

REHABILITATION SECTION

Original Research Article

Yoga for Chronic Neck Pain: A 12-Month Follow-Up

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Abstract

Objectives. To assess the effects of a 9-week yoga
intervention on chronic nonspecific neck pain 12
months after completion.

Design. Twelve-month follow-up of the pooled data
of both arms of a randomized, controlled trial.

Setting. Department of Internal and Integrative
Medicine at an academic teaching hospital.

Subjects. Fifty-one patients with chronic nonspe-
cific neck pain (mean age 47.8 years; 82.4% female).

Interventions. A 9-week yoga group intervention.

Outcome Measures. Neck pain intensity (100-mm
visual analog scale), functional disability (neck
disability index), health-related quality of life
(short-form 36 questionnaire, SF-36), generic dis-
ability (days with restricted activities), and global
improvement.

Results. From baseline to 12-month follow-up,
pain intensity improved from 48.81 ± 17.71 to
 32.31 ± 20.68 ($P < 0.001$), neck-related disability
decreased from 25.26 ± 9.02 to 19.49 ± 11.52
($P = 0.001$), and bodily pain in the SF-36 improved
from 49.37 ± 12.40 to 59.26 ± 17.57 ($P = 0.005$).
Improvements in pain intensity were predicted by
weekly minutes of yoga practice during the past 4
weeks ($r^2 = 0.12$, $P = 0.028$); improved neck-related
disability ($r^2 = 0.24$, $P = 0.001$) and bodily pain
($r^2 = 0.26$, $P = 0.006$) were predicted by regular yoga
practice during the past 12 months. Generic disabili-
ty did not decrease significantly. Twenty-four
patients (68.6%) rated their health as at least some-
what improved.

Conclusions. A 9-week yoga intervention improved
pain and neck-related disability for at least 12
months after completion. Sustained yoga practice
seems to be the most important predictor of long-
term effectiveness.

Key Words. Yoga; Complementary Therapies;
Neck Pain; Long-Term Effects; Regression
Analysis

Introduction

Up to 50% of the population can expect to experience at
least some neck pain in their lifetime [1]. As evidence of
effectiveness is limited for most treatment options includ-
ing pharmacotherapy [2], chronic neck pain has become a
major socioeconomic burden [3,4].

Neck pain is the second most common condition for
which complementary therapies are used [5]. In the United
States, more than half of the patients suffering from neck
pain use complementary therapies, and yoga is among
the most commonly used complementary treatments for
neck pain [6]. An estimated 15 million American adults
report having practiced yoga at least once in their
lifetime, 20% of those using yoga explicitly for spinal pain
relief [7].

Derived from ancient Indian spiritual practice, yoga comprises physical activity, relaxation, and lifestyle modification [8]. In North America and Europe, yoga is most often associated with physical postures (asana), breathing techniques (pranayama), and meditation (dyana) [9]. A number of meta-analyses have shown effectiveness of yoga in relieving pain and functional disability in different painful conditions such as low back pain [10], fibromyalgia [11], and others [12]. Recently, short-term effects of a 9-week yoga intervention in patients with chronic nonspecific neck pain have been reported [13]. In that randomized, controlled trial, yoga improved pain, functional disability, and mental quality of life compared with a wait-list control group. Longer term effects as well as the role of continued regular yoga practice as a possible predictor of treatment success remained unclear. Therefore, this study reports the results of a 12-month follow-up of the aforementioned study. As the original study used a wait-list design and both groups received the yoga intervention consecutively, data on the two groups were pooled.

Methods

Design

The study was approved by the institutional ethics committee of the medical institutions at the University of Duisburg-Essen (approval number: 10-4358) prior to patient recruitment. The study originally was designed as a two-armed randomized, controlled clinical trial. This long-term follow-up presents a longitudinal comparison of the pooled data of both arms.

