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An investigation of the effects of cervical traction. Part 1: Clinical effectiveness.

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Cervical traction is one of the most common methods of treating neck and arm pain, but its effects are poorly understood. This study tested the hypothesis, firstly, that mechanical traction is effective in relieving clinical symptoms and, as a secondary part of a study described elsewhere,[1] that the mechanism may be a reduction in muscle tension. One hundred patients with neck and arm pain were randomly allocated to one of two treatment groups: (1) weighted cervical traction (6–15lbs) applied according to a technique commonly used by physiotherapists; (2) placebo traction, applied in exactly the same way, but producing a force of not more than 1lb on the head. Both groups were given neck-care education. The weighted traction group tended to improve slightly more than the placebo group on measures of pain, sleep disturbance, social dysfunction, ADL and range of movement at the neck. No significant post-treatment differences were found between the two treatment groups except on flexion and right-side flexion.

Introduction

Cervical traction as a form of outpatient physiotherapy is widely recommended for the relief of neck and arm pain.[2–5] Many different methods of application are described, including forms of mechanical and manual traction, both of which can be either intermittent or sustained,[6] and the choice of method seems to be directed by individual preference and clinical experience in this area. Grieve[3], for example, advocates the use of the minimum poundage and duration necessary to achieve results, whilst Cyriax[5] refers to an estimated manual pull of up to 300 pounds for reducing a cervical disc.

The effects of traction on the joints and soft tissue are poorly understood, but it has been postulated that pain relief may be achieved by removing the pressure on the nerve root by enlargement of the intervertebral foramen, separation of facet joints and stretching of soft tissues.[4,7,8] Several studies have attempted to substantiate this theory by manipulating variables such as the angle of pull and poundage applied in order to compare the amount of joint separation obtained.[9–12] Another theory is that cervical traction relieves pain by facilitating relaxation of the neck musculature, and several

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mechanisms for this effect have been postulated.[6,7,13,14]

The only previous attempt to evaluate the clinical effectiveness of traction was a complex nine-centre trial conducted by the British Association of Physical Medicine in 1966.[15] This concluded that cervical traction was indicated only when severe symptoms could not be relieved in a simpler way, such as by means of postural advice, lying supine in a position of maximum comfort or by the use of a soft collar. This was an interesting and valuable study of traction and other physiotherapy techniques, but the conclusions that can be drawn are limited as the procedures were not standardized.

The purpose of this present study was to investigate the effects of cervical traction. In order that the method evaluated should be representative of current clinical practice, a small informal survey was conducted by one of the authors (JM) amongst 12 recently qualified physiotherapists, each representing a different school of physiotherapy in the UK. This suggested that most physiotherapists are taught to apply a relatively small poundage of 6–12 pounds, and very occasionally as much as 15 pounds. It is well accepted by the clinician and supported by extensive research findings that psychological factors such as stress and anxiety play an important role in complaints of neck and arm pain. Anxiety may determine both placebo and active response.[16]

The study described below focused on one of the most common methods of applying cervical traction (according to clinical and teaching experience as well as the survey) and aimed to establish whether:

1) Traction is more effective than placebo traction in reducing pain in the neck and arm, stiffness, and functional disability.
2) Anxiety effects the outcome of treatment.

Method

Design

This was a randomized, double-blind controlled trial, neither the patient nor the assessor being aware of the treatment allocation for the duration of the study. One hundred patients were allocated to group A (weighted traction) or group B (placebo traction). All patients attended 12 sessions over a four-week period (attending regularly on a Monday, Wednesday and Friday) unless they were symptom-free before the end of this time, and patients also attended a 'neck school' (one session of one hour) to receive neck-care education. Measures of pain, mobility and psychological function were administered before, immediately after treatment and at a three-month follow-up session. The use of a collar and drug intake was not modified if already prescribed, but instead was carefully monitored for subsequent analysis if appropriate.

