Effect of yoga on chronic non-specific neck pain: An unconditional growth model

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ABSTRACT

Objective: Chronic neck pain is a common problem that affects approximately half of the population. Conventional treatments such as medication and exercise have shown limited analgesic effects. This analysis is based on an original study that was conducted to investigate the physical and behavioral effects of a 9-week Iyengar yoga course on chronic non-specific neck pain. This secondary analysis uses linear mixed models to investigate the individual trajectories of pain intensity in participants before, during and after the Iyengar yoga course.

Method: Participants with chronic non-specific neck pain were selected for the study. The participants suffered from neck pain for at least 5 days per week for at least the preceding 3 months, with a mean neck pain intensity (NPI) of 40 mm or more on a Visual Analog Scale of 100 mm. The participants were randomized to either a yoga group (23) or to a self-directed exercise group (24). The mean age of the participants in the yoga group was 46, and ranged from 19 to 59. The participants in the yoga group participated in an Iyengar yoga program designed to treat chronic non-specific neck pain. Our current analysis only includes participants who were initially randomized into the yoga group. The average weekly neck pain intensity at baseline, during and post intervention, comprising 11 total time points, was used to construct the growth models. We performed a step-up linear mixed model analysis to investigate change in NPI during the yoga intervention. We fit nested models using restricted maximum-likelihood estimation (REML), tested fixed effects with Wald test p-values and random effects with the likelihood ratio test. We constructed 10 REML models.

Results: The model that fit the data best was an unconditional random quadratic growth model, with a first-order auto-regressive structure specified for the residual R matrix. Participants in the yoga group showed significant variation in NPI. They demonstrated variation in their intercepts, in their linear rates of change, and most tellingly, in their quadratic rates of change.

Conclusions: While all participants benefitted from the yoga intervention, the degree to which they benefitted varied. Additionally, they did not experience a consistent rate of reduction in NPI − their NPI fluctuated, either increasing and then decreasing, or vice-versa. We comment on the clinical and research implications of our findings.

1. Introduction

Chronic pain is highly prevalent[1,2] and has deleterious effects on the physical[5,6] and mental health[4,5] of those suffering from it. Additionally, chronic pain has a socioeconomic impact, contributing to both direct (physicians' visits, hospital stays, prescription drugs) and indirect (work absenteeism, disability) costs.[7,21] Neck pain is a common medical problem affecting approximately every other person[1] in the population and has been shown to be particularly prevalent among women[1–3,19–21] and the elderly.[19–21] Neck pain is associated with a decline in health-related quality of life[22] and has a major economic impact on society.[18] Conventional non-invasive treatments for neck pain include exercise, physical therapy, medication and educational interventions that utilize home exercises to improve self-efficacy.[23] However, such treatments have shown either negligible or small analgesic effects,[24] warranting the investigation of supplementary approaches to ameliorate pain.

Yoga has increasingly been shown to be effective in relieving pain and disability[10] that accompanies multiple physical ailments[8,9] such as cancer and chemotherapy,[28,43–46,58] migraine headaches,[25] osteoarthritis[26] and rheumatoid arthritis.[27] Several studies have investigated

the impact of yoga on musculoskeletal pain in general[11–13] and lower back pain in particular.[14–17,59] However, at the time of the original study[41] the impact of yoga on chronic non-specific neck pain had not yet been investigated. This secondary analysis investigated individual differences in chronic non-specific neck pain intensity during the 9-week Iyengar yoga course. While longitudinal analyses of pain in general,[52,53] and back pain in particular,[51,54,55] have become more common, longitudinal analyses of neck pain[56] are less common. Extant research has yet to investigate individual differences in chronic non-specific neck pain intensity (NPI) during a yoga intervention. The present study was conducted to address this void in the literature.

2. Methods

2.1. Participants

Participants were recruited through a local newspaper advertisement. Responders were screened by a researcher. Participants that successfully passed the screening interview were examined in person by a physician. The physician made physical and neurological assessments and also recorded medical and medication histories. Participants then completed a psychosocial questionnaire.

Participants included in the study were between 18 and 60 years of age and had self-reported non-specific neck pain for a minimum of 5 days per week for at least the preceding three months. Each included participant's mean NPI on a Visual Analog Scale of 100 mm was at least 40 mm. Participants with specific causes of neck pain, including radicular syndrome, congenital spine deformity, whiplash, disc protrusion, spinal canal stenosis, rheumatic and oncological diseases, were excluded from the study. Participants who reported invasive spinal treatment during the previous month or spinal surgery in the previous 12 months were excluded from the study, as were pregnant women and participants who were not able to practice yoga due to physical disabilities. Participants with severe psychiatric disorders and somatic comorbidity were also excluded. Participants who had started a new treatment during the previous month as well as those who were planning to start a new treatment in the subsequent nine weeks were also excluded from the study. Participants who met these criteria were provided detailed information about the study. Final participants provided signed, informed consent. Final inclusion age ranged from 19 to 60 years, with a mean of 47.8. Females made up 82.4% of the participants.

