รายงานวิจัยฉบับสมบูรณ์

โครงการ

Effectiveness of physiotherapy for seniors with recurrent headaches associated with neck pain and dysfunction: a randomized controlled trial

โดย ผศ.ดร.สุรีพร อุทัยคุปต์

4 กุมภาพันธ์ 2559

สัญญาเลขที่ MRG 5580145

รายงานวิจัยฉบับสมบูรณ์

Effectiveness of physiotherapy for seniors with recurrent headaches associated with neck pain and dysfunction: a randomized controlled trial

ผศ.ดร.สุรีพร อุทัยคุปต์
ภาควิชากายภาพบำบัด คณะเทคนิคการแพทย์
มหาวิทยาลัยเชียงใหม่

สนับสนุนโดยสำนักงานกองทุนสนับสนุนการวิจัย

Effectiveness of physiotherapy for seniors with recurrent headaches associated with neck pain and dysfunction: a randomized controlled trial

Sureeporn Uthaikhup[1], Jenjira Assapun[1], Kanokwan Watcharasaksilp[2], Gwendolen Jull[3]

[1] Department of Physical Therapy, Faculty of Associated Medical Sciences, Chiang Mai University, Chiang Mai, Thailand

[2] Department of Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand

[3] Physiotherapy, School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Australia

Address for Correspondence

Dr Sureeporn Uthaikhup

Department of Physical Therapy

Faculty of Associated Medical Sciences

Chiang Mai University

Chiang Mai

Thailand, 50200

Ph: 66 53 949 249

Fax: 66 53 946 042

Email: sureeporn.uthaikhup@cmu.ac.th

บทคัดย่อ

วัตถุประสงค์ เพื่อศึกษาประสิทธิผลของโปรแกรมกายภาพบำบัดในผู้สูงอายุที่มีอาการปวดศีรษะที่สัมพันธ์กับอาการปวดคอและความผิดปกติของโครงสร้างคอ

รูปแบบการศึกษา การศึกษาทดลองแบบ prospective, stratified, randomized controlled trial with blinded outcome assessment

วิธีการศึกษา อาสาสมัครที่มีอาการปวดศีรษะจำนวน 65 คน อายุระหว่าง 50–75 ปี ถูกสุ่มเข้ากลุ่มที่ได้รับโปรแกรมกายภาพบำบัด (33 คน) หรือการรักษาตามปกติ (32 คน) โดยตัวแปรหลักในการศึกษาได้แก่ ความถี่ของอาการปวดศีรษะ และตัวแปรรอง ได้แก่ ความรุนแรงและระยะเวลาของอาการปวดศีรษะ อาการปวดคอและความบกพร่องของอาการปวดคอ มุมการเคลื่อนไหวของคอ คุณภาพชีวิต ความพึงพอใจของผู้เข้าร่วมการศึกษา และยาที่ได้รับ การวัดประเมินผลทำก่อนการได้รับการรักษา สัปดาห์ที่ 11 หลังจากการรักษา และติดตามผลในเดือนที่ 6 และ เดือนที่ 9

ผลการรักษา อาสาสมัครกลุ่มที่ได้รับโปรแกรมกายภาพบำบัดมีความถี่ของอาการปวดศีรษะลดลงมากกว่ากลุ่มควบคุมหลังจากสิ้นสุดการรักษา (mean difference −1.6 days, 95% CI −2.5 to −0.6), และการติดตามผลในเดือนที่ 6 (−1.7 days, 95% CI −2.6 to −0.8) และเดือนที่ 9 (−2.4 days, 95% CI −3.2 to −1.5) และได้รับผลดีจากการรักษาเมื่อพิจารณาจากตัวแปรรองของการศึกษาทุกตัวแปร ($p < 0.05$) ไม่มีรายงานผลข้างเคียงจากการรักษา

สรุปผลการศึกษา โปรแกรมกายภาพบำบัดให้ประโยชน์เหนือกว่าการรักษาตามปกติสำหรับผู้สูงอายุที่มีอาการปวดศีรษะร่วมกับอาการปวดคอและความผิดปกติของโครงสร้างคอ

คำสำคัญ โรคกระดูกสันหลังคอ, ปวดศีรษะ, ปวดคอ, กายภาพบำบัด, ผู้สูงอายุ

Abstract

Objective. To determine the effectiveness of a physiotherapy program for seniors with recurrent headaches associated with neck pain and cervical musculoskeletal dysfunction, irrespective of the headache classification.

Design. A prospective, stratified, randomized controlled trial with blinded outcome assessment.

Setting. Headache clinic and community

Methods. Sixty-five participants with recurrent headache, aged 50-75 years were randomly assigned to either a physiotherapy (n =33) or usual care group (n = 32). The primary outcome was headache frequency. Secondary outcomes were headache intensity and duration, neck pain and disability, cervical range of motion, quality of life, participant satisfaction, and medication intake. Outcome measures were recorded at baseline, 11 weeks, 6 months and 9 months.

Results. There was no loss to follow-up. Compared to usual care, participants receiving physiotherapy reported significant reductions in headache frequency immediately after treatment (mean difference -1.6 days, 95% CI -2.5 to -0.6), at the 6-month follow-up (-1.7 days, 95% CI -2.6 to -0.8), at the 9-month follow-up (-2.4 days, 95% CI -3.2 to -1.5) and significant improvements in all secondary outcomes ($p < 0.05$ for all). No adverse events were reported.

Conclusion. Physiotherapy treatment provided benefits over usual care for seniors with recurrent headache associated with neck pain and dysfunction.

Trial registration. ClinicalTrial.gov NCT01736774

Key words. cervical disorder, headache, neck pain, physiotherapy, seniors

Introduction

Headache is a common health problem that affects quality of life. Headaches change with age (1-3). Their features become less typical, for example, a diagnosis of probable migraine is more prevalent in seniors than migraine (4). Secondary headaches increase in frequency (5) and associated neck pain is common (2). In line with this occurrence, we demonstrated that cervical musculoskeletal dysfunction (CMD) was more prevalent in seniors with, than without headache. CMD was not specific to cervicogenic headache but was present in various recurrent headache types (e.g. migraine, tension-type headache) (6). Nevertheless, the degree of CMD was variable. We characterised it as greater or lesser based principally on loss of motion and pain on palpation of cervical joints. We found that greater or lesser dysfunction likewise was not related to headache classification or length of headache history, albeit that there was a trend for more cervicogenic headaches to be in the greater neck dysfunction group. The CMD and neck pain in seniors might be the source of headache (cervicogenic headache), or a prevalent co-morbid feature and possibly an additional peripheral source of nociception in primary headaches as part of their changing nature with ageing.