Patients

One hundred patients with neck and arm pain referred from outpatient clinics at the Nuffield Orthopaedic Centre were included in the study. They were selected for inclusion if symptoms in the arm were considered clinically indicative of a radiculopathy or brachialgia stemming from the neck. Most patients were diagnosed as having cervical spondylosis. Six patients were considered as dropouts, having failed to complete the course of treatment (four in the weighted traction group) and/or failed to attend for both the second or third assessments. Table 1 shows baseline data analysis of the remaining 94 patients (36 men, 58 women). This sample had a mean age of 49.3 years (SD 10.2 years). Patients were excluded if they had:

1) a history of neck and arm pain of less than three months;
2) shoulder movement limited by 25% or more on the affected side (which might require additional physiotherapy);
3) received any physiotherapy for the same problem in the last six months;
4) previously had unsuccessful cervical traction;
5) a systemic or other condition for which traction would normally be contraindicated, e.g. vertebral artery insufficiency, severe spinal osteoporosis etc.

Consent to take part in the study was obtained from patients prior to examination and assessment.

Table 1 Comparison between the two groups of baseline data on initial assessment

Variable	Weighted traction		Placebo traction	
	n	Mean (SD)	*n*	Mean (SD)
Age (years)	44	49.32 (10.23)	50	49.50 (9.56)
Duration of symptoms (weeks)	44	33.98 (27.64)	50	31.84 (19.07)
Chronicity (years)	43	5.67 (5.89)	49	2.89 (3.32)
State anxiety scores (range = 20–80)	44	35.61 (10.33)	50	41.00 (13.65)
Trait anxiety scores (range = 20–80)	44	39.95 (11.52)	50	42.30 (11.90)
GHQ (range = 0–36)	43	13.72 (4.55)	48	15.08 (5.38)
VAS measures				
Pain scores (0–10)	44	5.00 (2.36)	50	4.58 (2.09)
Sleep disturbance (0–10)	44	3.61 (2.54)	50	3.70 (2.94)
Social dysfunction (0–10)	44	4.36 (3.08)	50	4.26 (2.83)
ADL (0–10)	43	5.70 (2.39)	50	5.56 (2.58)

Instrumentation and questionnaires

1) A simple inclinometer was used to measure neck movements.[17] Flexion, extension, left and right-side flexion were measured with the patient sitting upright, and left and right rotation in the supine position.
2) Self-report visual analogue scales (0–10) were used to rate: (i) pain intensity, (ii) sleep disturbance, (iii) social dysfunction and (iv) one individually chosen activity of daily living (ADL).

In each case patients were asked to provide an estimate averaged over the past 2–3 days.

3) The General Health Questionnaire (GHQ) (12-item version) which measures disturbances in normal psychological function.[18]
4) The State-Trait Anxiety Inventory (STAI)[19] which consists of two questionnaires measuring current anxiety and a generalized tendency to anxiety respectively.

Testing of upper limb muscle power and biceps/triceps reflexes were also recorded, but were not considered reliable enough to be included in the analysis.

Procedure

Group A: Traction

Sustained cervical traction was applied by means of a halter, aiming to give equal pull on the chin and the occiput using a simple rope and pulley system to which weights could be added. The patient's head was positioned in slight flexion on two pillows (approximately 25 degrees angle of pull). Patients were told that they would feel a gentle pull on their head and neck when the traction was applied, and that it was important that they should try and relax as much as possible. They were asked if they felt they were getting an even pull on the chin and occiput and also asked if they were comfortable or had any pain. In two cases only, patients chose to alter the position slightly. A weight of between six and 15 pounds was applied, based on the individual patient's bodyweight in stones. This figure minus one was used to determine the poundage. Thus, a 10-stone patient would receive a definitive pull of nine pounds by the second visit, but would receive only seven pounds on the first occasion to allow the neck to get used to the pull. On monitoring the symptoms it was found that two larger people (who according to this formula should ultimately have had 15 pounds or more applied) did not tolerate a weight of this size, complaining of a subsequent headache, and the weight was therefore reduced.

Group B: Placebo traction

Exactly the same procedure applied to Group B as Group A, except that only two pounds were applied to the rope and pulley system to take up the slack of the rope and mimic traction. With all the forces taken into account in no case was more than one pound acting on the neck.

Patients in both groups were not aware of the poundage being applied, and it was previously ascertained in a small exploratory study that it

is difficult for people to estimate whether they have had two or eight pounds applied.

