Systematic Review and Meta-Analysis

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Effectiveness of physical therapy on the suboccipital area of patients with tension-type headache

A meta-analysis of randomized controlled trials

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Abstract

Background: There has been a lot of research on physical therapy for tension-type headaches. However, the efficacy of physical therapy on the suboccipital region remains unclear.

Objective: To establish the effectiveness of physical therapy on the suboccipital area of patients with tension-type headache.

Methods: Databases including Cochrane Library, Medline/Pubmed, CNKI, Embase, and Google Scholar were searched. After independent study selection by 2 authors, data were extracted and collected independently. On 1 hand, authors compared the treatment of the suboccipital area with control group. On the other hand, the efficacy of several physical therapy techniques on the suboccipital region was compared. The quality of the included studies was assessed using the Cochrane Handbook. RevMan 5.3 software was used for data analysis. The primary outcome measures were the cervical range of motion, the visual analog scale, and headache disability inventory.

Results: Six randomized controlled trials with a total of 505 participants were included. Suboccipital soft-tissue inhibition technique (SIT) + occiput-atlas-axis global manipulation (OAA) was more effective than SIT in increasing craniocervical extension at 4 weeks post-treatment, the overall mean differences (MD) was 3.61, 95% confidence interval (CI) (0.89–6.34). There was no difference at 8 weeks post-treatment (MD 2.38, 95% CI −1.02 to 5.78, $P = .17$). SIT was more effective than SIT + OAA in increasing cervical flexion at 4-week post-treatment (MD −3.36, 95% CI −6.65 to −0.05). SIT + OAA was more effective than SIT on decreasing intensity of pain at 4-week post-treatment (MD −0.91, 95% CI −1.78 to −0.04), but no difference at 8-week (MD −0.43, 95% CI −1.18 to 0.33, $P = .27$). SIT + OAA was more effective than SIT in reducing the functional score of the headache disability inventory at 4-week post-treatment (MD −4.47, 95% CI −8.44 to −0.50). These results may indicate that the SIT + OAA combined therapy is more effective in short term (4-week), no major difference in longer term (8-week).

Conclusion: Combined therapy may be more suitable for the treatment of tension-type headache.

Abbreviations: Control group = no treatment, SI = suboccipital soft-tissue inhibition technique, SM = suboccipital area manipulation.

Keywords: cerebrospinal fluid circulation, meta-analysis, rehabilitation, suboccipital, tension-type headache

1. Introduction

Tension-type headache (TTH) is the most prevalent type of primary headache in adults[1] and it is a health problem with great socioeconomic impact.[2] Long-term headache can progress to chronic headache, which has a great impact on the daily life of patients, for instance in aspects of emotions, daily work, general life activities, and so on.[3] According to previous research, there may be several pathogenic factors involved in TTH:

(1) The development of TTH is related to myofascial trigger points (TrPs) and muscle tenderness.[4,5] Active TrPs in the head and neck muscles are associated with referred pain that radiates pain to the head.
(2) Active TrPs could cause sensitization of peripheral nociceptors which could contribute to central sensitization and increase persistent noxious stimulation input.[6]
(3) Among the suboccipital muscles, the rectus capitals posterior minor has the greatest concentration of muscle spindles.

The muscle spindles have high-density large diameter A-β fibers that transmit proprioceptive information.[7] Recent studies suggest that myofascial pains are mediated by thin myelin (Aδ)

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WJ and ZL have contributed equally to this work.

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fibers and unmyelinated (C) fibers, while thick myelinated A-β fibers usually mediate innocuous sensations.[8] These A-β fibers transmit proprioceptive signals that effectively inhibit C-fiber damage perception signals from reaching the spinal cord and higher pain centers.[7] Atrophy of the rectus capitis posterior minor results in a decrease in the A-β fibers, thus greater pain impulses are transmitted through the central pain pathways, this, in turn, causes headache.[7]

Physical therapy is one of the main methods of treating TTH. There are many manual therapy treatments used in physiotherapy for treating TTH. Most of the treatment area of TTH concentrates on the suboccipital area.[9–14] Therefore, the review of physical therapy techniques applied on the suboccipital region for the treatment of TTH may provide us with new ideas for the treatment of this type of headache, and a more accurate medical approach that will further improve the prognosis of patients. This meta-analysis indicates a concrete direction for future research.

2. Methods

Two researchers separately identified all studies by searching "(Atlas occipital joint) OR Atlanto Occipital Joint) OR Atlanto-Occipital Joints) OR Joint, Atlanto-Occipital) OR Joints, Atlanto-Occipital) OR Atloido-Occipital Joint) OR Atloido Occipital Joint) OR Atloido-Occipital Joints) OR Joint, Atloido-Occipital) OR Joints, Atloido-Occipital)) AND (Tension-Type Headache) OR Headache, Tension-Type) OR Headaches, Tension-Type) OR Tension Type Headache) OR Tension-Type Headaches) OR Idiopathic Headache) OR Headache, Idiopathic) OR Headaches, Idiopathic) OR Idiopathic Headaches) OR Stress Headache) OR Headache, Stress) OR Headaches, Stress) OR Stress Headaches) OR Tension Headache) OR Headache, Tension) OR Headaches, Tension) OR Tension Headaches) OR Psychogenic Headache) OR Headache, Psychogenic) OR Headaches, Psychogenic) OR Psychogenic Headaches) OR Tension-Vascular Headache) OR Headache, Tension-Vascular) OR Headaches, Tension-Vascular) OR Tension Vascular Headache) OR Tension-Vascular Headaches)) AND ((Rehabilitation) OR Habilitation) Filters: Clinical Trial" in the Cochrane Library, Medline/Pubmed, CNKI, Embase, and Google Scholar from May to July 2018. The search content was recorded in Table 1.

2.1. Ethical review and informed consent of patients

The meta-analysis data was from published research data. Therefore, ethical review and informed consent are not applicable.

2.2. Eligibility criteria

2.2.1. Types of participants. Participants included in the studies are adult subjects (age ≥18 years) with TTH diagnosed using the international headache society criteria.

Table 1

Search content.

Participants	(Tension-Type Headache) OR Idiopathic Headache) OR Stress Headache) OR Psychogenic Headache) OR Tension Vascular Headache
Interventions	1. Rehabilitation 2. Atlas occipital joint 3. Suboccipital
Comparators	No restrictions
Outcomes	No restrictions
Studies	Randomized controlled trial, (RCT)

2.2.2. Types of interventions. Any direct manual treatment on the suboccipital area.

2.2.3. Types of comparators. Acceptable comparators of any type of intervention in suboccipital area or no treatment.

2.2.4. Types of outcomes. The primary assessment outcomes were the visual analog scales (VAS) and the cervical range of motion (CROM). Second, authors also considered the quality of life, such as headache disability inventory (HDI).