Changes in the nature of headache with age play an important role in treatment choice. The effective management of headache in seniors remains a challenge. There is evidence that physiotherapy methods are effective for treating the CMD of cervicogenic headache (7, 8). It is unknown if management of the neck could be a useful adjunct treatment for those seniors with other recurrent headaches as probable migraine when they are associated with neck pain and CMD. This is a safe option given the widespread concerns about medication overuse, adverse drug events and drug interactions in senior populations (9, 10). Management of CMD may

reduce headache frequency or severity and enhance the quality of life and lessen medication use, cost and adverse drug events.

This trial was undertaken to determine the effectiveness of a physiotherapy program of cervical mobilization and therapeutic exercise for seniors with recurrent headache irrespective of headache classification, provided there was associated with neck pain and CMD. We hypothesized that treatment of the neck disorder would be more effective in reducing headache frequency than usual care and would result in greater improvements in secondary outcomes; headache duration and intensity, cervical range of motion, neck pain and disability, medication use, quality of life and participant's perception of treatment benefit. If treatment of the neck proved effective, we planned subgroup analyses to determine if there was a difference in effect if the headache was diagnosed as cervicogenic or whether greater or lesser musculoskeletal dysfunction was judged to be present.

Methods

Study design

A prospective, assessor-blinded, parallel group (1:1 allocation ratio) randomized controlled trial. Ethical approval was gained from the ethical review committee for research in humans, Faculty of Medicine, Chiang Mai University (#349/2012). The study was conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent. (ClinicalTrial.gov NCT01736774). The study commenced in January 2013 and was completed in July 2015.

Participants

Participants were recruited both from the headache clinic at Maharaj Nakorn Chiang Mai Hospital and from the local community by advertising on local radio, in newspapers and flyers. A neurologist from the headache clinic screened and diagnosed potential participants from both sources. To be eligible for the study, participants were to be aged between 50-75 years, have recurrent headaches diagnosed as either migraine, tension-type, cervicogenic or mixed headache with associated neck pain and CMD (restriction in active range of cervical motion in extension and rotation and palpable upper cervical joint dysfunction) (6). Headache frequency had to be at least one per week over the past year, with neck pain greater than or equal to 3 on a 0-10 visual analogue scale (VAS). Exclusion criteria were: headache diagnosed as temporal arteritis, trigeminal neuralgia, cluster headache, chronic paroxysmal hemicrania/hemicranias continua; temporomandibular disorders; neurological disorders (e.g. Parkinson disease, stroke); cognitive disturbance; previous serious head and neck trauma; any condition that contraindicated cervical mobilization; or receipt of physiotherapy treatment for headache during the past 12 months.

A research assistant conducted a preliminary screening telephone interview with participants responding to advertisements. For those provisionally eligible for the trial, appointments were made with the trial neurologist and an experienced physiotherapist. The neurologist examined all potential participants (recruited from advertisements or the headache clinic) and assigned a headache diagnosis (migraine, tension-type, cervicogenic, mixed headache or other headache type) according to the criteria of the International Headache Society (IHS) (11) or for cervicogenic headache, the criteria of the Cervicogenic Headache International Study Group (12). The physiotherapist, blinded to the neurologist's diagnosis, performed a physical examination of the neck to identify the presence or not of CMD and make a clinical rating of

greater, lesser or no CMD (6). This included assessment of range of movement and a manual examination of the cervical segments (13, 14). The participants rated any pain provoked on palpation on a numerical rating scale (NRS) and the physiotherapist rated the perceived tissue resistance to the manual palpation as normal, slight, moderate, or marked resistance. A joint was classified as symptomatic if pain provoked by manual examination was >2/10 in combination with the physiotherapist's rating of moderately or markedly abnormal tissue compliance (15). A participant was judged to have greater CMD if they had at least 2 levels of symptomatic joint dysfunction and displayed restricted range of cervical motion in extension and rotation. If musculoskeletal dysfunction was present, but rated to lesser degree, the participant was assigned to lesser CMD. If manual examination and range of movement were painfree, a participant was assigned to have no CMD. On the basis of the neurologist's and physiotherapist's assessments, participants were either invited to participate or were judged ineligible.

Randomization and masking

Randomization was undertaken by an independent research assistant, not otherwise involved in the trial. Randomization was by computer generated permuted blocks with a block size of four, stratified by greater or lesser CMD, to ensure similar dysfunction between groups. Allocation was concealed in sequentially numbered, sealed, opaque envelopes. The envelopes were opened by the research assistant allocating patients to the respective intervention. Physiotherapists were not blinded to the treatment being provided but were blinded to participants' headache diagnosis. Blinded assessors collected all baseline and follow-up physical measures and entered questionnaire data.

Interventions

Usual care: Participants randomly allocated to the usual care group continued with their usual care and received no physiotherapy treatment. Any treatments received and adverse events during the 10 week intervention period were recorded in a diary log-book.

Physiotherapy: The intervention was delivered by two physiotherapists, experienced in the trial treatments. The treatment period was 10-weeks and commenced within one week of baseline assessment. Participants received 14 individual treatment sessions (2 visits per week for the first 4 weeks followed by one visit per week for the last 6 weeks). Each treatment session lasted approximately 45 minutes and included a combination of cervical mobilization and a therapeutic exercise program, a regime which has proven successful in previous trials of headache management (7, 16). The cervical mobilization consisted of low-velocity techniques (17). The therapeutic exercise program was a low load exercise for the craniocervical flexor (7, 18) and axioscapular muscles (19) and postural correction exercises (18, 20). Muscle lengthening exercise could also be given to address any muscle tightness. The elements of the treatment were delivered at the discretion of the physiotherapist, based on the initial and progressive assessment of participant's cervical joint and muscular dysfunction. The exercise programs were progressed gradually from non-functional to functional performance. Participants were instructed to practice their exercise once daily (10-20 minutes) during the intervention period, without aggravating pain. Participants completed an exercise diary to monitor compliance and record adverse events.

Measurements

A baseline questionnaire was administered to document participant demographics, headache history and any treatment received to date. A daily headache diary was used to record headache

measures (frequency, intensity and duration) one week before baseline and follow-up assessments. Primary and secondary outcome measures were recorded at baseline, 11 weeks, 6 months and 9 months after randomization. The exception was cervical range of motion, participants' perception of treatment benefit and quality of life which were measured at baseline, 11 weeks and 9 months.

Primary outcome measure

Headache frequency was the primary outcome measure (21). The number of headache days was recorded in a daily headache diary one week before the respective assessment dates and the total number of headache days per week was used for analysis.

Secondary outcome measures

Other headache measures: Headache intensity and duration were measured with a daily headache diary. Participants reported daily headache pain intensity using a 0-10 NRS and the number of hours of headache for each day in the past week. Means scores across the 7-day period were used for analysis.