Results

Table 1 displays the means and standard deviations of the baseline data on entry to the study (n=94). Independent t-tests showed no significant difference between the two groups on any of the variables except the chronicity. In spite of random allocation to the two groups, the weighted traction group had a significantly longer mean duration of symptoms of 5.7 years compared to the placebo group with 2.9 years (t=2.73, df=63.3, p<0.01).

Of the 94 patients represented in Table 1, 10 patients failed to attend either the second or third assessment and could not therefore be included in further analysis. For two of the variables, social dysfunction (n=82) and ADL (n=77), a few patients were not able to supply appropriate and complete data. Table 2 shows the mean (and SD) reported pain, sleep disturbance, social dysfunction and ADL scores for the two groups, all of which appear to decrease slightly over time. This impression was confirmed by analysis of variance with repeated measures over time, which was used to compare improvement in scores (visual analogue scales) before and at follow-up three months later for pain (F=21.19, df=2,164, p<0.01), sleep disturbance (F=23.58, df=2,164, p<0.01), social dysfunction (F=20.73, df=2,160, p<0.01) and ADL (F=42.62, df=2,150, p<0.01). None of the between groups main effects yielded significant F ratios on any of these variables. Table 2 suggests that improvement in clinical measures was generally greater in the traction group; however, none of the group x-time interaction effects approached significance.

Since there was a high correlation between all the outcome variables, a multivariate analysis of variance was carried out to compare the effects of the two treatment groups on the combination of all these variables over time. The results were not significant for the group effect (F=0.23, df=4,70, NS) or for group x-time interaction (F=1.24, df=8,66, NS); however, the effect of time was significant (F=12.0, df=8,66, p<0.01).

The results of an analysis of variance for all the cervical movements comparing the effects of traction and placebo traction over time are shown in Tables 3 and 4. For the 80 patients who had complete data for these variables on all three occasions, there were no statistically significant differences for the group or time main effects. Analysis of the flexion and right-side flexion data yielded a significant group x-time interaction effect in favour of the weighted traction. In addition, Table 3 shows that in all cases the range of movement tended to increase slightly more in the weighted traction group; in the placebo group the mean movement decreased for flexion and right-side flexion over time.

Stepwise multiple regression was also carried out to see if any of the variables such as drug intake, use of a collar or the response to the psychological questionnaires were associated with any of the clinical outcome measures specifically or in combination. Only state anxiety scores were selected as a predictor of pain reduction, but this accounted for just 6.5% of the variation. This

Table 2 Comparison between the two groups on mean reported pain, sleep, disturbance, social dysfunction and ADL on visual analogue scales (0–10)

Outcome variable	Group	No. of cases	Before Mean (SD)	After Mean (SD)	Follow-up Mean (SD)
Pain scores	Weighted	41	5.10 (2.32)	3.17 (2.44)	2.78 (2.34)
	Placebo	43	4.60 (2.06)	3.67 (2.65)	3.19 (2.77)
Sleep disturbance	Weighted	41	3.68 (2.60)	1.70 (2.10)	2.10 (2.49)
	Placebo	43	3.77 (2.91)	2.44 (2.63)	1.86 (2.51)
Social dysfunction	Weighted	41	4.42 (3.09)	2.73 (2.90)	2.34 (2.75)
	Placebo	41	4.27 (2.78)	3.24 (2.95)	1.93 (2.25)
ADL	Weighted	35	5.86 (2.25)	3.09 (2.65)	2.80 (2.72)
	Placebo	42	5.74 (2.54)	3.60 (2.54)	3.93 (2.98)

relationship was confirmed by Pearson's product moment correlations of pain reduction with state trait anxiety scores, which were negatively and significantly correlated ($r=0.180$, $p=0.044$ and $r=-0.177$, $p=0.047$ respectively).