2.2.5. Types of studies. Randomized controlled trials (RCTs) written in English or Chinese language.

2.3. Other criteria

The treatment time, treatment method, treatment area, follow-up time at post-treatment, patient's age range, and a control group of the final selected studies must be consistent.

2.4. Study selection

Two independent authors (JWB, LZ) searched the database for title and abstract by applying the eligibility criteria. At the end of the screening process, full-text articles were retrieved and assessed for other eligibility in this meta-analysis. Discrepancies were resolved by consensus after discussion, otherwise a third author (CW) made the final choice.

2.5. Risk of bias of RCTs

The risk of bias (RoB) in the included RCTs was assessed by examining selection bias, reporting bias, performance bias, detection bias, attrition bias, and other bias. Each domain could be classified as "high," "low." If the study did not provide sufficient information, it will be defined as "unclear" internal validity. The research plan for each trial was searched for in the clinical trial registration database, and if necessary, the original author will be contacted to determine the specific process of the trial implementation.

2.6. Data extraction

Two reviewers (JWB, LZ) performed data extraction independently using a predefined standardized electronic table. When the outcome measures of a published data were inadequate for meta-analysis, reviewers emailed the authors to request for adequate information. The reviewers extracted the data of eligible studies including: author, year, clinical trials number, participants (sample type, number of participants recruited, drop-outs), interventions (treatment and control), duration, flow-up, outcome measures, results of interventions. Disagreements regarding collected data were resolved through discussion between the 2 reviewers or if no agreement could be reached, a third author (CW) was consulted.

2.7. Statistical analysis

RevMan 5.3 software from the Cochrane Collaboration was used for statistical analysis. $P < .05$ was considered to be statistically significant. Mean differences and 95% confidence intervals (CI) were calculated for continuous outcomes. The dichotomous outcomes used relative risk and 95% CI to represent the magnitude of the effect. A fixed effect model was used when no heterogeneity was detected; otherwise, a random effect model was used.[15] Chi-square test was used to detect heterogeneity between studies, the

significance level was set to $P < .10$[15]; I^2 statistic was used to quantify the degree of heterogeneity,[16] value >50% means significant heterogeneity. The percentage of I^2 represents the degree of heterogeneity: 25%, 50%, and 75% of the percentages indicate low, medium and high heterogeneity respectively.[17] When the heterogeneity is >50%, a subgroup analysis and sensitivity analysis was performed. If a study did not provide usable summary measures for an outcome it was included in the review, but excluded from the meta-analysis. Funnel plot asymmetry was used to assess publication bias.

3. Results

3.1. Study selection

Figure 1 shows the detailed screening process. An initial search identified 89 titles and abstracts from the electronic databases. After reading the abstract and title, 67 records were excluded. After reading the full-text articles by the inclusion and exclusion criteria, 6 records were included.

3.2. Characteristics of identified studies

All studies were RCTs, their age range: 18 to 65 years, the frequency of treatment was once a week for 4 weeks, with each treatment lasting 20 minutes, follow up time is 8 weeks.[18–23] The general study characteristics are recorded in Table 2.

3.3. Methodological quality assessment

One RCT had a low RoB for all methodological items,[21] 4 studies had 1 high RoB domain.[19–21,23] All studies had low risk in allocation concealment.[18–23] Three RCT had high risk for incomplete outcome data because some patients did not adhere to

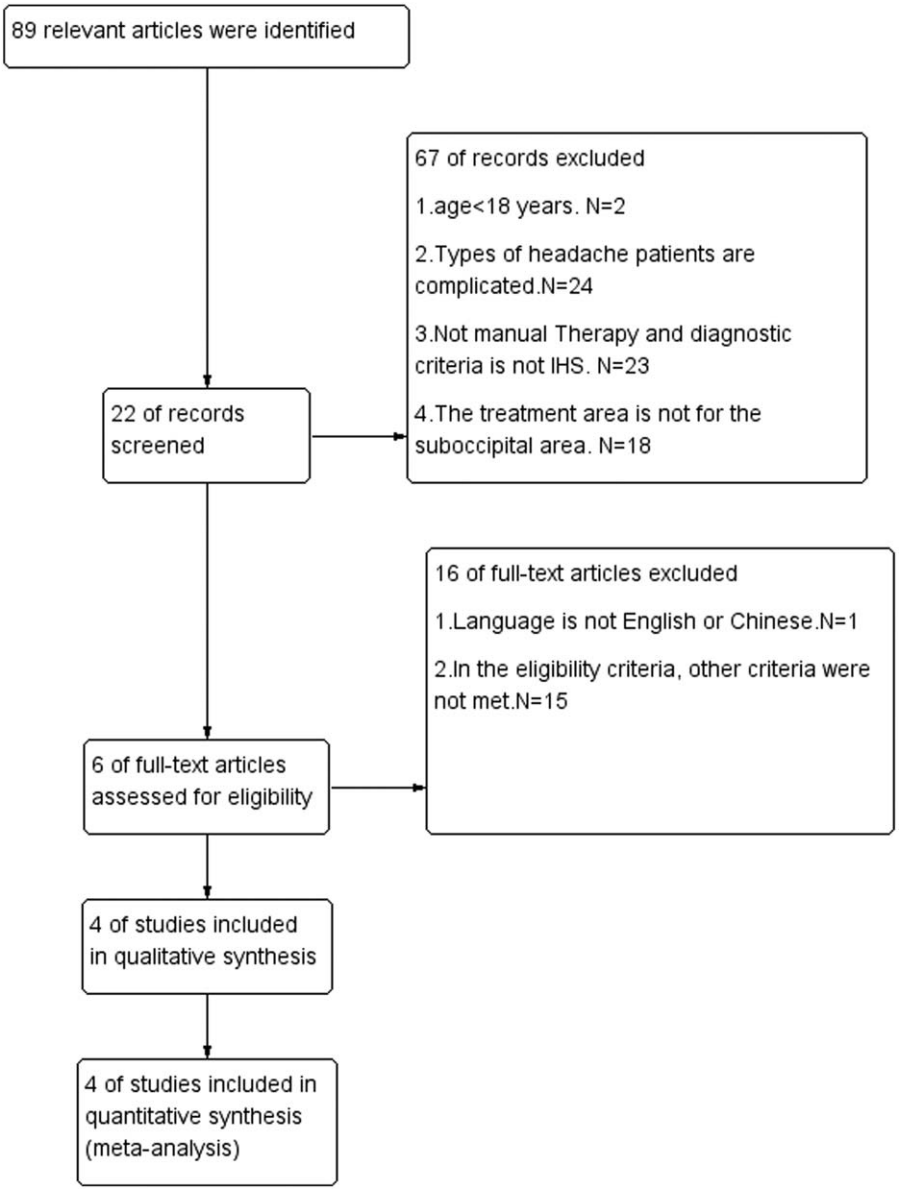

Figure 1. Screening process.

