Effectiveness of Strengthening Exercises in Patients with Ergonomically Low Back Pain: A Randomized Controlled Trial

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Abstract

Background: Low back pain is often associated with imbalances in hip muscle length and strength. It can result from prolonged over stretching of the innervated soft tissues when poor sitting or standing postures are maintained. These changes in muscular tone create muscle imbalance, which leads to movement dysfunction.

Objective: To evaluate the effect of stretching and strengthening exercises (Janda's approach) with conventional treatment in the subjects with postural low back pain in terms of pain intensity, level of function, index of lumbar lordosis, muscle strength and muscle length.

Method: The study design was a single observer blinded randomized controlled trial. 200 subject aged between 18 to 55 years, clinically diagnosed with ergonomical low back pain with LCS were included. The subjects were randomly allocated to two groups. Group A (control group) was provided with moist pack and core stability exercises and Group B (experimental group) was given moist pack and core stability exercises along with stretching of illiopsoas, rectus femoris and erector spinae and strengthening of abdominal and gluteal muscle for 10 sessions.

Keywords – Strengthening, Randomized, Controlled

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INTRODUCTION

In the fashionable age in all fields of man's Endeavour organized ideas and scientific practices are followed in accordance with the philosophies based on acquaintance, understanding and application of knowledge of science. The life style of an individual is also no immunity to this. Developed and under developed countries like U.S.A., Germany, Russia, Australia, Britain, India and other have ended rapid evolution in technologies, and all kinds of necessities of human beings, this advancement and the international achievements have been possible due to the research trialing and claim of scientific knowledge. Scientific physical training techniques have been evolved and an individual is given training scientifically with the latest training methods and classy instruments for enhancement in their performance in different orbits of life. Exercise science has consent to an individual for developing physical capacities beyond anything expected. Exercise and different physical activities have turn out to be corrective and openhanded alternative for medicines.

In the present era of modernization every individual lives a busy life putting stress on their body which is perceived as trivial by human nature. This stress over time mounds to a level where it presents as pain primarily in the low back region. Low back pain refers to complaints of acute or chronic pain and discomfort in or near the lumbar region.

The spine is the backbone of the body. It is an aggregate of spinal segments joined together to take over the load of the Head Arms and Trunk. The spine is made up of 32 vertebrae supported by the active mechanism of an array of soft tissue structures such as ligaments, joint capsules, fascia, intervertebral discs and muscles. Spinal column is divided into the cervical, thoracic, lumbar and sacral region. The most susceptible region that is under high stress load is the lumbar region. The lumbar spine functions as a complex interplay of musculoskeletal and neurovascular structures generating a movable yet stable transition linking the thorax and pelvis. The lumbar region repetitively sustains enormous loads throughout one's lifetime, while still providing the mobility necessary to allow a person to perform numerous tasks associated with daily living.

The lumbar region has core muscles wrapped around it to give it the necessary strength to sustain high load and aids in transmission of forces during high velocity activities. The core muscles are made up of key local and global muscles. The main stabilizing muscles are abdominals, back extensors, hip flexors and the gluteal muscles.

The human body functions optimally when it attains correct posture to perform everyday tasks. A myriad of occupations in today's world demanding prolonged sustained postures such as seen in the IT setups along with the changing lifestyle patterns towards a sedentary life has made non- specific low back pain as one of the most common health problem that leads to absenteeism at workplace.

Ergonomical Low back pain is a major cause of disability that occurs in similar magnitude across all cultures. It affects work performances, degrades quality of life and is the most common reason for medical consultations. The Global Burden of Disease Study (GBD) in 2010 showed that low back pain is among the top ten towering burden of ailments and injuries, with an average number DALYs (disability-adjusted life years) higher than HIV, road injuries, tuberculosis, lung cancer, chronic obstructive pulmonary disease and preterm birth complications. International surveys of LBP reports a point prevalence of 15-30%, and a 1-month prevalence of 19 - 43%. Worldwide estimates of lifetime prevalence of ELBP vary from 50 to 85%. The prevalence of non-specific low back pain (postural back pain) is estimated at 60–70% in industrialized countries (one-year prevalence 15–45%, adult incidence 5% per year).In India, occurrence of ELBP is peaking with nearly 60% of the population having significant back pain at sometime in their lives. 6,7 Ergonomical Low back pain is defined as pain and discomfort beneath the costal margin and above the inferior gluteal fold, without or with referred leg pain. It may be experienced as aching, burning, stabbing, sharp or dull, well-defined, or vague with intensity ranging from mild to severe.

