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Effects of Manual Therapy in Reducing Headaches

A Literature Review

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<p>Headache is a quite common conditions in the nervous system and can be very painful and affect the day to day life. Most of the world's adults are suffering from tension-type headache cervicogenic headache and migraine. Medication is the first choice for headaches in the modern world rather than manual therapy to get a fast recovery.</p> <p>The purpose of this literature review was to investigate the effects of manual therapy techniques in reducing headache.</p> <p>The method used for this thesis was based on literature review. It follows the main principles of systematic search. A systematic search was conducted in PubMed, CINAHL, Academic search Elite and manual search. Nine randomized controlled trials (RCT) and systematic reviews of meta-analysis of RCT articles that were selected for the thesis fulfilled the inclusion criteria.</p> <p>According to the results, outcome measures of headache frequency and complaints of daily headache were significantly reduced with manual therapy treatments. Manual therapy helps to reduce pain frequency and maintain long term effectiveness at 4-8 weeks of follow-up period. In addition, two articles show that manipulative treatment and combined treatment gives good results to reduce tension-type headache and migraine. Furthermore, manual therapy and exercise therapy together reduce headaches and benefit to maintain long term effect.</p> <p>Conclusion of this study was, manual therapy, manipulative treatment and combine treatment (manual therapy and exercises) have shown effect on reducing pain frequency of tension-type headache, cervicogenic headache and migraine and effects have maintained. In few studies with manual therapy, exercise therapy and combined therapy had also (Jull et al.2002, Chaibi et al.2014, Espi-Lopez et al.2014, Monzani et al.2016) quite a long-term effect on headache frequency. The result was maintained from 4-26 weeks in reducing headache frequency. To find out about the efficacy of manual therapy, long term follow-up needs to be done with big group of participants.</p>	
Keywords	manual therapy, manual therapy techniques, tension-type headache, migraine, cervicogenic headache

Content

1. Introduction	1
2. Literature review	3
2.1. Types of Headaches	3
2.2. Types of manual therapy techniques used for headaches	5
2.3. Treatment effects for headaches	6
3. Aim and Methods	8
4. Results	12
5. Discussion	26
6. References	28

1 Introduction

Headache is a quite common impairment in the nervous system and it is very painful and affects the day to day life. The estimated globally, that headache prevalence among adults is about 50%. Globally 50%-75% of adults 18–65 years old have had headaches during the last year. Within this group of people 30% or more have had migraine (IHS, 2018). Tension-type headache and migraine are the ones most common widespread two types of headaches (Woltan et al.2011). According to the International Headache Society's article, migraine was the third most prevalent impairment and was ranked as the third highest disability that impacts personal and socio-economic states, which is also mentioned in Woltan's article on Global Burden of Disease Study (2013) (IHS, 2018).

Tension-type headache, migraine, cluster headaches and medication-overuse headaches are main types of headaches. Headache is a condition that affects public health, and it is important to consider consulting a specialist and getting treatment for it, since it is affecting to large amount of population disability. Common cause for headache is tightness in the muscles around neck, shoulders and scalp areas. Muscle tension can also get worse with lack of sleep, poor postural habits and emotional or mental stress (Woltan et al.2011).

Researchers have found that this neurological condition significantly contributes to health and life style. Most of the people who suffer from migraine and sixty percent of people with tension-type headache show a drastic drop in their social activities and work capabilities (Leonadi et al.2005). Tension headaches can reduce person's quality of life, interpersonal relationships, work related issues, mental or psychological aspects and finally, it effects the person's financial status. Chronic headaches affect family life and can lead to some other illnesses, like depression and anxiety. That is more common in people who has migraine than people who does not have it (Falsiroli Maistrello et al.2018).

Manual therapy techniques are based on hands-on skills, which can decrease symptoms through correction of posture, training of cervical muscles and mobilisation of the spine. Many research articles have shown that improving the range of motion, mobility of the cervical spine, thoracic spine and muscle strengthening have helped to improve the

symptoms of headache. Manual therapy is used by physiotherapists, osteopaths, chiropractors, and other trained practitioners (Chaibi et al.2014, Posadzki et al. 2011, Posadzki et al.2012).

The main reason for this study is that there are not many studies based on the effects of manual therapy on headaches. This literature review was conducted to improve the awareness of effectiveness of manual therapy treatment methods instead of pharmacological methods for tension-type headache, migraine and cervicogenic headache.

2. Literature review

1.1 Types of headaches

According to the International headache society classification, migraine and tension-type headache are classified under primary headaches (IHS, 2018). Tension-type headache and migraine are painful, conditions that affect throughout life (Woltan et al.2011).

