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Original Article

Physiotherapy Section

Combined Effects of Static Stretching and Ergonomic Modifications on Forward Head Posture among Desk Job Employees: A Quasi-experimental Study

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ABSTRACT

Introduction: The musculoskeletal condition known as Forward Head Posture (FHP) is common among desk workers and is frequently affected by extended screen time and inadequate ergonomic set-ups. This changed posture might result from muscle imbalance, decreased productivity, and neck pain. For posture correction and pain reduction, static stretching as well as ergonomic adjustments are proven techniques.

Aim: To evaluate the combined effects of static stretching and ergonomic modifications on FHP among desk job employees.

Materials and Methods: The present quasi-experimental multi-center study was carried out in the of Delhi NCR area, India among desk job workers. Thirty people between the age group of 20 to 50 years participated in the three weeks trial. group A (static stretching +ergonomic modifications) and group B (ergonomic modifications+ general physical activities) were randomly assigned to participants after they were examined by the inclusion criteria. Each participant did static stretching four times a week in three sets of ten repetitions each. Assessments were conducted utilising conventional musculoskeletal and postural criteria both before and after the intervention. Data analysis was done with Statistical Package for Social Sciences (SPSS) version 27.0 using a paired t-test. The level of significance was set at 0.05.

Results: Thirty volunteers with an average age of 31.87±1.65 years were included in the study. Both groups experienced significant improvements in Craniovertebral (CV) angle, with group B increasing from 45.77±1.73 to 47.46±1.72 ($p<0.001$) and group A increasing from 44.74±2.29 to 48.07±2.06 ($p<0.001$). In the same manner, Numeric Pain Rating Scale (NPRS) scores dropped dramatically in group B from 7.40±0.73 to 3.87±0.64 ($p<0.001$) and in group A, respectively, from 6.87±1.24 to 2.73±0.88 ($p<0.001$). The post-intervention results showed that group A CV angle and scores for pain improved more than group B.

Conclusion: Static stretching combined with ergonomic modifications has greater benefits than ergonomic modifications with general activities; however, both stretching and ergonomic modifications, as well as ergonomic modifications with general activities, have significant effects on FHP among desk job employees.

Keywords: Cervical vertebrae, Forward head posture, Posture, Workplace

INTRODUCTION

Ergonomics is the science of how to make a workplace so that employees may be as productive as possible while still feeling safe, secure, and comfortable at their desks [1]. Many people now suffer from musculoskeletal issues as a result of their increased use of smartphones and other electronic devices, particularly as a result of poor posture over time [2]. Instead of changing the worker for the job, ergonomics focuses on modifying the task to suit human abilities [3]. It is reasonable to assume that the percentage of time workers spend standing or walking versus sitting varies by occupation [4]. Comparing statistics from 2006 to 2012, roughly 40.7% of the world population was projected to be using computers in 2012 [5]. Studies have indicated that prolonged use of these devices can result in bad posture and health problems like back and neck pain [6]. For example, waiters and waitresses spend 96.3 percent of their workday standing or walking and only 3.7 percent of their time sitting, according to the Bureau of Labour Statistics and the National Compensation Survey programme [7]. An ergonomically appropriate workplace necessitates an assessment of demand for every given light activity in light of employees' capabilities throughout a specific period [8], while 90% of software engineers, 80.7% of accountants, and 83.3% of insurance sales agents were found to spend an average of their workdays sitting in 2016 [9]. Around 60% of workers used computers for work related tasks by 2013, and this percentage is expected to continue to increase as Information and Communication Technology (ICT) use increased significantly worldwide between 2006 and 2013 [10,11]. According to numerous studies, sleeping seven hours a night and spending 5.41 hours at a desk has a significant negative impact on one's physical and emotional well-being [12-15]. Ergonomically adjusted workplaces are essential for reducing workplace injuries, according to regulatory frameworks such as the Occupational Safety and Health Administration's (OSHA) standards [16]. Workplace productivity, decrease in stress, and psychological well-being have all been demonstrated to improve with interventions that include regular physical activity, especially static stretching exercises [17,18]. Further, recent research indicates that the combined use of stretching exercises and ergonomic adjustments significantly reduces discomfort in the muscles and improves the ability to function in office-based workers [19]. On the other hand, ignoring extended exposure to Visual Display Terminals (VDTs) might result in the occurrence of computer vision syndrome, a medical condition marked by eye strain, neurological signs, and related pain [20]. Although ergonomics and stretching have been the subject of several studies, very few have examined the combined effects of static stretching and ergonomic changes, particularly for those who spend a lot of time on computers. The main aim and objective of the study are to identify the effects of static stretching and ergonomic modifications on FHP among desk job employees.

MATERIALS AND METHODS

The present quasi-experimental multi-center study was conducted across the regions of Delhi NCR areas from several centers, among desk job operators between December to May 2022.