It is characterized by an axial or parasagittal discomfort in the lower lumbar region and is musculoskeletal in nature.

Ergonomically Low back pain can be classified as acute or chronic based on the symptom duration. Another categorization of back pain is based on the underlying cause with non specific ergonomically low back pain bring reported more often than a known cause. An acute episode of low back pain further gives a history of having recurrence rate of 52-60% over a one year follow up which was claimed to be work related.

The prevalence of ergonomically low back pain has been reported in the range of 6.2% to 92% with increase of prevalence with age and female preponderance. An association of ergonomically low back pain is found with various psychological factors such as anxiety, job dissatisfaction, lack of job control mental stress, inconvenient working hours and depression. Low Socioeconomic status, poor education, previous history of ELBP along with physical factors such as lifting heavy loads, repetitive job, prolonged static posture and awkward posture make people susceptible to chronic economical low back pain.

History of back pain dates back to the time of Hippocrates where ancient methods were used in diagnosing and treating pain. Since then low back pain has undergone extensive research in order to find out the causative factors responsible for the debilitating condition. With advancement in medical science various causes of low back pain have surfaced. Causes of agronomical low back pain can be classified as referred pain syndromes and non referred pain syndromes. Referred pain syndromes include sacroiliac joint syndromes, posterior joint syndromes and nerve root compressions.

Nerve root compressions commonly reported are herniated disc lesions and lateral spinal stenos is. Non referred pain syndromes are mainly caused due to local bony and soft tissue pathology. Common conditions include muscle strains, ligament sprains and muscle imbalances.

OBJECTIVES OF THESTUDY

1. To evaluate the effectiveness of strengthening exercises with conventional treatment in the subjects with ergonomically low back pain in terms of pain intensity, level of function, index of lordosis, muscle length and strength.

REVIEW OF LITERATURE

Garbin AJ, Garbin CA, Diniz DG, (2011) conducted a descriptive, analytical and observational study in Brazil among undergraduate dental students to examine their knowledge of ergonomic postural requirements and their application during clinical care. The results showed that 65.7% of the ergonomics knowledge questions were answered correctly, and 35% of the photographic cases were in compliance with ergonomic requirements (+ 0.67, p<0007) and concluded that knowledge of ergonomics postural requirements, and their clinical application among the dental students surveyed were not satisfactory. The reasons for the learning difficulties encountered by the students should be identified to improve the learning process.

Ro-Ting Lin, Chang-Chuan, (2009) conducted a prospective comparative intervention study in Taiwan over 3 months to evaluate the effect of ergonomic workstation design on musculoskeletal risk factors and musculoskeletal symptoms reduction among 40 female semiconductor fabrication room workers by using observation checklist and Nordic musculoskeletal questionnaire. The study found that there was significant difference in discomfited shoulder postures between two groups at one month (p = 0:05) and three months (p = 0:02) after intervention. Postural analysis by Rapid Upper Limb Assessment showed high score (7/7). These indicate the vulnerability of many of the postures to musculoskeletal disorders and injury. The study concluded that majority of the activities are in the high risk category and demands immediate ergonomic intervention in the form of tool, workstation and process design.

Meirav Taieb-Maimon, Julie Cwikel, Bracha Shapira, Ido Orenstein (2011) conducted an intervention study in Israel among office workers using computers to evaluate an effect of ergonomic intervention on musculoskeletal risk. A pre-test/post-test design was used. Musculoskeletal risk was evaluated using the Rapid Upper Limb Assessment (RULA) method. The result showed that the RULA scores of the control group did not differ significantly throughout the experiment (mean _ SD of 4.02 _ 0.52). The average RULA scores of the ergonomic intervention training group dropped from an initial mean _ SD of 3.70 _ 0.52 during the baseline phase to mean _ SD of 2.50 _ 0.47, respectively.

Michelle Robertson, Benjamin C. Amick , Kelly DeRangoc, Ted Rooneyd, Lianna Bazzanid, Ron Harriste, (2010) undertaken a large-scale field intervention study to examine the effects of office ergonomics training coupled with a highly adjustable chair on knowledge and musculoskeletal risks among office workers. Office workers were assigned to one of two study groups: a group receiving a training-only group and a control group. A pre/post test design was used. The RULA scale is used to collect data. The ergonomic intervention group experienced a significant improvement in computing postures post-intervention compared to the control group for the left side of the body (2.25 P< 0.01 level .