Migraine symptoms are more pronounced to disturb daily lifestyle. Subject with migraine can have more than one type of headache with different types of clinical features such as nausea and aura. This can be varying with each individual (Charles et al.2018). These symptoms can last from 4 to 72 hours and severe migraine attacks can be triggered by features like high stress levels, illness, emotions, or the cycle of menstruation (Voigt et al.2011). Migraine aggravates with physical activity (Woltan et al.2011). Most of the participants like to stay in dark rooms or areas when they get the attack which was mentioned in Martelletti's article. In addition, they suffer from helplessness, depression, sleeping difficulties and the fear of next attack (Martelletti et al.2018). According to Martelletti et al.2018, migraine has impact on the different aspects of professionals' work life, and 87% of the participants' professional, private or social life have been affected. Impact on private life includes relationships with friends, relations and parents; missing private birthday parties or weddings and avoiding family commitments. When it comes to the effects on social life, people stop engaging in hobbies, physical or sports activities due to the impact of migraine attacks. Voigt's et al. mentions that the cost of migraine in Europe adds up to 27 billion Euros in total for the treatment of 41 million patients 18–65 years old and almost 90% of this is an indirect cost to the country, like reduced efficiency when working (Voigt, 2011). In addition, some articles (Falsiroli Maistrello et al.2018, Monzani et al.2016, Martelletti et al.2018) show that the majority of the participants were women above age 18 years (mean age was 39 years) and that the prevalence of headaches is higher in women than in men.

Tension-type headache is not clearly defined as it can be originating from muscles, s related to stress or related to musculoskeletal disorders around the neck. This type of headache is seen most often among teenagers and ages up to 30 years, and the peak time of it will be closer to 30 years. The pain can be commonly described as band around the head or one side of the head, spreading pain into neck or from the neck with tightening or pressure. Also, pain can be either mild or moderate (Woltan et al.2011). Tension-

type headache can last maximum few hours or sometimes can persist for few days (Woltan et al.2011). Tension-type headache symptoms do not get worse with daily activities such as walking and climbing stairs, but people who are suffering with tension-type headache might have photophobia, mild nausea or phonophobia with the headache (HIS, 2018). Tension-type headache has two subtypes: tension-type headache and episodic tension-type headache, which occurs like migraine attacks in episodes (Woltan et al.2011). “Headaches lasting more than 15 days per month on average for more than 3 months are diagnosed as tension-type headache”. Also, the headache which lasts hours, days or is continuous over long periods are taken into consideration. (HIS,2018).

Another cause for headache is excessive use of medication and this “type of headache is called medication overuse headache. According to the International Headache Society this is classified under headache attributed to substance abuse or its withdrawal category” (HIS, 2018). Past medical history is taken into consideration when diagnosing medication overuse headache, which begins with episodic headache with tension-type headache or migraine. Chronic headaches need long-term medical treatment. Development of medication overuse headache depends on the mechanism of the drug classes and it varies person to person or tolerance level in the body (Woltan et al.2011). Chronic excessive medication overuse headache can start with headache lasting for 2 weeks, more days or even months and it is worse in the morning (Woltan et al.2011). Another study (Castien et al.2009) shows that manual therapy helps to improve the movement of cervical, thoracic spine and function, which leads to reduced frequency and number of headache days compared with intake of medication. In addition, Castien et al.2009 article mentioned and statistics illustrated that only 20% will seek medication for chronic tension-type headache and most of them can become addicted to analgesics or overuse medication, as chronic headaches increase the risk of overuse of analgesics (Castien et al.2009). Zwart’s study shows that the prevalence of chronic headache which is associated with the use of pain-relieving medication taken every day or almost daily for one or less than one month was 1% and for pain relieving medication the overuse duration of three months or less than three months 0.9% (Zwart et al.2004).

“Cervicogenic headache is a classification of headache or facial pain attributed to disorder of the neck, sinuses, cranium, ears, nose, eyes, teeth, mouth, other facial or cervical structures, which means that most commonly the signs and symptoms arise from the neck”. Cervicogenic headache commonly originates from the upper neck, it can be either from the joints, ligaments, muscles or discs. Bodes-Pardo’s study states that trigger

points can be involved in all these types of headaches, mainly for cervicogenic headaches. Furthermore, It has been suggested that cervicogenic headaches respond well to trigger point manual therapy treatment techniques (Bodes-Pardo et al.2013). To differentiate cervicogenic headache features from tension-type headache and migraine, it includes symptoms like pain which is side locked, pain is radiating posterior to anterior and headache occurs with cervical movement. In addition, nausea and vomiting can be present like in migraine (HIS,2018).

1.2 Types of manual therapy techniques used for headaches

According to Bendtsen et al. 2010, manual therapy treatment helps to reduce headaches but results are still in conflict state. The treatment techniques or therapeutic skills can be different from client to client depending on the type of headache. According to their research, chronic tension-type headache and cervicogenic headache have improved with manual therapy. In addition, their study shows that manual therapy is more effective than pharmacological methods of treatments (Bendtsen et al.2010).

Reducing tension type headache and pathophysiological components such as the sensitivity of the nervous system and to improve joint and muscle mobility, the use of manual therapies like trigger point therapy, joint mobilization, joint manipulation, exercises, soft tissue manipulation and chiropractic treatment are effective (Fernández-de-Las-Peñas et al.2014).