Sample size: This study was a randomised comparative analysis with 30 individuals. Since a formal sample size calculation was not carried out, the sample size was decided based on feasibility and the availability of eligible individuals during the study period. A straightforward random sample technique was used to select participants among the desk job operators in nearby office environments. The goal was to gain a basic understanding of how static stretching and ergonomic modifications affect FHP and neck pain so that pilot-level research could be conducted. All participants provided informed consent before participation. The study was conducted by institutional ethical guidelines and approved protocols.

Inclusion criteria: Male and female desk job operators aged between 20-50 years, individuals working for 6-8 hours or more daily in a sitting position, presence of FHP (clinically assessed), presence of chronic neck pain for more than three months with no history of any cervical/shoulder pathology were included.

Exclusion criteria: Those having history of cervical radiculopathy, trauma, or any diagnosed cervical/shoulder pathology, presence of neurological, psychiatric, inflammatory, rheumatic, endocrine, connective tissue, or cardiovascular conditions (e.g., stroke, myocardial infarction), and recent surgery within the past three months were excluded from study.

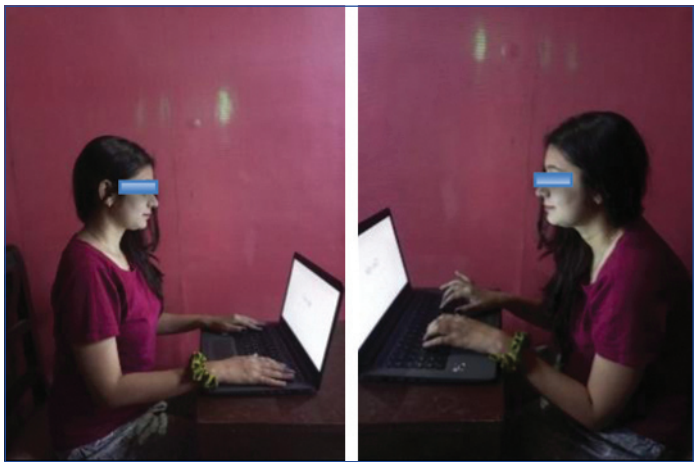
Study Procedure

Participants were divided into two groups group A and group B. Group A: Subjects with FHP received static stretching such as static levator scapulae stretch, static sternocleidomastoid stretching, chin tuck exercises and ergonomics modifications [21] were taught. The level of the eyes and the monitor, right sitting posture were taught.

Group B: Subjects were taught ergonomic modifications and general physical activity.

Ergonomic Modifications:

- Modifications of the chair height and the working desk.
- Modifications of the sitting posture [Table/Fig-1].
- Modifications of the distance and level between the eyes and the monitor.
- Maintenance of correct posture while sitting and standing.
- Avoiding awkward posture (head down posture) is essential [Table/Fig-2].
- Repeated stooping to be avoided.



[Table/Fig-1]: Modification of sitting posture.
[Table/Fig-2]: Avoid awkward posture. (Images from left to right)

Everyone who took part received three sets of static stretching every day, with 10 repetitions in each set, four times a week, and they did this for three weeks straight, prior to and after work. CV angle was measured by taking two lateral photographs of the subject in a relaxed, backless seated position. The spinous process of C7 and the tragus of the ear were identified with a body marker. Through C7, a horizontal line was generated that intersected the vertical at a straight angle. The angle between the line from the C7 spinous process to the tragus of the ear and the horizontal line was then measured using the MB ruler software [22]. Numeric Pain Rating Scale (NPRS) was rated on the basis of scale in which Individuals rated their pain on the basis of 0-10 point numerical scale, where 0 define no pain and 10 means extreme pain [23].

STATISTICAL ANALYSIS

The data analysis was carried out using the SPSS 27.0 edition of the software. Readings were analysed using a paired t-test. If the p-value was less than 0.05, the data was considered not normally distributed; if it was larger than 0.05, the data was considered to have a normal distribution. The level of significance was set up at $p<0.05$. A paired t-test was applied for within group comparison; $p<0.05$ was considered statistically significant. An independent t-test was applied, for between-group comparison; $p<0.05$ was considered to be statistically significant.

RESULTS

There were 30 participants in total, and their mean age was 31.87 years (±1.65). Group A (the experimental group) and group B (the control group) showed homogeneity in their baseline CV angle and NPRS scores. According to within group analysis using the paired t-test [Table/Fig-3]. The CV angle significantly improved in both group A (mean difference: +3.33±2.17, $p<0.001$) and group B (mean difference: +1.69±1.72, $p<0.001$). Accordingly, the NPRS scores declined significantly in group B (mean difference: -3.53±0.68, $p<0.001$) and group A (mean difference: -4.14±1.06, $p<0.001$) [Table/Fig-4]. According to an independent t-test intergroup comparison [Table/Fig-5], group A showed significant improvement in terms of improving CV angle ($p<0.01$) and lowering NPRS scores ($p=0.011$) than group B. This suggests that group A was more effective in enhancing posture and lowering discomfort, which was consistent with the findings of the research.

