Preliminary Communication

Yoga-Based Intervention for Carpal Tunnel Syndrome

A Randomized Trial

Marian S. Garfinkel, EdD; Atul Singhal, MD; Warren A. Katz, MD; David A. Allan, MD, PhD; Rosemary Reshetar, EdD; H. Ralph Schumacher, Jr, MD

Context.—Carpal tunnel syndrome is a common complication of repetitive activities and causes significant morbidity.

Objective.—To determine the effectiveness of a yoga-based regimen for relieving symptoms of carpal tunnel syndrome.

Design.—Randomized, single-blind, controlled trial.

Setting.—A geriatric center and an industrial site in 1994-1995.

Patients.—Forty-two employed or retired individuals with carpal tunnel syndrome (median age, 52 years; range, 24-77 years).

Intervention.—Subjects assigned to the yoga group received a yoga-based intervention consisting of 11 yoga postures designed for strengthening, stretching, and balancing each joint in the upper body along with relaxation given twice weekly for 8 weeks. Patients in the control group were offered a wrist splint to supplement their current treatment.

Main Outcome Measures.—Changes from baseline to 8 weeks in grip strength, pain intensity, sleep disturbance, Phalen sign, and Tinel sign, and in median nerve motor and sensory conduction time.

Results.—Subjects in the yoga groups had significant improvement in grip strength (increased from 162 to 187 mm Hg; $P = .009$) and pain reduction (decreased from 5.0 to 2.9 mm; $P = .02$), but changes in grip strength and pain were not significant for control subjects. The yoga group had significantly more improvement in Phalen sign (12 improved vs 2 in control group; $P = .008$), but no significant differences were found in sleep disturbance, Tinel sign, and median nerve motor and sensory conduction time.

Conclusion.—In this preliminary study, a yoga-based regimen was more effective than wrist splinting or no treatment in relieving some symptoms and signs of carpal tunnel syndrome.

JAMA. 1998;280:1601-1603

CARPAL TUNNEL syndrome (CTS) is a common problem in the workplace and causes significant morbidity. In addition to its potentially debilitating physical aspects, CTS has a negative financial impact resulting from lost time from work and increasing medical expenses.[1] Traditionally, CTS has been treated with wrist splints, anti-inflammatory agents, avoidance of occupational duties, career changes, injection therapy, and surgery. However, many of these options have provided less than satisfactory symptom relief.[1]

Yoga and relaxation techniques have been used to help alleviate musculoskeletal symptoms.[2] However, except for a previous study on osteoarthritis of the hand,[3] to our knowledge, these methods have not been studied in a prospective controlled trial. Our previous investigation showed significant improvement in range of motion, decreased tenderness, and decreased hand pain during activity in patients with osteoarthritis who followed a supervised program of yoga and relaxation.

The purpose of this study was to evaluate whether a program of yoga and relaxation techniques might offer an effective treatment alternative for patients with CTS. Yoga was proposed to be helpful because stretching may relieve compression in the carpal tunnel, better joint posture may decrease intermittent compression, and blood flow may be improved to decrease ischemic effects on the median nerve. In this article, we report the results of a randomized controlled trial examining the effects of an intervention using supervised yoga and relaxation techniques specifically designed for patients with CTS.

METHODS

Subject Selection

Approximately 400 potential subjects were recruited through advertisements in the city newspaper and notices posted at study sites. After initial screening by telephone, 72 interested, available, and suitable patients with characteristic symptoms of CTS were interviewed in person and examined; 51 subjects met the criteria for inclusion in the study.

Entry criteria included the presence of at least 2 of 5 of the following clinical findings: positive results on Tinel sign, positive results on Phalen sign, pain in the median nerve distribution, sleep disturbances resulting from hand symptoms, and numbness or paresthesias in the median nerve distribution. All potential subjects were required to have abnormal median nerve conduction latencies on neuroelectrical testing.[4] All subjects were required to agree not to change medications, receive other new treatments, or change work duties during the study. Exclusion criteria were previous surgery for CTS, rheumatoid arthritis or other recognized inflammatory arthritis, CTS related to systemic disease (such as hypothyroidism), and pregnancy.