Other manual therapy methods like soft tissue manipulation, trigger point therapy, stretching and exercises are targeted to treat the muscles. In addition, most frequently used conservative treatments include “biofeedback, relaxation techniques, specific physiotherapy techniques (electrotherapy, manual therapy, exercise programmes, and posture correction guidelines), and acupuncture”. However, these treatment methods and their effectiveness are still unknown among most patients and health care professionals (Álvarez-Melcón et al.2018).

Individual soft tissue treatments alone do not have a significant impact on reducing headache. However, some research results show positive effect of manual therapy on tension type headache. When two or three techniques are combined together it shows better results than single treatment methods (Fernández-de-Las-Peñas et al.2014). When it comes to evidence-based practice, several physiotherapy practices have shown that

manual therapy techniques like dry needling, spinal manipulation, stretching, soft tissue, massage and myofascial mobilization, spinal mobilization or neuromuscular approaches are beneficial to reduce tension-type headache and cervicogenic headaches, which is mentioned in Bendtsen et al. 2010 study.

As a treatment option, general practitioner can recommend spinal manipulation for tension type headache that is used by osteopaths, chiropractors and physiotherapists. This treatment method is safe, cost effective and higher in effectiveness compared to analgesic medicine, but manual therapy still not recommended as a treatment for headaches among general practitioners. (Posadzki et al.2012)

Jull et al.2002 study shows that for cervicogenic headaches, the two conservative approaches for headaches i.e. manipulative therapy and specific low pressure or weight exercises help to educate the muscle control of the scapular and neck region. Therapeutic exercise will address the muscle impairments of cervicogenic headache patients (Jull et al.2002). According to Espi-Lopez study, sub-occipital soft tissue inhibition treatment technique helps to prevent sub-occipital muscle spasms, which in general leads to occipital, atlas and axis mobility dysfunction. Another technique that Espi-Lopez used was manipulative treatment to restore mobility of the joints in upper neck (Espi-Lopez et al.2014a). In the Castine study, low and/or high-velocity cervical and thoracic spine mobilization and manipulation technique and therapeutic exercise consisting of low pressure or weight craniocervical endurance exercises and correction of posture in standing and sitting are used as manual therapy techniques (Castine et al.2009). Manual therapy techniques that were used in Maistrello study were trigger point treatment with any direct or indirect manual treatment, for example muscle energy techniques, acupuncture, compression techniques, positional release techniques, myofascial releasing and inhibition techniques or soft tissues releasing and inhibition techniques. These techniques are used to lessen the muscle contractions with some mechanical forces like compression and distraction, targeting exactly on the trigger point or surrounding tissues and also teach the muscle to lessen muscle contraction used for neurophysiological mechanisms to regulate the muscle tone (Falsiroli Maistrello et al.2018).

1.3 Treatment effects for headaches

Tension-type headache (TTH) is the most common type of primary headaches. Main primary outcome measures of TTH are severity and frequency and it is associated with high socio-economic problems. According to this study, the prevalence rates of TTH in population range in different studies from 30 to 78% (Posadzki et al.2012).

Manual therapy techniques like spinal manipulation, dry needling, stretching, myofascial induction, connective tissue, spinal mobilization, massage, or neuromuscular approaches will help in reducing and maintaining effects of the chronic tension headaches and cervicogenic headaches. When it comes to headaches, pain frequency has an effect on a broad spectrum and pain has not only the biological, but also the sociological and psychological aspects as well (Fernández-de-Las-Peñas et al.2014).

Álvarez-Melcón et al.2018 says that according to Biondi DM et al.2005 and Luedtke K et al.2016 studies, that some of the physiotherapy techniques have improved cervical neuromuscular control with TTH and they have been successful in treating tension-type headache, but results are inconclusive. According to the results of the study, non-invasive treatment like physiotherapy and in pain reducing relaxation techniques are effective with people suffering from TTH. Group treatment showed a significant improvement, which helped patients to identify and control the possible reasons that can maintain headache (Álvarez-Melcón et al.2018).

However, study has (Gwendolen Jull et al.2002) proven that therapeutic exercises are effective to reduce and manage with chronic headaches. Active and progressive therapeutic exercises have been used successfully for headaches with working women during the treatments. According to the study of Gwendolen Jull, manipulative therapy and exercises can decrease the indications of cervicogenic headache and the therapeutic effects are maintained even for 12 months which was significantly noticed during the assessment. In this study, the treatment period was six weeks and follow-up was after receiving treatment had taken place at three, six, and twelve months. The longer follow-up period shows a significant reduction of headaches (Jull et al.2002).

There are not many studies about prevention of headaches. Most of these articles are inconclusive, due to lack of study population, commitment of the clients to participate in the interventions and short follow-up periods.

3. Aim and methods

3.1 Aim

The purpose of this literature review was to investigate effects of manual therapy techniques in reducing headache.

