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RESEARCH ARTICLE

Nerve muscle physiology changes with yoga in professional computer users

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ABSTRACT

Background: Nerve muscle dysfunction is a common cause of occupational injuries collectively called as repetitive stress injury or musculoskeletal diseases adversely affecting the patients socially and economically. Yoga an ancient Hindu practice which combines body and mind relaxation techniques is finding the new interest of modern world due to its simple and natural technique and associated benefits. **Aims and Objectives:** The objective of this study is to evaluate the objective changes associated with yoga in the nerve muscle physiology of professional computer users. **Materials and Methods:** A total of 60 study participants were randomly divided into a group that received yoga therapy and those who did not receive any intervention. Motor performance using handgrip strength (HGS) and endurance, median nerve conduction velocity (MNCV) and bimanual coordination were recorded before and after the intervention. **Results:** HGS has increased in yoga with counseling group for both hands (statistically not significant). Yoga with counseling group has shown significant improvement in right MNCV as compared to counseling ($P < 0.006$). The participants of yoga with counseling group have shown a significant decrease in error during bimanual coordination ($P = 0.003$), and efficiency index has shown a trend toward improvement. **Conclusion:** This study showed yoga improves neuromuscular physiology in computer-related musculoskeletal disorders.

KEY WORDS: Yoga; Computer Users; Occupational Diseases; Handgrip Strength; Nerve Conduction Velocity; Bimanual Coordination

INTRODUCTION

Neuromuscular tissues are at a high risk of injury in occupations where a constant posture is adopted for a longer duration than usual. Exposures to occupational hazards substantially increase workers' risk of developing musculoskeletal disorders (MSDs) and can exacerbate pre-existing disorders.[1] Possible pathophysiological mechanisms of tissue injury include inflammation followed by repair and/or fibrotic scarring, peripheral nerve injury, and central nervous system reorganization. Computers have become essential in the modern world where a working minimum of 8 h continuously has become a norm in many professions. With computers finding a way into all professions almost everyone is at risk of developing repetitive stress injury (RSI).[2] MSDs are the most common self-reported work-related illness in the U.K. with upper limb disorders the second highest reported condition.[3] Computer users often adopt poor wrist postures, working in deviated postures and incorrect adjustment of the workstation are thought to increase the risk of injury.[4] MSDs have a higher prevalence and incidence in women.[5] Symptoms of RSI can appear in the neck, shoulders, elbows, and wrists, RSI can be severely disabling, leading to unemployment and chronic pain or weakness.[6] Exposure to occupational hazards accounts for a significant proportion of the global burden of disease and injury, which could be substantially reduced through application of proven risk prevention strategies.[7]

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Yoga and relaxation technique have been used to help alleviate musculoskeletal symptoms and can be an effective tool to reduce the work-related stress disorders. The credibility of yoga is established as a complementary treatment and management modality in different neurological disorders. Yoga was proposed to be beneficial as stretching may relieve compression in the carpal tunnel, better joint postures may decrease intermittent compression over nerves, and blood flow may be improved to decrease ischemic effects in the median nerves.[8]

Although yoga has shown beneficial results in general, there are no randomized controlled studies that have objectively evaluated the neuromuscular physiology. Hence, the proposed study evaluates the neuromuscular changes associated with yoga in the subset of computer professionals reporting musculoskeletal symptoms.

MATERIALS AND METHODS

A cross-sectional study was conducted at Department of Physiology at JN Medical College Belgaum, Karnataka, India. The study was approved by Institutional Ethics Committee. Informed written consent was obtained from all the study participants. Symptomatic administrative and supportive staff aged <45 years, who spent at least 10-15 h/week with the computer and who have been in the same occupation for the past 12 months were recruited into the study.

Physical deformity of the upper limbs or neck, previous history of diagnosed neuropathy or history of thyroid disease excluded participation in the study. The 60 eligible and consented subjects were enrolled in the study. Of the eligible and consented 60 subject's descriptive data such as age, sex, personal history about alcoholism and smoking, occupational history regarding years of employment, duration of work/week was collected by a predesigned and pretested pro forma. Motor performance was measured by; Power of the hand muscles by handgrip strength using handgrip spring dynamometer model 5030 kits. Median nerve motor conduction by Neurocare™-2000 computerized EMF/NCV/EP equipment. Time and error in executing the task during bimanual coordination test by electronic chronoscope.

After enrollment in the study, randomly chosen 29 participants received training from yoga expert of Yoga center for 3 days for 1 h based on the teaching of yoga master Dr. B.K.S. Iyenger.[7] Participants performed the yoga daily in the morning for 1 h, 6 days in a week for 3 months. The observation was done twice weekly. Remaining 29 participants acted as controls who were given only counseling.