After providing informed consent and attending the first assessment session, patients were randomized to either a yoga group or a wait-list control group. One week later, a 9-week yoga intervention started for the yoga group. The control group continued their usual medical care and was provided with a self-care manual designed by a large statutory German health insurance company to relieve neck pain and stiffness [14]. After 10 weeks, the assessment was repeated, and the control group started the yoga intervention. The final assessment took place 12 months after the end of the yoga intervention.

Patients

Patients were recruited through local newspaper announcements. Patients were eligible for inclusion if they were 18–60 years old and suffered from nonspecific neck pain for at least the previous 12 weeks at least 5 days a week. The mean neck pain intensity had to be at least 40 mm on a 100-mm visual analog scale (VAS), with 0 mm meaning “no pain” and 100 mm meaning “worst pain imaginable.”

Exclusion criteria included 1) specific neck pain (disc protrusion, radicular syndrome, whiplash, congenital deformity of the spine, spinal canal stenosis, neoplasm); 2) inflammatory rheumatic disease; 3) active oncological disease; 4) affective disorder, addiction, or psychosis; 5)

physical disability precluding yoga practice; 6) pregnancy; 7) invasive treatment of the spine within the previous 4 weeks or spinal surgery within the previous 12 months; 8) practice of yoga or Pilates within the previous 12 weeks; 9) start of a new treatment for neck pain within the previous month or plan to start a new treatment within the next 9 weeks.

Intervention

Both groups attended a 9-week Iyengar yoga program [8] consecutively. Iyengar yoga is based on the teachings of the yoga master BKS Iyengar who applied therapeutic variations of classical yoga postures to many health problems including spinal pain [8].

Yoga classes were led by a certified Iyengar yoga instructor and physiotherapist with long-standing experience in applying Iyengar yoga to patients with chronic pain conditions who was assisted by a master's degree psychologist. The program was specifically designed for patients with chronic neck pain without previous experience in yoga and consisted of weekly 90-minute yoga classes over a 9-week period [13].

Each class consisted of 75 minutes of gentle yoga postures that put a focus on lengthening and strengthening muscles of the neck and shoulder region and 15 minutes of guided relaxation. Throughout the classes, the instructor and the assistant focused on correcting improper alignment and posture, and the patients were provided with belts, blocks, bolsters, and blankets to enhance alignment and to prevent injury. More details about the yoga intervention have been reported earlier [13].

Patients were asked to continue daily yoga practice at home. For this purpose, patients received a manual describing and depicting three basic standing postures (mountain pose, standing half-forward bend [at wall], and warrior pose II) and three basic sitting postures (Bharadvaja's twist, prosperous pose without and with spinal twist) [13].

Outcome Assessment

Outcome measures were assessed three times. One week after the first assessment, the yoga group started the yoga intervention, while the control group received a self-care manual for home-usage [13]. Ten weeks later, both groups attended a second assessment. One week after the second assessment, the control group started the yoga intervention. The third assessment was completed 12 months after completion of the yoga program, that is, 12 months after the first assessment for the treatment group and 12 months after the second assessment for the control group. For the purpose of this follow-up analysis, data that had been collected immediately before the start of the program (this is first assessment for the treatment group and second assessment for the control group) were combined and served as baseline assessment, and data that had been collected 12 months after

completion of the program (this is third assessment for both groups) were combined and served as 12-month follow-up assessment.

Pain Intensity

Patients were asked to indicate their average pain in the past 4 weeks on a 100-mm VAS ranging from “no pain” to “worst pain imaginable.” Pain assessments on a VAS have been shown to be highly reliable in patients with chronic musculoskeletal pain [15]. Patients that obtained reductions in pain intensity from baseline to 12-month follow-up of at least 30% were regarded as obtaining a clinically meaningful improvement [16,17]. In addition, patients that obtained reductions of at least 50% were regarded as obtaining a substantial improvement [16].