3.2 Search strategy

Data collection method was a systematic search using randomized controlled trial (RCT) and systematic review of meta-analysis of RCT. This literature review was carried out on publications which were published after 2000. Research was done with newest research articles as the manual therapy techniques have improved with time, and to maintain the quality of the research. Inclusion and exclusion criteria are summarized in table 1. Furthermore, for this study research articles about adverse effects were excluded. Searches were conducted between December 2018 and April 2019 in the PubMed, CINAHL, Academic search elite and manual search. The following keywords were used; manual therapy, tension-type headache, cervicogenic headache, headaches and RCT. To limit the errors and the searches, the publication language used was English and other languages were excluded. The flowchart of the study is presented in figure 1. Search terms that were used are manual therapy and RCT, tension-type headache and RCT, headaches and RCT, cervicogenic headache and RCT, Manual therapy and Headache.

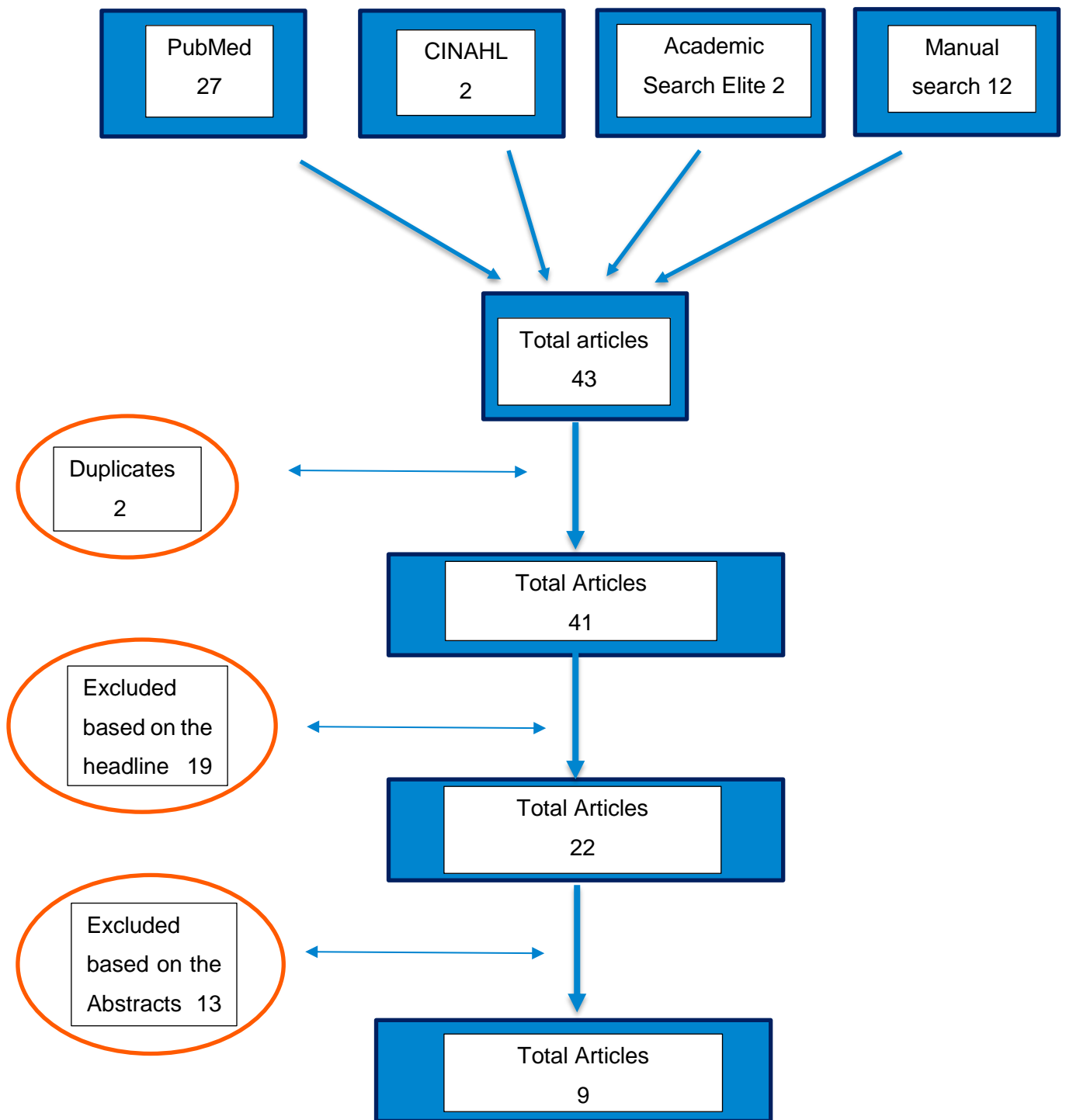


Figure 1: Study flowchart of application process for systematic literature review studies

For this study, selection was able to identify 43 articles through searching the database. After removal of 2 duplicates, a total of 41 records were selected for screening. Out of 41, 19 articles were excluded after reading headlines and 22 articles were selected. The articles were excluded because they did not fulfil the aim of the literature review, includ-

ing articles with adverse effects about manual therapy. Out of 22 studies, 13 were excluded based on abstracts. The main reason to exclude articles from this study was that the abstracts mentioned manual therapy treatments methods used for thoracic pains and massage. Out of the 22 remaining articles assessed, only nine articles were considered eligible. (Figure 1)