Martin Varkey CHN Fr Muller (2013). Conducted a cross-sectional study in India to determine the prevalence of eyestrain among computer operators and its association with various epidemiological factors among 419 subjects using pre-tested questionnaire, personal interview The result showed that 194 (46.3%) suffered from eyestrain during or after work on computer. Marginally higher proportion of eyestrain was noted in females compared to males. Occurrence of eyestrain was significantly associated with age of starting use of computer, presence of refractive error, viewing distance, and level of top of the computer screen with respect to eyes, use of antiglare screen and adjustment of contrast and brightness of monitor screen.

A Klussmann (2012) conducted a cross-sectional study in Germany among 1,065 employees, to determine the prevalence and the predictors of musculoskeletal symptoms in the upper extremities and neck at computer workstations using standardized questionnaire, standardized checklist and physical examination. The result showed that the prevalence of symptoms of the neck, shoulder region, hand/wrist, or elbow/lower arm was 55%, 38%, 21%, and 15% respectively. The duration of computer work had a significant impact on the frequency of neck symptoms in employees performing such work > 6 h/d. The study concluded that preventive measures at computer workstations should be focused on neck and shoulder symptoms (e.g. ergonomic measures, breaks to avoid sitting over long periods).

Priyanga Ranasinghe (2011) conducted a study in Sri Lanka to analyze the presence of Complaints of Arm, Neck and Shoulder in relation to the effects of exposure to physical and psychological factors, and their probable interactions among 2,500 computer office workers using Maastricht Upper extremity-Questionnaire, Visual-Display-Terminal workstation-checklist and knowledge questionnaire. The prevalence of Complaints of Arm, Neck and Shoulder in the study population was 56.9%. Prevalence of Complaints of Arm, Neck and Shoulder in males and females were 54.7% and 59.2% respectively (p > 0.05). The most commonly reported complaints were in the forearm and hand region (42.6%), followed by neck complaints (36.7%) and shoulder and arm complaints (32.0%). The prevalence in Southern province was significantly lower than in the other provinces (p < 0.001). The study concluded that work-related physical factors, psychosocial factors and lack of awareness were all important associations of Complaints of Arm, Neck and Shoulder and effective preventive strategies need to address all three areas.

Juul-Kristensen B, Søgaard K, Strøyer J, Jensen C (2011) conducted a prospective study in Denmark to determine factors of computer work that predict musculoskeletal symptoms in the shoulder, elbow, and low-back regions using questionnaire on ergonomics, work pauses, work techniques, and psychosocial and work factors. The results showed that in the follow-up, 10%, 18%, and 23% had symptoms more often in the elbow, shoulder, and low back, respectively, and 14%, 20%, and 22% had more intense symptoms which implies that, influence on work pauses, reduction of glare or reflection, and screen height are important factors in the design of future computer workstations.

F Gerr – (2011) conducted a prospective study in United States among 632 newly hired computer users to evaluate associations between posture and neck or shoulder and hand or arm physical discomfort and musculoskeletal disorders. Participants' postures were measured at entry, and they reported symptoms on weekly diaries.

Participants reporting symptoms were examined for specific disorders. The result showed that keying with a greater downward head tilt, and presence of armrests on the participant's chair was associated with lower risk of neck or shoulder symptoms. Keying with elbow height below the height of the "J" key and the presence of a telephone shoulder rest were associated with a greater risk of neck or shoulder discomfort or neck or shoulder disorders. More than 50% of computer users reported musculoskeletal discomfort during the first year after starting a new job.

A. Ekman (2011) conducted a study to investigate whether gender or different methods of operating a computer mouse have an effect on performance and musculoskeletal load through the use of a computer mouse. Thirty experienced computer mouse users, 15 men and 15 women, participated in the study. Electromyography, a force-sensing mouse, and subjective ratings were used to register muscular load. The result showed that the women worked with greater extension and range of motion and tended to work with a greater ulnar deviation of the wrist. They also applied higher forces to the mouse when expressed as a percentage of a maximum voluntary contraction and had higher muscular activity in the right extensor digitorum. The study concluded that gender differences were found for musculoskeletal load, and for most of the measured variables, the women worked with higher loads than the men.