Neck-Related and Generic Disability

Neck-related disability was assessed using the neck disability index (NDI) [18]. A sum score is computed from 10 items that can range from 0 to 100. Higher values indicate higher disability. To assess generic disability, patients were asked to indicate the number of days during which they were unable to perform their normal activities of daily living during the past 4 weeks [19].

Health-Related Quality of Life

Health-related quality of life was assessed using the short-form 36 health survey questionnaire (SF-36) [20]. The SF-36 assesses health-related quality of life on eight subscales (physical functioning, physical role functioning, bodily pain, general health perceptions, vitality, social functioning, emotional role functioning, and mental health) as well as on two component scores (mental component score, physical component score). Each scale can range from 0 to 100, and higher values indicate better quality of life.

Overall Improvement

At 12-month follow-up assessment, patients were asked to indicate their global impression of change compared with 12 months before [19,20]. A five-point numerical rating scale ranging from 1 = “very much worsened” to 5 = “very much improved” was used.

Intervention Adherence

During yoga intervention, course adherence was assessed by the yoga assistant. At 12-month follow-up, patients were asked to indicate whether they had continued to practice yoga regularly (this is at least once a week) in the 12 months after the end of the intervention program. Moreover, patients were asked to indicate the weekly number of minutes they had practiced yoga during the past 4 weeks.

Statistical Analysis

The analyses were based on all patients that completed baseline and 12-month follow-up. In order to determine

systematic biases in response rates at follow-up assessment, sociodemographic characteristics were compared between patients who completed the 12-month follow-up assessment and those who were lost to follow-up using unpaired *t*-tests or Mann-Whitney *U*-tests.

Change in pain intensity from baseline to 12-month follow-up was defined as the main outcome measure. Neck-related and generic disability, health-related quality of life, and overall improvement served as secondary outcome measures. Within-group paired *t*-tests were used to evaluate changes in all outcome measures except “overall improvement” from baseline to 12-month follow-up. A (two-sided) *P* value of <0.05 was considered statistically significant for all outcome measures.

To ensure comparability between the different outcome measures, standardized effect sizes (Cohen’s *d*) were calculated by dividing the difference between means at baseline and 12-month follow-up by the baseline standard deviation (SD).

To analyze the role of yoga practice as a possible predictor of treatment success, linear forward stepwise regression analyses with linear outcome and linear or dichotomous regressors were conducted for all outcomes that significantly changed from baseline to follow-up. In the same manner, binary logistic regression analyses were conducted to analyze possible predictors for obtaining clinically meaningful reductions (at least 30%) or substantial reductions (at least 50%) in pain intensity. To control for possible effects of sociodemographic variables, age and gender were included in regression analyses in addition to the number of attended yoga courses, regular yoga practice in the past 12 months (coded yes/no), and weekly minutes the patient had practiced yoga during the past 4 weeks.

All analyses were conducted using SPSS® (release 20.0, IBM, Armonk, NY, USA).

Results

Patients

Two hundred twenty-seven patients were assessed for eligibility. Of those, 51 patients were included, attended the baseline assessment, and were randomized. Thirty-six patients (70.6%) completed the 12-month follow-up assessment (Figure 1).

Sociodemographic and neck pain characteristics are presented in Table 1. There were no significant differences between patients who completed the 12-month follow-up assessment and those who were lost to follow-up.

Outcome Measures

From baseline to 12-month follow-up, pain intensity improved from 48.81 mm (SD = 17.71 mm) to 32.31 mm (SD = 20.68 mm) (*P* < 0.001; Table 2); this was a mean