The study took place at Ralston House, the Geriatric Center of the University of Pennsylvania in Philadelphia, and at QVC

From the Department of Medicine, Division of Rheumatology, University of Pennsylvania School of Medicine (Drs Garfinkel, Singhal, Katz, and Schumacher), the Arthritis-Immunology Center, Veterans Affairs Medical Center (Dr Schumacher), University of Pennsylvania Health System/Presbyterian Medical Center (Drs Katz and Allan), and the American Board of Internal Medicine (Dr Reshetar), Philadelphia, Pa. Dr Garfinkel is now with Cooper Health System and Center for Health and Wellness, Cherry Hill, NJ. Dr Singhal is now in private practice in Mesquite, Tex. Dr Reshetar is now with the Educational Testing Service, Princeton, NJ.

Reprints: Marian S. Garfinkel, EdD, 2301 Cherry St, #16F, Philadelphia, PA 19103 (e-mail: mariang102@aol.com).

Table 1.—Yoga Postures Used for Carpal Tunnel Syndrome*

1. **Sitting with extension of the trunk (dandasana).—**Sit on a chair with the trunk upright. Press hands into the seat. Press shoulder blades into the back. Move shoulders back and down.
2. **Hands in prayer position (namaste).—**Press palms and fingers of each hand together, with fingers away from their position of ulnar deviation. Release and repeat, pressing palms together with fingers spread as widely as possible. Repeat by pressing metacarpals of each finger. Pull fingers back into hyperextension, increasing distance between fingers of each hand.
3. **Arms extended overhead (urdhva hastasana).—**Stretch arms and fingers forward and up, with hands facing vertically. Open palms, keep fingers together and lock the elbows. Lift sides of the body. Keep arms straight.
4. **Arms extended overhead with fingers interlocked (parvatasana).—**Interlock fingers with the right thumb base over the left, with the base of the fingers in contact. Turn palms out and stretch arms forward and up. Lock elbows and keep arms straight. Raise trunk by lifting the arms and pull arms further back. Lower arms. Repeat with left thumb over the right.
5. **Arms interlocked in front of the body (garudasana).—**Bend elbows, crossing arms in front of the chest with the forearms stretching up and thumbs facing the head. Cross left elbow over the right. Move right hand toward the head and the left hand away; cross hands and place fingers of the right hand on left palm. Stand and raise elbows to shoulder level and bend them. Stretch hands and fingers. Release arms and stand straight.
6. **Chair twists (bharadvajasana).—**Sit sideways on a chair, with right hip and thigh against the back of chair. Stretch the trunk up and pull shoulders back. Keep knees and feet together, turn toward the back of chair. Place hands on back of chair. Pull left hand to bring left side toward back of chair and push with right hand to turn right side away. Turn body then the head to look over right shoulder.
7. **Standing, mountain pose (tadasana).—**Stand straight in bare feet, facing forward, feet together, toes and heels in line, with big toes and centers of the inner ankles touching. Balance weight evenly on inner and outer edges of both feet and heels and soles. Lift knee caps into the joints. Raise upper chest and collarbones.
8. **90-Degree forward bend to wall (half uttanasana).—**Stand with feet 1 foot apart. Stretch the arms over head. Bend from the hips, extending entire body toward the wall, hands touching the wall. Stretch forward.
9. **Arms extended overhead with palms together in prayer position (virabhadrasana 1, arms only).—**Stand in tadasana. Stretch arms to sides at shoulder level keeping fingers together. Turn arms circularly in their sockets, palms facing the ceiling. Keeping arms straight, extend them over the head until they are parallel. While moving arms upward, stretch the sides of chest and armpits. Take arms back, and bring them closer together; join palms, with the fingers stretching upward. Lock elbows.
10. **Dog pose with chair, with special emphasis on hand placement (urdhva mukha svanasana).—**Stand, feet hip width apart, facing the seat of a chair. Bend, placing palms on the seat, shoulder width apart. Straighten arms and lift waist, hips, and knees a few inches above chair. Turn arms out and curve trunk back between them. Bring coccyx, sacrum, and lumbar spine forward, keeping buttocks tight. Stretch front of the body from the pubis. Raise sternum and ribs. Hold shoulders back. Press shoulder blades and dorsal spine in.
11. **Hands joined in prayer position behind the back (namaste).—**Stand in tadasana. Join palms behind the back, fingers pointing down and in line. Turn hands toward the trunk and then up. Raise them as high as possible between the shoulder blades. Join heels of the hands and press little fingers into the dorsal spine. Stretch fingers up. Turn upper arms outward and press shoulders back and down.
12. **Relaxation.—**Lie flat on the back. Keep arms slightly away from thighs, palms up, heels together, and toes apart. Close eyes. Breathe deeply. Concentrate on soft, slow exhalation. Relax lower jaw, tongue, and pupils of the eyes. Relax completely and exhale slowly. Remain in pose for 10 to 15 minutes.