Table 1: Inclusion and Exclusion criteria used in the thesis

	Inclusion criteria	Exclusion Criteria
Publication Date	Publications after year 2000	Articles published before year 2000
Publication language	Publications in English	Articles not published in English
Method	randomized controlled trials, systematic review of meta-analysis of randomized controlled trials	Publications done other than randomized controlled trial methods
Contents	Manual therapy technique, exercises, migraine, tension type headache, cervicogenic headache.	Drugs, articles not related to manual therapy technique, adverse effects

Quality included studies

To evaluate the overall quality of evidence “The Joanna Briggs Institute (JBI) critical appraisal checklist” was used and the main outcome measurement was based on the methodological quality of included trials. The highest quality rating is for evidence based on the highest number of ‘yes’ from the checklist. For this study, all the articles that were rated with more than 7 ‘yes’, were taken into consideration. Low quality articles were excluded to maintain a high-quality level.

Critical appraisal was carried out by applying “The Joanna Briggs Institute (JBI) critical appraisal checklist” (The Joanna Briggs Institute, 2017, p.03.).

4. Results

Finally, nine research articles were selected for the review and all the articles are randomized controlled trials (RCT) and systematic review of randomized controlled trials according to the inclusion and exclusion criteria. For this research, four articles were taken from PubMed, one article from Academic search elite and four articles from manual search. Baseline quality characteristics were analysed by using The Joanna Briggs Institute (JBI) critical appraisal checklist. Results of the quality evaluation of the studies and more detailed information are presented in Table 2. According to the quality checklist, one article received 10 'yes', three received 9 'yes', one article received 8 'yes' and out of 9 articles four have got 7 'yes'. This proves that articles are at high and moderate standard levels.

From the analysis of nine research articles, six articles describe that manual therapy helps to reduce the headaches with tension-type headache and cervicogenic headache (Castien et al.2009, Falsiroli Maistrello et al.2018, Chaibi et al.2014, Monzani et al. 2016, Posadzki et al.2011, Posadzki et al.2012) and other three (Jull et al.2002, Espi-Lopez et al.2014a, Espi-Lopez et al.2014b) articles describe the effectiveness of combined treatment (manipulative treatment combined with manual therapy).

Five articles (Jull et al.2002, Espi-Lopez et al.2014a, Falsiroli Maistrello et al.2018, Espi-Lopez et al.2014b, Chaibi et al.2014) clearly discussed headache frequency compared to other outcome measures such as intensity and duration of pain. Manual therapy, manipulative treatment and combined treatment (manual therapy and exercises) have shown better effect on reducing pain frequency of cervicogenic headache, tension-type headache and migraine compared to exercises, suboccipital soft tissue inhibition treatment and control groups (placebo, sham treatment) and maintain long term effectiveness after 4-8 weeks of follow-up period (Jull et al.2002, Chaibi et al.2014, Espi-Lopez et al.2014, Monzani et al.2016).

Table 2: Conclusions made by the original authors.

Authors, Year and place	Purpose of the study	Methods	Participants	Intervention	Results and conclusion	Validation assessment (According to JBI)
Jull et al.2002	To identify the effectiveness of manipulative therapy and a low pressure or weight exercise program for cervicogenic headache with the targeted treatment groups.	Randomized controlled trials	200, ages 18 to 60 years participants were diagnosed with cervicogenic headache and history more than 2yr, 2-5yr, 5-10yr	One intervention group was given exercises and taught muscle lengthening exercises. The other intervention was combination of manipulative therapy and exercise therapy given same day. Control group, no physical therapy interventions. In the	Manual therapy, exercise therapy and the combined therapy of manual therapy and exercise therapy significantly reduced headache frequency, intensity and the neck pain index immediately after treatment. For pain duration only combined treatment was effective. Combined therapy	Yes= 10 No= 3 Unclear= 0 N/A= 0

				control or active treatment groups, medication intake, treatment period was in daily headache diaries for 2-weeks. Before follow-up assessment. The active treatment was carried out for 6 weeks and ranging between 8-12 treatments. 30 minutes treatment session.	was always superior to exercise therapy during the intervention period P=0.008 and 0.046 respectively.	
Castien et al.2009	To assess the effectiveness of manual therapy compared to the general practitioners' treatments in patients with Chronic cervicogenic headache.	Randomized controlled trials	Patients between 18-65yr with chronic tension-type headache.	Two intervention groups were divided randomly into manual therapy group and usual care from general practitioner (GP). Manual therapy was	The results may affect to clinical decision making of general practitioners regarding referral to manual therapy in patients with chronic tension-type headache.	Yes= 9 No= 4 Unclear= 0 N/A= 0