Following yoga postures were included in the study: (a) Dandasana (sitting with extension of the trunk); (b) namaste (Hands in prayer position); (c) Urdhva hastasana (arms extended overhead); (d) Parvatasana (Arms extended overhead with fingers interlocked); (e) Garudasana (Arms interlocked in front of the body); (f) Bharadvajasana (chair twists); (g) Tadasana (standing, mountain pose); (h) Half uttanasana (90-Degree forward bend to wait); (i) Virabhadrasana 1, arms only (Arms extended overhead with palms together in prayer position); (j) Urdhva mukh svanasana (Dog pose with chair, with special emphasis on hand placement); and (k) Savasana (Relaxation). After 3 months of intervention, all the parameters were recorded again.

RESULTS

Of the eligible 60 participants, one participant from each group was excluded as they withdrew from the study and 58 patients completed the study (Figure 1).

A total of 58 participants were analyzed (Table 1). The readings taken before intervention were considered as baseline values. Paired and unpaired *t*-test was used to compare the means of continuous variables. Chi-square test was used to compare the rates of categorical variables. $P < 0.05$ was considered statistically significant.

Yoga group has shown more improvement in handgrip strength in both hands compared to controls, but this was significant in the left side ($P < 0.018$). Decrease in right-hand

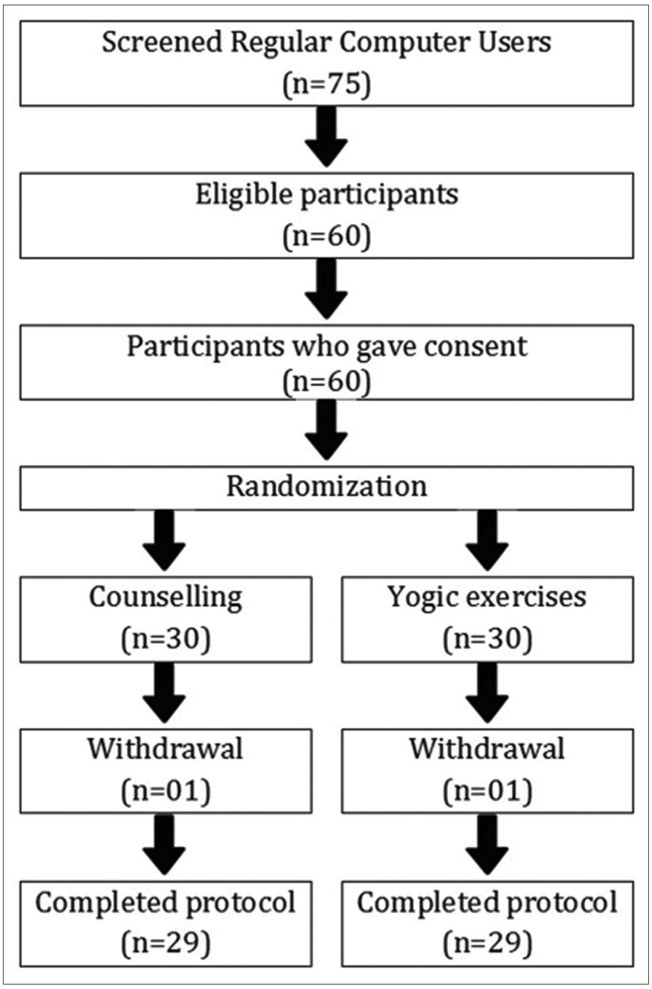

Figure 1: Study flow-chart

grip endurance is less in yoga group although statistically not significant (Table 2). There was a trend of increased NCV in both right and left hands when compared to control group. Right hand NCV was statistically significant (*P* < 0.006) (Table 3). Time taken for bimanual coordination was decreased in both groups but less in the yoga group. Errors done during bimanual coordination was more in controls than yoga group (Table 4). This mean difference was statistically significant (*P* = 0.003). Efficiency index (EI) of bimanual coordination showed trends toward improvement in yoga group as compared to control group (*P* = 0.075) (Table 5).

Table 1: Demographic profile of the participants

Variables	Yoga group	Control group
Age (mean±SD)	34.31±8.12	31.24±5.17
Sex		
Male	23	19
Female	06	10
Length of service (mean±SD)*	10.00±3.95	7.96±3.20
Mean h/week (mean±SD)	28.82±7.92	28.58±6.34
Nature of work		
Keyboard	13	10
Mouse	07	03
Both	05	07
Breaks during working		
Yes	05	07
No	24	22

SD: Standard deviation, *$P<0.05$

Table 2: HGS and endurance HGE before and after intervention

Variables	Yoga	Control
Right		
HGS (Kg)		
Before	22.62±7.45	22.82±6.90
After	24.79±7.64	23.51±6.90
Mean difference	2.17±3.75	0.69±4.18
HE (min)		
Before	01.23±1.14	01.02±1.26
After	01.19±1.41	00.64±0.61
Mean difference	−0.04±1.41	−0.38 1.35
Left		
HGS (Kg)		
Before	22.13±7.97	22.27±6.46
After	22.58±8.27	22.58±7.58
Mean difference	0.44±2.97	00.31±4.12
HGE (min)*		
Before	00.77±0.94	00.87±0.92
After	01.08±1.15	00.50±0.47
Mean difference	0.30±1.08	−0.37±1.01

HGS: Handgrip strength, HGE: Handgrip endurance, *$P<0.05$

In this study, right handgrip strength (HGS) increased in yoga group by 9.6% (control 3%) and in left HGS 2% (1.4%). NCV was increased in yoga group by 7% versus 0.7% in control group on right side and 4.5% yoga group versus 2.3% in controls. Time taken during bimanual coordination was decreased in yoga group by 4% compared to and in counseling group by 11.2% in control group. Error during bimanual coordination improved in yoga group by 57.2% following the intervention. EI of bimanual coordination increased in yoga by 2.5% and in control group by 0.02%.

