that while previous studies have attempted to evaluate manual therapy for CTTH have been conducted, they have been plagued with small sample sizes and heterogenous treatment techniques. The present study sought to evaluate manual therapy for CTTH, while using headache frequency, medication usage, and the impact of headaches as determinants of effectiveness. A comparison group of CTTH sufferers undergoing regular medical care by a GP was also evaluated.

### Pertinent Results:

- In total, 82 participants were recruited over an 18 month period and were randomized. A total of 40 subjects received treatment in each group. Three subjects in the manual therapy (MT) and four subjects in the usual care (UC) groups were lost to follow-up.
- At baseline, the UC group reported high dose-usage of analgesics, had higher Headache Disability Index scores, lower CROM measurements and higher algometry scores.
- After 8 weeks of care, significant differences were found for the MT group with respect to a decrease in headache frequency (by 6.4 days; -8.3 to -4.6), duration of headache and headache intensity (down 1.8 points; -3.1 to -0.7).
- A 50% reduction in headache frequency was found in 87.5% of the MT group versus only 27.5% of the UC group. No significant differences were found in medication usage between groups.
- At 26 weeks, the MT group maintained a significant decrease in headache frequency (4.9 days less; -6.95 to -2.98) and pain intensity (1.4 points less; -2.7 to -0.2). A 50% reduction in headache frequency at 26 weeks was experienced by 81.6% of the MT group and 40.5% of the UC group.
- Self-reported disability questionnaires reported significant improvements for the MT group at 8 weeks and at 26 weeks. Significant differences were also found for CROM, neck flexor endurance and pressure algometry at 8 weeks in the MT group versus the UC group. Physical measures were smaller at 26 weeks and no longer significant.
Clinical Application & Conclusions:

This trial is helpful to clinicians as it guides us towards the understanding that manual therapy is effective in the treatment of CTTH. Compared to medical care, those receiving manual therapy over an 8 week period demonstrated significant improvements in frequency of headache and pain intensity. While the specifics of the treatment techniques and parameters were not reported on (EDITOR’S NOTE: seriously, can researchers PLEASE start including these details!), this study is helpful in once again identifying the advantages of a conservative approach through manual therapy in disorders which have musculoskeletal ties.

Of note within the reported outcome measurements, the frequency of medication usage did not demonstrate significant changes for either the MT or the UC group, which creates concern from both a research and clinical standpoint. Given the side-effect profile of many analgesics, particularly with respect to rebound headaches, their usage is of great importance in this patient population. Additionally, the fact that subjects were still taking these medications at the same frequency may indicate that the other outcome measurements were not reporting results as clinically meaningful as each patient’s self-perceived need for medication. Keeping this in mind however, the baseline reported medication usage in the preceding two weeks was low, with a range of 1.2-1.5 NSAID pills used per week and 2.8-3.5 analgesic pills used per week. Also, 70% of the MT group and 65% of the UC group did not use NSAIDs and 41% of each group did not use analgesics.

Dr. Thistle’s Treatment Recommendations for CTTH: EDITOR’S NOTE: since the authors did not describe in detail what they did for the manual therapy arm of this trial, I thought I would mention a few approaches that I have found useful with CTTH patients (again, if you’ll indulge me for a moment, and again, these are in no particular order and represent only my opinion and clinical experience):

- Mobilization and/or manipulation to the cervical spine or upper thoracic spine and costovertebral joints – patients with CTTH often have chronic postural strain including forward head posture and reduced upper thoracic mobility as at least a partial cause or contributing factor to their headaches
- Soft tissue therapy to the cervical spine musculature – don’t forget the anterior aspect of the neck, the suboccipitals and even some facial muscles (like the procerus, frontalis) which can harbor trigger points in chronic headache patients
- Postural relief exercises – most of these patients will work in an office environment and sit at a desk or computer for 7-10 hours per day! Educate them on appropriate tissue-sparing techniques such as the Brugger Postural Relief position. I
recommend 1-2 ‘Bruggers’ every 20-30 minutes (and don’t forget the deep breathing with this position – that could be the most beneficial part!)
- Hydration – I believe that CTTH can relate to chronic dehydration – ask your patients about their fluid intake and you might see that even a small increase can make a difference if they stick to it
- Prescription eyewear – I also believe that chronic eyestrain can contribute to forward head posture and many headache syndromes. This is a silly reason to allow headaches to persist so if your patient wears glasses or contact, see how recent their prescription is