Neck pain and disability measures: Neck pain intensity was measured using a VAS. The participants indicated their average neck pain intensity over the past week by marking a 100mm line. Likewise a weekly measure was recorded of neck related disability using the Neck Disability Index-Thai version (NDI-TH) (22). The NDI-TH has 10 sections and each has a five point Likert response (total score, 50). A higher score indicates greater perceived disability (23).

Cervical range of motion: A cervical range of motion (CROM) device was used to measure flexion/extension, left-right rotation, left-right lateral flexion and left-right upper cervical rotation (24). The CROM is a reliable tool to assess cervical range of motion (25).

Quality of life: Health-related quality of life was assessed using the SF-36-Thai version (26), which contains 36 questions covering eight domains of health. The eight domains were summed into a physical component summary score (PCS) and a mental component summary score (MCS) and then expressed as a percentage, with higher score representing better health.

Participant's perception of treatment benefit: Perceived benefit was measured with a 0-10 scale (0 = no benefit and 10 = maximum benefit).

Medication: Participants recorded the type and dose of all medications taken in a medication diary for a one-week baseline period and for one week prior to follow-up points. Medication consumption was converted into defined daily dose (DDD) unit by multiplying the units dispensed field with the DDD conversion (27). For example, the DDD for paracetamol is 3g and the strength of one tablet is 500mg. Each 500mg tablet is equivalent to 0.17 DDD. Multiplying the quantity (6 tablets) by a conversion factor of 0.17 equals a consumption of 1.02 DDDs. The sum of DDDs of all medications consumed in one week was calculated and used for analysis.

Procedure

Participants attended the Department of Physiotherapy, Chiang Mai University for baseline assessment. They were randomly allocated to either the 10 week physiotherapy program or usual care. All participants were reassessed at 11 weeks (at the university), 6 months (postal questionnaires) and 9 months (at the university). All completed a headache diary one week

before assessment dates. Participants receiving the physiotherapy intervention were asked to refrain from seeking other treatment for their headache during the trial. Due to ethical considerations, usual medication was not withheld from any participant, regardless of group. Participants recorded the type and dose of all medications taken in a medication diary. Reminder telephone calls were used to help to maintain a high retention rate, including two calls to participants in the usual care group during the 10 week intervention.

Sample size calculation

Sample size was based on the primary outcome of headache days per week. According to the IHS guidelines (21), a 50% reduction in headache days per week is considered a clinically significant difference. A sample size of 58 participants was required for the study based on a priori power analysis with a power of 0.8 and an alpha of 0.05. Assuming a dropout rate of 10%, 64 participants (32 per group) was the target sample size for enrollment.

Statistical analysis

Missing data was imputed using intention-to treat with the last observation carried forward. Independent t-tests, Chi-square and Mann-Whitney were used to test for between group differences in demographic data. The change from baseline (mean and 95% confidence interval) for each pairwise between-group comparison was estimated using a linear mixed model and the baseline value was used as a covariate. A partial $\eta 2$ was calculated to determine effect size. An effect size of 0.01 was regarded as small, 0.06 as medium, and 0.14 as large (28). Dichotomous responder analysis was conducted to evaluate whether improvement in headache frequency was clinically significant ($\geq$ 50% reduction in the number of headache days post-treatment and at follow-ups). The results are presented as relative risks with 95% confidence interval.

Subgroup analyses were explored to determine whether any effects of neck treatment differed according to headache diagnosis (cervicogenic or non-cervicogenic) or CMD (greater or lesser). Analyses were performed based on tests for the 3-way interaction between each subgroup (headache diagnosis or musculoskeletal dysfunction), treatment allocation (physiotherapy and usual care), and time (11 weeks, 6 months and 9 months). No interaction would indicate similar treatment effects in subgroups over time (29). Subgroup analyses were confined to the primary outcome (headache frequency) and key secondary outcomes (headache intensity and duration, and neck pain and disability).

Statistical significance was set at $p < 0.05$. Data were analyzed using SPSS Statistics version 18 (SPSS Co., Ltd. Bangkok, Thailand).

Results

Participant characteristics

Figure 1 presents the flow diagram of participant recruitment and retention. Sixty-five participants entered the study and none were lost to follow-up. Data for cervical movement was not collected from one participant (3%) in the physiotherapy group at the 9-month follow-up. Demographics were similar between groups (Table 1).