Table 2

Characteristics of included studies.

Author, yr	Participants	Interventions	Time pre-treatment duration follow up	Outcome measures	Results
Espi-lopez GV 2012[18]	TTH for IHS 76 (62 women) Drop out: 0	1. SIT N=19 2. OAA N=19 3. SIT+OAA N=19 4. Control N=19	Pre- at the begining Duration: 4 wk Follow-8 wk	HIT-6 CROM VAS	1. CROM, OAA most effective 2. VAS, SIT+OAA most effective 3. HIT-6, 2, 3group most effective
Antonia Gomez Conesa 2014[19]	TTH for IHS 84 (68 female) Drop out:4	1. SIT N=20 2. OAA N=22 3. S IT+OAA N=20 4. Control N=22	Pre- at the begining Duration: 4 wk Follow-8 wk	McGill CROM NRS	1. CROM: OAA most ffective 2. McGill, NRS: OAA or combine most effective
Josep Benitez Martinez 2014 NCT01550276[20]	TTH for IHS 84 (68 female) Drop out: 4	1. SIT N=20 2. OAA N=22 3. SIT+OAA N=20 4. Control N=22	Pre- at the begining Duration: 4 wk Follow-8 wk	HIT-6 HDI VAS CROM	1. CROM, VAS, HIT-6, HDI, SIT+OAA most effective
Gemma V. Espoi-lopez -2016 NCT02455323[21]	TTH for IHS 76 (62 female) Drop out: 0	1. SI N=19 2. SM N=19 3. Combine N=19 4. Control N=19	Pre- at the begining Duration: 4 wk Follow-8 wk	S F-12V2	1. OQOF:SI ef 2. IDQOF: Co mbine ef.
Lucas-Monzani 2016[22]	TTH for IHS 80 (68 female) Drop out:0	1. IT N=20 2. AT N=20 3. Combine N=20 4. Control N=20	Pre- at the begining Duration: 4 wk Follow-8 wk	SF-12	1. WPL:IT ef. 2. WPH: Com bine ef.
Deborah falla 2016 NCT02450955[23]	TTH for IHS 105 (82 female) Drop out:3	1. Massage N=51 2. Manipulation+ massage N=51	Pre- at the begining Duration: 4 wk Follow-8 wk	HDI CROM	1. CROM: 2th group ef 2. HDI:2th group ef.

AT = articulatory technique, ef = effective, HIT-6 = headache impact Ttest-6 questionnaire, IDQOF = individual dimensions of quality of life (vitality, emotional), IT = myofascial inhibitory technique, McGill = McGill qestionnaire, NCT = clinical trials number, NRS = the numeric pain scale, OQOF= overall quality of life (general life activities), SF-12 = SF-12 questionnaire, SF12V2 = SF12V2 questionnaire, WPH = work presenteeism was high, WPL = work presenteeism was very low.

treatment for various reasons.[19,20,23] One RCT had high risk for performance bias.[22] Three RCTs were judged to have low risk of others bias.[20,21,23] (Figs. 2 and 3).

3.4. Meta-analysis

3.4.1. Cervical range of motion. Four trials[18–20,23] compared the CROM after physical therapy, 3 articles studied the relationship between craniocerebral flexion, extension angle, and TTH[18,20,23] (Fig. 4).

(1) A significant heterogeneity was identified for craniocerebral flexion at 4 weeks post-treatment ($P=.11$, $I^2=54\%$). A random-effects model was applied for meta-analysis and the results showed that there were no significant differences between the SIT+OAA and SIT in the craniocerebral flexion (MD 0.34, 95% CI −1.83 to 2.52, $P=.76$).

(2) These studies showed no significant heterogeneity about craniocerebral flexion at 8 weeks post-treatment ($P=.51$, $I^2=0$). A fixed-effects model was applied for meta-analysis and the results showed no difference between SIT+OAA and SIT treatments on enhancing craniocerebral flexion (MD −0.12, 95% CI −0.56 to 1.32, $P=.87$).

(3) No significant heterogeneity was identified for craniocerebral extension at 4 weeks ($P=.79$, $I^2=0$) or 8 weeks post-treatment ($P=.82$, $I^2=0$). The results showed that patients treated with SIT had a significantly lower mean extension

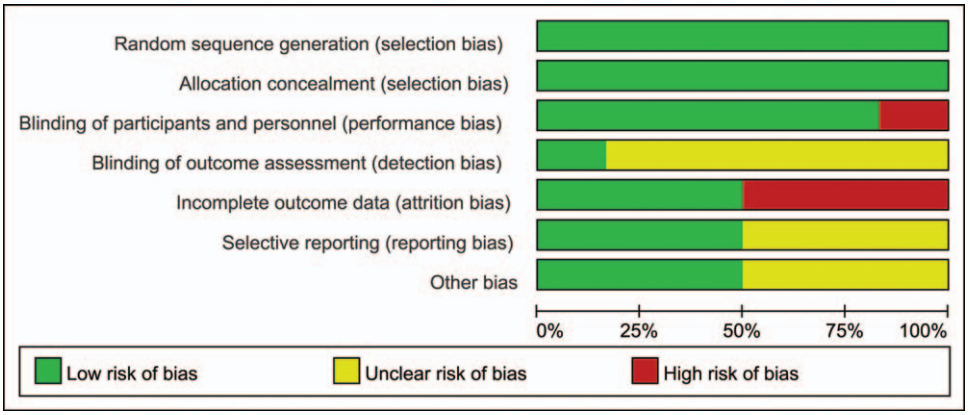

Figure 2. RoB graph: review authors' judgments about each RoB item presented as percentages across all included studies. RoB = risk of bias.