| Study Methods: | This study was a pragmatic, randomized, multi-centred trial. Thirty-eight GP’s provided headache patients with trial information. Interested parties were screened via a research assistant who conducted a standard history and evaluated the 2 week headache diary (carried out by potential subjects prior to the screening). Participants were enrolled if they were between 18-65 yrs and fulfilled the CTTH criteria defined by the IHS (listed above). Participants were excluded if they suffered from Rheumatoid Arthritis, or were suspected of malignancy, pregnancy, were using triptans, ergotomines or opioids more than 10 days per month, or were using simple analgesics for more than 15 days per month. Subjects were also excluded if they had received manual therapy within 2 months of enrollment.

Primary outcome measures (recorded via a headache diary) consisted of the number of days in the preceding two weeks in which a headache was experienced, and the number of days in which analgesics were used. A reduction of 50% in either outcome was deemed to be clinically relevant.

Secondary outcome measures consisted of headache pain intensity in the preceding 24 hours using an 11 point pain scale, the Headache Disability Inventory and the Headache Impact Test-6, active cervical range of motion (determined by a CROM-device), trapezius and suboccipital muscle algometry, neck flexor endurance testing, and patients’ perceived improvement using a 7 point likert scale. Outcomes were assessed at baseline, immediately after the treatment period (8 weeks) and again at 26 weeks for short-term follow-up.

Usual Care Intervention:
Subjects were provided with reassurance and a discussion of life style changes. If required, analgesics or NSAIDs were prescribed. This intervention was delivered by twenty GP’s in 2-3 sessions.
**Manual Therapy Intervention:**
A combination of mobilizations to the cervical and thoracic spine, exercise therapy and postural correction was utilized. Four manual therapists were trained in the treatment protocol over two meetings. Treatment sessions were 30 minutes in length for a maximum of nine sessions. Approaches to treatment included mobilization, exercise or postural correction, with the therapist deciding the approach at each session depending on the individual subject’s status.

<table>
<thead>
<tr>
<th>Study Strengths/Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within the introduction of this paper, Castien and colleagues state that previous studies are limited by their heterogenous application of therapy techniques. Yet within their own study, they repeat this mistake. Within this investigation’s treatment protocol, manual therapists provided one of three treatment approaches, determined at the time of treatment according to the subject’s status. While the purpose of a pragmatic study is to offer insight into to overall effectiveness of one type of treatment, greater details of how these treatment decisions were made would be significantly useful to the reader.</td>
</tr>
<tr>
<td>Another limitation of this study is its primary use of self-reported outcome measures, its lack of description on the specifics of manual therapy provided (though it was identified that therapists were certified in mechanical diagnosis and therapy via the McKenzie Institute) and the manner in which CROM measurements were reported. Surprisingly, CROM measurements were not reported with respect to changes in flexion, extension or other specific ranges. Rather, changes in degrees from all ranges were added together to create one value.</td>
</tr>
<tr>
<td>This paper is however strengthened by the moderate sample size. Additionally, the research assistant who allocated subjects to their specific groups and conducted the outcome measure assessments, was blinded to patient allocation until after the baseline assessment. This study could have been further strengthened by then having a separate research assistant conduct the 8 week and 26 week assessments, blinded from treatment allocation.</td>
</tr>
<tr>
<td>Another consideration should be given to the fact that subjects were recruited from medical practice environments, whereby the Castien et al. themselves reported that only 20% of CTTH sufferers seek medical care, leaving a large proportion of patients undergoing self management. It is also unclear what proportion of sufferers seek care elsewhere, for example from chiropractors or registered massage therapists.</td>
</tr>
</tbody>
</table>
Section Four: Stress & Tension-Type Headache

Study Title: Stress and tension-type headache mechanisms

Authors: Cathcart et al.