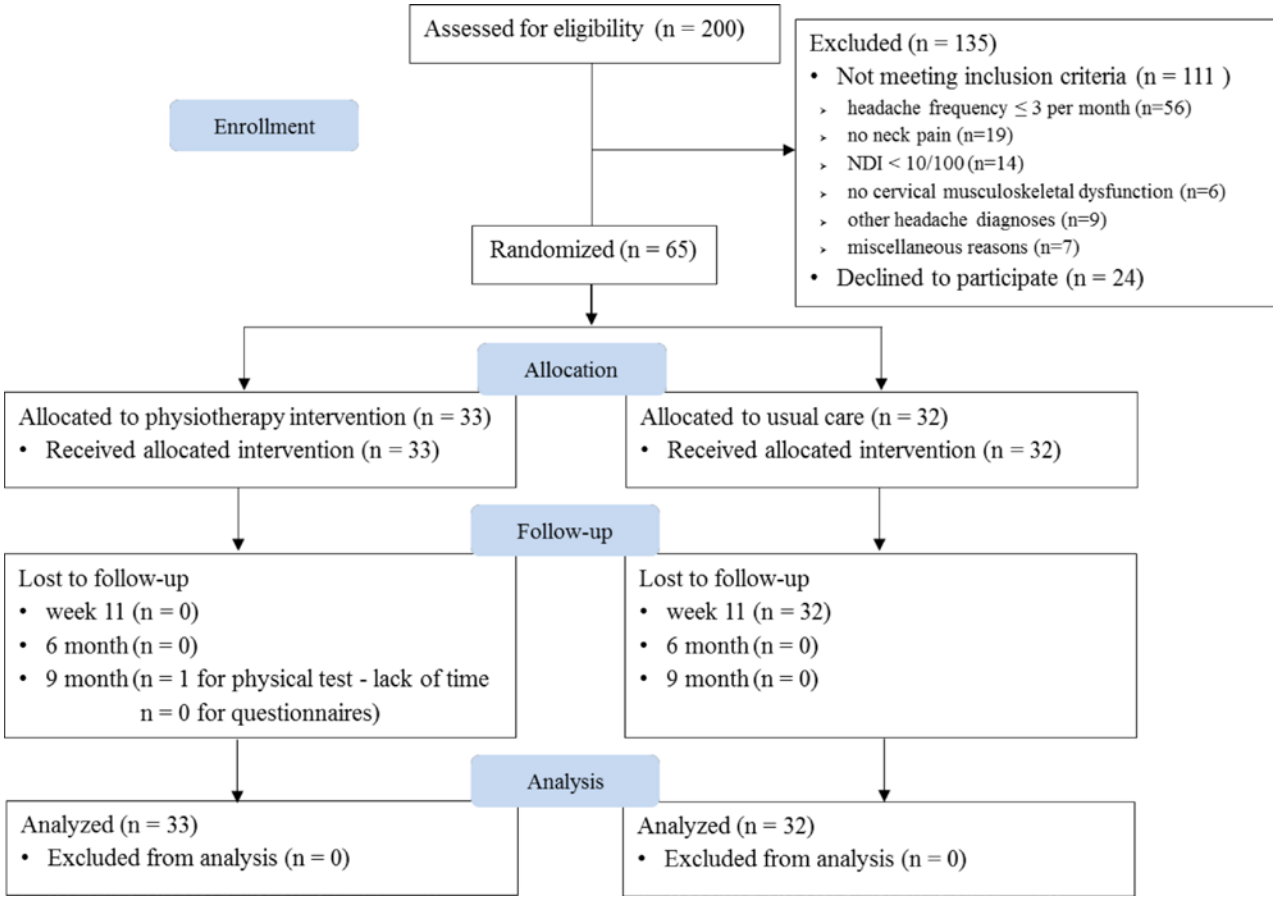

Figure 1 Flow diagram of the trial

Interventions

All participants in the physiotherapy group completed 14 treatment sessions over 10 weeks. Analysis of exercise diaries indicated that participants practiced exercises on 63.4 (SD, 8.7) of 70 days of the treatment period. Three participants in the usual care group reported using balm to reduce pain, six received massage, and one received acupuncture. No significant adverse effects were reported in either group.

Primary outcome

Descriptive data for the primary outcome from baseline to each follow period are summarized in Table 2 and results of analysis of changes between and within-groups are presented in Table

3. The participants receiving physiotherapy had significantly reduced headache frequency immediately after treatment (week 11) compared with usual care. The difference remained significant at 6- and 9-month follow-ups. Effect size estimates indicated a large effect for physiotherapy treatment on headache frequency (Table 4). The effectiveness of the intervention was also investigated by examining the number of participants who responded to treatment. At all follow up points, the physiotherapy group had a significantly higher proportion of participants who experienced greater than 50% reduction in headache frequency than the usual care group and 60% were headache free at 9-months (Table 5).

Secondary outcomes

Descriptive data for secondary outcomes at each time point are summarized in Table 2. Results of analysis of changes between and within-groups are presented in Table 3. There were significant reductions in headache intensity and duration, neck pain and disability measures (VAS and NDI-TH) immediately after treatment (11 weeks), and at 6- and 9-month time points compared to the usual care group. Significant differences between groups were recorded at the post-treatment (11 week) and 9 month follow-ups, for cervical ranges of motion, quality of life measures and participant's perception of treatment benefit. The exception was upper cervical rotation at 9 month follow up. There was a positive trend for reduced medication use in the physiotherapy group, but differences from the usual care group were not significant.

Subgroup analyses

Descriptive data for subgroup analyses are present in Tables 6 and 7. Cervicogenic headache was the most common diagnosis (69.7%, physiotherapy group; 65.6%, usual care group) and, for analysis, all other headaches were pooled into a non-cervicogenic headache group. Approximately 75% of participants in each group were rated with greater CMD. There were no

interactions between subgroups (headache diagnosis and CMD) and treatment allocation over time for the primary outcome and secondary outcomes (headache intensity and duration; neck pain and disability measures ($p > 0.05$). The exception was headache duration, where a significant interaction was found between subgroup of CMD, treatment allocation and time ($p = 0.012$). Bonferroni post-hoc results showed that post-treatment (11 weeks), participants with greater CMD in the physiotherapy group had significantly greater improvement in headache duration than those with lesser CMD (mean difference = 3.3 hours/day, 95% CI = 0.3 to 6.3, $p = 0.031$).

Table 1 Participant demographic data

Variables	Physiotherapy (n = 33)	Usual care (n = 32)	*p*-value
Age (yrs), mean (SEM)	59.9 (1.2)	61.6 (0.9)	0.25
Gender (female), %	81.8	90.6	0.30
BMI (kg/m^2), mean (SEM)	24.1 (0.7)	25.8 (0.6)	0.07
Employment status, n			0.19
Retired	7	8	
Full time employment	9	3	
Self-employed	10	16	
Housewife	7	5	
History of headache (yrs), mean (SEM)	8.5 (1.6)	6.3 (1.5)	0.30
Headache diagnosis (type), n			0.42
Migraine	6	7	
Tension-type headache	2	0	
Cervicogenic headache	23	21	
Mixed headache	2	4	
CMD (greater), %	75.8	75.0	0.94

CMD = cervical musculoskeletal impairment

Table 2 Primary and secondary outcomes for each intervention group. Means and (standard deviations) are presented.

Outcome variables	Physiotherapy (n = 33)				Usual care (n = 32)			
	Baseline	11 weeks	6 months	9 months	Baseline	11 weeks	6 months	9 months
Primary outcome								
Headache frequency (days/week)	4.3 (0.4)	1.7 (0.4)	1.5 (0.4)	0.8 (0.2)	3.9 (0.4)	3.0 (0.4)	2.9 (0.5)	2.9 (0.5)
Secondary outcome								
Headache intensity (0-10 NRS)	4.5 (0.3)	1.4 (0.3)	1.5 (0.3)	1.2 (0.3)	4.7 (0.4)	4.8 (0.4)	4.0 (0.5)	3.6 (0.6)
Headache duration (hours/day)	5.2 (1.0)	2.2 (0.6)	2.7 (0.9)	1.9 (0.9)	4.8 (1.0)	4.7 (1.0)	4.7 (1.1)	5.60 (1.2)
Neck pain intensity (0-10 VAS)	5.1 (0.3)	1.7 (0.2)	1.4 (0.3)	1.5 (0.3)	5.4 (0.2)	4.73 (0.2)	4.8 (0.3)	4.80 (0.3)
Neck pain and disability (%)	30.9 (1.6)	10.1 (1.2)	9.2 (1.3)	8.4 (1.3)	27.7 (1.7)	26.4 (1.5)	24.6 (1.6)	23.83 (1.8)
Cervical range of motion (degrees)								
Flexion-extension	105.0 (1.6)	115.6 (1.9)	N/A	113.0 (1.7)	105.5 (1.8)	105.9 (1.6)	N/A	107.23 (2.5)