				consisting of mobilization of cervical, thoracic spine, exercises and correction of postural. GP's advice and educate the client and if needed prescribe analgesics. Manual therapy intervention is done 30 minutes, maximum 9 sessions for 8 weeks. Follow up was done after 8- and 26-weeks long term follow ups and completed a 2 weeks headache diary.		
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Posadzki et al.2011	To assess the effectiveness of spinal manipulation as a treatment option for cervicogenic headache.	Systematic review of RCT's	Patients diagnosed with cervicogenic headache	Nine randomized clinical trials, involving 607 patients. The databases were Amed, Embase, Medline, Cinahl, Mantis, ICL, and Cochrane Central Register of Controlled Trials	Evidence that spinal manipulation is effective for cervicogenic headache is not clear.	Yes= 7 No= 5 Unclear= 0 N/A= 0
Posadzki et al.2012	To assess the effectiveness of spinal manipulation as a treatment option for tension-type headache	Systematic review of RCT's	Patients diagnosed with tension-type headache	Eight databases were used and five RCT articles were selected involving 348 patients with tension type headache.	Evidence that spinal manipulation improves tension type headache and reassures the client, but inconclusive.	Yes= 7 No= 5 Unclear= 0 N/A= 0

Chaibi et al.2014	Study was done to identify that massage and physiotherapy is more effective than medical treatments.	Systematic review of randomized controlled trials	Participants were cluster as headache frequency and intensity.	Six RCT which include one article about massage therapy and five about physiotherapy.	This study suggests that massage and physiotherapy show good results in improving chronic tension-type headaches. Headache frequency was reduced up to 0.62 than other primary indications like intensity, duration. With manual therapy treatments >75% reduction in headache frequency	Yes= 7 No= 6 Unclear= 0 N/A= 0
Espino-Lopez et al.2014a	To assess the effectiveness of manual therapy techniques to the suboccipital region, disability patients with tension-type headache.	Randomized controlled trials	Participants were age between 18-65yr old, with headaches for over three months. 76 participated (62 women)	Treatments were conducted for 4 sessions with 7 days intervals with all the groups for 4 weeks. During the initial session all the group participants including control group had to undergo a test,	Individual manual therapy treatments showed a positive effect on headache. Measures of photophobia and peri-cranial tenderness only improved with combined treatment. Headache severity was reduced with all the three treatment	Yes= 9 No= 4 Unclear= 0 N/A= 0

				<p>with patients lying on supine - the vertebral artery occlusion test was applied bilaterally. After every treatment session, resting position was supine with neutral head maintained for 5 minutes and 10 minutes with the control group. Patients were divided into three groups were consisting with suboccipital soft tissue inhibition treatment, other group with manipulative treatment of the upper neck</p>	<p>groups except control group (all $P < 0.05$). So, for Tension-type headache combined (upper neck and soft tissue inhibition) treatments are suggested. Headache severity was reduced with all the three treatment groups except control group (all $P < 0.05$). Upper neck treatment showed a greater effect on reducing the tension-type headache frequency and severity (47.63% and 45.32%) compared with other groups.</p>	
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				lastly combine group with 2 methods.		
Espi-Lopez et al.2014b	To evaluate the efficacy of manipulative and manual therapy treatments regarding pain and neck mobility with people having tension-type headache.	Randomized controlled trials	84 adults diagnosed with tension type headache were included and out of them 16 men and 68 women.	For the 4 groups in the initial session, the vertebral artery occlusion test was applied bilaterally with 2-minute massage. Participants were divided into 4 treatment groups, one group with suboccipital soft tissue inhibition treatment, other group with manipulative treatment of the upper neck. lastly combined group with 2 methods and control group without any treatment lying supine for 10	Combined treatment shows more efficacy on tension type headache, and to improve the cervical range separate treatment shows better results.	Yes= 8 No= 5 Unclear= 0 N/A= 0

				minutes. Other three groups resting time was 5 minutes. 4 treatment sessions were conducted with an interval of 7 days to identify the efficacy of manual and manipulative treatments.		
Monzani et al.2016	To assess the efficacy of manual therapy for tension-type headache workers' quality of life.	Randomized controlled trials	80 patients with tension type headache and without current symptoms of any other conditions.	Research was done with 4 groups, myofascial inhibitory technique, articulatory technique, combine group with 2 treatment techniques and control group. Control group was lying in supine for 10 minutes. Supine head resting on PT's hands and	Manipulative technique is more effective to improve the quality of work life. efficacy on patient's quality of life (F (9.63) =2.25) to improve	Yes= 9 No= 4 Unclear= 0 N/A= 0

				treatment for 10 minutes with eyes closed. It was done in supine position for 5 minutes. 5 minutes rest after treatment in supine.		
Falsiroli Maistrello et al.2018	The effectiveness of manual trigger point therapy compared to minimal active or no active groups in terms of duration, frequency and intensity of attacks in adult people with primary headaches.	A systematic review of meta-analysis of RCT's	Patients over 18 years old adults with chronic tension type headache according to classification of headache disorder	5 times in 2 weeks to 24 times in 12 weeks. Follow up period from 2 weeks to 4 months after the end of treatment.	Manual trigger point treatment of neck and head may reduce duration, frequency and intensity of headaches. Significant reduction in headache frequency per month for tension type headache (MD-3.50;95% CI from MD- 4.91 to -2.09; 4RCT)	Yes= 7 No= 6 Unclear= 0 N/A= 0

