# Active Treatment of Chronic Neck Pain

## A Prospective Randomized Intervention

Simo Taimela, MD, DMSc,*† Esa-Pekka Takala, MD, DMSc,‡ Tom Asklöf, MD,*
Kitty Seppälä, PT,* and Sirkka Parviainen, RN*

**Study Design.** A randomized comparative study with single-blind outcome assessments.

**Objectives.** To compare the efficacy of a multimodal treatment emphasizing proprioceptive training (ACTIVE) with activated home exercises (HOME) and recommendation of exercise (CONTROL) in patients with nonspecific chronic neck pain.

**Summary of Background Data.** The efficacy of active exercises and passive physiotherapy for neck trouble has been somewhat disappointing in the previous few studies.

**Methods.** Seventy-six patients (22 men, 54 women) with chronic, nonspecific neck pain participated. Sixty-two participated the 1-year follow-up. Subjective pain and disability, cervical ranges of motion, and pressure pain threshold in the shoulder region were measured at baseline, at 3 months, and at 12 months. The ACTIVE treatment consisted of 24 sessions of proprioceptive exercises, relaxation, and behavioral support. The HOME regimen included a neck lecture and two sessions of practical training for home exercises and instructions for maintaining a diary of progress. The CONTROL treatment included a lecture regarding care of the neck with a recommendation to exercise.

**Results.** The average self-experienced total benefit was highest in the ACTIVE group, and the HOME group rated over the CONTROL group ($P < 0.001$). Differences between the groups in favor of the ACTIVE treatment were recorded in reduction of neck symptoms and improvements in general health and self-experienced working ability ($P < 0.01–0.03$). Changes in measures of mobility and pressure pain threshold were minor.

**Conclusions.** Regarding self-experienced benefit, the multimodal treatment was more efficacious than activated home exercises that were clearly more efficacious than just advising. No major differences were noted in objective measurements of cervical function between the groups, but the content validity of these assessments in chronic neck trouble can be questioned. [Key words: active, cervical spine, exercise, neck, neck pain, randomized, treatment] **Spine 2000;25:1021–1027**

Neck pain is a common symptom among workers in several occupations. Besides the subjective distress, the pain may cause absenteeism from work and subsequent costs to society. Given that the cause of the various cervical disorders is not fully understood,[30] treatments for chronic neck disorders vary from traditional means for pain management and manipulative therapy to group gymnastics, neck-specific strengthening exercises, and ergonomic changes at work. Strengthening exercises have been used for the treatment of neck pain,[3,7] but only a few controlled intervention studies have been conducted to examine active therapy for neck problems. The efficacy of group gymnastics, active exercises, and passive physiotherapy has been partly disappointing.[1,11,22,29,32] In a recent randomized study, investigators found that a multimodal treatment of persistent whiplash symptoms was superior to traditional approaches involving ultrasound and electric stimulation.[26] The multimodal treatment included postural, manual, psychological, relaxation, and visual training techniques. The patients returned to work earlier, and they had better results in pain intensity, emotional response, and postural disturbances.[26]

The goal of the current study was to compare the efficacy of another new multimodal treatment emphasizing proprioceptive exercises with both neck lecture and activated home exercise, and neck lecture with a recommendation of exercise in patients with chronic nonspecific neck pain. The outcomes were self-ratings of the treatment's efficacy, changes in pain levels and impairment, and measures of range of motion and pressure pain threshold in the neck and shoulder region.

## ■ Methods

The study was a randomized, single-blind trial of three interventions. Measurements were obtained before the randomization, after the intervention period of 3 months, and at 12 months. Researchers performing measurements and interviews were kept blinded to the interventions. The ethics committee of the Finnish Institute of Occupational Health, Helsinki, approved the study design.