Outcome variables	Physiotherapy (n = 33)				Usual care (n = 32)			
	Baseline	11 weeks	6 months	9 months	Baseline	11 weeks	6 months	9 months
Lateral flexion (right-left)	58.5 (2.0)	66.3 (2.1)	N/A	68.1 (2.1)	59.7 (1.6)	59.9 (1.5)	N/A	64.6 (1.7)
Rotation (right-left)	115.2 (2.2)	125.0 (1.9)	N/A	125.2 (2.1)	115.1 (2.0)	115.5 (2.4)	N/A	117.9 (1.9)
Upper cervical rotation	47.7 (1.1)	53.3 (1.0)	N/A	53.6 (1.2)	49.0 (0.9)	51.0 (1.0)	N/A	51.7 (1.0)
Quality of life SF 36 (%)								
Physical component summary	54.5 (2.6)	78.4 (2.0)	N/A	77.7 (2.1)	55.7 (2.8)	53.6 (2.7)	N/A	56.6 (2.2)
Mental component summary	65.6 (2.8)	83.7 (1.9)	N/A	79.4 (2.4)	68.8 (2.7)	62.1 (3.0)	N/A	63.2 (3.0)
Treatment benefit (0-10 VAS)	4.5 (0.6)	9.3 (0.2)	N/A	9.4 (0.2)	3.6 (0.6)	6.3 (0.5)	N/A	6.7 (0.4)
Medication (DDD per week)	2.0 (1.5)	0.04 (0.02)	0.05 (0.04)	0.03 (0.02)	0.7 (0.3)	1.2 (0.8)	1.0 (0.8)	1.3 (0.8)

Data are expressed in mean (standard error), NRS = Numerical Rating Scale, VAS = Visual Analogue Scale, DDD = Defined Daily Dose

Table 3 Means (standard error) for within group changes and adjusted mean (95% confidence interval) for differences in between-group change for all outcome variables

Outcome variables	Time frame	Change within groups*				Changes between-groups**	
		Physiotherapy	*p*-value	Usual care	*p*-value	Difference	*p*-value
Primary outcome							
Headache frequency (days/week)	Baseline-week 11	2.6 (0.3)	<0.001	0.9 (0.4)	0.052	-1.6 (-2.5 to -0.6)	0.001
	Baseline-6 months	2.8 (0.4)	<0.001	1.0 (0.4)	0.041	-1.7 (-2.6 to -0.8)	0.001
	Baseline-9 months	3.5 (0.3)	<0.001	1.0 (0.3)	0.023	-2.4 (-3.2 to -1.5)	<0.001
Secondary outcomes							
Headache intensity (0-10 NRS)	Baseline-week 11	3.1 (0.3)	<0.001	-0.1 (0.3)	1.00	-3.3 (-4.1 to -2.4)	<0.001
	Baseline-6 months	2.9 (0.4)	<0.001	0.7 (0.4)	0.49	-2.3 (-3.4 to -1.3)	<0.001
	Baseline-9 months	3.2 (0.5)	<0.001	1.1 (0.5)	0.32	-2.4 (-3.6 to -1.1)	<0.001
Headache duration (hours/day)	Baseline-week 11	3.0 (0.8)	0.005	0.2 (0.9)	1.00	-2.6 (-4.4 to -0.7)	0.007
	Baseline-6 months	2.5 (0.8)	0.020	0.2 (0.8)	1.00	-2.2 (-4.4 to -0.04)	0.046
	Baseline-9 months	3.3 (1.2)	0.033	-0.8 (1.2)	1.00	-3.8 (-6.6 to -1.0)	0.008

Outcome variables	Time frame	Change within groups*				Changes between-groups**	
		Physiotherapy	*p*-value	Usual care	*p*-value	Difference	*p*-value
Neck pain intensity (0-10 VAS)	Baseline-week 11	3.5 (0.3)	<0.001	0.7 (0.3)	0.18	-3.0 (-3.7 to -2.4)	<0.001
	Baseline-6 months	3.7 (0.3)	<0.001	0.6 (0.3)	0.58	-3.3 (-4.1 to -2.6)	<0.001
	Baseline-9 months	3.7 (0.3)	<0.001	0.6 (0.3)	0.59	-3.3 (-4.1 to -2.4)	<0.001
Neck pain and disability (%)	Baseline-week 11	20.8 (1.5)	<0.001	1.3 (1.5)	1.00	-17.7 (-21.1 to -14.2)	<0.001
	Baseline-6 months	21.7 (1.7)	<0.001	3.1 (1.7)	0.49	-16.5 (-20.4 to -12.6)	<0.001
	Baseline-9 months	22.5 (1.8)	<0.001	3.9 (1.9)	0.26	-16.4 (-20.6 to -12.2)	<0.001
Cervical range of motion (degrees)							
Flexion-extension	Baseline-week 11	-10.6 (1.5)	<0.001	-0.5 (1.6)	1.00	10.0 (6.0 to 14.0)	<0.001
	Baseline-9 months	-8.1 (1.7)	<0.001	-1.8 (1.7)	0.91	6.19 (1.5 to 10.9)	0.010
Lateral flexion (right-left)	Baseline-week 11	-7.9 (1.6)	<0.001	-0.3 (1.7)	1.00	7.1 (3.0 to 11.3)	0.001
	Baseline-9 months	-9.6 (1.6)	<0.001	-4.9 (1.6)	0.01	4.3 (0.2 to 8.5)	0.043
Rotation (right-left)	Baseline-week 11	-9.8 (1.8)	<0.001	-0.3 (1.8)	1.00	9.5 (4.8 to 14.2)	<0.001
	Baseline-9 months	-10.0 (1.9)	<0.001	-2.8 (1.9)	0.48	7.3 (2.6 to 12.0)	0.003

Outcome variables	Time frame	Change within groups*				Changes between-groups**	
		Physiotherapy	*p*-value	Usual care	*p*-value	Difference	*p*-value
Upper cervical rotation	Baseline-week 11	-5.6 (1.2)	<0.001	-1.9 (1.2)	0.30	2.8 (0.1 to 5.5)	0.045
	Baseline-9 months	-5.9 (1.2)	<0.001	-2.7 (1.2)	0.10	2.4 (-0.6 to 5.4)	0.11
Quality of life SF 36 (%)							
Physical component summary	Baseline-week 11	-24.0 (2.7)	<0.001	2.1 (2.7)	1.00	25.3 (19.2 to 31.4)	<0.001
	Baseline-9 months	-23.3 (2.6)	<0.001	-0.9 (2.7)	1.00	21.6 (16.0 to 27.2)	<0.001
Mental component summary	Baseline-week 11	-18.1 (2.3)	<0.001	6.7 (2.4)	0.019	23.4 (17.6 to 29.2)	<0.001
	Baseline-9 months	-13.8 (2.5)	<0.001	5.6 (2.6)	0.10	17.9 (11.6 to 24.2)	<0.001
Treatment benefit (0-10 VAS)	Baseline-week 11	-4.8 (0.7)	<0.001	-2.8 (0.7)	0.001	3.1 (2.1 to 4.1)	<0.001
	Baseline-9 months	-4.9 (0.7)	<0.001	-3.1 (0.7)	<0.001	2.8 (2.0 to 3.6)	<0.001
Medication (DDD per week)	Baseline-week 11	2.0 (1.1)	0.56	-0.5 (1.2)	1.00	-1.3 (-2.8 to 0.3)	0.10
	Baseline-6 months	1.9 (1.2)	0.57	-0.3 (1.2)	1.00	-1.1 (-2.6 to 0.5)	0.17
	Baseline-9 months	2.0 (1.2)	0.56	-0.6 (1.2)	1.00	-1.4 (-3.0 to 0.1)	0.073