Figure 3. RoB summary: review authors' judgments about each RoB item for each included study. RoB = risk of bias.

angle than those who were treated with SIT + OAA at 4 weeks (MD 3.61, 95% CI 0.89–6.34, $P = .009$) but no differences at 8 weeks (MD 2.38, 95% CI −1.02 to 5.78, $P = .17$).

Three trials[18,19,23] compared the cervical range of flexion and extension after physical therapy (Fig. 5).

(1) Acceptable heterogeneity was identified for cervical range of flexion at 4 weeks ($P = .24$, $I^2 = 29\%$) or 8 weeks post-treatment ($P = .74$, $I^2 = 0$). The results showed a significantly increased mean flexion angle in SIT compared with SIT + OAA at 4-week (MD −3.36, 95% CI −6.68 to −0.05, $P = .05$) but no differences at 8 weeks (MD −2.59, 95% CI −5.93 to 0.76, $P = .13$).
(2) These studies showed no significant heterogeneity on the cervical range of extension at 4 weeks ($P = 1.00$, $I^2 = 0$) or 8 weeks ($P = .56$, $I^2 = 0$) post-treatment. The results showed no significant differences in the cervical range of extension between SIT + OAA and SIT at 4 weeks (MD 0.75, 95% CI −3.47 to 4.96, $P = .73$) or 8 weeks (MD 1.54, 95% CI −2.27 to 5.35, $P = .43$).

3.5. Pain Intensity for the VAS

Three studies[18–20] provided data on the VAS for pain.

Figure 6 showed the efficacy of 3 treatments:

(1) There was no significant heterogeneity in SIT versus Control at 4 weeks ($P = .85$, $I^2 = 0$) or 8 weeks ($P = .81$, $I^2 = 0$) post-treatment. No impact of SIT on reducing VAS score at 4 weeks post-treatment (MD −0.44, 95% CI −1.29 to 0.41, $P = .31$). But the results showed that SIT can decrease VAS score at 8 weeks (MD −1.02, 95% CI −1.77 to −0.27, $P = .008$).
(2) Acceptable heterogeneity was identified in OAA versus Control at 4 weeks ($P = .97$, $I^2 = 0$) or 8 weeks ($P = .53$, $I^2 = 0$) post-treatment. The VAS scale was lower after the treatment of OAA at 4 weeks compared to control group (MD −0.98, 95% CI −1.83 to −0.12, $P = .03$). But no effect at 8 weeks (MD −0.72, 95% CI −1.51 to 0.07, $P = .07$).
(3) A tolerable heterogeneity was identified in SIT + OAA versus Control at 4-weeks post-treatment ($P = .21$, $I^2 = 35\%$). But no 8 weeks ($P = .11$, $I^2 = 54\%$). The results showed that SIT + OAA can decrease VAS score at 4 week (MD −1.38, 95% CI −2.21 to −0.56, $P = .0010$) and 8-week (MD −1.29, 95% CI −2.46 to −0.13, $P = .03$).

Figure 7 showed which the most effective treatment was:

(1) No significant heterogeneity was identified between SIT and OAA at 4-week ($P = .79$, $I^2 = 0$) or 8-week ($P = .83$, $I^2 = 0$) post-treatment. No difference in reduction was seen between SIT and OAA in the VAS scale at 4-week (MD 0.49, 95% CI −0.42 to 1.40, $P = .29$) or 8-week (MD −0.26, 95% CI −1.05 to 0.53, $P = .52$).
(2) No significant heterogeneity was identified between SIT + OAA and OAA at 4-week ($P = .17$, $I^2 = 44\%$) or 8-week ($P = .68$, $I^2 = 0$) post-treatment. Reduction in the VAS scale for SIT + OAA and OAA treatments did not differ at 4-week (MD −0.58, 95% CI −1.42 to 0.26, $P = .18$) or 8-week (MD −0.59, 95% CI −1.40 to 0.22, $P = .16$).
(3) Acceptable heterogeneity was identified in SIT + OAA versus SIT at 4-week ($P = .55$, $I^2 = 0$) or 8-week ($P = .28$, $I^2 = 22\%$) post-treatment. SIT + OAA showed better effect on VAS scale than SIT (MD −0.91, 95% CI −1.78 to −0.04, $P = .04$). But not differ at 8-week (MD −0.43, 95% CI −1.18 to 0.33, $P = .27$).

3.6. Headache disability inventory

Two studies[20,23] evaluated the functional and emotional aspects of the HDI (Fig. 8).

(1) No significant heterogeneity was identified in SIT + OAA versus SIT for functionality at 4-week ($P = .84$, $I^2 = 0$) or 8-week ($P = .92$, $I^2 = 0$) post-treatment. The results showed that patients treated with SIT + OAA had a significantly lower functional impact than those who were SIT treated (MD −4.47, 95% CI −8.44 to −0.50, $P = .03$). But no differ at 8-week (MD −2.71, 95% CI −6.36 to 0.94, $P = .15$).
(2) No significant heterogeneity was identified in the emotional aspect for SIT + OAA versus SIT at 4-week ($P = .93$, $I^2 = 0$) or 8-week ($P = .77$, $I^2 = 0$) post-treatment. No difference was seen in the emotional aspects of the TTH HDI between SIT + OAA and SIT at 4-week (MD −1.13, 95% CI −5.26 to 2.99, $P = .59$) or 8-week (MD −2.30, 95% CI −5.93 to 1.34, $P = .22$).

3.7. Subgroup analysis and sensitivity analysis

In order to reduce heterogeneity during literature screening, the age range, diagnostic criteria, physical therapy, treatment time,