**Patients.** The study participants were recruited from various workplaces through their respective occupational health care systems. A physician had examined them before they entered the study. Imaging of the cervical spine was not required. General inclusion criteria included age 30–60 years, height more than 140 cm, and possession of a permanent job. Both genders were included. The inclusion criterion for neck trouble was nonspecific, recurrent or chronic neck pain that had lasted longer than 3 months and had caused pain, impairment of function, and physical disability. Exclusion criteria included known neural tissue involvement, such as current nerve root entrapment, spinal cord compression, malignancy, or other corresponding disorders; severe disorders of the cervical spine, such as severe instability, known anomaly of the cervical spine,

**Table 1. Subject Characteristics in the Multimodal Active Therapy (ACTIVE), Home-Training (HOME), and Control (CONTROL) Groups of Neck Pain Patients at Baseline. Mean Values, SD in Parentheses**

| Variable | ACTIVE | | HOME | | CONTROL | | Between Groups Effects |
|---|---|---|---|---|---|---|---|
| | Women (N = 17) | Men (N = 8) | Women (N = 19) | Men (N = 6) | Women (N = 18) | Men (N = 8) | |
| Age (yr.) | 44.0 (8.4) | 38.8 (7.6) | 44.8 (9.0) | 36.0 (8.0) | 47.1 (16.8) | 43.2 (11.0) | $P = 0.43$ |
| Height (cm) | 163 (6) | 178 (5) | 165 (5) | 179 (5) | 166 (6) | 179 (10) | $P = 0.65$ |
| Weight (kg) | 67.3 (9.2) | 78.0 (12.3) | 68.9 (10.9) | 83.9 (10.8) | 68.4 (8.7) | 80.4 (7.4) | $P = 0.49$ |
| Pain intensity VAS 6 wk (mm) | 53.4 (23.4) | 40.3 (23.0) | 41.1 (19.3) | 28.3 (17.3) | 59.9 (19.6) | 33.0 (13.6) | $P = 0.11$ |
| Pain intensity VAS now (mm) | 48.8 (23.1) | 31.5 (24.3) | 33.3 (23.1) | 23.2 (19.1) | 45.9 (24.7) | 25.9 (23.5) | $P = 0.31$ |
| Physical impairment (VAS, mm)* | 33.8 (20.0) | 31.7 (10.9) | 27.9 (16.1) | 31.6 (17.2) | 32.9 (14.3) | 29.5 (15.5) | $P = 0.86$ |
| Fear avoidance behavior Questionnaire score | 25.8 (13.8) | 21.8 (15.9) | 23.2 (11.7) | 19.7 (11.9) | 25.3 (12.2) | 23.5 (14.3) | $P = 0.76$ |

* The average reading of 13 different questions concerning activities of daily living.

severe osteoporosis, fresh fracture, or other similar disorders; other severe diseases preventing physical loading; a recent major operation; acute infection; and refusal to cooperate.

Seventy-six consecutive patients fitting the listed criteria were enrolled in the study. Persons with neck pain of more than 3 months' duration without contraindications to the planned treatment were included. The average duration of the recurrent or chronic neck pain was 7.6 ± 6.0 (SD) years. Based on pain drawings, half of the patients had local neck pain and half referred pain below the elbow. Patients were not excluded based on their pain drawings. Pain was reported as occasional by 15 (20%) patients, recurrent by 50 (66%), and continuous by 11 (14%). Thirty-four (45%) patients reported no use of pain medication, 36 (47%) used anti-inflammatory drugs, and 6 (8%) reported use of drugs affecting the central nervous system. No statistically discernible differences were recorded in pain location, pain frequency, or use of medication between the treatment groups. Subject characteristics are presented in Table 1.

**Measurements.** After signing a written informed consent, all patients answered the same questionnaire and underwent the same measurement protocol three times: before and after the intervention and at 12 months (Figure 1). Measurements were made of cervical ranges of motion and pressure pain threshold in the upper trapezius muscle area. All the measurements were recorded in blinded fashion—that is, the observer did not know the patient's grouping.

**Questionnaires.** The questionnaire inquired about the following variables:

• demographic and anthropometric variables such as age, height, and weight;
• pain intensity (100 mm visual analog scale, [VAS] for average pain during the past 6 weeks and currently);
• pain regularity and pain drawings;
• use of pain medication;
• physical impairment in daily activities;
• loading at work (rush, control, breaks) and habitual physical activity (mode, frequency, intensity, duration); and
• fear avoidance beliefs (Fear Avoidance Beliefs Questionnaire).