*Hold positions 1 through 11 for 30 seconds and breathe through the nose. Do not tense the throat and keep the shoulders away from the ears. Repeat each position. The Iyengar system of hatha yoga emphasizes structural alignment. These postures are described in abbreviated form. A detailed description of the yoga intervention is available on request from the author.

Corporation, an industrial site in West Chester, Pa. Participants from QVC were actively employed and were compensated to arrive 1 hour before their shift began. Ralston House participants included employed and retired subjects. The study was approved by the institutional review boards of Presbyterian Medical Center, Philadelphia, Pa, and the University of Pennsylvania Medical Center. Written informed consent was obtained from study subjects.

Interventions

Subjects were randomized into 2 groups by having them select sealed envelopes containing a group assignment. Subjects in the control group were offered a standard wrist splint with a metal insert (if not already in use) to supplement their current treatment. Subjects in the yoga-based intervention group received a program focused on upper body postures: improving flexibility; correcting alignment of hands, wrists, arms, and shoulders; stretching; and increasing awareness of optimal joint position during use. We used the Iyengar approach to hatha yoga, which emphasizes proper structural alignment of the body and is based on the teachings of yoga master B. K. S. Iyengar.[3,5] The method of study is orderly and progressive, and postures are adjusted to meet the physical conditions of the subjects. With education in the postures (asanas), habitual poor posture can improve. As musculoskeletal alignment improves, the ability to perform the asanas also should improve. Potential benefits of this method include improvements in strength, coordination, and flexibility and an increased sense of well-being.

The sequence of postures used in this study was designed to focus on the upper body for subjects with CTS. The exercises were performed while the subject was sitting and standing and were designed to take each joint in the upper body through its full range of motion with strengthening, stretching, and balancing each part.[5] Instructions for the 11 asanas used and the relaxation technique are shown in Table 1.

Every session ended with relaxation using the relaxation response of savasana (corpse pose), which is proposed to help counteract the energy-draining effects of prolonged stress and chronic pain.[5] During relaxation, the body remains still and movement is not possible.

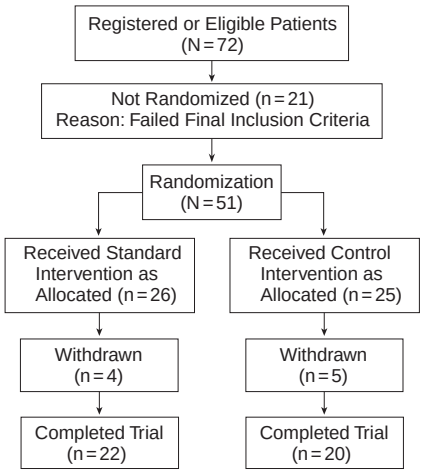

Figure.—Progress through the various stages of a randomized controlled trial, including flow of participants, withdrawals, and timing of primary and secondary outcome measures.

The yoga program was given for 1 to 1½ hours twice weekly by 1 instructor (M.S.G.) for 8 weeks.

