SPINE Volume 27, Number 17, pp 1835–1843

A Randomized Controlled Trial of Exercise and Manipulative Therapy for Cervicogenic Headache

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Study Design. A multicenter, randomized controlled trial with unblinded treatment and blinded outcome assessment was conducted. The treatment period was 6 weeks with follow-up assessment after treatment, then at 3, 6, and 12 months.

Objectives. To determine the effectiveness of manipulative therapy and a low-load exercise program for cervicogenic headache when used alone and in combination, as compared with a control group.

Summary of Background Data. Headaches arising from cervical musculoskeletal disorders are common. Conservative therapies are recommended as the first treatment of choice. Evidence for the effectiveness of manipulative therapy is inconclusive and available only for the short term. There is no evidence for exercise, and no study has investigated the effect of combined therapies for cervicogenic headache.

Methods. In this study, 200 participants who met the diagnostic criteria for cervicogenic headache were randomized into four groups: manipulative therapy group, exercise therapy group, combined therapy group, and a control group. The primary outcome was a change in headache frequency. Other outcomes included changes in headache intensity and duration, the Northwick Park Neck Pain Index, medication intake, and patient satisfaction. Physical outcomes included pain on neck movement, upper cervical joint tenderness, a craniocervical flexion muscle test, and a photographic measure of posture.

Results. There were no differences in headache-related and demographic characteristics between the groups at baseline. The loss to follow-up evaluation was 3.5%. At the 12-month follow-up assessment, both manipulative therapy and specific exercise had significantly reduced headache frequency and intensity, and the neck pain and effects were maintained ($P < 0.05$ for all). The combined therapies was not significantly superior to either therapy alone, but 10% more patients gained relief with the combination. Effect sizes were at least moderate and clinically relevant.

Conclusion. Manipulative therapy and exercise can reduce the symptoms of cervicogenic headache, and the effects are maintained. [Key words: cervical spine, clinical trial, exercise, headache, manipulative therapy] **Spine 2002;27:1835–1843**

Headaches arising from musculoskeletal disorders of the cervical spine, termed cervicogenic headaches,[30,38] are a common form of chronic and recurrent headache.[33,35] Physical therapies are recommended as a first line of management.[36] Authorities in the field, however, are skeptical of the benefits,[4,39] and there is little research to clarify the debate.

In the few controlled trials of conservative management,[16,34] the principal method tested has been manipulative therapy for upper cervical joint arthropathy associated with these headaches.[5,6,10] The systematic reviews of Hurwitz et al[14] and Vernon et al[43] found preliminary evidence to suggest some benefit at short-term follow-up evaluation, but the scarcity and quality of the evidence precluded definitive recommendations about the effectiveness of manipulative therapy. Little attention has been afforded to the muscle system, although muscle impairments are listed as a characteristic of cervicogenic headache[15] and specific deficits in what can be described as muscle control of the region have been identified.[3,17,47] No trial has investigated the combined use of manipulative therapy and exercise for cervicogenic headache, although there is preliminary evidence to suggest that multimodal treatment is superior for neck disorders.[1,7]

This randomized controlled trial assessed the short- and long-term effectiveness of two conservative approaches for cervicogenic headache: manipulative therapy and a new program of specific low-load exercise to

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The research was undertaken and administered from The University of Queensland, Brisbane, Queensland, Australia.

Supported by grants from the National Health and Medical Research Council (NH&MRC grant 971139), the Physiotherapy Research Foundation, the University of Queensland Foundation, the St Vincent's Foundation, and the Centre of National Research on Disability and Rehabilitation Medicine.

Acknowledgment date: August 31, 2001.

First revision date: November 19, 2001.

Acceptance date: February 12, 2002.

Device status/drug statement: The submitted manuscript does not contain information about medical devices or drugs.

Conflict of interest: No funds were received in support of this work. Although one or more of the authors have received or will receive benefits for personal or profession use from a commercial party related directly or indirectly to the subject of this manuscript, benefits will be directed solely to a research fund, foundation, educational institution, or other nonprofit organization with which the authors have been associated. One or more of the authors have received or will receive benefits (*e.g.*, royalties, stocks, stock options, or decision-making position) for personal or professional use from a commercial party related directly or indirectly to the subject of this manuscript.

DOI: 10.1097/01.BRS.0000025471.27251.BA

reeducate muscle control of the cervicoscapular region instead of muscle strengthening. The exercises directly addressed the muscle impairment found in cervicogenic headache patients.[3,17,47] The two therapies also were used in combination in a multimodal approach. The effectiveness of the active treatments was tested against the results for a control group that received no physical therapies.

■ Methods

Design. The study was a prospective, multicenter randomized controlled trial with unblinded treatment and blinded outcome assessment. A 2 × 2 factorial design was chosen, in which the independent variables were manipulative therapy and exercise therapy with two levels, active treatment and no active treatment. A randomized permuted block design was used with stratification for length of headache history (< 2 years, 2 to 5 years, 5 to 10 years) and city of residence. An independent body implemented randomization by telephone contact with each trial center. The inclusion of 200 participants into the study was based on a power of 0.80 to detect a 50% reduction in headache frequency 6 months after treatment with an alpha of 0.05. Ethical clearance was gained from the medical ethics committees of the University of Queensland, other participating universities, and the Royal Australian College of General Practitioners. Written informed consent was provided before participation.