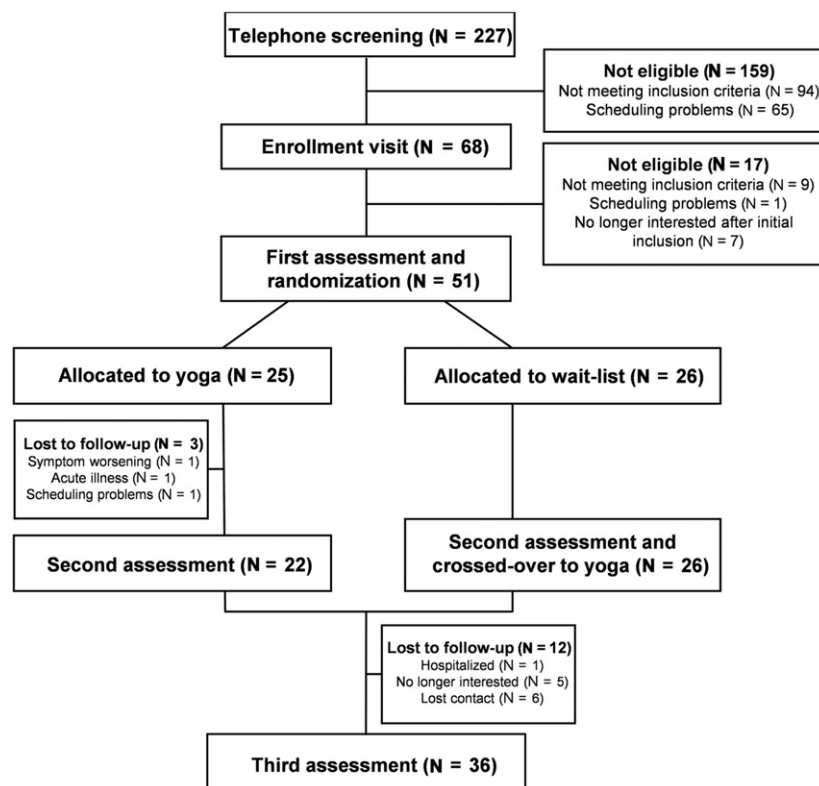


Figure 1 Participant flow diagram.

Table 1 Baseline sociodemographic characteristics and neck pain characteristics (mean ± standard deviation)

| Patient Characteristics | Total (N = 51) | Completed Follow-Up (N = 36) | Lost to Follow-Up (N = 15) | P |
|---|----------------|------------------------------|----------------------------|-------|
| Sociodemographic characteristics | | | | |
| Age | 47.8 ± 10.4 | 47.8 ± 10.4 | 48.0 ± 10.8 | 0.945 |
| Gender, N (%) | | | | 0.280 |
| Female | 42 (82.4) | 31 (86.1) | 11 (73.3) | — |
| Male | 9 (17.6) | 5 (13.9) | 4 (26.7) | — |
| BMI (kg/m ²) | 24.6 ± 4.5 | 24.0 ± 3.8 | 26.4 ± 5.6 | 0.084 |
| Education, N (%) | | | | 0.311 |
| <High school | 20 (39.2) | 15 (41.7) | 5 (33.3) | — |
| High school | 14 (27.5) | 11 (30.6) | 3 (20.0) | — |
| University degree | 17 (33.3) | 10 (27.8) | 7 (46.7) | — |
| Employment | | | | 0.458 |
| Unemployed | 11 (21.6) | 8 (22.2) | 3 (20.0) | — |
| Employed | 37 (72.5) | 27 (75.0) | 10 (66.7) | — |
| Self-employed | 3 (5.9) | 1 (2.8) | 2 (13.3) | — |
| Neck pain characteristics | | | | |
| Duration in years | 8.1 ± 6.3 | 8.8 ± 6.9 | 6.4 ± 4.4 | 0.218 |
| Pain intensity (mm VAS) | 49.6 ± 16.2 | 48.8 ± 17.7 | 51.4 ± 12.2 | 0.607 |
| Functional disability (NDI) | 28.2 ± 12.8 | 25.3 ± 9.0 | 34.4 ± 17.8 | 0.086 |

NDI = neck disability index; VAS = visual analog scale.