Headache frequency. Out of nine articles, five articles have described the decrease of headache frequency with manual therapy and its effectiveness (Jull et al.2002, Espi-Lopez et al.2014a, Falsiroli Maistrello et al.2018, Espi-Lopez et al.2014b, Chaibi et al.2014). According to Falsiroli Maistrello et al.2018, effectiveness of trigger point manual therapy treatment on intensity, frequency and duration for primary headaches, shows significant reduction of frequency compared to minimal active intervention (placebo, sham treatment). This study was focused on tension-type headache and migraine treatment with using trigger point manual therapy treatment vs minimal active intervention. Statistically significant reduction was noticed in frequency of attacks per month in the treatment group after receiving treatment compared to control group, with a mean reduction of 3.05 attacks/month. Jull et al. 2002 study shows that headache frequency, intensity and the pain index were significantly reduced after treatment in manipulative therapy. Wilcoxon analysis method in this study showed that manipulative therapy, exercise therapy, and the combined manipulative therapy with exercise therapy all significantly reduce frequency of headache, intensity and the neck pain index after treatment (50% of participants), as compared with the control group, and these differences were still obvious even after 12 months follow-up period ($P < 0.05$ for all) and 42% reported that pain was 80%-100% less after treatment. Control group did not receive any physiotherapy interventions. Two-way ANOVA analyses method shows that manipulative therapy and exercise therapy groups have significant impact on headache frequency and intensity compared to combined group and control group (Jull et al. 2002). Complaints of daily headaches mean 12/14 days reduced to 3/14 days after manual therapy treatments which equals to >75% reduction in daily headache frequency compared with placebo treatment (Chaibi et al. 2014). According to the Espi-Lopez et al.2014 two studies also show that manipulative treatment of upper neck and combined manual therapy treatment methods (spinal manipulation and postural correction exercises) significantly reduce headache frequency compared to suboccipital soft tissue inhibition treatment ($P > 0.05$), but upper neck showed a greater effect on reducing headache frequency and severity between 4-8 weeks of follow-up assessment period.

Manipulative treatment and combined manual therapy treatment. Two articles show that manipulative treatment and combined treatment give good results to reduce tension-type headache and migraine (Espi-Lopez et al.,2014a, Espi-Lopez et al., 2104b), and these articles were written by the same researcher. As reported by Espi-Lopez et al.2014a, treatments were conducted in four sessions with seven days intervals with all

the groups for four weeks. From the total number of participants, 40.8% suffered from chronic tension type headaches and 59.2% suffered from episodic tension type headaches. Headache severity was reduced with all the three treatment groups except control group (all $P < 0.05$). The clients received manipulative treatments of upper neck and combined treatment groups showed a significantly reduction in headache frequency were observed after 4 weeks of treatment. Upper neck showed a greater effect on reducing the tension-type headache frequency and severity (47.63% and 45.32%) compared with other groups. The group that received combined treatment only was able to improve the photophobia and pericranial tenderness. Therefore, they suggest that combined treatment (upper neck and suboccipital soft tissue inhibition treatment) is most suitable for symptomatic relief of tension-type headache. As reported by Espi-Lopez et al.2014b, four treatment sessions were for seven days to identify the efficacy of manual and manipulative treatments. With manipulative treatment, the pain perception rate was significantly different from other groups (control group and manual therapy group) of studies. The other outcome measurement was the headache frequency which showed significant results constantly until the end with combined treatment. In addition, headache intensity was decreased in the groups with manipulative, combined and the control group. When it comes to cervical range, with the use of manual therapy it is more effective to reduce pain and improve the cervical flexion and extension. According to Jull et al.2002, the headache frequency, intensity and the pain index were significantly reduced after treatment in manual therapy, exercise therapy and combine treatment of manual therapy and exercise therapy compared with control group. Combine therapy was always better than to exercise therapy during the intervention period $P=0.008$ and 0.046 respectively.

Efficacy of manual therapy and exercise therapy. According to some of research articles, manual therapy and exercise therapy reduce headaches and help maintain long term effect (Jull et al.2002, Castien et al.2009). According to Jull et al.2002, the headache frequency, intensity and the pain index significantly reduce after treatment in manual therapy, exercise therapy and combine treatment of manual therapy and exercise therapy compared with control group. Combine therapy was always superior to exercise therapy during the intervention period $P=0.008$ and 0.046 respectively. In addition, Castien et al.2009, describes that with manual therapy, exercises therapy and postural correction will help to maintain long term effects compared to medication.