Participants. Participants, ages 18 to 60 years, were recruited either by referral from general practitioners (GPs) or through advertising in five centers located in capital cities in Australia. The inclusion criteria followed those documented by Sjaastad et al[38] for cervicogenic headache, which required unilateral or unilateral dominant side-consistent headache associated with neck pain and aggravated by neck postures or movement, joint tenderness in at least one of the upper three cervical joints as detected by manual palpation,[18,24] and a headache frequency of at least one per week over a period of 2 months to 10 years. Exclusion criteria specified bilateral headaches (typifying tension headache), features suggestive of migraine,[15] any condition that might contraindicate manipulative therapy,[11] involvement in litigation or workers' compensation, and physiotherapy or chiropractic treatment for headache in the previous 12 months.

In response to advertising, participants were screened initially using a sample selection proforma relevant to the inclusion and exclusion criteria. Potentially suitable participants and those referred by GPs were invited to trial centers for further assessment of their eligibility. Those who fulfilled the symptomatic criteria underwent a physical examination of the cervical spine for baseline assessment, which included manual palpation of the upper cervical joints relevant to the inclusion criteria. Independent assessors conducted this examination in each trial center. A preparatory intertherapist reliability study indicated excellent agreement between pairs of assessors in manual joint examination for subject eligibility.[19] The subjects who responded to the advertisements were then screened by their GP, and all the participants had a precautionary lateral radiograph of their cervical spine.

Interventions. The manipulative therapy (MT) intervention followed the regimen described by Maitland et al.[25] This regimen includes the use of both low-velocity cervical joint mobilization techniques (in which the cervical segment is moved passively with rhythmical movements) and high-velocity manipulation techniques in the treatment of cervical joint disorders. The manipulative therapy intervention followed normal clinical practice, in which the choice of initial and subsequent manipulative therapy techniques is at the treating therapist's discretion, based on the initial and progressive assessment of the patient's cervical joint dysfunction. Thus patients could receive a combination of low- and high-velocity techniques as indicated in best clinical practice with the Maitland regimen.

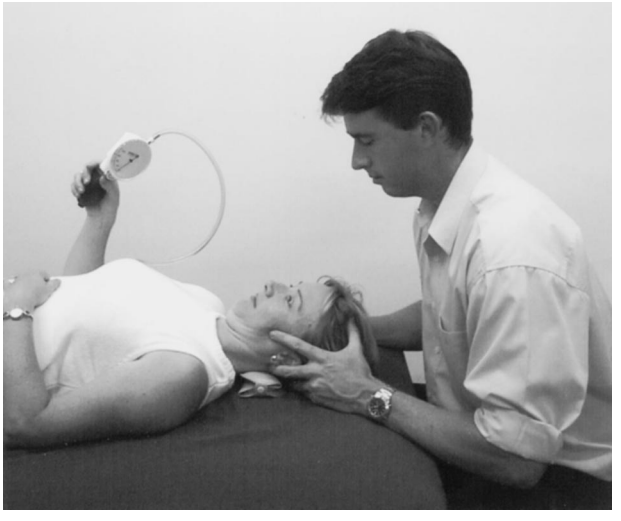

Figure 1. Training the cranio-cervical action with the use of feedback from the pressure biofeedback unit.

The therapeutic exercise (ExT) intervention was a new program. In contrast to strength training, this program used low-load endurance exercises to train muscle control of the cervicoscapular region.[21] The first stage consisted of specific exercises to address the impairment in neck flexor synergy found in cervicogenic headache and other neck pain disorders.[17,20,47] Craniocervical flexion exercises, performed in supine lying, aimed to target the deep neck flexor muscles and the longus capitus and colli, which have an important supporting function for the cervical region.[28] The subjects were first taught to perform a slow and controlled craniocervical flexion action. They then trained to be able to hold progressively increasing ranges of craniocervical flexion using feedback from an air-filled pressure sensor (Stabilizer™, Chattanooga Group Inc., Chattanooga, TN) placed behind the neck (Figure 1). This sensor monitors the slight flattening of the cervical curve that occurs with contraction of the longus colli.[27] The muscles of the scapula, particularly the serratus anterior and lower trapezius, were trained using inner range holding exercises of scapular adduction and retraction, practiced initially in the prone lying position. The participants practiced these two formal exercises twice daily to increase the endurance capacity of the muscles. Training of these neck and scapular muscles also was incorporated into postural correction exercises performed regularly throughout the day in the sitting position. The subjects were trained to sit with a natural lumbar lordosis while gently retracting and adducting their scapulas and gently elongating their cervical spine to facilitate the longus colli.[27] Subsequently, isometric exercises using a low level of rotatory resistance were used to train the cocontraction of the neck flexors and exten-

sors. All the participants received these elements of exercise. They also could be taught muscle lengthening exercises to address any muscle tightness assessed to be present.[3,17]

The third intervention was a combination of manipulative therapy and exercise therapy (MT + ExT) applied on the same day. The control group received no physical therapy interventions. Usual medication was not withheld from any participant regardless of group allocation (control or active treatment), and intake was monitored in daily headache diaries during the 2-week baseline period, the treatment period, and the 2 weeks before each follow-up assessment.