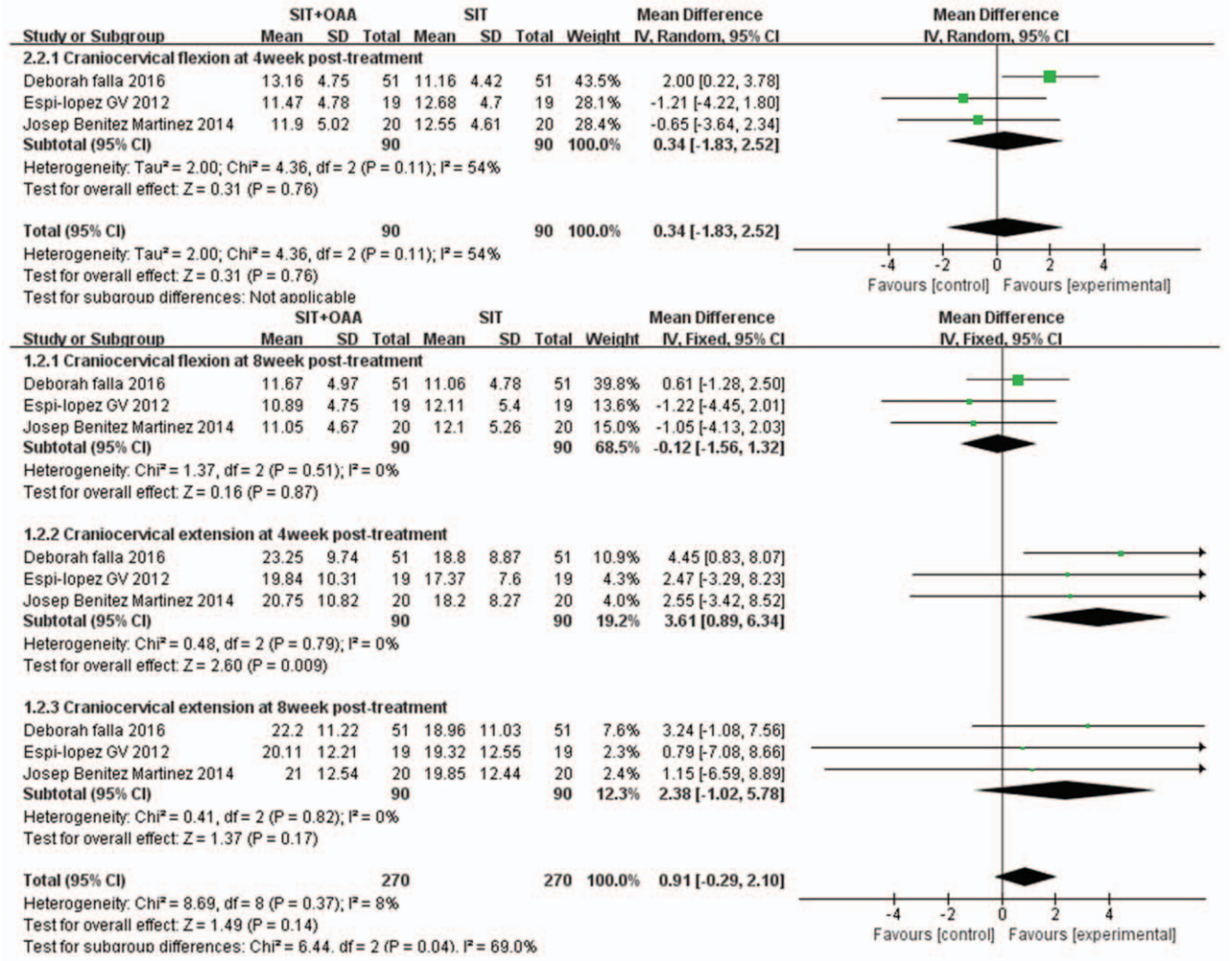

Figure 4. Craniocerebral flexion and extension.

and follow-up time were the same for each studied patient. In addition, 3 articles were combined in the 2 analyses, resulting in heterogeneity >50%. Subgroup analysis may lead to greater heterogeneity. Finally, the heterogeneity was slightly higher than 50% (54%). So, considering the small heterogeneity and small sample size, sensitivity and subgroup analyses were not to be performed.

3.8. Publication bias

Considering the small sample size (<10) in our meta-analysis, funnel plot analysis was not applicable for the determination of publication bias.

4. Discussion

4.1. Main findings

According to the meta results: the positive results were summarized in Table 3. In Table 3, the treatment of SIT+OAA has the most positive indicators. For patients with tension headache, this treatment may be more advantageous than other treatments. In addition, using the SF-12 questionnaire, Gemma et al[21] reported that manual therapy techniques have a positive effect on quality of life. In terms of overall quality of life (general life activities), the suboccipital inhibitory treatment was the most effective. The combined treatment showed the greatest change in individuals with good quality of life such as in emotion and vitality. At the same time, Monzani et al[22] indicated that myofascial inhibitory technique was most effective when the patients work presenteeism was very low, otherwise, the combined treatment was the most effective. In fact, the combined treatment may have the best effect in improving the mental state of patients.[21,22]

4.2. Interpretation of the results

In the interpretation of previous studies, whether it is the theory of Trp[24] or central sensitization,[25] or the relationship between muscles, joints, and headaches from the perspective of functional movements,[26,27] these theories were essentially linked to muscles. The relationship between muscle and TTH has been described in literature, Fernandez-de-Las-Penas et al[28] observed that muscle atrophy of the rectus capitis posterior minor (RCPmi)