Author's Affiliations: Centre for Applied Psychological Research, School of Psychology, University of South Australia


Background Information: As we know, headaches are classified, according the IHS, into either primary or secondary headaches. A primary headache is one that is not attributable to a secondary disease process, therefore is manifesting directly, and is classified according to its symptoms. These include tension-type headaches and migraine, and more rarely, cluster headache and trigeminal neuralgia. A secondary headache on the other hand, is a form of headache disorder due to another etiology, a secondary disease process elsewhere in the head and neck. These disorders are classified according to the etiology rather than the symptoms.

Tension-type headache is the most common type of primary headache, representing ~80% of all headache diagnoses. (Now, the accuracy of these diagnoses can obviously be called into question.)
given the controversy surrounding tension-type headache versus cervicogenic headache. But that is a different review all together.)

Stress, from work, daily-life, relationships etc., has been found to be the most common headache trigger (1,2). As a result, previous hypotheses have estimated the effect which stress would have on muscle tension, therefore causing or aggravating headaches in sufferers (3). Unfortunately, this hypothesis has not been strongly supported.

The purpose of this review is to explore the possibility that stress may contribute to Tension-Type Headache (TTH) through a sensitizing effect of the pain processing pathway. Therefore, the cited paper reviews three particular topic areas:

1. specific pain mechanics of TTH;
2. the relationship between stress, pain and head pain mechanisms; and
3. the relationship between stress and pain processing in TTH.

### Pertinent Results: Mechanisms of TTH

**Muscle Contraction:**

- Muscle contraction leading to ischemia or the development of trigger points was previously thought to be the cause of TTH. However, no evidence has been identified showing an increase in muscle tension, as surface EMG studies have found no, or only a minimal, increase in pericranial muscle tension in TTH sufferers.
- EMG levels have not correlated with stress levels or stress-induced headaches in TTH sufferers.
- For example, one cross-over designed study evaluated TTH subjects who were either exposed to a placebo (undefined) versus jaw clenching. The results found no difference between groups with respect to the number of subjects who developed headaches (4).
- A further study compared TTH sufferers to healthy controls and examined the effect of static trapezius contraction on the development of headache symptoms. It was found that TTH sufferers developed significantly more headaches as a result of the experiment (5). Therefore, the authors concluded that the act of muscle contraction itself was not responsible for the results and that it was only one part of the mechanism (if muscle contraction were the primary mechanism, all patients...
would have shown equal incidence of headache).

**Myofascial Tenderness:**

- Increased muscle tenderness is thought to be related to TTH given that: it has been linked to headache history and severity, it is increased during a headache episode and it precedes headache episodes subsequent to voluntary muscle contraction.
- This leads to the hypothesis that this represents a peripheral disorder causing sensitization of the myofascia OR a central disorder causing sensitization at the spinal/trigeminal dorsal horns.
- However, muscle biopsy in ETTH sufferers has proven unremarkable, and central processing to mechanical, thermal or electrical stimulation has equally been proven normal. This is untrue for CTTH however.
- Central mechanisms appear to be abnormal in CTTH sufferers given increased responses to pain stimulation.
- Also, as muscle tenderness increases in CTTH sufferers, pain thresholds decrease, indicating a relationship with central sensitization.
- This being said, other studies have failed to show a correlation between muscle tenderness and TTH, therefore another factor must be considered, such as endogenous pain regulatory mechanisms.