Effectiveness of spinal manipulation. As reported by Posadzki et al.2011, spinal manipulation is effective for tension-type headaches, although soft tissue mobilization, manipulation along with spinal manipulation treatments give better results. It is not conclusive that spinal manipulation is effective for tension-type headache but spinal manipulation is more effective than any drug therapy. Posadzki et al.2012, aimed to determine the effectiveness of spinal manipulation on cervicogenic headaches. Results of six studies (Chaibi et al. 2014, Posadzki et al.2011, Posadzki et al.2012, Espi-Lopez et al. 2014a, Espi-Lopez et al. 2014b, Jull et al.2002) suggest that spinal manipulation is more effective for treating cervicogenic headache compared to light massage, physical therapy and drug therapy.

Some of the studies show that manual therapy is more effective than pharmacological treatments (Castien et al.2009, Chaibi et al.2014, Jull et al.2002). According to Jull et al.2002, medication intake was reduced with all the active treatment groups (7-week follow-up assessment) after manual therapy treatment. All these methods helped to reduce the cervicogenic headaches. To gain a long-term effect, combined therapy was found to be better than single treatment (Jull et al.2002). According to Castien et al.2009, most of the patients, select a general practitioner's medication as their first treatment. Only very few patients select manual therapy as their treatment option. This study mainly wanted to reduce the number of days of headaches with the treatments and to identify which treatment is more effective than the analgesics. Manual therapy treatment, exercise therapy and correction of posture will help to maintain long term effects compare to medication. Castien used mobilization of the cervical vertebrae, thoracic vertebrae, therapeutic exercises and correction of posture methods as manual therapy techniques for the study. This study helps to increase the patient's awareness about manual therapy and General practitioner's treatments and this study can be taken into clinical decision making for General practitioners to refer clients for manual therapy more than analgesic treatments. Conferring the study of Chaibi et al.2014, chronic tension type headaches are very difficult to manage even though >50% have reduced intake of traditional pain medications after using manual therapy. Overall, manual therapy is more effective than pharmacological treatment.

5. Discussion

The purpose of this thesis was to evaluate the effect of manual therapy to reduce headaches. Headaches have specific pain characteristics, according to classification of the International Headache society about headaches (IHS, 2018). The perception of pain, manual therapy, manipulative treatment and combined therapy have shown effect on pain frequency.

Intervention studies were done mainly to test the treatment effects. Follow-up time period was longer than treatment time as they provide the most effective way to identify benefits of one treatment over another. This provides a clear idea to select the best treatment methods.

Manual therapy assists to reduce the pain frequency which leads to improve tension-type headache and cervicogenic headache which has been mainly reviewed through this research. Medication intake was decreased in all the treatment groups after receiving manual therapy treatment (Chaibi et al.2014). This trial also helps to provide evidence for physical therapies where treatment effect was maintained over the 12-month period. There are not many trials available about this topic.

To find out about the efficacy of manual therapy, long term follow-up studies needs to be done with big group of participants. According to research analysis, four studies (Jull et al.2002, Chaibi et al.2014, Espi-Lopez et al.2014, Monzani et al.2016) had follow-up periods between 4–26 weeks. Long term follow-up periods give a clear idea about the reduction of pain frequency, number of days and duration of pain-free days with treatments (Castine et al.2009). Based on this study a headache diary can give a clear picture of the headache pattern, frequency and effects of daily activities on headaches.

According to some articles, the majority of the participants were women aged above 18 years (mean age was 39 years) and higher prevalence of headaches were among working women than unemployed women. In working sectors more than 50% of women suffer from headaches.

Furthermore, manual therapy not only helps to reduce headaches, but it also improves the range of motion and mobility of the cervical spine. It improves the cervical flexion, extension and rotation, which leads to reduce headache reoccurring frequency (Espino-Lopez et al.2014, Castien et al.2009). In addition, with manual therapy treatment helps to reduce headaches and also focused on further self-management with educating the clients about exercise programs and postural correction methods will aim for a sustained long-term effect and this is referred to as a combine treatment method. There was no significant effect if exercise or manipulative therapy were used alone compared to controls at 12 months.

Headache is the most common cause disrupts work efficacy. The research emphasizes the importance of exercise for daily wellbeing. Exercise helps to relax the muscles, improve the joint mobility and strength improves the quality of life. Manual therapy helps to maintain a long-term effect. Monzani et al.2016, argues that all manual treatment methods had an effect on improving quality of life. According to Castine, 20% of patients tend to overuse analgesic medication due to overcome chronic pain, which is affecting their day to day lifestyle (Castien et al.2009).

The strength of this thesis was that the majority of the selected articles met the aim of the bachelor's thesis. The research articles were all RCT studies and systematic reviews of RCTs. Also, the selected articles show the effects of different types of manual therapy techniques and importance of exercises to reduce headaches. Major weakness was that it was difficult to find good quality RCT articles that relate to the research question and there are not many studies. Because of that, only nine articles were selected. This study shows that manual therapy helps to reduce and maintain long term effects with people suffering from cervicogenic headache, tension-type headache and migraine. Importantly, medical professionals could promote manual therapy for the clients suffering from chronic headaches. Moreover, future studies should be carried out based on manual therapy with longer follow-up periods and it would be interesting to see research about manual therapy and combined exercise therapy.

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