The active treatment, extending over a period of 6 weeks, included a minimum of 8 and a maximum of 12 treatments. Whether the single or combined intervention was delivered, none of the treatment sessions were longer than 30 minutes. Treatment was delivered by 25 experienced physiotherapists across trial centers. The nature of the interventions precluded any blinding of physiotherapists or participants to assigned treatments.

Outcome Measures. A series of headache-associated measures and physical tests of the cervical spine were taken at baseline, in the week immediately after treatment (week 7), then 3, 6, and 12 months after the intervention. The primary outcome measure was a change in headache frequency from baseline to immediately after treatment and at month 12. Changes in headache intensity and duration and in neck pain were secondary outcome measures. Frequency was recorded as the number of headache days in the past week. Average intensity was rated on a VAS, and duration was the average number of hours that headaches lasted in the past week. Neck pain and disability were measured using the Northwick Park Neck Pain Questionnaire.[23] The participant-perceived effect of treatment and relief gained were rated on VASs. Medication intake was monitored. It comprised predominantly over-the-counter medications, mainly analgesics and in some cases antiinflammatory medications, taken only in short and low doses for pain relief. For analysis, medication was converted to a defined daily dose of analgesics using the Anatomic Therapeutic Chemical code.[31]

The tertiary physical assessments included pain with neck movements (VAS). The three movements with the highest pain scores were assessed at follow-up assessment. The pain provoked by manual palpation of the upper cervical joints (VAS) and the two joints exhibiting the highest tenderness scores at baseline were reassessed. These physical assessments also included performance on the craniocervical flexion muscle test[17] and a photographic measure of the craniocervical angle representing the forward postural position of the head, a posture that has been associated with cervicogenic headache.[47]

Several prognostic and evaluative assessments were made for baseline comparisons including a full headache history, an MPQ,[29] and a psychometric evaluation, the Headache-Specific Locus of Control Scale.[26] Treatment records were reviewed for attendance, receipt of the allocated treatment, and any adverse effects. Participants also rated the global perceived effect of treatment and the headache relief obtained (VASs).

Statistical Analysis. Baseline characteristics were compared between treatment groups using χ^2 tests for categorical variables and Kruskal–Wallis tests for continuous variables. For all outcome measures, short-term and long-term treatment effects were assessed using the Wilcoxon rank-sum test, administered immediately after treatment (week 7) and at the 12-month follow-up assessment. This allowed separate comparisons of the three active treatment arms with the control arm. Two-way ANOVAs (two-tailed) were used to investigate both treatment effects simultaneously, taking advantage of the study's factorial design. This allowed the individual effects of MT and ExT to be examined as well as whether there was an additive effect of applying both treatments (MT + ExT) in a multimodal treatment. In cases wherein this interaction was found to be nonsignificant, analyses were repeated after pooling across treatment arms to increase the power of the treatment effect in the tests. Effect sizes were calculated by taking the difference between the mean changes in the primary outcome of headache frequency in the intervention group and those in the control group and dividing it by the standard deviation of the change score in the total population. An effect size of 0.2 was regarded as small, 0.5 as medium, and 0.8 as large.[9] All analyses investigated changes since baseline and were performed on an intention-to-treat principle.[32]

■ Results

Participant flow and retention are summarized in Figure 2. Of the 200 participants who entered the trial, only 3.5% were lost to follow-up assessment. During the 12 months after the treatment period, 24% sought additional or alternate treatment (12% MT + ExT, 19% ExT, 21% MT, 46% control group). Baseline characteristics across the four treatment groups were similar (Table 1). The only exception was the distribution of females across treatment groups, subsequently included as a covariate in the analysis. All but four participants in the MT group and one in the ExT group received the minimum of eight treatments, and half of all the participants received the maximum 12 treatments. No important adverse events with treatment were reported in any group. As a minor and temporary side effect, 6.7% of the headaches experienced by subjects during the 6-week intervention period were reported by subjects in the headache diaries as provoked by treatment.