** adjusted for baseline values

* For changes within groups, positive values denote improvement, except for cervical range of motion, SF 36 and treatment benefit where negative values denote improvement.

** For differences in changes between-groups, positive values in cervical range of motion, SF 36 and treatment benefit, and negative values in the headache characteristics, neck pain intensity, neck disability and medication favor the first named group (physiotherapy) in the pairwise comparison.

Table 4 Effect size estimates for group differences

Outcome	Effect size (η2p)		
	Baseline to after treatment	Baseline to 6 month-follow up	Baseline to 9 month-follow up
Headache frequency	0.16	0.17	0.35
Headache intensity	0.49	0.25	0.19
Headache duration	0.11	0.06	0.11

Table 5 The number of participants (%) with a greater than 50% and 100% reduction in headache frequency at follow-ups compared to baseline

	50% reduction				100% reduction			
Headache frequency	Physiotherapy n =33	Usual care n =32	*p*-value	Relative risk (95% confidence interval)	Physiotherapy n =33	Usual care n =32	*p*-value	Relative risk (95% confidence interval)
11 weeks	24 (72.7)	13 (40.6)	0.009	1.8 (1.1 to 2.9)	16 (48.5)	2 (6.3)	<0.001	7.8 (1.9 to 31.1)
6 months	27 (81.8)	15 (46.9)	0.003	1.8 (1.2 to 2.6)	15 (45.5)	7 (21.7)	0.045	2.1 (1.0 to 4.4)
9 months	31 (93.9)	14 (43.8)	<0.001	2.2 (1.4 to 3.2)	20 (60.6)	9 (28.1)	0.008	2.2 (1.2 to 4.0)

Table 6 Sub-group analyses based on cervicogenic or non-cervicogenic headache for the primary outcome and key secondary outcomes

Outcome variables	Physiotherapy		Usual care		*p* value for interaction treatment*sub-group*time
	Cervicogenic (n = 23)	Non-cervicogenic (n = 10)	Cervicogenic (n = 21)	Non-cervicogenic (n = 11)	
Primary outcome					
Headache frequency (days/week)	1.6 (0.6 to 2.5)	1.6 (0.3 to 3.0)	2.1 (1.0 to 3.1)	4.0 (2.8 to 5.2)	0.19
Secondary outcome					
Headache intensity (0-10 NRS)	2.1 (1.1 to 3.0)	1.5 (0.2 to 2.9)	3.7 (2.6 to 4.7)	4.7 (3.4 to 5.9)	0.079
Headache duration (hours/day)	3.4 (1.3 to 5.5)	0.6 (-2.4 to 3.6)	4.2 (1.8 to 6.6)	6.5 (3.7 to 9.3)	0.87
Neck pain intensity (0-10 VAS)	1.8 (1.3 to 2.3)	1.1 (0.3 to 1.8)	4.6 (4.0 to 5.1)	5.1 (4.4 to 5.9)	0.45
Neck pain and disability (%)	10.2 (7.8 to 12.7)	4.6 (1.0 to 8.3)	25.0 (22.4 to 27.6)	27.0 (23.5 to 30.5)	0.23

Value are estimated mean (95% confidence interval) after adjust for baseline values and age

Table 7 Sub-group analyses based on greater or lesser musculoskeletal dysfunction for the primary outcome and key secondary outcomes

Outcome variables	Physiotherapy		Usual care		*p* value for interaction treatment*sub-group*time
	Greater dysfunction (n = 25)	Lesser dysfunction (n = 8)	Greater dysfunction (n = 24)	Lesser dysfunction (n = 8)	
Primary outcome					
Headache frequency (days/week)	1.1 (0.5 to 1.7)	1.2 (0.2 to 2.2)	3.1 (2.5 to 3.6)	3.1 (2.1 to 4.2)	0.15
Secondary outcome					
Headache intensity (0-10 NRS)	1.2 (0.6 to 1.8)	2.0 (0.9 to 3.1)	3.9 (3.3 to 4.5)	4.7 (3.6 to 5.7)	0.20
Headache duration (hours/day)	1.9 (0.4 to 3.4)	2.7 (0.01 to 5.3)	4.9 (3.4 to 6.4)	6.0 (3.3 to 8.7)	0.012
Neck pain intensity (0-10 VAS)	1.6 (1.1 to 2.1)	1.3 (0.5 to 2.2)	4.5 (4.0 to 5.0)	5.5 (4.6 to 6.4)	0.68
Neck pain and disability (%)	8.1 (5.6 to 10.5)	9.6 (5.3 to 13.8)	24.9 (22.5 to27.3)	28.5 (24.1 to 32.9)	0.71

Value are estimated mean (95% confidence interval) after adjust for baseline values and age

Discussion

In older age, primary headaches as migraine become less typical, secondary headaches increase in frequency and neck pain with headache is prevalent (2, 4, 5). We included participants with diagnoses of migraine, tension-type, mixed or cervicogenic headache. Nevertheless, our primary inclusion criteria were the presence of neck pain and CMD for which there is evidence of effectiveness of the physiotherapy interventions used in this study (7, 16). This study demonstrated that a treatment program consisting of cervical mobilization and therapeutic exercise significantly reduced headache frequency in seniors with recurrent headache compared with usual care. Greater improvement also occurred in headache intensity and duration, neck pain intensity and disability, range of motion and quality of life. Participants perceived treatment as beneficial. Additionally, there was a trend for reduction in average daily medication dose in the physiotherapy group. Treatment effects were evident immediately after treatment and were maintained in the long-term. No adverse effects were reported. Taken together, the results indicate that conservative treatment of the neck is a suitable intervention for seniors with recurrent headache associated with neck pain and CMD.