The physical impairment was determined by responses to a series of 13 questions on activities in daily living, each assessed with a 100-mm VAS scale, and the average was calculated. The

modified Fear Avoidance Beliefs Questionnaire inquired into beliefs about physical and work activities as a cause of the patient's neck trouble and fears about the dangers of such activities when experiencing an episode of neck pain.[31]

At 3 and 12 months after the study began, the patients answered another questionnaire about self-experienced total benefit with a scale from 1 (very much harm) to 5 (very much benefit), with 3 representing a neutral assessment (no harm, no benefit). In addition, the outcome questionnaire included items on reduction of symptoms (general health, neck, other pains), psychological well-being (mood, stamina), work-related changes (working ability, absenteeism), fears and knowledge (general health, coping with neck pain, fears of neck pain), and changes in daily habits (exercise, healthier lifestyle). The scale in this questionnaire was from 1 ("I strongly disagree") to 5 ("I strongly agree"), with 3 representing a neutral assessment ("I do not know").

The questionnaires were initially pilot tested with another
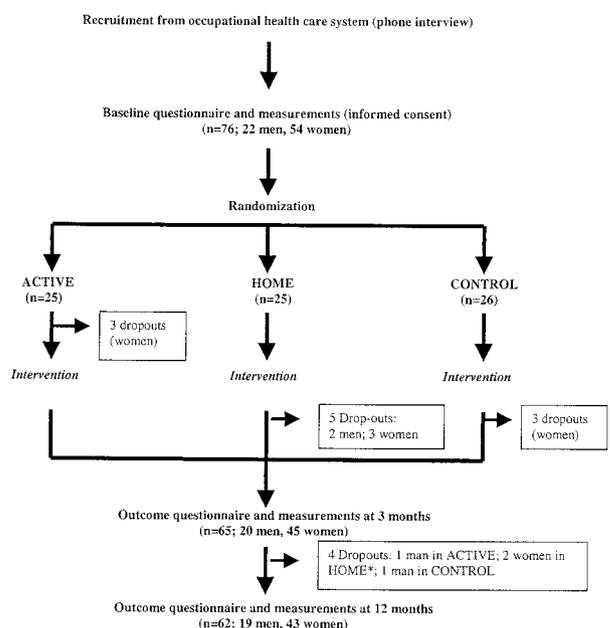


Figure 1. Flow-chart showing the study flow, number of participants, and number of withdrawals.

group of patients, as recommended by Deyo et al,[6] to evaluate its wording, length, and general adequacy.

**Cervical Mobility.** Cervical mobility was assessed with a measurement helmet equipped with goniometer (CROM, Basic Instrument; Performance Attainment Associates, Vadnais Heights, MN). Total range of motion was assessed in flexion–extension, lateral flexion, and rotation. The tester manually stabilized the patient, and the movements of the thoracic spine and trunk were controlled visually. The results were recorded in degrees. Reproducibility of cervical mobility with a goniometer has been reported to be acceptable.[5]

**Pressure Pain Threshold.** Pressure pain thresholds on the upper trapezius and levator scapulas muscles were assessed according to a technique described before,[28] using a mechanical force gauge.

**Reproducibility of Measurements.** Although reproducibility of the measurements has earlier been found to be acceptable, reproducibility of the measurements in the present setting was assessed in 15 patients who were measured twice at 2-day intervals.

**Interventions.** After the baseline measurements, the subject was randomly assigned into one of the three interventions. The randomization was performed in blocks of three stratified by sex, age, and severity of the disorder based on pain drawing. All treatments were provided free of charge to the patient. There were 25 participants in the ACTIVE group, 25 in the HOME group, and 26 in the CONTROL group.