2.2. Procedure

The study was conducted in the Department of Internal and Integrative Medicine, Kliniken Essen-Mitte, University of Duisburg-Essen in Essen, Germany. The study was approved by the local ethics committee (approval number 10–4358) and registered at https://clinicaltrials.gov (registration number NCT01171274). A non-stratified block randomization with randomly varying block length was used to assign participants. The RANUNI function of the SAS language (created by Anthony Barr at North Carolina State University) was used to generate random numbers. The generated random numbers along with their respective assigned interventions were individually printed and sealed in envelopes. After each successful assessment, the physician opened the envelope with the lowest available number to discover which intervention the participant was to be assigned to. Of the 58 participants included in the study, seven dropped out prior to group randomization; of those remaining, 25 were randomized to the yoga group and 26 were randomized to the exercise group. Two students in each group dropped out prior to the start of the intervention, resulting in 23 participants in the yoga group and 24 participants in the exercise group. The participants in the exercise group were offered the opportunity to participate in a yoga course upon study completion. The current analysis focused on the yoga intervention.

2.3. Measures

2.3.1. Visual analog scale for pain intensity

Study participants recorded their current NPI in a daily diary for one week prior to randomization and 10 weeks post randomization. Neck pain intensity was measured on a Visual Analog Scale (VAS) of 100 mm (0 indicated no pain, and 100 indicated unbearable pain). The weekly average NPI was used for this analysis. Participants were also asked to journal their supervised and self-directed yoga practice as well as any treatment received during the study period, including medications and physical therapies.

2.4. Interventions

2.4.1. Yoga intervention

Iyengar Yoga[42] is a school of Yoga developed by B. K. S. Iyengar. Iyengar yoga is characterized by detailed attention to posture form and the use of props. Props, such as belts and blocks, increase stability and alignment and also reduce the risk of injury. Each participant was assigned to a cohort of 10–15 participants. The classes met once per week for 90 min for a total of nine weeks. The primary instructor for the course was both a certified Iyengar yoga teacher as well as a physiotherapist who had experience treating patients with chronic neck pain. A psychologist with a master's degree and specific experience treating chronic non-specific neck pain with Iyengar yoga functioned as a secondary instructor.

The intervention was designed for participants with chronic non-specific neck pain and no prior yoga experience. A pool of 14 yoga postures (Table 1) was selected to improve the posture and stability of the neck and shoulders, to lengthen and strengthen the neck and shoulder muscles and to relax these muscle groups. Each posture was to be practiced in the standing, sitting or supine position. Each week eight to 11 postures were selected from the pool. Every class began with the mountain pose (the most basic standing posture) and ended with the corpse pose (a guided relaxation performed in the supine position). Participants were introduced to increasingly advanced poses as the intervention progressed.

Participants were also required to engage in home practice for at least 10 minutes daily. The required home practice sequence did not vary during the intervention. The sequence included basic standing (mountain pose, standing half forward bend and warrior pose II) and sitting postures (Bharadvaja's twist and prosperous pose with and without spinal twist). Participants journaled daily home practice. As this secondary analysis did not investigate variation related to the home exercise group, the reader may refer to the previous paper for further details.[41] Participants in both groups were asked to make no changes to their routine medical care and medication protocols.

Table 1
Postures in Yoga Course.

POSTURE		WEEK								
(English)	(Sanskrit)	1	2	3	4	5	6	7	8	9
Bharadvaja's twist	Bharadvājāsana	x	x							
Bridge pose	Setu bandha sarvāngāsana	x				x	x	x		
Corpse pose	Shavāsana	x	x	x	x	x	x	x	x	x
Downward facing dog	Adho mukha svānāsana		x	x	x	x	x	x	x	x
Downward facing hero	Adho mukha virāsana		x	x		x			x	x
Extended side angle	Utthita pārshvakonāsana	x		x	x		x	x	x	x
Extended triangle	Utthita trikonāsana		x							
Mountain pose	Tādāsana	x	x	x	x	x	x	x	x	x
Prosperous pose	Svastikāsana			x	x	x	x	x	x	x
Reclining big toe	Supta pādāngusthāsana	x		x		x	x	x	x	x
Standing half forward bend (at wall)	Ardha uttānāsana	x	x	x	x	x	x	x	x	x
Thunderbolt pose	Vajrāsana		x	x		x	x	x	x	
Upward hand pose	Ūrdhva hastāsana				x	x				
Warrior pose II	Vīrabhadrāsana II	x	x	x	x	x	x	x	x	x