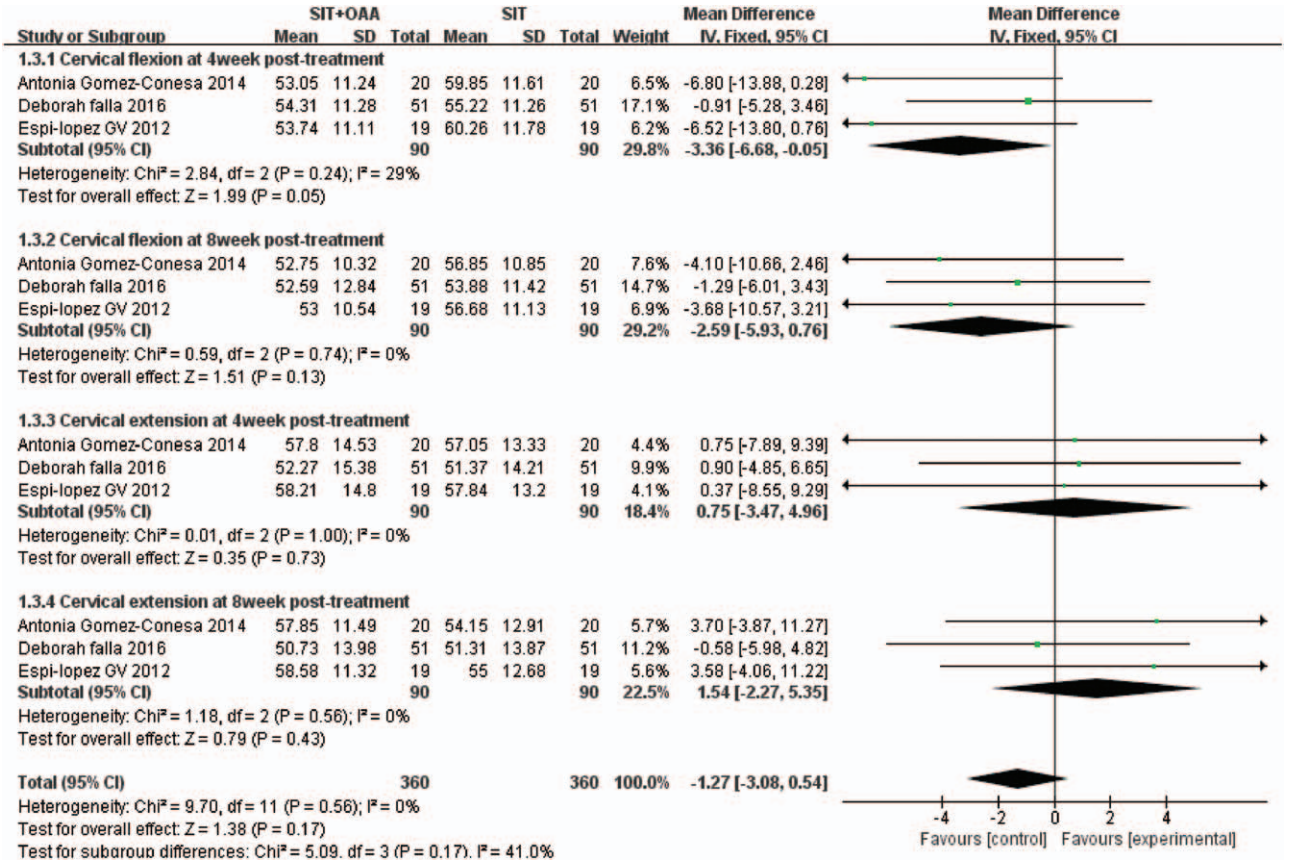

Figure 5. Cervical range of flexion and extension.

and the rectus capitis posterior major (RCPma) is associated with headache symptoms. The relative cross-sectional area (rCSA) of the RCPmi and the RCPma of the CTTH patients was significantly reduced, but the semispinalis capitis and the splenius capitis did not change. The rCSA of RCPmi and RCPma was negatively correlated with the intensity and duration of headache. In 2008, Fernandez-de-Las-Penas et al[29] compared the rCSAs of RCPmi, RCPma, semispinalis capitis, and the splenius capitis of patients with chronic tension headache using nuclear magnetic resonance imaging method, the study showed that the patients RCPmi and RCPma were obviously atrophied, but it was still unknown whether the muscle atrophy was primary or secondary. Fakhran et al[7] reported the influence of the RCPmi on patients with mild traumatic brain injury. They believed that strengthening of the RCPmi muscle may reduce patients pain and improve prognosis.

Regarding the relationship between the RCPmi and headache, Hack et al[30] conducted a 2-year follow-up investigation of a myodural bridge (The "myodural bridge" is a dense fibrous tissue connecting the RCPmi, RCPma, and obliquus capitis inferior with the spinal dura mater in human studies.) release surgery performed on a chronic headache patient. Significant relief of the patient's headache was observed. Subsequently, Yuan et al[31] reported that the area of the RCPmi in patients with chronic headache was significantly increased compared with normal people. The results of this study show an existing relationship between RCPmi and headache.

Authors tried to analyze the treatment mode of SIT + OAA, which can increase the elasticity and extensibility of muscles and restore muscle function to a greater extent. The treatment can not only eliminate the Trp,[4,5] but can improve local blood circulation[26,27] and increase proprioception.[7] It is also possible that the treatment of the suboccipital region can cause a change in the cerebrospinal fluid flow rate. The mechanical pressure applied on the suboccipital region may disturb the cerebrospinal fluid, like the fourth ventricle compression therapy mentioned in craniosacral technique.[32] The myodural bridge establishes a direct connection between muscles and dura mater.[33]

Sui et al supposed a mechanism that relates the myodural bridge with the cerebrospinal fluid circulation (CSF).[34] They suggested that when lesions such as swelling and inflammation appear in the RCPmi, the traction of the RCPmi on the dura mater changes, and the "pumping action" (during head movement, the RCPmi pulls on the dura mater through the myodural bridge. This may cause a change in the volume of the subarachnoid space thereby producing a negative pressure, which may act as a pump and cause CSF) changes, which in turn affects CSF. Alternatively, when neck motion is limited, the CSF power at the suboccipital region is weakened, causing changes in the CSF and thus the intracranial pressure. This may result to chronic headache in the patient. In 2016, Xu et al[35] measured the flow rate of cerebrospinal fluid before and after head rotations, the results showed that after head rotation, the maximum and average cerebrospinal fluid flow rate of the ventricular diastolic