Mean changes in primary and secondary outcomes of headache frequency, intensity, duration, and the neck pain questionnaire from baseline to each follow-up period are plotted in Figure 3. The changes recorded at week 7 and month 12 are presented in Table 2. The Wilcoxon analyses showed that MT, ExT, and the combined program of MT + ExT all significantly reduced headache frequency and intensity and the neck pain index immediately after treatment, as compared with the control group, and these differences were still evident at month 12 ($P < 0.05$ for all). The exception was headache duration, for which the combined program was effective, but for which the effect of ExT was no greater than in the control group at both the 7-week and 12-month end points. At the 12-month follow-up assessment, MT was not significantly different from the control group in terms of headache duration and neck pain. No pairs of active treatment were significantly different from each other in their effect on outcomes, with the exception of headache duration at 7 weeks and 12 months, with MT + ExT

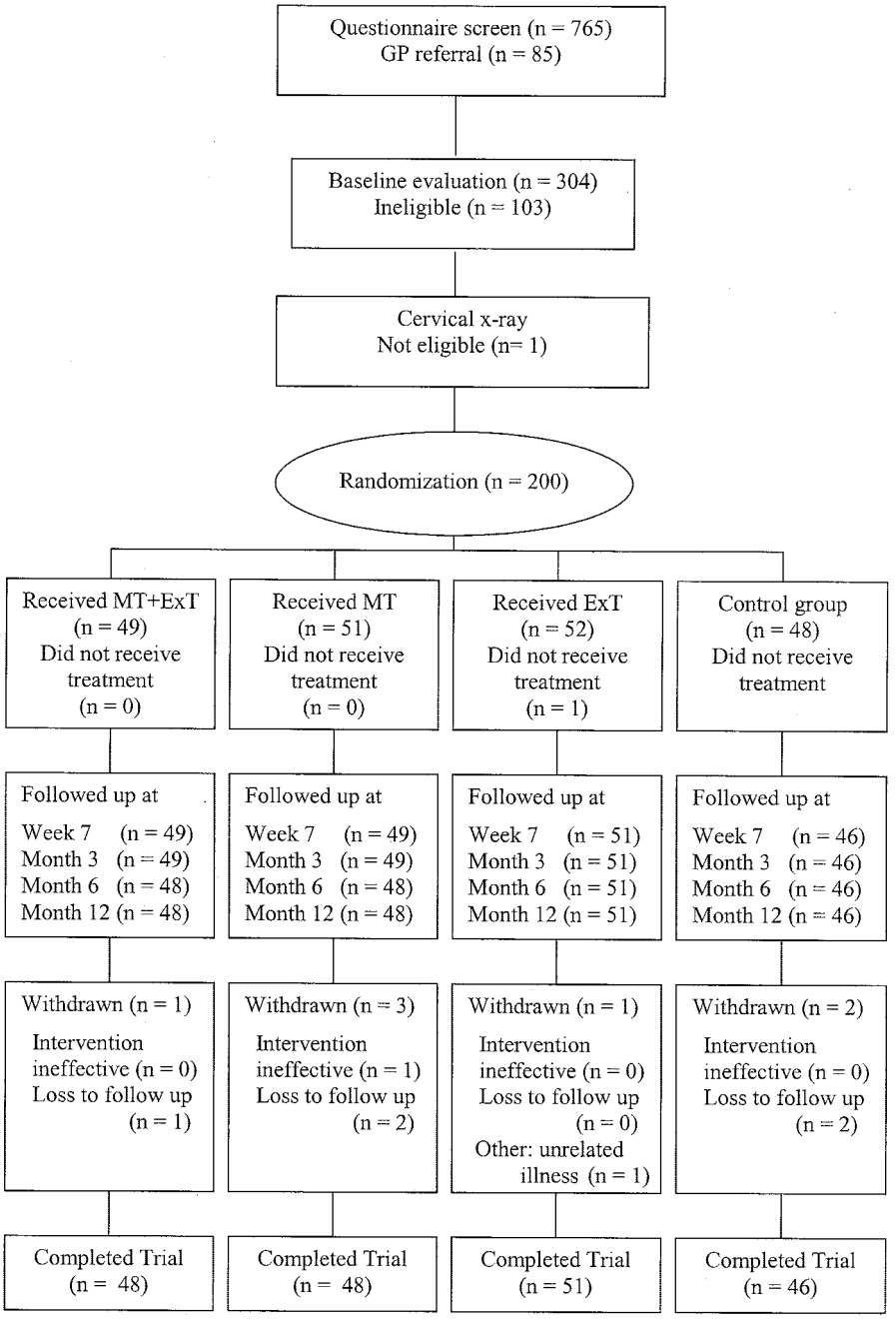

Figure 2. Progression of participants through the trial including withdrawals and losses to follow-up.

found to be superior to ExT alone ($P = 0.008$ and 0.046, respectively).

The two-way ANOVA analyses were consistent with the observation that MT and ExT are significant factors for headache frequency, intensity, and neck pain, but that ExT is not a significant factor for headache duration. For headache frequency and intensity, the analyses showed significant posttreatment interactions between the two active treatments ($P = 0.001$ and $P = 0.04$, respectively), suggesting that MT + ExT did not significantly reduce headache frequency or intensity more than either treatment alone. For headache duration and neck pain, the posttreatment interactions were found to be nonsignificant, indicating no significant departure from the "additive effects" of MT and ExT. For neck pain, there was no evidence to suggest that the combined treatment was better than either treatment alone, whereas for headache duration, the combined treatment was found to be better than ExT. Analyses were repeated using gender as a covariate, and the results remained unchanged.