Table 2 Effects (mean \pm standard deviation) of yoga from baseline to 12-month follow-up

| Outcome | Baseline | 12-Month Follow-Up | Change | Effect Size | <i>P</i> |
|--|-------------------|--------------------|--------------------------|------------------------|----------|
| Pain intensity | 48.81 \pm 17.71 | 32.31 \pm 20.68 | -16.50 (-23.73 to -9.27) | -0.93 (-1.34 to -0.52) | <0.001 |
| Neck-related disability | 25.26 \pm 9.02 | 19.49 \pm 11.52 | -5.77 (-9.15 to -2.39) | -0.64 (-1.01 to -0.26) | 0.001 |
| Generic disability | 1.19 \pm 1.72 | 0.68 \pm 1.40 | -0.51 (-1.25 to 0.22) | -0.30 (-0.73 to -0.13) | 0.163 |
| Short-form 36 health-related quality of life | | | | | |
| Physical functioning | 83.11 \pm 12.41 | 83.43 \pm 16.97 | 0.32 (-4.29 to 4.92) | 0.02 (-0.35 to 0.40) | 0.889 |
| Physical role functioning | 57.58 \pm 37.23 | 67.42 \pm 35.62 | 9.85 (-3.25 to 22.95) | 0.27 (-0.09 to 0.62) | 0.135 |
| Bodily pain | 49.37 \pm 12.40 | 59.26 \pm 17.57 | 9.89 (3.15 to 16.62) | 0.80 (0.25 to 1.34) | 0.005 |
| General health perceptions | 62.03 \pm 19.16 | 63.73 \pm 20.39 | 1.70 (-3.37 to 6.76) | 0.09 (-0.18 to 0.35) | 0.500 |
| Vitality | 51.57 \pm 18.54 | 53.14 \pm 20.59 | 1.57 (-3.94 to 7.08) | 0.08 (-0.21 to 0.38) | 0.566 |
| Social functioning | 73.57 \pm 21.39 | 79.29 \pm 22.68 | 5.71 (-1.60 to 13.03) | 0.27 (-0.07 to 0.61) | 0.122 |
| Emotional role functioning | 73.53 \pm 33.61 | 68.63 \pm 41.80 | -4.90 (-19.26 to 9.45) | 0.15 (-0.57 to 0.28) | 0.492 |
| Mental health | 66.57 \pm 15.85 | 67.43 \pm 17.92 | 0.86 (-4.47 to 6.19) | 0.05 (-0.28 to 0.39) | 0.746 |
| Physical component score | 44.05 \pm 8.17 | 46.45 \pm 9.91 | 2.40 (-0.58 to 5.37) | 0.29 (-0.07 to 0.66) | 0.111 |
| Mental component score | 46.44 \pm 10.07 | 46.22 \pm 12.01 | -0.22 (-3.71 to 3.27) | 0.02 (-0.37 to 0.32) | 0.899 |

reduction in pain intensity from baseline of 31.16% (SD = 45.81%). Twenty-three patients (63.9%) obtained a reduction in pain intensity from baseline of at least 30%, and 17 patients (42.2%) obtained a reduction of at least 50%. Neck-related disability decreased from 25.26 (SD = 9.02) to 19.49 (SD = 11.52) ($P = 0.001$; Table 2). This represents an effect size of $g = 0.93$ for pain intensity and $d = 0.64$ for disability. Days with restricted activities during the past 4 weeks did not decrease significantly from baseline to 12-month follow-up (Table 2). Regarding health-related quality of life, the only significant improvement from baseline to 12-month follow-up was found for bodily pain ($P = 0.005$; Table 2). Compared with 12 months before, 10 patients (28.6%) rated their health as very much improved, 14 patients (40.0%) as somewhat improved, 8 patients (22.9%) reported no change, 1 patient (2.9%) rated his health as somewhat worsened, and 2 patients (5.7%) as very much worsened.