Estimates of effect size were large for most headache symptoms at week 11, and at 6 and 9 months. In clinical terms, treating the neck was approximately twice as effective as usual care in achieving a clinically relevant reduction in headache frequency (>50% reduction) and approximately 60% reported complete relief from headache with neck treatment compared to 28% in the usual care group at the long term follow-up. Notably, two-thirds of seniors were diagnosed with cervicogenic headache, and of the remainder, migraine was diagnosed most commonly (60%). This may reflect our

inclusion criteria of the presence of neck pain and CMD and the purported greater prevalence of cervicogenic headache after the age of 50 (30, 31).

Other studies have also demonstrated effectiveness of cervical mobilization and therapeutic exercise for patients with cervicogenic headache (7, 8). Interestingly, the sub-group analyses revealed that our clinical estimate of magnitude of CMD (lesser or greater) did not impact on the chance of a favorable outcome and notably there was no difference in treatment effects according to headache classification (cervicogenic or non-cervicogenic). We make no general claim that treatment of the neck is efficacious for non-cervicogenic headaches as migraine. Neck pain may be an expression of the centrally sensitized trigemino-cervical nucleus (32) rather than signal a local cervical disorder. Indeed, a systematic review in 2011 concluded that there was no support for the use of spinal manipulations in treatment for migraine (33). Likewise, a recent study investigating the effect on migraine of medication alone or combined with physiotherapy (cervical mobilization and muscle stretching) found marginal but no significant additional benefit of physiotherapy on headache frequency (34).

These findings seem at variance to the results of our study where the diagnosis of migraine in some participants did not mitigate against benefit from the physiotherapy intervention. Interestingly in the previous migraine trial (34), there was no improvement in cervical range of motion. An improvement could be expected with such treatment if any neck pain was related to CMD. Our participants, receiving similar physiotherapy interventions showed improvements in range of movement in excess of the minimal clinically important difference (6.5° in any direction) (25) and achieved clinically meaningful change (≥20%) in the NDI score (35). The difference

in our cohort was that, regardless of headache diagnosis, they were required to have CMD in association with headache and any associated neck pain. The outcomes of our trial would suggest that this CMD played an active role in headache. Our results provide evidence that cervicogenic headache in seniors is responsive to local treatment of the neck. The results also suggest that neck pain associated with CMD could be an additional peripheral source of nociception in primary headache in seniors, which is responsive to local treatment of the neck. The study highlights the importance of offering a pragmatic approach for management of seniors who experience recurrent headache in association with neck pain and CMD.

There are limitations to this trial. Blinding of the treating physiotherapists and participants was not possible. Participant selection was based on classification criteria for migraine, tension-type (11) and cervicogenic headache (12), but diagnostic nerve or joint blocks to confirm cervicogenic headache could not be justified for our cohort of seniors. The subgroup analyses represented a relatively small number of participants and results should be interpreted with some caution, although results were non-significant.

Conclusions

A program of low-velocity cervical mobilization and therapeutic exercise is effective for seniors with recurrent headache when associated with neck pain and CMD, regardless of headache classification. Given the heterogeneity of headache in this age group, concerns about medication overuse and drug interactions, management of any associated painful CMD might contribute positively to a multifactorial headache intervention strategy for this group.

Acknowledgements

This trial was granted by the Thailand Research Fund (TRF)

Conflict of Interest Statement

There is no conflict of interest.

Clinical Implications

- Treatments of cervical mobilization and therapeutic exercise effectively reduced headache frequency for seniors with recurrent headache associated with neck pain and musculoskeletal dysfunction.
- Treatment effects were independent of headache classification, although many seniors were diagnosed with cervicogenic headache.
- Neck pain associated with cervical musculoskeletal dysfunction could be another source of nociceptive pain in primary headaches in seniors as a part of ageing.

References

1. Haan J, Hollander J and Ferrari M. Migraine in the elderly: a review. *Cephalalgia* 2007;27:97-106.
2. Kelman L. Migraine changes with age: IMPACT on migraine classification. *Headache* 2006;46:1161-1171.
3. Ozge A, Uluduz D, Selekler M, et al. Gender differences in older adults with chronic migraine in Turkey. *Geriatr Gerontol Int* 2015;15:652-658.
4. Bigal ME, Liberman JN and Lipton RB. Age-dependent prevalence and clinical features of migraine. *Neurology* 2006;67:246-251.
5. Hershey LA and Bednarczyk EM. Treatment of headache in the elderly. *Curr Treat Options Neurol* 2013;15:56-62.
6. Uthaikhup S, Sterling M and Jull G. Cervical musculoskeletal impairment is common in elders with headache. *Man Ther* 2009;14:636-641.
7. Jull G, Trott P, Potter H, et al. A randomized controlled trial of exercise and manipulative therapy for cervicogenic headache. *Spine* 2002;27:1835-1843.
8. Ylinen J, Nikander R, Nykanen M, et al. Effect of neck exercises on cervicogenic headache: a randomized controlled trial. *J Rehabil Med* 2010;42:344-349.
9. Braunstein D, Donnet A, Pradel V, et al. Triptans use and overuse: A pharmacoepidemiology study from the French health insurance system database covering 4.1 million people. *Cephalalgia* 2015;35:1172-1180.
10. Prencipe M, Casini AR, Ferretri C, et al. Prevalence of headache in an elderly population: attack frequency, disability, and use of medication. *J Neurol Neurosurg Psychiatry* 2001;70:377-381.

11. International Headache Society. The International Classification of Headache Disorders 2nd edition. *Cephalalgia* 2004;24 (Suppl 1):S1-151.
12. Sjaastad O, Fredriksen TA and Pfaffenrath V. Cervicogenic headache: Diagnostic criteria. *Headache* 1998;38:442-445.
13. Jull G, Bogduk N and Marsland A. The accuracy of manual diagnosis for cervical zygapophysial joint pain syndromes. *Med J Aust* 1988;148:233-236.
14. Schneider GM, Jull G, Thomas K, et al. Derivation of a clinical decision guide in the diagnosis of cervical facet joint pain. *Arch Phys Med Rehabil* 2014;95:1695-1701.
15. Jull G, Amiri M, Bullock-Saxton J, et al. Cervical musculoskeletal impairment in frequent intermittent headache. Part 1: subjects with single headaches. *Cephalalgia* 2007;27:793-802.
16. van Ettekoven H and Lucas C. Efficacy of physiotherapy including a craniocervical training programme for tension-type headache; a randomized clinical trial. *Cephalalgia* 2006;26:983-991.
17. Maitland GD, Hengeveld E, Banks K, English K. *Maitland's vertebral manipulation.* 6th ed. Edinburgh, New York: Butterworth-Heinemann, 2005.
18. Jull G, Sterling M, Falla D, Treleaven J, O'Leary S. *Whiplash, headache, and neck pain.* Edinburgh: Churchill Livingstone, 2008.
19. Wegner S, Jull G, O'Leary S, et al. The effect of a scapular postural correction strategy on trapezius activity in patients with neck pain. *Man Ther* 2010;15:562-566.
20. Caneiro JP, O'Sullivan P, Burnett A, et al. The influence of different sitting postures on head/neck posture and muscle activity. *Man Ther* 2010;15:54-60.