Calculation of treatment effect sizes indicated at least a medium-size effect of all treatments on all dependent variables, except for the effect of MT and ExT on headache duration (Table 3). The effectiveness of the three interventions also was investigated by examining the number of subjects who responded to treatment (7-week follow-up assessment). In the treatment groups, 76% of the participants gained the benchmark of a 50% or better reduction in headache frequency, and 35% experienced an ideal result, that is complete relief of headache

Table 1. Comparability of Intervention Groups at Baseline in Headache Characteristics, Prognostic Variables, and Outcome Measures*

	Control (n = 48)	MT (n = 51)	ExT (n = 52)	MT+ExT (n = 49)	*P*
Age	36.5 (1.68)	36.8 (1.76)	36.8 (1.72)	36.6 (1.67)	0.99
Gender % female	77.1	62.8	82.7	57.1	0.02
Headache frequency (days per week)	3.5 (0.26)	3.6 (0.25)	3.7 (0.25)	3.3 (0.24)	0.76
Intensity (VAS 0–10)	5.3 (0.25)	4.8 (0.26)	5.4 (0.30)	5.1 (0.25)	0.49
Duration (hours per day)	6.5 (0.64)	5.9 (0.66)	5.3 (0.59)	6.8 (0.73)	0.30
Length of history (years)	6.7 (0.49)	5.4 (0.46)	6.6 (0.50)	5.6 (0.46)	0.17
Onset (insidious, trauma) % trauma	18.8	18.0	19.2	18.4	0.23
Neck pain index (Northwick Park)	30.7 (1.84)	27.5 (1.70)	29.6 (1.58)	29.7 (1.75)	0.61
Medication (DDD) pretreatment 2 weeks	0.245	0.158	0.179	0.164	0.85
HSLC					
Internal	35.4 (1.09)	34.4 (1.25)	35.5 (1.04)	34.7 (1.25)	0.94
Powerful others	25.5 (1.10)	23.5 (1.02)	23.3 (0.89)	27.3 (1.24)	0.09
Chance	30.6 (1.14)	29.3 (1.28)	29.4 (1.29)	31.9 (1.39)	0.28
MPQ	26.2 (1.97)	20.5 (1.21)	21.0 (1.24)	21.0 (1.48)	0.12
Cervical movement (pain score, VAS)	3.7 (0.19)	4.1 (0.17)	4.0 (0.17)	3.9 (0.21)	0.37
Joint pain on manual palpation (VAS)	6.4 (0.27)	6.8 (0.25)	6.7 (0.22)	7.3 (0.20)	0.08
CCF muscle test (pressure score mm Hg)	3.9 (0.28)	4.1 (0.31)	3.7 (0.29)	4.0 (0.30)	0.84
Posture (craniocervical angle, degrees)	47.0 (0.85)	47.8 (0.73)	49.7 (0.68)	48.0 (0.82)	1.00

* Data are expressed in frequencies or means (SEM).
MT = manipulative therapy; ExT = therapeutic exercise; VAS = visual analog scale; DDD = Defined daily dose; HSLC = Headache specific locus of control; MPQ = McGill pain questionnaire; CCF = Craniocervical flexion.

(Table 4). Although the responses to treatments were similar, there was up to a 10% better chance of achieving a good or excellent outcome with the combined therapies (MT + ExT).

The median medication intake, comparing baseline and the 12-month follow-up assessment, decreased by 93% in the MT + ExT group, and by 100% in the MT and ExT groups, but increased by 33% in the control group. Wilcoxon analyses at month 12 showed the active therapy groups to be significantly different from the control group regarding medication intake ($P < 0.015$ for all), but not different from each other ($P > 0.65$). These results were confirmed after stratification by the baseline medication intake.

Mean changes in the physical assessments from baseline to each follow-up assessment are presented in Table 5. The results of analyses (Wilcoxen) showed that the changes in pain with neck movements after treatment were significantly different from the control condition for all three interventions ($P < 0.05$ for all), but with the improvement in the control group at the 12-month end point, only the responses of the ExT group maintained significance. The results of the two-way ANOVAs provided no evidence of an additive effect with the combined therapies. Pain on palpation of the most symptomatic joint was significantly reduced in each treatment group immediately after treatment ($P < 0.05$ for all), but at month 12, the reduction in pain for the ExT group, as compared with the control group, just failed to reach significance ($P = 0.084$). The results of the two-way ANOVA provided some evidence that MT + ExT was more beneficial initially in reducing pain produced on joint palpation than either therapy alone, but there was no indication that the additive effect of MT + ExT was maintained at month 12. The results for the second ranked symptomatic joint were similar. Analysis of performance in the craniocervical flexion muscle test showed that the treatments inclusive of exercise (MT + ExT and ExT) were both significantly different from those without exercise (MT and control) at week 7 and at month 12 ($P < 0.001$ for all). There was no change in the photographic measure of forward head postural angle in any group over the trial period.