Intervention Adherence

During the yoga intervention, patients attended a mean of 6.00 (SD = 2.66) yoga sessions (range 0–9). Twenty-three patients (63.9%) indicated that they had continued to practice yoga after the end of the yoga intervention. Of those, 13 patients (36.1%) had practiced yoga at least once weekly. During the past 4 weeks, patients had practiced yoga for a mean of 32.19 (SD = 40.05; range 0–110) minutes per week.

Regression Analyses

Regression analyses revealed that improvements in pain intensity from baseline to 12-month follow-up were predicted by higher baseline pain intensity ($r^2 = 0.17$, $P = 0.007$) and higher weekly minutes of yoga practice during the past 4 weeks ($r^2 = 0.12$, $P = 0.028$) (Table 3). Obtaining a reduction in pain intensity from baseline to

12-month follow-up of at least 30% was predicted by higher weekly minutes of yoga practice during the past 4 weeks only ($r^2 = 0.21$, $P = 0.037$) (Table 3). The same was true for obtaining a reduction of at least 50% ($r^2 = 0.19$, $P = 0.031$) (Table 3). Improved neck-related disability in the NDI was predicted by regular yoga practice during the past 12 months ($r^2 = 0.24$, $P = 0.001$) and higher baseline disability ($r^2 = 0.09$, $P = 0.044$) (Table 3). Improved bodily pain in the SF-36 was predicted by regular yoga practice during the past 12 months ($r^2 = 0.26$, $P = 0.006$) and higher baseline bodily pain ($r^2 = 0.13$, $P = 0.014$) (Table 3). Age or gender did not predict any changes in the previous variables.

Safety

During the follow-up period, five patients reported adverse events. One patient had been diagnosed with rheumatoid arthritis; she was currently hospitalized in a rehabilitation facility at the follow-up time point. Two patients reported mental symptoms, one of them experienced a transient burnout syndrome and the other patient reported increased anxiety and depression at the follow-up time point. The latter patient had, however, not continued yoga practice after the end of the intervention. Another patient reported a worsening of neck pain during the follow-up period. At the follow-up time point, she was being treated by her physical therapist and did not continue to practice yoga. Another patient had stopped practicing yoga due to transient pain in lower abdomen after practice.

Discussion

This study investigated the long-term effectiveness of yoga for chronic neck pain. The short-term effects on pain intensity and neck-related disability that had been observed immediately after completion of the intervention [13] were found to persist over the 12-month follow-up

Table 3 Regression analyses

| Dependent Variable | Predictor Variable | B ± SE | β | P | R ² |
|-----------------------------------|---|---------------|-------|-------|----------------|
| Change in pain intensity* | Constant | 15.40 ± 9.76 | — | 0.124 | — |
| | Baseline pain intensity | −0.53 ± 0.18 | −0.43 | 0.007 | 0.17 |
| | Weekly minutes of yoga practice during the past 4 weeks | −0.18 ± 0.08 | −0.34 | 0.028 | 0.12 |
| ≥30% reduction in pain intensity† | Weekly minutes of yoga practice during the past 4 weeks | 0.03 ± 0.12 | — | 0.037 | 0.21 |
| | Constant | −0.13 ± 0.44 | — | 0.769 | — |
| ≥50% reduction in pain intensity† | Weekly minutes of yoga practice during the past 4 weeks | 0.02 ± 0.01 | — | 0.031 | 0.19 |
| | Constant | −0.97 ± 0.48 | — | 0.045 | — |
| Change in neck disability* | Constant | 6.65 ± 4.54 | — | 0.153 | — |
| | Regular yoga practice during the past 12 months | −10.80 ± 3.02 | −0.53 | 0.001 | 0.24 |
| | Baseline neck disability | −0.34 ± 0.16 | −0.31 | 0.044 | 0.09 |
| Change in bodily pain* | Constant | 33.29 ± 12.65 | — | 0.013 | — |
| | Regular yoga practice during the past 12 months | 17.15 ± 5.77 | 0.43 | 0.006 | 0.26 |
| | Baseline bodily pain | −0.61 ± 0.23 | −0.37 | 0.014 | 0.13 |

* Linear regression model.