Parameters	Mean±SD	t-test	p-value
Group A Pre	44.74±2.29	7.203	p<0.001
Group A Post	48.07±2.06		
Group B Pre	45.77±1.73	4.565	p<0.001
Group B Post	47.46±1.72		

[Table/Fig-3]: Pre-Post Comparison of Craniovertebral (CV) angles between group A and group B.
Paired t-test applied for within group comparison; $p<0.05$ considered statistically significant

Parameters	Mean difference	t-test	p-value
Group A Pre	6.87±1.246	15.101	p<0.001
Group A Post	2.73±0.884		
Group B Pre	7.40±0.737	12.159	p<0.001
Group B Post	3.87±0.640		

[Table/Fig-4]: Pre and post comparison of Numeric Pain Rating Scale (NPRS) Scores between group A and group B using paired t-test.
Paired t-test applied for within group comparison; $p<0.05$ was considered statistically significant

Outcome measures	Group A (mean difference)	Group B (mean difference)	t-test	p-value
Craniovertebal (CV) angle	+3.33±2.175	+1.69±1.725	3.23	<0.01
NPRS	-4.14±1.065	-3.53±0.688	-2.63	0.011

[Table/Fig-5]: Intergroup comparison of change in Craniovertebral (CV) angle and NPRS.
An independent t-test was applied for between-group comparison; $p<0.05$ was considered statistically significant

DISCUSSION

The present study examined how ergonomic modifications and static stretching exercises affect desk job operators' FHP and neck pain. The results showed that the individuals who received static stretching and ergonomic adjustments (group A) had improved CV angle and reduced pain considerably more than those who only received ergonomic modifications (group B).

The mean increase in the CV angle was greater in group A (+3.33±2.17) than in group B (+1.69±1.72). The intergroup difference was statistically significant ($p<0.01$). This showed that the experimental group's FHP correction was more noticeable. These results were consistent with earlier research by Singh R et al., who showed that by lengthening shortened muscles such as the levator scapulae and sternocleidomastoid, focused static stretching enhances cervical posture [21]. A higher CV angle was a sign of improved head-neck alignment, which was important for avoiding the long-term musculoskeletal strain brought on by desk job.

Both groups reported a significant decrease in pain, although group A's NPRS scores decreased more than group B's (-4.14±1.06), and the intergroup comparison also reached statistical significance. This improved pain relief in group A was also supported by earlier research by Shariat A et al., and Howe MS et al., [18,24], which showed that office workers' musculoskeletal discomfort significantly decreased when stretching and ergonomic modifications were combined. Improved circulation, less mechanical stress, and a reduction in muscular tension brought on by stretching techniques may be the reasons for the experimental group's higher pain reduction.

The findings had significant clinical and practical implications for occupational health, particularly in India, where ergonomics is frequently neglected. Cervical alignment and pain can be improved by putting in place a planned workplace health program that incorporate ergonomic changes (such as modifying chair settings, monitor height, and posture signals) with quick static stretching exercises. Regular micro breaks with shoulder and neck stretches should be a part of desk based work jobs, according to occupational health managers and employers. These tactics are very flexible for big businesses because they are affordable, non-intrusive, and require little training.

By offering factual evidence of support for the complementary effects of stretching therapies and ergonomic adjustments, this study contributes to the expanding evidence of research on musculoskeletal problems associated with the workplace. The findings demonstrated that these therapies work best when combined, in contrast to research that assessed them separately. Occupational health should be approached more holistically, especially for occupations that require a lot of screen time.

The present study supported the findings of Singh R et al., who found that static stretching improves postural correction by focusing on shortened cervical muscles [21]. The enhanced CV angle was consistent with ergonomic research that indicated posture focused therapies lessen neck strain Howe MS et al., [24]. The present study results were consistent with those of Howe MS et al., and Shariat A et al., who found that combining ergonomic training with stretching significantly reduced neck pain associated with the job [18,24]. This provide assurance to the idea that more comfort is achieved by treating the musculoskeletal and biomechanical causes of discomfort.

To the best of the context, this is one of the few studies that assesses a dual intervention method in an Indian occupational setting. Combining education with useful therapies like static stretching could be a fresh and workable way to address posture-related illnesses in organisations with low ergonomic knowledge.

To confirm the results in various work environments, more research should be carried out with bigger and more varied sample sizes. Long-term monitoring is required to determine the long-term effects of static stretching added to ergonomic adjustments on posture correction and pain reduction. Future research can also look at how effectively similar interventions work in different work environments, such as virtual jobs or professions that need a lot of screen time. The financial burden of musculoskeletal issues in sedentary job opportunities, productivity among employees, and workers health could be significantly improved by a broader implementation of this research.

Limitation(s)

The study's modest participant count and short intervention period may have limited the findings' potential applications. Furthermore, the combination intervention's long-term effects were not evaluated.

CONCLUSION(S)

Performing static stretching and ergonomics modifications substantially improved forward head position and decreased neck pain in desk job workers, according to this quasi-experimental study. Combined static stretching as well as ergonomic changes, demonstrated a more significant decrease in discomfort and a higher improvement in CV angle, who received ergonomic alterations in addition to general physical activity.

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