■ Discussion

This trial provided evidence that manipulative therapy and a specific therapeutic exercise regimen were effective for cervicogenic headache, although there was no statistical evidence of an additive effect when the two therapies were used simultaneously. Beneficial effects were found for headache frequency and intensity as well as neck pain and disability for both therapeutic methods used alone and in combination. For headache duration, exercise used alone did not have a significant effect, and manipulative therapy used alone was not different from the control condition at month 12. Medication intake was reduced in all the active treatment groups. This trial also provided evidence, not available for many of the trials of physical therapies,[1,12,22] that treatment effect was maintained in the long term over the 12-month period.

The calculated effect size showed at least moderate effect sizes for most headache symptoms. The effect size of the active treatments is possibly an underestimate. The data were analyzed with an intention-to-treat analysis, although 46% of the control group received active interventions for their headache within the trial period. Additional treatment was sought by 19% of participants in the treatment groups. A 50% reduction in headache frequency is regarded as a clinically relevant result by the IHS.[42] In the current study, 72% of the participants in

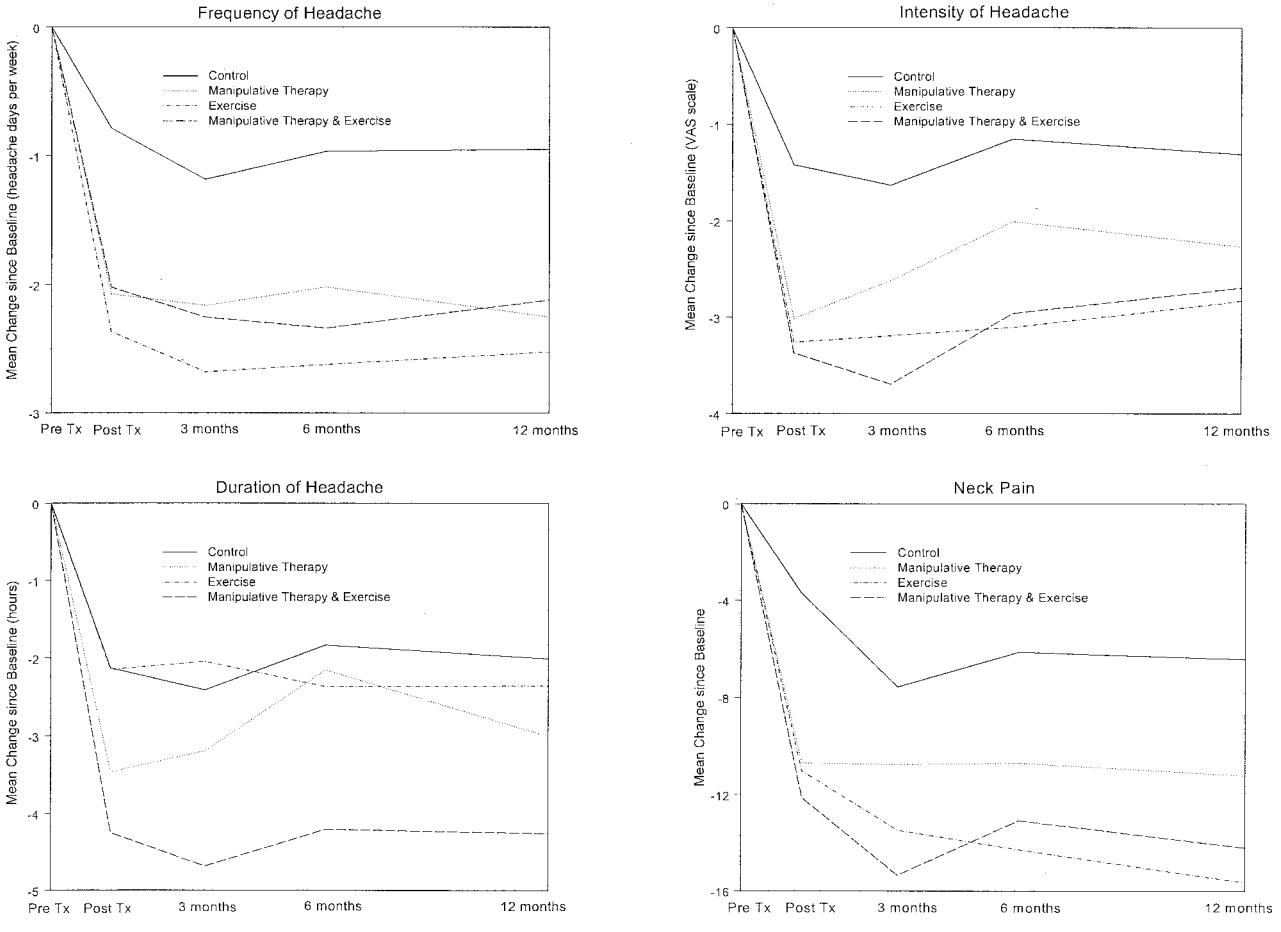

Figure 3. The mean change in headache frequency, intensity, duration, and neck pain index from baseline to each of the follow-up periods for each treatment group.

the active treatment groups had achieved a reduction of 50% or more in headache frequency at the 12-month follow-up assessment, with 42% reporting 80% to 100% relief at this time, indicating that the results were clinically relevant.