*Multimodal Treatment: ACTIVE Group.* Two specially trained physical therapists provided the treatment, which involved two sessions per week, lasting approximately 45 minutes each, during 12 weeks. Altogether, there were 24 treatment sessions. Each session of the experimental active treatment contained the following: 1) Cervicothoracic stabilization training designed to restore cervical muscle endurance and coordination[20,26]; 2) relaxation training to reduce unnecessary muscle tension[9]; 3) behavioral support to reduce anxiety and fear of pain[8,21]; 4) eye fixation exercises to prevent dizziness[10]; and 5) seated wobble-board training to improve postural control.[2,20,23] The cervicothoracic stabilization and proprioceptive training were provided with the aid of specific rehabilitation devices for cervical extension, cervical rotation, shoulder blade adduction, and exercises for arm extension and arm curl. In each of the devices, the fixation mechanisms for trunk, hip, knees, and feet were adjusted so that the force for the target movement was primarily produced with the corresponding cervicothoracic muscles. The level of initial loading and progression was low, using modest ranges of motion. The order of the exercise was as follows: 1) warm up with free arm, shoulder, and neck movements; 2) functional exercises, stretching, and relaxation; 3) cervical extension with the device; 4) relaxation; 5) cervical rotation with the device; 6) relaxation; 7) shoulder movements with the device; 8) relaxation; 9) arm movements with the device; and 10) seated wobble board. Eye exercises were performed during cervical rotation training.

Behavioral and cognitive support was provided throughout the treatment program during treatment sessions by the physical therapists in discussions concerning the benign nature and good prognosis of nonspecific cervical pain. A record was kept of the progression of loading and the course of pain during the treatment. In the final stage of the program, the patients also attended a lecture about neck pain and its consequences and received written information about home exercises.

*Neck Lecture and Activated Home Exercises: HOME Group.* Patients assigned to this treatment attended a lecture about neck pain and its consequences and received written information about neck exercises plus additional practical training for their home exercises and maintaining a progress diary. The practical part of the regimen was provided in smaller groups at the beginning, twice with a 1-week interval.

*Neck Lecture and Recommendation of Exercise: CONTROL Group.* Patients assigned to this group attended one lecture about neck pain and its consequences and received written information about neck exercises to be applied at home and at the workplace.

**Statistical Analyses.** To design the study, the following calculations for an appropriate sample size were performed with MedStat software (ASTRA-Gruppen, Copenhagen, Denmark): As an assumption, Type I error probability 5%, Type II error probability 10%, standard deviation 30 units of the parameter (pain intensity on a 100-mm VAS scale) and 30 units of mean difference in the outcome between the groups produced the minimum number of patients as 21 in each group. With an assumption of a few withdrawals the final number was selected to be at the minimum 25 patients in each group, altogether, 75 patients. Thus, the study was designed to show a difference of a 30-mm reduction in pain intensity, should such a difference exist between the groups. The data collected were recorded on specific data cards and stored to computer files with data check. The statistical analyses included appropriate parametric and nonparametric tests.

Intraclass correlation coefficients (ICCs) were calculated to assess reproducibility of the measurements. The self-experienced outcome (outcome questionnaire) was analyzed with the nonparametric Kruskal–Wallis analysis of variance (ANOVA; group; between-factor analysis). *Post hoc* comparisons were calculated when indicated with the Mann–Whitney test. Nonparametric statistics were chosen because the outcome variable was not continuous.

The distributions of several continuous variables were skewed or bimodal. Therefore, the nonparametric Kruskal–Wallis ANOVA was used in the comparison between the groups at each time point and repeated-measures ANOVA and the Wilcoxon matched-pairs test in the analysis of changes within groups. Because of the large number of comparisons, care must be taken when interpreting the nominally significant $P$.

The $\chi^2$ test with cross-tabulation tables was used in the intention-to-treat analyses. In this analysis, all patients, including withdrawals, were included in the data for the group to which they originally were assigned. Success in treatment was defined as either self-experienced benefit (very much or much benefit) or absence of pain chronicity (pain intensity VAS <30 and pain frequency noncontinuous). The analyses were calculated by using Statistica for Windows 5.0 software (StatSoft Inc., Tulsa, OK).

■ **Results**

*Withdrawals*

The withdrawal rate was 14% (11 cases) at 3 months and 18% (14 cases) at 12 months. The withdrawals at

3 months were distributed as follows: three patients in the ACTIVE group, five in the HOME group, and three in the CONTROL group. Three withdrawals in the ACTIVE group occurred before they began the treatment because they had malignant disease (1 subject) or problems with arranging participation in an intervention twice a week for 12 weeks (two patients). No complications occurred because of any of the treatments. No differences were noted between those who finished the intervention and withdrawals in sex distribution ($\chi^2$ $P$ = 0.39), pain intensity ($t$ = 0.65, $P$ = 0.52), physical impairment ($t$ = 0.65, $P$ = 0.52), or physical activity ($t$ = 0.92, $P$ = 0.34).