Discussion

Cervical Traction is still frequently used by physiotherapists and recommended by orthopaedic surgeons and rheumatologists, despite the questions raised 20 years ago in the multicentre study conducted by the British Association of Physical Medicine.[15] The present

Table 3 Comparison between the two groups on mean range of motion of the cervical spine

Movement	Group	No. of cases	Before Mean (SD)	After Mean (SD)	Follow-up Mean (SD)
Flexion	Weighted	42	44.73 (12.96)	48.17 (12.57)	47.83 (14.13)
	Placebo	38	49.11 (13.02)	47.03 (10.07)	46.21 (12.76)
Extension	Weighted	42	52.05 (14.21)	53.86 (11.54)	54.87 (13.56)
	Placebo	38	48.53 (14.00)	50.74 (13.25)	50.97 (14.99)
Left-side flexion	Weighted	42	33.76 (7.88)	36.71 (11.42)	37.10 (11.93)
	Placebo	38	32.79 (8.88)	33.63 (10.79)	32.61 (10.67)
Right-side flexion	Weighted	42	34.52 (9.21)	36.76 (12.67)	36.24 (12.62)
	Placebo	38	37.61 (9.09)	36.89 (9.12)	33.55 (10.66)
Left rotation	Weighted	42	58.52 (12.88)	60.79 (11.20)	61.83 (11.49)
	Placebo	38	57.39 (11.70)	58.40 (13.16)	58.79 (14.48)
Right rotation	Weighted	42	56.14 (12.46)	59.50 (15.97)	60.79 (14.75)
	Placebo	38	59.89 (13.04)	60.29 (12.74)	60.08 (15.44)

Table 4 Results of analysis of variance with repeated measures over time of cervical range of movement comparing the two groups pre- and post-treatment and at follow-up

Movement			*F*	*df*	*p*
Flexion	Main effects	Group	0.05	1,78	NS
		Time	0.19	2,156	NS
	Interaction	Group *x*-time	3.94	2,156	0.02
Extension	Main effects	Group	1.74	1,78	NS
		Time	1.80	2,156	NS
	Interaction	Group *x*-time	0.02	2,156	NS
Left-side flexion	Main effects	Group	1.96	1,78	NS
		Time	2.21	2,156	NS
	Interaction	Group *x*-time	1,68	2,156	NS
Right-side flexion	Main effects	Group	0.01	1,78	NS
		Time	2.02	2,156	NS
	Interaction	Group *x*-time	4.48	2,156	0.01
Left rotation	Main effects	Group	0.59	1,78	NS
		Time	2.79	2,156	NS
	Interaction	Group *x*-time	0.14	2,156	NS
Right rotation	Main effects	Group	0.21	1,78	NS
		Time	1.97	2,156	NS
	Interaction	Group *x*-time	1.58	2,156	NS

smaller controlled study looked at the effects of simple mechanical traction on clinical symptoms such as pain reports, sleep disturbance and range of movement (ROM).

According to our results, weighted traction tended to produce a greater range of cervical motion compared with the placebo. Possibly it helped to stretch out soft tissue contractures and allow a little more movement to take place. Whilst statistically significant differences were found, it is questionable whether they were of clinical significance. In a previously reported study the reliability of the method of measurement using a simple inclinometer was studied in a series of normal subjects without neck pain and it was concluded that differences of less than 10 or 15 degrees of change should not be taken as a measure of progress.[17] It could be argued that more treatment might produce a bigger difference in the range of motion.

In spite of the chronicity of the problem, patients in both the treatment groups reported significant clinical improvements on all measures at three months. Post-treatment scores for the clinical symptoms appeared to show slightly more improvement for the weighted traction than for the placebo traction; however, there was no significant difference between the groups except on the ROM. It was considered that the apparent failure of weighted traction to produce a markedly better effect than placebo traction could be due to the greater chronicity of the former group, although this interpretation is considered unlikely since, according to the results of the multiple regression analysis, chronicity was not a predictor of outcome.

These findings are consistent with those of Brewerton who found that 75% of patients with neck and arm pain improved after treatment at four weeks whether they received traction, were positioned comfortably, given a collar, had heat or took aspirin. Since these patients will probably get better with time regardless of treatment,[15,20] future studies should include no-treatment control groups in order to assess the effects of repeated testing and the passage of time alone.

An association between lower levels of anxiety and a better chance of pain reduction were found in this study, lending some support to the hypothesis that anxiety effects the outcome of treatment. Whether weighted or placebo traction were applied did not appear to be a significant factor.

Attendance at the 'neck school', a one-hour session of neck care education, was included as a component of treatment in both groups in this study and aimed to increase postural awareness and give ergonomic counselling. This may have been an important factor in increasing the rate of recovery. Further work is needed in this area to investigate its effectiveness and compare it to a no-treatment control group.

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