**Central Sensitization**

**Spinal/Trigeminal Sensitization**

- Central nuclei in the trigeminal nucleus caudalis receive convergent input from the pericranial muscular, vascular, trigeminal and cervical nerves of the neck and shoulders, in addition to the head itself. As a result, a neural interplay exists between these structures and supra-spinal structures. (for reference, this link is the proposed mechanism behind the vascular-supra-spinal-myogenic {VSM} model of migraine, as well as TTH).
- Abnormal trigeminal and trigemino-cervical reflexes in CTTH sufferers suggest a link at this level. More importantly, increased sensitivity is noted generally and not just within muscular structures.
Supra-spinal Sensitization

- This specifically refers to sensitization of the third order neurons, in the thalamic or cortical areas.
- Recent imaging studies have identified cortical abnormalities in CTTH sufferers in the areas of the pons, anterior cingulated cortex, insular cortex, temporal lobe, orbito-frontal cortex and hippocampus. These areas all have functions pertaining to pain processing and demonstrate consistent decreased tissue mass in CTTH sufferers. It is still unclear however if the atrophy is the primary cause or a secondary response.
- Additionally, atrophy could be the result of prolonged activation from lower structures which are conveying noxious stimuli.

Temporal Summation

- Temporal summation, or ‘wind-up,’ is the process whereby noxious stimulation delivered consistently generates a cumulative activation of neurons that does not return to baseline.
- This phenomenon is suggested to be the reason by which prolonged myofascial input results in central sensitization in TTH sufferers.
- Studies examining this phenomenon specifically in TTH sufferers have been conflicting however, as results have not shown significant trends or demonstrated no difference between TTH subjects and healthy controls.

Pain Modulation

- Another proposed central mechanism involved in TTH pain is a deficiency of pain modulation and inhibitory mechanism rather than, or in addition to, central sensitization (see Related Reviews below)
- One study examined the effect of pressure pain thresholds at the finger following an experimentally sustained muscle contraction in the jaw. In those subjects who did not experience a headache following the contraction, their pressure pain thresholds were increased. In other words, they exhibited an anti-nociceptive response. Alternatively, those subjects who did experience a headache after muscle contraction demonstrated no change in pressure pain thresholds. This is thought to indicate an impaired inhibitory system.
Psychological Pain Processing

- Lastly, pain response could be due to psychological changes, such as anticipation, hypervigilance and increased attention, increased reporting or effects on the meaning of pain.
- This is relevant to TTH as sufferers have been found to have poorer coping mechanisms, poor memory recall of previous episodes and increased arousal. Also, anxiety, depression and anger have been shown to be higher in TTH sufferers.

Stress and Pain

Based on the shared responses with the neural, endocrine and autonomic systems, as well as behavioral mechanisms, stress and pain are closely related.

While nociceptive stimulation activates the stress system, stress results in a release of epinephrine which can aggravate sensitized nociceptors. This is one simple connection. The link becomes even more complex when examining the midbrain and the inter-relationships between the hypothalamic pituitary adrenocortical and sympathetic adrenomedullary axes, the periaqueductal grey, the rostroventral medulla, etc.

As a result of this complex system, stress can have both an inhibitory and an excitatory effect on pain processing.

Inhibitory Effects of Stress:

- Based on observations of wounded soldiers in battle, stress has been thought to play an inhibitory effect on pain processing, thus enabling us to either fight or flee in spite of pain/injury. However, this is only true in situations of acute psychological stress whereby our attention is focused on the stressor, rather than on the pain.
- This type of response is an important survival instinct.

Excitatory Effects of Stress

- Pain processing can be facilitated by stress in situations of sustained arousal, negative mood states, anxiety, chronic or daily stress or even from poor coping strategies.
- These links are also thought to be a survival instinct, whereby our response to a stressor helps us avoid a similar situation in
Stress as the Cause of Pain
It has been suggested that, given the complex link between pain and stress pathways, stress may cause pain in the absence of an incoming noxious stimuli. This is likely due to the limbic system potentially binding the two systems together.