The effects of the treatments on physical outcomes also were monitored. All the treatments significantly reduced the pain associated with neck movement and joint palpation, but none changed the measure of forward head postural position. Manipulative therapy used alone failed to improve performance in the muscle test of craniocervical flexion, indicating that there was no spontaneous return of this muscle function without the use of exercise, despite the relief of pain with this treatment.

Table 2. Mean Changes (SEM) From Baseline for Each Outcome by Treatment Group*

	Control†	MT	ExT	MT+ExT
Changes to week 7				
Frequency	0.79 (0.25)	2.07 (0.29)‡	2.37 (0.21)‡	2.02 (0.24)‡
Intensity	1.43 (0.30)	3.01 (0.32)‡	3.26 (0.38)‡	3.37 (0.39)‡
Duration	2.13 (0.55)	3.46 (0.56)§	2.15 (0.50)	4.25 (0.63)‡
Neck pain	3.72 (1.44)	10.69 (1.79)‖	11.03 (2.16)‡	12.13 (1.80)‡
Changes to 12 months				
Frequency	0.95 (0.23)	2.25 (0.28)‖	2.52 (0.24)‡	2.12 (0.23)‡
Intensity	1.32 (0.36)	2.27 (0.38)§	2.83 (0.37)‖	2.69 (0.32)‖
Duration	2.01 (0.65)	3.01 (0.70)	2.36 (0.65)	4.26 (0.67)§
Neck pain	6.44 (1.68)	11.21 (1.88)	15.66 (2.01)‡	14.21 (1.82)‖

* *P* values for tests of treatment effect comparative to those of the control group are based on the Wilcoxon rank sum test.
† No *P* values as tests are comparative with those of the control group.
‡ $P < 0.001$
§ $P < 0.05$
‖ $P < 0.01$
MT = manipulative therapy; ExT = therapeutic exercise.

Table 3. Posttreatment Effect Sizes Based on Changes to Week 7

	Frequency	Intensity	Duration	Neck Pain
MT	0.71	0.62	0.33	0.53
ExT	0.87	0.72	0.00	0.56
MT+ExT	0.68	0.76	0.53	0.64

MT = manipulative therapy; ExT = therapeutic exercise.

Table 4. Proportion of Subjects Gaining a 50% and 100% Reduction in Headache Frequency Immediately After Treatment (Week 7)

Treatment Group	50% Reduction	100% Reduction
MT+ExT	0.81	0.42
MT	0.71	0.33
ExT	0.76	0.31
Control	0.29	0.04

MT = manipulative therapy; ExT = therapeutic exercise.

The new specific low-load therapeutic exercise emphasized motor control rather than muscle strength. It was equally as effective as manipulative therapy in improving physical outcomes (including performance in the craniocervical muscle test) and relieving neck pain and headache.

It is interesting to understand mechanisms of treatment effect, although they were not addressed directly in this study. The findings in this trial that the two different treatment methods achieved similar outcomes suggest that both manipulative therapy and low-load exercise produce similar responses in the pain system. Both treatment methods are likely to induce quite local afferent input into the system to modulate pain perception. There is research to suggest that the afferent input induced by manipulative therapy procedures may stimulate neural inhibitory systems at various levels in the spinal cord,[2,8] and may also activate descending inhibitory pathways from, for example, the lateral periaqueductal gray area of the midbrain.[44,45,48,49] Furthermore, Thabe[41] measured a reduction in electrical activity in the small suboccipital extensors that overlie C1–C2 in response to joint mobilization and high-velocity manipulation, a response that also could be achieved through reciprocal relaxation with exercise of the deep neck flexors. In this study, a reduction in palpable tenderness over the upper cervical joints was demonstrated in the exercise group. Although answers cannot be provided from this trial, the results do point to the need for researching multimechanisms to explain the pain relief gained by these physical treatments.

There are concerns about the small yet substantial risks associated with cervical manipulation such as stroke or death.[37] No important adverse events were reported in this study, although two of the intervention groups received manipulative therapy management. Nevertheless, this trial demonstrated that if there are concerns about the use of manipulative therapy for some patients with cervicogenic headache, such patients can be treated successfully using only the specific, low-load exercise program, for which there are no known risks.