In the ACTIVE group, two patients reported muscular pains and dizziness at the beginning of the treatment. These were treated with anti-inflammatory medication and soft tissue manipulation.

The additional three withdrawals during the follow-up were evenly distributed among the three groups. The reasons for the withdrawals are presented in the Table 2.

### Reproducibility of the Measurements
Reproducibility of all the measurements was found to be acceptable, with ICCs varying from 0.61 to 0.97.

### Group Differences at Baseline
No statistically discernible differences among the groups were found in cervical mobility (multivariate ANOVA [MANOVA] $R$ = 0.37, $P$ = 0.89), pressure pain threshold in the trapezius area (MANOVA $R$ = 0.79, $P$ = 0.62), average pain intensity VAS score (MANOVA $R$ = 0.99, $P$ = 0.42), physical impairment (ANOVA F = 0.16, $P$ = 0.86), physical activity (ANOVA F = 0.06, $P$ = 0.94), or in work characteristics ($\chi^2$: all $P$ > 0.09).

### Self-Experienced Benefits of the Treatment
Three months after the treatment, the average self-experienced total benefit was highest in the ACTIVE group (mean score 4.6) compared with both HOME (3.8) and CONTROL (3.3) groups (H = 33.7, $P$ < 0.001). In *post hoc* testing, all the groups were different ($P$ < 0.001) from each other. Similar difference was noted at 12 months: The average self-experienced total

**Table 2. Reasons for Dropping Out of the Study in Multimodal Active Therapy (ACTIVE), Home-Training (HOME), and Control (CONTROL) Groups**

| | ACTIVE (n = 4) | | HOME (n = 7)* | | CONTROL (n = 4) | |
|---|---|---|---|---|---|---|
| Reason | Men | Women | Men | Women | Men | Women |
| Other disease | | 1 | 1 | 1 | 1 | 1 |
| Moving to another city | 1 | | | 1 | | 1 |
| Not reached | | | | | | |
| Personal reasons | | 2 | 1 | 2 | | 1 |
| Not known | | | | 1 | | |

\* 1 male in the HOME group who did not attend the 3-month measurements due to personal reasons, participated in the 12-month measurements.

benefit was still highest in the ACTIVE group (mean score 4.2) as compared with the HOME (3.8) or the CONTROL (3.4) group (H = 22.2, $P$ < 0.001). In *post hoc* testing, all the groups were different ($P$ < 0.03) from each other at 12 months.

Differences between the groups in favor of the ACTIVE treatment were recorded in reduction of various symptoms. Especially, reduction in neck symptoms (H = 12.1, $P$ = 0.002) and improvement in general health (H = 10.4, $P$ = 0.005) were reported at 3 months, and the differences were still visible at 12 months (H = 10.0, $P$ = 0.007; H = 7.6, $P$ = 0.022, respectively). Also a tendency in favor of the ACTIVE treatment was recorded as an improvement in psychological well-being (mood) at 3 months (ANOVA H = 5.4, $P$ = 0.066), and this tendency remained until 12 months (H = 5.2, $P$ = 0.073).

An improvement in self-reported working ability in favor of the ACTIVE treatment was seen at 3 months (ANOVA H = 11.0, $P$ = 0.004) and this difference remained during the 12-month follow-up (H = 9.3, $P$ = 0.01). No statistically discernible differences were noted among the groups in reduction in fears and improvement in knowledge (general health, coping with neck pain, fears of neck pain), or in changes in daily habits (exercise, healthier lifestyle).