Stress and Pain Processing in TTH

- TTH sufferers have been found to have higher levels of stress than healthy controls (6).
- TTH sufferers have been found to have higher levels of cold pressor pain than healthy controls (6).
- This findings are a bit controversial, as other results have demonstrated that sufferers were found to only have higher levels of stress than healthy controls, without a change cold pressor pain levels (7).
- Catastrophizing has also been found to a higher degree in sufferers versus healthy controls (8).
- Linkage between muscle tenderness and anxiety levels in TTH sufferers has been difficult to determine, as study results disagree widely.
- Stress has been linked to pain sensitivity as an effect. Pain experienced on exertion has been found to be increased in TTH sufferers following an hour long task which induced stress (9).
- When muscle tenderness and pain thresholds were tested in a group of depressed TTH sufferers, muscle tenderness was found to increase following an hour long stressful task. Additionally, depressed TTH sufferers were more likely to experience a headache following the task (9).
- A series of articles completed by Cathcart et al. have found that stress induces an increased pain sensitivity in TTH sufferers versus healthy controls.

Clinical Application & Conclusions:
The authors’ primary objective within this manuscript was to suggest that stress may contribute to, or aggravate the abnormal pain processing within TTH sufferers.

This information is helpful in clinical practice, taken with limitations into consideration, as it allows clinicians to generate a more accurate and reasonable prognosis.

When stress is apparent in a TTH patient, we may assume that pain
processing, interpretation and coping behaviors may be different. This can create a negative prognosis for the patient. Therefore, they may experience their symptoms for a longer time frame to resolution than a non-stressed individual, or they may not respond in at all to a particular intervention.

Next steps in research could be to examine the same group of TTH sufferers to determine:

1. How to effectively modify daily stress in their lives;
2. how to modify their coping behaviors; and
3. if these modifications offer a more favorable prognosis for the patient and their headache patterns.

| Study Methods: | This review follows that of a narrative format, with no information regarding the literature search strategy or results provided. |
| **Study Strengths/Weaknesses:** | The authors made all efforts available however to limit studies to those examining TTH specifically. When possible, TTH was subdivided into chronic TTH (CTTH) or episodic TTH (ETTH). Also ETTH was also subdivided into frequent and infrequent ETTH. |
| | The authors of the study offer the following limitations to their own work: |
| | • To date, the evidence base which examines the direct effect of stress on experimental pain is minimal |
| | • The evidence base examining the importance of stress as an aggravator is equally minimal. |
| | • Future research is also needed to examine the specifics aspects of pain which are affected by stress. |
| | • Greater understanding is needed to examine how stress affects pain processing. |
| | The major limitation of this work is its narrative structure. The study’s search results and presentation are in no way systematic, and therefore biased. |
| | More importantly, while the authors outline a reasonable and linear pathway to their hypothesis, the information itself becomes confusing. |
| | Throughout many sections, evidence is presented supporting their hypothesis. Then evidence is presented refuting the previous findings. After this pattern is repeated many times, it becomes confusing as a reader. You are unsure of how they are eventually going to support |
their theory. This is made clear in the end with a short paragraph describing several referenced works written by the primary author that do in fact support the theory. Prior to this, most evidence is presented which only indirectly supports their hypothesis.

This aside, their theoretical presentation is sound and offers clinical consideration.