DISCUSSION

MSD are one of the major causes of disability around the world.[9] The root cause includes a high level of strain, high repetition, holding long isometric contractions, poor posture, and direct pressure over nerves. Characteristic complaints of these disorders include pain, weakness, numbness, loss of function, and a variety of neuromuscular symptoms. These conditions are far easier to prevent than cure once contracted.

Table 3: Median nerve conduction velocity before and after intervention*

MNCV (min/sec)	Yoga group	Control
Right*		
Before	55.80±7.68	60.19±8.70
After	59.79±6.59	61.54±7.79
Mean difference	3.98±3.87	1.35±3.07
Left		
Before	57.22±5.97	61.04±7.99
After	59.80±5.60	62.44±7.76
Mean difference	2.58±3.03	1.40±2.84

MNCV: Median nerve conduction velocity, *$P<0.05$

Table 4: Bimanual coordination before and after intervention

Variables	Yoga group	Control group
Time (s)		
Before	258.37±76.40	252.96±71.53
After	247.93±57.99	224.69±62.98
Mean difference	−10.44±70.60	−28.27±51.15
Error* (min)		
Before	07.27±8.30	03.00±3.99
After	03.11±4.32	04.00±5.55
Mean difference	−4.16±6.82	0.99±5.59
EI (%)		
Before	93.01±13.27	97.04±4.69
After	95.34±9.17	97.06±3.99
Mean difference	2.33±4.87	0.01±4.87

EI: Efficiency index of bimanual coordination, *$P<0.05$

Table 5: Summary for changes (%) following intervention for participants in the yoga and counseling groups

Groups	RHGS	RE	LHGS	LE*	RNCV*	LNCV	Time	Error*	EI
Yoga with counseling	9.6	−3.2	2.0	40.2	7.1	4.5	−4.0	−57.2	2.50
Counseling	3.0	−37.2	1.4	−42.5	0.7	2.3	−11.2	33.3	0.02

*Significant at P=0.05, RHGS: Right handgrip strength, RE: Right endurance, LHGS: Left handgrip strength, LE: Left Endurance, RNCV: Right nerve conduction velocity, LNCV: Left nerve conduction velocity, TBMC: Time taken during bimanual coordination, EDBMC: Error done during bimanual coordination, EI: Efficiency index of bimanual coordination

During recent years, there has been worldwide interest in yoga. The use of yoga as a complementary therapy in clinical practice may lead to health benefits beyond traditional treatment alone; however, to effect changes in health-care policy, more high-quality, evidence-based research is needed.[10] The effect of yoga is not immediately seen on the body as is the case with another physical exercise. It takes a longer period to repair injuries incurred over a long time. Yoga is not a technique or a tool, but a way of life with discipline.

All the demographic profiles between the two groups were comparable except for the length of service which was more in yoga group and was found to be significant. When motor performance was assessed by HGS, strength increased in both hands in yoga group as compared to control group and this finding is consistent with the previous studies.[8,11] When handgrip endurance was compared, left-hand endurance showed significant improvement in yoga group as compared to controls, and this is consistent with the previous study.[11] The right handgrip endurance has decreased in both groups but the magnitude of deterioration is more in control group. This finding that is decreased deterioration in yoga group could be attributed to yogic exercises which have arrested the progress of the disease and have increased the overall motor performance of the participants.

In this study, median NCV has shown better improvement in yoga group when compared to controls, and this is in accordance with the previous study.[8] For bimanual coordination even though the yoga group took more time to complete the task, the error done was significantly less as compared to control group. EI for bimanual coordination was also found to be more yoga group. To assess the effect of yoga on bimanual coordination no previous studies were reported so far.

Hence, yoga is a potential, useful intervention for MSDs. However, further studies are required including large sample size, longer observation periods, more intense training should be carried out to achieve a better evaluation of the potentials of the practice of yoga to modify computer related MSDs. The program could be initiated at workplaces with high incidence of MSD. Continued evaluation of outcomes is needed to evaluate long-term effects.

CONCLUSION

Findings of this study with 12 weeks of yogic exercise as intervention indicate, yoga group has shown improvement in handgrip strength of hands, left-hand grip endurance, median NCV and EI of bimanual coordination. Hence, the study revealed a yoga based regimen is effective in relieving computer related MSDs proved by objective measures. However, further studies with larger numbers with well-defined criteria's across different occupations are required. This should be carried out to achieve a better evaluation of the potentials of the practice of yoga to modify or prevent work-related MSDs.

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