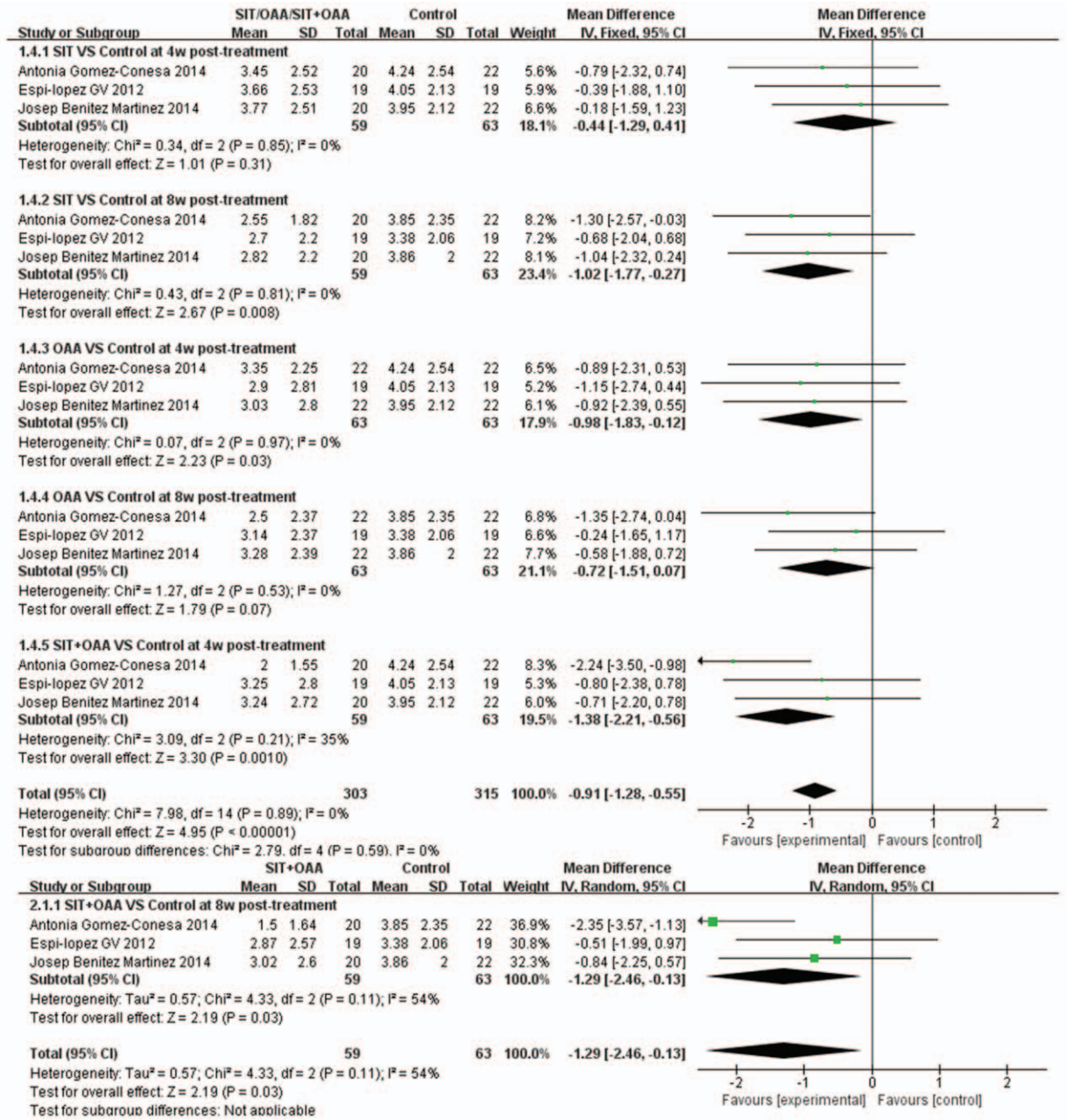

Figure 6. Effectiveness of each group.

phase increased significantly, and the CSF stroke volumes during diastole and during the entire cardiac cycle significantly increased. Only 3 occipital muscles are connected to the dura mater through the myodural bridge, so the myodural bridge may, in head rotations, have a certain effect on the CSF.

Simply put, the presence of the myodural bridge may explain the treatment of SIT + OAA. On 1 hand, SIT + OAA eliminates the myofascial TrPs present in the suboccipital muscles, relieves the fascia limitation and reduce central sensitivity. On the other hand, it may be because of the effect on cerebrospinal circulation.

Furthermore, the suboccipital region includes the RCPmi and RCPma, the obliquus capitis superior and obliquus capitis inferior that function in the movement of the craniocervical region, such as head extension and flexion. Cervical movement involves more muscles, so the factors affecting the curative effect may be more complicated than simply considering the craniocervical area. During cervical flexion, the cervical vertebra drives the head forward. OAA's treatment involves functional movement at the Occiput-Atlas and Axis joints, which is exhibited in the movement of the head. Thus, for cervical ROM, more experiments are still needed to test the significance of physical therapy in the suboccipital region. However, considering the available literature, combined treatment has more advantages in treating TTH.

What is more, studies have shown that[36] posture analysis is a primary evaluation criteria in the physical therapy of patients

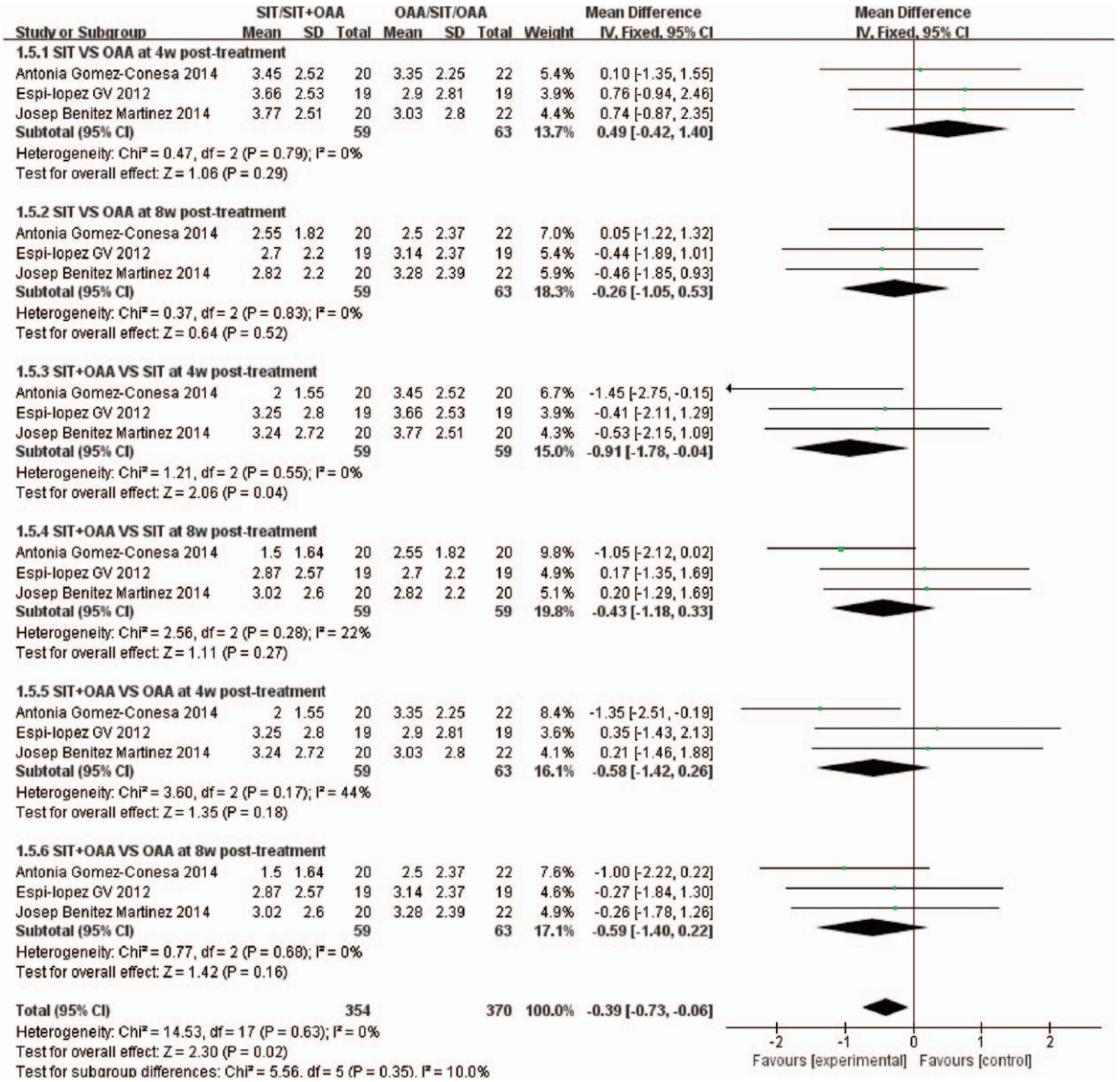

Figure 7. Which is the best effectiveness in all group.