Additional References:

## Section Five: Tension-Type Headache in Children

<table>
<thead>
<tr>
<th>Review Title:</th>
<th>Tension-Type Headache in Children</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Background Information:</strong></td>
<td>We are all aware that neck pain and headaches, whether as distinct or coexisting clinical conditions, are very common. Tension-type headache (TTH) is a primary headache disorder that is prevalent in both adults and younger patients. In fact, despite variable estimates, TTH is thought to occur in about 30% of children. Prevalence increases with age, and many patients seek our assistance with this problem. Theories regarding the interplay between cervical spine structures and tension-type headaches (TTH) seem logical from both anatomical and neurological perspectives, despite varying degrees of supporting evidence. Headaches (in general) and neck pain can arise from numerous pain generators – muscles/fascia, facet joints/articular capsules, intervertebral discs or nerves, intracranial structures etc. As manual therapists, our interventions can positively influence pain syndromes of the head and neck by modulating soft tissue tension, improving aberrant or reduced mobility, correcting posture or faulty movement patterns, or facilitating pain reduction. For headache patients in particular, holistic clinicians will also counsel patients regarding contributing factors for their headaches such as: hydration, fitness, prescription eyewear, ergonomic issues, food or allergen triggers, and so on. Those in practice would likely agree that most patients with headache will experience at least some relief with treatment directed to dysfunctional soft tissue structures or joints in the head/neck region. As evidence-informed clinicians, it is very important for us to be up to date on recent developments that can enhance our understanding of what we do, and the relationship between musculoskeletal structures and pain syndromes. As such, I thought it would be appropriate to combine these two studies into one review. One updates us on the state of the literature surrounding TTH in children and the other reports on some clinical data regarding neck mobility in younger TTH patients.</td>
</tr>
</tbody>
</table>
| **Pertinent Results:** | **Diagnostic Criteria for Tension-Type Headache:**  
To quickly review, the diagnosis of TTH is based on the International... |
Classification of Headache Disorders, second edition (ICHD-II) as follows:

1. At least 10 episodes occurring on < 1 day/month on average (12 days/year) and fulfilling criteria 2-4
2. Headache lasting 30 min to 7 days
3. Two of the following characteristics: a) Bilateral location b) Pressing/tightening (non-pulsating) quality c) Mild to moderate intensity d) Not aggravated by routine activity
4. At least one of the following associated symptoms: a) No nausea or vomiting b) Photophobia or phonophobia

Subtypes of TTH:

1. Episodic - may occur with or without pericranial muscle tenderness – there are 2 types:
   - Infrequent: at least 10 episodes occurring on < 1 day/month on average (<12 days/year and fulfilling criteria 2-4 above)
   - Frequent: at least 10 episodes occurring on ≥ 1 but < 15 days/month for at least 3 months
2. Chronic: ≥ 15 days/month on average for > 3 months

TTH in Children & Adolescents:

Childhood and adolescence are periods of rapid growth, emotional maturation, physiological perturbations and hormonal changes, all of which may influence the expression of primary headache disorders in those who are predisposed. It is not surprising then that the prevalence of TTH increases with age in adolescents.

Classification & Diagnostic Challenges:

There are some obvious limitations in diagnosing any type of headache in children. Sometimes it may be difficult to obtain an accurate history, particularly in younger children. In these cases, some suggest that behavior may be a better measure of pain intensity. Look for or ask a parent about changes in social interaction, a need for more sleep, or an appearance of decreased school involvement. Aside from the practical aspects, the primary clinical challenge in properly diagnosing TTH in children or adults is the frequent symptom overlap and similarity to migraine. Migraines commonly present as a bilateral, short-lasting headache, with episode-to-episode differences in associated features resembling TTH. A further problem is that the phenotype may not be fully developed with age because the phenotype of migraine without aura can evolve in adolescence or early adulthood from a bilateral to unilateral headache. When the headache is unclassifiable, it may be helpful to evaluate further information to determine a diagnosis. Parents usually accompany their children and make it plausible to obtain a detailed family history of headache. Typically, TTH lacks the circadian rhythmicity
seen in other primary headache disorders such as migraine or cluster headache. A history of motion sickness and ice cream headaches in the childhood may be useful markers for migraine in unclear diagnostic circumstances. Further, a history of cyclical vomiting or recurrent abdominal pain in an unclassifiable patient is suggestive of an evolution to migraine. Clinicians should remember that in general, recurrence of headache symptoms is reassuring in confirming the benign nature of a headache disorder. Regarding headache triggers, it is generally accepted that migraine headaches have more reliable triggers than TTH, despite the commonly held belief that TTH can be related to posture, stress, hydration and so on. Clinicians should also remember that high rates of headache transformation between TTH and migraine can occur. In practice, it is often difficult to distinguish the two entities, and this does not even take into consideration that the two types of headaches can coexist! (CLINICAL NOTE: From a practical perspective, it is arguable whether a distinction needs to be made between TTH and migraine from our perspective, as manual therapists typically assess and treat similar structures in both conditions.)