21. Tfelt-Hansen P, Pascual J, Ramadan N, et al. Guidelines for controlled trials of drugs in migraine: third edition. A guide for investigators. *Cephalalgia* 2012;32:6-38.

22. Uthaikhup S, Paungmali A and Pirunsan U. Validation of Thai versions of the Neck Disability Index and Neck Pain and Disability Scale in patients with neck pain. *Spine* 2011;36:1415-1421.

23. Vernon H and Mior S. The Neck Disability Index: a study of reliability and validity. *J Manipulative Physiol Ther* 1991;14:409-415.

24. Hall TM, Robinson KW, Fujinawa O, et al. Intertester reliability and diagnostic validity of the cervical flexion-rotation test. *J Manipulative Physiol Ther* 2008;31:293-300.

25. Audette I, Dumas JP, Cote JN, et al. Validity and between-day reliability of the cervical range of motion (CROM) device. *J Orthop Sports Phys Ther* 2010;40:318-323.

26. Lim LL, Seubsman SA and Sleigh A. Thai SF-36 health survey: tests of data quality, scaling assumptions, reliability and validity in healthy men and women. *Health Qual Life Outcomes* 2008;6:52.

27. World Health Organization Collaborating Centre for Drug Statistics and Methodology: *Guidelines for ATC classification and DDD assignment*. Oslo: Norway, 2013.

28. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. New York: Routledge Academic, 1988.

29. Assmann SF, Pocock SJ, Enos LE, et al. Subgroup analysis and other (mis)uses of baseline data in clinical trials. *Lancet* 2000;355:1064-1069.

30. Biondi DM and Saper JR. Geriatric headache: How to make the diagnosis and manage the pain. *Geriatric* 2000;55:40-50.

31. Anthony M. Cervicogenic headache: prevalence and response to local steroid therapy. *Clin Exp Rheumatol* 2000;18 (Suppl 19):S59-64.

32. Bartsch T. Migraine and the neck: new insights from basic data. *Curr Pain Headache Rep* 2005;9:191-196.

33. Posadzki P and Ernst E. Spinal manipulations for the treatment of migraine: a systematic review of randomized clinical trials. *Cephalalgia* 2011;31:964-970.

34. Bevilaqua-Grossi D, Goncalves MC, Carvalho GF, et al. Additional effects of a physical therapy protocol on headache frequency, pressure pain threshold, and improvement perception in patients with migraine and associated neck pain: a randomized clinical trial. *Arch Phys Med Rehabil.* Epub ahead of print 21 Dec 2015. Doi: 10.1016/j.apmr.2015.12.006.

35. Young BA, Walker MJ, Strunce JB, et al. Responsiveness of the Neck Disability Index in patients with mechanical neck disorders. *Spine J* 2009;9:802-808.

Output จากโครงการวิจัยที่ได้รับทุนจาก สกว.

1. ผลงานตีพิมพ์ในวารสารวิชาการนานาชาติ Cephalagia Impact factor = 4.891 (submitted for publication)
2. การนำเสนอผลงาน
   International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT) 2016, 4–8 July, 2016

IFOMPT2016
Advanced assessment/practice and managing complex patients

IFOMPT2016-484
EFFECTIVENESS OF PHYSIOTHERAPY TREATMENT FOR SENIORS WITH FREQUENT INTERMITTENT HEADACHE: A RANDOMIZED CONTROLLED TRIAL

Sureeporn Uthaikhup[* 1], Jenjira Assapun[1], Kanokwan Watcharasaksilp[2], Gwendolen Jull[3]
[1]Physical Therapy, [2]Medicine, Chiang Mai University, Chiang Mai, Thailand, [3]Physiotherapy, Queensland University, Brisbane, Australia

Presentation Preference: Oral
Has the abstract been previously presented?: No

Background: A previous study demonstrated that in seniors, the presence of cervical musculoskeletal impairment was not specific to cervicogenic headache but was present in various frequent intermittent headache types when compared to seniors without headache. Physiotherapy treatment is indicated in those seniors diagnosed with cervicogenic headache but could also be adjunct treatment for those with cervical musculoskeletal signs who are suspected of having transitional headache.

Purpose: To determine the effectiveness of physiotherapy treatment for seniors with frequent intermittent headache as compared to usual care

Methods: This study was a prospective, stratified, randomized controlled trial with blinded outcome assessment (ClinicalTrial.gov NCT01736774). Sixty-five participants with frequent intermittent headache for at least one year, aged 50-75 years were randomly assigned to either a physiotherapy (n =33) or usual care group (n = 32). The primary outcome was headache frequency (headache days per week). The secondary outcomes included headache intensity and duration, neck pain intensity, neck disability, cervical range of motion, quality of life, participant satisfaction, and medication intake. Outcome measures were recorded at baseline, immediately after treatment, at 6- and 9-months following treatment.

Results: There was no loss to follow-up at any time point for the primary outcome. Participants in the physiotherapy group compared to the usual care group reported significant reductions in headache days per week (mean difference -1.55 days, 95% CI -2.49 to -0.63 immediately after treatment, -1.68 days, 95% CI -2.61 to -0.75 at 6-month follow-up, -2.35 days, 95% CI -3.17 to -1.54 at 9-month follow-up) and in all secondary outcomes immediately post-treatment and at the 6- and 9-month follow-ups, ($p < 0.05$ for all). Effect sizes were at least moderate and clinically relevant.

Conclusion: Physiotherapy treatment provided benefits over usual care for seniors with frequent intermittent headache and the benefits were maintained in the long term.

Implications: Headache is a common health problem. Our RCT investigated physiotherapy intervention included low-velocity cervical mobilization techniques

and therapeutic exercise program delivered by physiotherapists for seniors with frequent intermittent headache. Results of this study suggest that the physiotherapy treatments are effective for the management of frequent intermittent headache in seniors and that the effects are maintained in the long term. The study extends knowledge of optimal management of frequent intermittent headache in seniors and also helps to better understand the role of cervical musculoskeletal impairment in seniors' headache.

Funding Acknowledgements: This study was financially supported by the Thailand Research Funding (TRF)

Ethics Approval: Ethical approval was gained from the ethical review committee for research in humans, Faculty of Medicine, Chiang Mai University.

Disclosure of Interest: None Declared

Keywords: Elders, Headache, Physiotherapy