Measurements

Subjects reported the approximate number of hours of disturbed sleep per night during the previous week. Subjects indicated the intensity of pain for the previous week on a visual analog scale of 0 to 10, with 10 indicating the greatest level of pain.[6] Phalen[7] sign (90 seconds) and Tinel sign[8] were assessed, with results recorded as positive or negative for each involved wrist. Patterns of paresthesia and numbness were recorded on hand diagrams. Grip strength was measured with a sphygmomanometer cuff that was rolled, taped, and inflated to 20 mm Hg. The subject was encouraged to squeeze with maximum strength and the best of 3 efforts was recorded for each hand.

An electroneurometer[4] (NERVE-PACE, NeuMed [Neurotron Medical], Lawrenceville, NJ) was used to measure the distal latency of the median nerve across the wrist. This electroneurometer has been validated to show comparable specificity to standard nerve conduction studies.[9] All tests were assessed at baseline and were repeated at the end of 8 weeks. The assessments all were conducted by 1 physician (A.S.) who was blinded to the patient's group assignment and the intervention.

Statistical Analysis

Differences between the pretest and posttest changes were examined using repeated-measures analysis of variance for within-group differences in improvement for continuous measures of grip strength and nerve conduction times (sensory and motor) for each involved

Table 2.—Characteristics of Study Subjects by Group

Characteristic	Yoga Group* (n = 22)	Control Group (n = 20)
Age, mean (median) [range], y	48.9 (45) [17-68]	48.7 (42) [18-70]
Sex		
Women	16	12
Men	5	8
Race		
Black	3	3
White	18	17
Smokers	2	5

*Demographic data missing for 1 subject. Data are presented as number of subjects unless otherwise indicated.

Table 4.—Improvement in Phalen Sign, Tinel Sign, and Sleep Disturbance*

Variable	Yoga Group	Control Group	χ^2	P Value
Phalen sign				
Improved	12	2		
Same	18	19	9.72	.008
Worsened	2	7		
Tinel sign				
Improved	7	3		
Same	22	21	1.88	.39
Worsened	4	6		
Sleep disturbance				
Improved	4	2		
Same	13	14	2.68	.26
Worsened	0	2		

*Data are presented as number of involved wrists for Phalen sign and Tinel sign, and as number of subjects for sleep disturbance.

Table 3.—Comparison Between Grip Strength, Pain, and Sensory and Motor Nerve Conduction Times*

Variable	n†	Mean (SD) Pretest	Posttest	Improvement	P Value‡
Grip strength, mm Hg					
Yoga	33	161.6 (70.4)	187.4 (68.8)	25.8 (41.4)	.009
Controls	29	183.9 (69.5)	190.5 (68.2)	6.6 (41.1)	.37
Pain, visual analog scale (1-10)					
Yoga	22	5.0 (2.8)	2.9 (2.2)	2.1 (3.1)	.02
Controls	20	5.2 (2.1)	4.3 (2.2)	0.9 (2.8)	.16
Median nerve sensory conduction, ms					
Yoga	35	4.40 (1.5)	3.97 (1.5)	.42 (1.8)	.18
Controls	32	4.66 (1.4)	4.36 (1.6)	.29 (1.5)	.28
Median nerve motor conduction, ms					
Yoga	33	4.79 (1.3)	4.27 (1.4)	.52 (1.7)	.08
Controls	29	4.78 (1.1)	4.52 (1.1)	.26 (0.8)	.09

*Repeated measures analysis for each of the variables (grip strength, pain, and sensory and motor conduction time) showed none of the test results was significant at the .05 level for between-group differences.
†Data are presented as number of involved wrists for grip strength and median nerve conduction times, and as number of subjects for pain.
‡*P* values are 2-tailed and reflect paired differences within groups.

wrist, and for pain intensity for each subject. Paired difference *t* tests were conducted to examine pretest vs posttest differences on continuous variables within each group. χ^2 Tests were used to examine the relationship between group membership and categorically coded variables of improvement on Phalen sign, Tinel sign, and sleep disturbance. The $P<.05$ level of significance was used. Post hoc analysis was carried out to calculate the appropriate sample size to detect clinically meaningful differences in each of the proposed tests. For variables measured on a continuous scale this sample size would yield a power of 80%, and for variables measured on a categorical scale power would be 64%.