with musculoskeletal pain. For patients with tension headaches,[37] unhealthy postures such as forward head posture, were associated with headache symptoms. Among the causes of unhealthy posture, the most important factor is the bad habits of daily life. For example, working at desk for a long time, lowering heads to use smartphone. In the treatment of TTHs, unchanged lifestyle habits may have a "zero-sum" effectiveness when physical therapy is administered. This may be the biggest problem in the implementation of physical therapy, and a very important factor in the patient's follow-up. Therefore, educating the patient on better living habits during physical therapy may help to improve treatment.

4.3. Implication from this research

This meta-analysis shows that SIT + OAA treatment may have a better effect on pain relief or can better improve patients' prognosis. It provides a new idea for headache treatment in patients with TTH in the future. Finally, this information may provide a new direction for the exploration of the pathogenesis of TTH. In summary, the combination therapy of SIT + OAA on TTH patients is significant in short term efficacy and prognosis.

4.4. Limitations

Due to few published articles and clinical trials on this subject, this meta-analysis included few data. In the future, more RCT experiments will need to be included to get more realistic results.

5. Conclusion

Despite these limitations, physical therapy in the suboccipital region is very effective for TTH. The advantages of using SIT + OAA to treat TTH are as follows: reduction in the intensity of

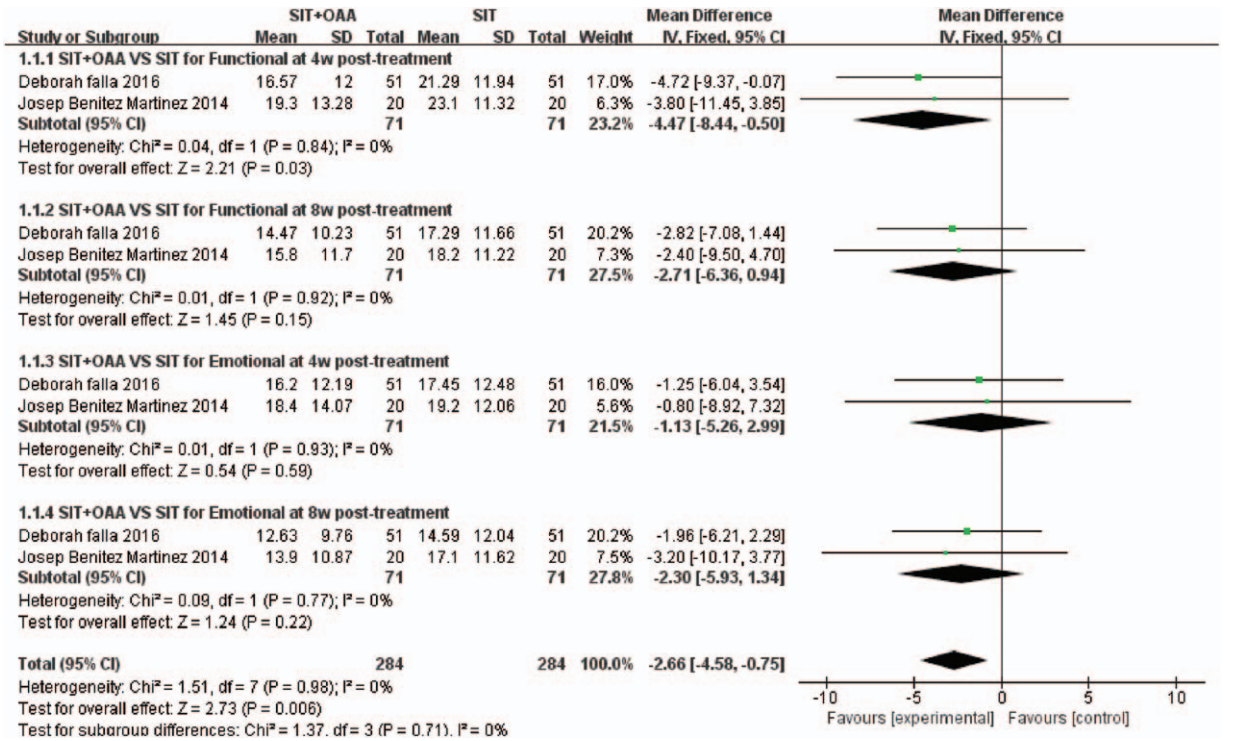

Figure 8. Headache disability inventory.

headache, relieve in psychological stress and increase in craniocerebral activity. The use of SIT only in TTH treatment can improve cervical mobility. In conclusion, it is necessary to use a combination therapy for patients with TTH.

Table 3

All positive indicators in this paper.

	SIT	OAA	SIT + OAA
Craniocervical flexion:			
1. Post-treatment 4 wk			
2. Post-treatment 8 wk			
Craniocervical extension:			
1. Post-treatment 4 wk			☆
2. Post-treatment 8 wk			
Cervical flexion:			
1. Post-treatment 4 wk	Δ		
2. Post-treatment 8 wk			
Cervical extension:			
1. Post-treatment 4 wk			
2. Post-treatment 8 wk			
Intensity of pain for VAS:			
1. Post-treatment 4 wk		☑	☑ ☆
2. Post-treatment 8 wk	☑		☑
HDI for Functional:			
1. Post-treatment 4 wk			☆
2. Post-treatment 8 wk			
HDI for Functional:			
1. Post-treatment 4 wk			
2. Post-treatment 8 wk			

Δ: The SIT was more effective than SIT + OAA for CCTH.
☆: The SIT + OAA was more effective than SIT for CCTH.
☑: This way ia effective for VAS.

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