† Binary logistic regression model.

B = regression coefficient; SE = standard error.

period. Based on Cohen's categories, the effect sizes for pain intensity and neck-related disability were large and moderate, respectively [21]. About two thirds of patients obtained a reduction in pain intensity from baseline of at least 30%, which has been considered a clinically meaningful improvement and might be associated with changes in pain behavior [16,17]. Moreover, almost half of patients obtained a reduction in pain intensity from baseline of at least 50%, which represents a substantial change in pain that patients have considered a "treatment success" in prior studies [17,22]. This is also reflected in the rating of overall health, where about 70% rated their overall health as improved, about 30% even as very much improved.

These results are partly comparable with prior studies on yoga for chronic low back pain [13,23–25]. Improvements of pain intensity and back-related function have been reported up to 6 months after the end of the intervention [23,24]. Twelve months after a 12-week yoga intervention, low back pain patients reported better back-related function but not lower pain intensity than a usual care control group [25]. Moreover, the results are comparable with the results of studies investigating the effect of exercise interventions for chronic neck pain [26–28]. Effects of those interventions have been reported to persist for up to 24 months after treatment [26].

In the present study, higher amounts of yoga practice in the past 4 weeks significantly predicted pain intensity in the past 4 weeks. Practice time accounted for 12% of the variance in pain intensity. Moreover, practice time in the past 4 weeks was the only significant predictor of clinically meaningful improvements in pain intensity and accounted for 21% of the variance of whether a clinically meaningful improvement was obtained or not [16,17]. Regarding the other pain-related variables, "bodily pain" in the SF-36 and neck-related disability, regular yoga practice during the

past 12 months was the most important predictor of improvement. Regular yoga practice accounted for about 25% of the variance in bodily pain and disability; this is more than the respective baseline value. As the number of classes that were attended did not predict improvements in pain or disability, the importance of sustained regular home practice of considerable intensity after the end of the intervention for maintaining intervention effects in the long-term is obvious. These results are comparable with a study on fibromyalgia where higher yoga home practice—especially use of yoga postures—was associated with better short-term and medium-term treatment outcomes [29].

Regarding mechanisms, yoga can be seen as a form of isometric muscle training that can relieve muscle spasm and pain [30]. Moreover, yoga puts a focus on increasing awareness of muscle tonus and joint position [31] that has been showed to help recognizing and changing habitual patterns of posture and muscle tension in daily life [32].

There are several limitations in this study. Particularly, there was no control group in this long-term follow-up. Therefore, nonspecific effects like treatment expectancy, attention from health professionals, or social aspects of group interventions might have played a role in the effect of yoga. However, the results of the regression analyses suggest that regular practice *after* the completion of the intervention was more important for relief of pain and disability than socializing or increased attention *during* the intervention. While there were no significant differences between patients that completed the 12-month follow-up and those who were lost to follow-up and dropout rates were acceptable for a long-term follow-up [33], attrition bias cannot totally be ruled out. Specifically, it remains unclear whether the patients that were lost to follow-up maintained their yoga practice after the intervention period and

whether they experienced the same improvement as those that completed the follow-up. Moreover, the small mainly female and well-educated sample might limit generalization to the general population of chronic neck pain patients. The results of this study might be especially applicable to patients suffering from nonspecific chronic neck pain of low-to-moderate intensity.

In conclusion, a 9-week yoga intervention appears to be effective in relieving pain and functional disability in patients with chronic nonspecific neck pain for at least 12 months. Sustained yoga practice seems to be the most important predictor of long-term effectiveness. Further, more rigorous studies are needed that compare yoga with active control groups before the long-term effectiveness of yoga for chronic neck pain can be conclusively judged.

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