RESULTS

Of the 51 subjects who met inclusion criteria and were randomized, 9 dropped out or were excluded (Figure 1). Final data were analyzed for 42 subjects (67 unique wrists with CTS), 22 (35 wrists) in the yoga group and 20 subjects (32 wrists) in the control group (Table 2).

Table 3 shows a comparison between pretest and posttest results for pain, grip strength, and nerve conduction time (sensory and motor) in the yoga-treated and control groups. Patients in the yoga-treated group had statistically significant improvements for grip strength and pain reduction. Trends toward improvement also were observed within the yoga-treated group in pretest to posttest measures of motor nerve conduction time, Phalen sign, Tinel sign, and sleep disturbance, although these trends were not statistically significant. Both groups also showed trends toward improvement in sensory and motor nerve conduction times, but no significant differences between pretest and posttest values were found. Results of repeated-measures analyses for between-group differences were not statistically significant for any of the variables. Improvement on Tinel sign, Phalen sign, and reported sleep disturbance were more common in the yoga-treated group, but were statistically significant only for improvement in Phalen sign (Table 4).

COMMENT

Occupationally related health problems such as CTS are the leading cause of lost earnings in the workplace.[10] As a result of cumulative trauma disorders, businesses sustain substantial losses annually due to medical expenses and lost productivity. In this study, a program of yoga-based simple stretching and postural alignment, which does not require drugs, expensive equipment, or surgery, reduced pain and improved grip strength for patients with CTS.

Yoga classes such as the one used in this study can improve awareness of proper postures and use of the upper extremities. Although not studied here, we propose that a properly supervised program may be helpful not only to treat symptoms, but also to prevent recurrences or the onset of symptoms.

Our study was designed as a preliminary study and as such has several limitations including small sample size, lack of generalizability, and the use of a simple wrist splint as a control. We did not obtain data on medication use, time lost from work, or patient compliance with wrist splint use or other therapies.

Although not systematically studied, many subjects in the yoga group reported that they maintained improvement in their CTS symptoms 4 weeks after conclusion of the program. Further studies are needed to ascertain whether a single course of yoga intervention with occasional reinforcement can be effective for long-term relief. Programs could be initiated at workplaces with a high incidence of CTS, perhaps with 2 classes per week for 8 to 10 weeks, with monthly follow-up sessions to monitor home practice. Continued evaluations of outcomes are needed to evaluate long-term effects of yoga on CTS symptoms, lost time from work, and patient satisfaction.

This study was supported by grant 91-07-14 from the Commonwealth of Pennsylvania.

References

1. Pascarelli E, Quilter D. *Repetitive Strain Injury: A Computer User's Guide.* New York, NY: John Wiley & Sons Inc; 1994:55-57.
2. Garfinkel MS. *The Effect of Yoga and Relaxation Techniques on Outcome Variables Associated With Osteoarthritis of the Hands and Finger Joints.* [dissertation]. Philadelphia, Pa: Temple University; 1992.
3. Garfinkel MS, Schumacher HR Jr, Husain A, Levy M, Reshetar RA. Evaluation of a yoga based regimen for treatment of osteoarthritis of the hands. *J Rheumatol.* 1994;21:2341-2343.
4. Atroshi I, Johnsson R. Evaluation of portable nerve conduction testing in the diagnosis of carpal tunnel syndrome. *J Hand Surg Am.* 1996;21:651-654.
5. Iyengar BKS. *Light on Yoga.* London, England: Allen & Unwin; 1966:544.
6. Huskisson EC. Measurement of pain. *J Rheumatol.* 1982;9:768-769.
7. Phalen GS. The carpal tunnel syndrome: seventeen years' experience in diagnosis and treatment of six hundred fifty-four hands. *J Bone Joint Surg Am.* 1966;48:211-228.
8. Mossman SS, Blau JN. Tinel's sign and the carpal tunnel syndrome. *BMJ.* 1987;294:680.
9. Steinberg DR, Gelberman RH, Rydevik B, Lundborg G. The utility of portable nerve conduction testing for patients with carpal tunnel syndrome: a prospective clinical study. *J Hand Surg Am.* 1992;17:77-81.
10. Thompson R. Workers' comp costs: out of control. *Nation's Business.* July 1992;80:1-6.