### Changes in Pain and Self-Experienced Impairment
At the beginning, the average VAS pain intensity score during the preceding 6 weeks was 51 ± 21 mm [SD]) all the groups combined (Table 1). The respective VAS scores after the intervention at 3 months were significantly lower in the ACTIVE (22 mm) and HOME (23 mm) groups than in the CONTROL group (39 mm; Kruskal–Wallis ANOVA H = 8.0, $P$ = 0.018). No statistically discernible differences between the groups were noted at 12 months (mean VAS 33 ± 24 mm, all groups combined; Kruskal–Wallis ANOVA H = 5.4, $P$ = 0.066), but the tendency was in favor of the HOME group.

Both self-experienced physical impairment (F = 26.5, $P$ < 0.001) and fear avoidance beliefs (F = 10.1, $P$ < 0.001) decreased during the follow-up, but no statistically discernible differences were noted among the groups in the reduction of physical impairment (F = 0.27, $P$ = 0.73), or Fear Avoidance Behavior Questionnaire score (F = 0.08, $P$ = 0.92).

### Cervical Mobility and Pressure Pain Threshold
Only a few changes were noted in these objective measurements. Sagittal mobility tended to increase in the HOME group at 3 months, but no group differences were seen at 12 months in cervical mobility (Table 3). Pressure pain threshold in the trapezius and levator scapulas muscle areas increased in the HOME group at 3 months, but no statistically discernible group differences were seen at 12 months (Table 3).

**Table 3. Outcome Measurements and ANOVA Results in the Multimodal Active Therapy (ACTIVE), Home-Training (HOME), and Control (CONTROL) Groups of Neck Pain Patients at Baseline, After Interventions (3 Months) and at 12-Months Follow-Up. The Data of Men and Women are Pooled; No Significant Sex Times Intervention Interactions were Found**

| Variable | ACTIVE (N = 21) | | HOME (N = 19) | | CONTROL (N = 22) | | Between Groups Effects |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | Mean | SD | Mean | SD | Mean | SD | |
| Sagittal Mobility (degrees) | | | | | | | |
| Baseline | 115.4 | 15.7 | 118.9 | 19.0 | 117.4 | 18.3 | $P = 0.94$ |
| 3 months | 112.3 | 16.0 | *126.3 | 15.4 | 121.9 | 15.8 | $P = 0.066$ |
| 12 months | 111.7 | 27.2 | 116.0 | 17.5 | *111.0 | 14.5 | $P = 0.61$ |
| Within Group Effects | $P = 0.70$ | | $P = 0.012$ | | $P = 0.011$ | | |
| Rotational Mobility (degrees) | | | | | | | |
| Baseline | 129.8 | 18.3 | 133.3 | 14.2 | 135.1 | 19.6 | $P = 0.96$ |
| 3 months | 134.4 | 12.7 | 135.2 | 11.5 | 141.5 | 14.5 | $P = 0.62$ |
| 12 months | 131.2 | 16.6 | 132.0 | 15.2 | 135.6 | 19.3 | $P = 0.96$ |
| Within Group Effects | $P = 0.46$ | | $P = 0.41$ | | $P = 0.062$ | | |
| Lateral Flexion Mobility (degrees) | | | | | | | |
| Baseline | 73.0 | 16.0 | 76.2 | 14.6 | 76.7 | 17.6 | $P = 0.97$ |
| 3 months | 72.8 | 15.1 | 78.3 | 9.4 | 77.2 | 17.9 | $P = 0.81$ |
| 12 months | 71.9 | 19.3 | 77.2 | 13.4 | 72.7 | 15.9 | $P = 0.91$ |
| Within Group Effects | $P = 0.94$ | | $P = 0.037$ | | $P = 0.12$ | | |
| Trapezius Pressure Pain Threshold (N/cm$^2$) | | | | | | | |
| Baseline | 25.9 | 14.3 | 29.6 | 15.0 | 28.3 | 8.1 | $P = 0.39$ |
| 3 months | 25.0 | 19.7 | **42.1 | 27.2 | 35.1 | 18.3 | $P = 0.023$ |
| 12 months | 18.7 | 13.8 | *25.6 | 19.3 | **16.5 | 10.9 | $P = 0.14$ |
| Within Group Effects | $P = 0.11$ | | $P = 0.0001$ | | $P = .000004$ | | |
| Levator Scapulae Pressure Pain Threshold (N/cm$^2$) | | | | | | | |
| Baseline | 40.9 | 20.8 | 41.7 | 25.4 | 41.5 | 14.5 | $P = 0.85$ |
| 3 months | 42.8 | 29.1 | **56.3 | 28.7 | 52.8 | 27.2 | $P = 0.16$ |
| 12 months | *31.6 | 17.1 | 38.5 | 26.0 | *31.3 | 17.6 | $P = 0.62$ |
| Within Group Effects | $P = 0.075$ | | $P = 0.0001$ | | $P = 0.0002$ | | |