Nociceptive/Neurological Considerations:
While nociception from myofascial structures in the neck/head region is considered important in TTH, the exact contribution of peripheral versus central mechanisms has not been precisely determined. It is within reason that both are important, with muscle/joint/fascia pain itself (peripheral) potentially contributing to central sensitization (central), which likely has a distinct role to play in chronic TTH (we should also remember that these factors could and likely do contribute to migraines as well). The exact roles of biological substances like nitric oxide (NO) and calcium-gene-related-peptide (CGRP) in TTH have not been fully established and at this point, there is no definitive biomarker to identify TTH.

Management:
The literature pertaining to manual treatment of childhood and adolescent TTH is essentially non-existent. Again, it is within reason that addressing soft tissue and joint dysfunction, postural strain, stress, sleep, hydration etc. could be of great benefit to younger TTH patients, however exact recommendations cannot be made at this point. For the sake of perspective, it is important to keep in mind that there is not conclusive evidence to support any other form of therapy for this condition either. Manual therapy, lifestyle interventions, biofeedback, and judicious minimal use of NSAIDs or other pain medications may be of benefit, but more research is required.

Cervical Spine ROM in Children with TTH – some clinical data:
From a clinical perspective, dysfunction in the cervical spine has been tied to many types of headaches. This blinded, controlled study investigated the relationship between cervical ROM and headache intensity by comparing
ROM values in a group of children with chronic TTH to those in control subjects. Fifty children, 13 boys and 37 girls (average age 8.5 ± 1.6 years) with CTTH and 50 age- and gender-matched children without headache (13 boys, 37 girls, average age 8.5 ± 1.8 years) participated. Cervical ROM was objectively assessed with a cervical goniometer by an assessor blinded to the children’s condition. Children completed a headache diary for 4 weeks to confirm the diagnosis. Pertinent results of this study include:

- Children with CTTH demonstrated significantly reduced cervical ROM in flexion, extension and left/right lateral bending compared to controls without CTTH (all directions, P < 0.001)
- Interestingly, there was no significant difference in rotation between groups.
- In the CTTH group, cervical ROM was not correlated to headache intensity, frequency or duration.

The authors of this study speculated that the differences noted in flexion/extension but not in rotation might be due to tightening or trigger point formation (or both) in the sternocleidomastoid (restricting extension) and splenius capitus (restricting flexion) – a plausible theory that requires further study. It should also be noted that the authors did not evaluate facet joint play in the cervical spine as many of us do in practice so we cannot clarify this association based on this study. It would seem reasonable that joint restrictions may accompany the reduced ROM, but again further research is required.

Clinical Application & Conclusions: Tension-type headache is a common problem affecting patients of all ages. Keeping the limitations of the existing literature in mind, particularly in the area of management, prudent clinicians should continue to employ a holistic approach to all headache patients. Investigating for dysfunction in the cervical spine is currently a reasonable approach, provided that the remaining aspects of the clinical encounter are performed comprehensively. There is likely a lot we can do for TTH patients with manual techniques but don’t forget to address other triggers and contributing factors such as sleep, stress management, exercise, hydration, prescription eyewear, ergonomics, tissue-sparing strategies, and so on.

In time, the literature should continue to define the relationship between cervical spine structure and headaches, helping us better explain the benefits our patients experience each day under our care for TTH and other headache conditions.