It was surprising that the combined treatment of manipulative therapy and exercise did not produce a significantly better effect than the single therapies across all outcomes given the preliminary evidence of a better effect from combined treatments.[1,7] Nevertheless, there was a 10% better response for the participants who received the combined therapy, which is clinically relevant (Table 4). Additionally, if the patient-centered and physical outcomes are viewed collectively (Figure 3; Tables 2 and 5), overlap is observed in the effects of the three treatments, but it is apparent that particular treatments could have a better effect on one outcome than another. Although statistical differences were not gained for all outcomes, there were trends to suggest that treatments inclusive of exercise produced better outcomes over the long term than manipulative therapy used alone. Thus it could be argued that manipulative therapy and exercise should be used in combination for the management of the cervicogenic headache patient to ensure that an optimal effect is gained across all outcomes over the long term.

Table 5. Mean Changes From Baseline for Each Outcome by Treatment Group*

	Control†	MT	ExT	MT+ExT
Changes to week 7				
Pain on neck movement	1.20	2.23‡	2.55‡	2.40§
Pain on joint palpation	1.49	2.99‡	3.25‡	3.97‖
Craniocervical flexion test (mm Hg)	−0.03	−0.04	3.13‖	2.83‖
Changes to 12 months				
Pain on neck movement	2.09	2.33	2.95§	2.58
Pain on joint palpation	2.68	3.73	3.74§	3.56§
Craniocervical flexion test (mm Hg)	0.47	0.76	2.96‖	2.55‡

* *P* values for tests of treatment effect comparative to those of the control group are based on the Wilcoxon rank sum test.
† No *P* values as tests are comparative with those of the control group.
‡ $P < 0.01$
§ $P < 0.05$
‖ $P < 0.001$
MT = manipulative therapy; ExT = therapeutic exercise.

Despite advocacy for conservative management for cervicogenic headache,[36] some believe that physiotherapy interventions are time limited and suitable only for cases with minor symptoms.[39] The results of this trial challenge these beliefs. Headache relief was maintained over the 12-month follow-up period. The length of headache history was not a determinant of treatment effectiveness, and headache symptoms were chronic in nature (average, 6.1 years) and of moderate intensity (5.2/10).

Trials of conservative therapies for cervical spine disorders have been criticized for poor methodologic quality,[1,13,14,22] which we tried to avoid. Subject selection was based on validated criteria for cervicogenic headache;[40,46] randomization was by an independent body; and evaluation was performed by blinded assessors. The statistical power was adequate to detect the expected effects, and the loss to follow-up evaluation was low (3.5%). The nature of the intervention precluded the placement of any blind condition on participants or therapists. Some participants, particularly in the control group, sought additional treatment, but use of the intention-to-treat analysis more likely underestimated than overestimated the effect of the active interventions.

■ Conclusions

This study showed that the conservative treatments of manipulative therapy and a specific exercise program are effective for the management of cervicogenic headache, and that the effects are maintained in the long term. Although there was not statistical evidence of an additive effect from the treatments, there were some differing effects of the interventions on some outcomes, and 10% more participants receiving the combined therapy obtained good and excellent outcomes. This would support the use of combined manipulative therapy and exercise in the management of cervicogenic headache.

■ Key Points

- A randomized controlled trial of 200 patients with cervicogenic headache tested the effectiveness of manipulative therapy and a new low-load exercise program emphasizing muscle control rather than strength. Interventions were used alone and in combination.
- The intervention period was 6 weeks, and patients were followed up over 1 year.
- Significantly, all three treatments were equally effective in reducing the symptoms of headache and neck pain, and these effects were maintained over the 12-month period.
- Some differing effects of the interventions on both patient-centered and physical outcomes support a recommendation for the use of combined therapies.
- The headaches in this population were chronic and of moderate intensity.

Acknowledgments

The authors are indebted to Professor Nikolai Bogduk, medical advisor to the trial; the administrators of the trial centers; the participating physiotherapists and participants; and the NHMRC Clinical Trials Center for administering the randomization process.

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Point of View

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The authors have conducted a solid multicenter trial of treatment for cervicogenic headache. By carefully crafting their experimental methods, they have avoided a number of methodologic pitfalls to which earlier works succumbed. By the nature of physical treatments, this study remains open to question whether the absence of blinding for either the treating providers or the patients meaningfully influences the outcome of the trial. This is a problem similar to that faced by trials of surgical intervention, and it is not likely to be resolved under modern ethical research practices.

The results support the use of physical treatments (manipulation of the upper cervical spine or endurance training for cervicoscapular muscle complex) for patients with head pain patterns consistent with cervicogenic headache. Apparent changes in mean outcomes across several variables favored an argument that combining exercise with manipulation would be clinically beneficial although not statistically significant in view of the predetermined 50% improvement effect of this trial. Clearly, enough people improved with strong effect sizes by each therapy to warrant posing both as treatment options. Does it suggest something else?

Does the fact that two groups of patients respond to two different treatments mean that both methods have a common pathway? Are there features differentiating those who respond to one treatment from those who respond to the other? Do patients who fail therapy represent an error in diagnosis or a separate subgroup requiring, as yet, different treatment? This study adds to the pool of evidence suggesting that physical treatments can be useful for cervical headache. Similarly, it poses intriguing questions about the nature of pain production.