Within-group changes from baseline measurements data, Wilcoxon paired test * $P < 0.05$, ** $P < 0.01$.

### *Intention-to-Treat Analysis*

There were no statistically discernible differences between the groups with respect to persistence of pain either at 3 months ($\chi^2$ 0.63, $P = 0.73$) or at 12 months ($\chi^2$ 0.74, $P = 0.69$). Regarding self-experienced total benefit, differences were seen at 3 months ($\chi^2$ 21.0, $P < 0.001$; success rate 21/25 in the ACTIVE, 17/25 in the HOME, and 6/26 in the CONTROL group) and at 12 months ($\chi^2$ 10.6, $P = 0.005$; success rates 19/25 in the ACTIVE, 14/25 in the HOME, and 8/26 in the CONTROL group).

### ■ Discussion

The current study was a randomized clinical trial of the efficacy of three forms of therapy for chronic neck pain. The study was performed as far as was practicable in accordance with previous recommendations,[6,16,19,33] to ensure that it was scientifically sound and that the findings were statistically and clinically relevant. It was not possible to blind the patients to the treatment that they received, although emphasis was placed on blinding them from any prerandomization expectation biases to the efficacy of the different treatments. Although these factors are considered to threaten the methodologic quality of a randomized clinical trial, it is common to face such limitations in studies designed to evaluate exercise or physical therapies.[34] The current patients did not come from a random sample of the Finnish workforce, but they were, in general terms, a reasonably rep-

resentative subset of working-age Finns with recurrent or chronic neck pain. The study included both men and women who came from different workplaces and were office workers as well as manual laborers. They displayed pain and disability characteristics comparable to those of the typical patients with chronic neck problems described in many previous studies (average pain duration of 7.6 years, average pain intensity of 51 on a 0–100-mm VAS, 80% with recurrent or continuous pain).[4] However, the patients involved in the study were recruited on a voluntary basis from the occupational health care systems and therefore represent a group with good self-motivation to alleviate their prevailing symptoms. They all were participants in a working life.

The primary findings in the current study were that the self-experienced benefits were highest in the multimodal treatment emphasizing exercises (ACTIVE) compared with both activated home exercises (HOME) and recommendation for home exercises (CONTROL), and that higher self-experienced benefit scores were recorded in the HOME group than in the CONTROL group. These findings support the initial hypotheses that multimodal treatment emphasizing exercises are beneficial for chronic nonspecific neck problems and that activated home exercises are better than just a recommendation for exercise. The self-experienced ability to work differed significantly among the groups, as well. Thus, it is possible that the treatments have an effect in absenteeism

and costs due to neck pain. However, the rather small number of patients did not provide sufficient statistical power to study this aspect, because after the intervention very few of them were out of work because of neck pain. Moreover, return to work and absenteeism as outcome variables are strongly influenced by factors unrelated to the patient's health and treatment,[6] and their validity and sensitivity as an outcome measure are reputedly questionable.[13]

No change was noted in the objective measurements in the ACTIVE group, and the changes in cervical sagittal mobility and pressure pain threshold were temporary and minor in the HOME group as well, which makes the overall efficacy of the interventions somewhat questionable. These measurements have been used before in neck pain populations and they showed fair reproducibility in the current study. However, it is acknowledged that the assessment of outcome in cervical rehabilitation is methodologically problematic. Results of strength and mobility assessments, for example, have been similar among patients and control subjects in many studies.[1,30,32] Although it has been suggested that pressure pain threshold measurements could be used as outcome measure in individual follow-up,[28] it is well recognized that a decrease in pressure pain threshold occurs a few days after submaximal exercises.[17,24,25] This feature may limit the validity of using pressure pain threshold as an outcome tool immediately after the interventions, as was the case in the current study at 3 months.

In the current study the ACTIVE intervention was intended primarily to restore coordination and postural control of the neck and shoulder region rather than to strengthen or mobilize the neck. Therefore, cervical mobility increases were not expected. Perhaps the ACTIVE program had induced physical changes in coordination and movement control that could not be measured, because appropriate measurement tools were not available. The intention of the HOME program was to induce mobility and endurance changes by using a stretching and strengthening approach. Thus, the observation of somewhat increased sagittal mobility was expected. The blinded, controlled design of the study allows attribution of the observed changes to the interventions; however, the authors cannot judge which subcomponents of the ACTIVE and HOME programs are responsible for the results. They were, however, able to estimate the total amount of exercises by examining the exercise diaries in the HOME group: the total amount was far larger in the HOME than in the ACTIVE group on average. Thus, the large self-experienced benefits of the interventions in the ACTIVE group are not directly attributable to the amount of exercises, *per se*. Other possible explanations include the different mode (quality) of exercises, multimodality of the ACTIVE treatment, or the interaction (attention and nursing) between the therapist and the patient.

It would be important to study cost effectiveness or cost utility when comparing different treatment methods.

However, it is very difficult to make such a calculation in this case, because the outcome cannot be estimated on the same terms (units) as the input. It is unclear in which way subjective improvement and pain reduction, which are by definition arbitrary and subjective, should be valued against costs and time spent for the treatment, which can be valued by objective (*e.g.,* financial) terms. Thus, such a calculation could not be provided. However, both the time the provider spent in the treatments, and the cost of investment in the instruments is the largest in the ACTIVE group. Another issue may as well be raised. It is very difficult to estimate the clinical relevance of the group differences in the outcome. An external reference is needed, *i.e.,* a gold standard. Such a standard does not, however, exist. Additional studies are needed, for example, on the association between pain reduction, self-experienced benefits, health care utilization, and work absenteeism.

The efficacy of active treatments for neck pain has been partly questionable in the previous studies. In some studies, only minor or short-term improvements were induced with active treatments, or the results have been similar to passive pain-relieving treatment methods.[18,22,29] Systematic reviews published in 1996 and 1997 concluded that there is little information available from clinical trials to support many of the treatments for mechanical neck pain, and that conservative interventions have not been studied in enough detail to assess efficacy or effectiveness adequately.[1,11,32] However, a few randomized trials with findings favoring active treatments have been published recently[15,27] with results comparable to the current findings.

The relatively small number of patients and the lack of long-term, objective changes do not allow firm conclusions to be made on the overall efficacy of the treatment programs. In the current study, the responses of men were generally slightly worse than those of women, but a statistically significant interaction was not noted between gender and intervention. There may still be underlying gender differences that this small a sample of men could not show. Also a part of the reported benefits seemed to vanish within 1 year after the treatment, but some of the self-experienced benefits, including experienced working ability, were clearly seen at the end of the 12-month follow-up period. However, the variables that differed among the study groups in the long term included self-experienced benefits only, no objective parameters. Nonetheless, in recent studies it has appeared that self-experienced benefits are the most important factors determining the outcome of treatment or rehabilitation of back and neck problems, even when measured as return to work.[12,14]

In conclusion, the application of active treatments (ACTIVE and HOME) was related to reduction of pain and self-experienced benefits. The authors conclude that the multimodal active treatment including exercises offer benefits in chronic neck trouble including improved self-experienced working ability. Home exercise advice with-

out activation and control is insufficient in the treatment of the condition, because no change was observed in any of the outcome variables. Activated home exercises with phone monitoring and control visits were significantly more efficacious in reducing pain and producing self-experienced benefits than the advice to exercise only. The possible effects of the interventions on work absenteeism and health care utilization remain to be shown.

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■ **Key Points**

● Results in a randomized study with single-blind outcome assessments showed that a multimodal active treatment was more efficacious than the two other interventions in self-experienced benefits, but activated home exercises were more efficacious than just a recommendation for exercise. Minor differences only were noted in objective measurements of cervical function among the three groups.

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