Andreea Niţa (2010) conducted a Retrospective study is to assess the prevalence of musculoskeletal complaints to computer workers and occupational risk factors among Romanian computer workers from several institutions in Romania, working in different areas - IT, commerce, administration, insurance. The result revealed in Analysis of musculoskeletal symptoms in the studied population. Most subjects (78.9%) confirmed the presence of musculoskeletal symptoms is related to computer work. Analyzing symptoms by gender, there are statistically significant differences: women present a greater frequency of symptoms in the neck (p = 0.0004), for other localizations there are no statistically significant differences related to gender. The predominant symptom reported was pain (73.4%). Other frequently reported symptoms were muscle stiffness (25.7%) and paresthesia (31%). In terms of gender differences, women reported significantly more presence of stiffness (p = 0.02). S Eltayeb (2010) conducted a study to investigate the prevalence of Complaints of Arm, Neck and Shoulder in a Dutch population of computer workers and to develop a questionnaire aimed at measuring workplace physical and psychosocial risk factors for the presence of these complaints among 264 computer office workers using a structured questionnaire .The result showed that 54% of the respondents reported at least one complaint in the arm, neck and/or shoulder. The highest prevalence rates were found for neck and shoulder symptoms (33% and 31% respectively), followed by hand and upper arm complaints (11% to 12%) and elbow, lower arm and wrist complaints (6% to 7%).The study concluded that neck and shoulder complaints are more frequently reported among Dutch computer workers than arm, elbow and hand complaints.

METHODOLOGY

Source of Data Collection: Chandras Homoeopathy& Physiotherapy out Patient Department of Physiotherapy, Hyderabad.

Study Type: An Experimental study

Study Design: Prospective Randomized Controlled Trial

Study Participants: All male & female subjects with complaint of postural backache attending Physiotherapy OPD.

Study Period: March 2018 – September2021

Sampling Design: Non Probability sampling

Sampling Method: Consecutive sampling

Sample Allocation- Random allocation to two groups using envelope method

Calculation of Sample Size: A pilot study was conducted with 20 subjects (10 in control and 10 in interventional group). The flexibility of rectus femoris (ROM) score was recorded at pretest and posttest day 10. The outcome was measured in both the groups and the difference score was calculated, based on this the sample size was estimated**.**

SD for rectus femoris ROM in control group = 2.11^0

SD for rectus femoris ROM in study group = 3.60^0

Mean of Study Group (Pretest) = 32.79

Mean of Control Group (Pretest) = 31.56 Mean difference (d) = 0.75

$N= 2S^2 (Z_{1-\alpha/2} + Z_{1-\beta})^2 = 170$

D^2Rounded of to 200, 100 in each group to care for omissions etc.

$Z_{1-\alpha/2}$ = 1.96 for 5% level of significance $Z_{1-\beta}$ = 1.282 for 90% of power of test

2S = S1 + S2

S1, S2 = sample standard deviation d= mean difference

[Level of significance p<0.05] Control group (C) – 100 sample size Study group (S) – 100 sample size

RESULTS

The results of the present study were analyzed in terms of Visual Analogue Scale, Modified Oswestry Disability Questionnaire, Index of Lumbar lordosis%, Manual Muscle Testing of Gluteal and Abdominal Muscles& flexibility of Iliopsoas, Rectus femoris and Erector spinae.

STATISTICAL ANALYSIS

Data was analyzed using SPSS software version20.0

Normality (ND) of all the variables was assessed in both groups by KolmogorovSmirnov Z test, found that all were follows normal distribution.

Comparison of control and intervention groups was done on the basis of age and BMI and was tested by paired t test and Z tests.

VAS and MODQ between the groups were compared using ANCOVA (pretest as covariate)- pre-test day1, post-test day 1 and post-test day10.

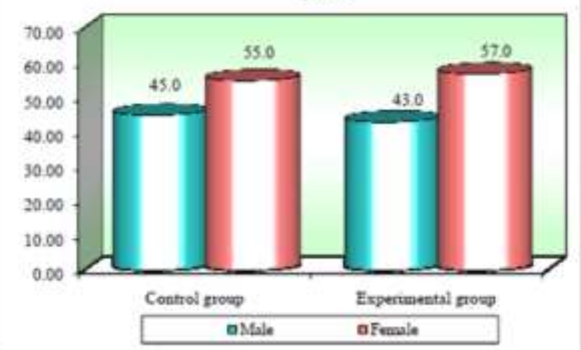
Comparison between the groups was done for IL%, gluteal and abdominal muscle strength and Iliopsoas, Rectus femoris, Erector spine muscle length using ANCOVA (pretestascovariate) onday1pre-testandday10post-test.

DEMOGRAPHIC DATA

Gender	Control Group (nos)	Experimental Group (no.s)
Male	45	43
Female	55	47
Total	100	100

The total number of male participants in the control group was 45 and female were 55. In the experimental group, there were 43 males and 57 females. This indicates that both the groups had an equal distribution of male & female subjects which suggests that the sample were homogenous.

Figure 1 :Distribution of Gender in control and experimental groups



CONCLUSION

The present study concludes that strengthening exercises significantly reduces pain, improves level of function, normalizes of lumbar lordosis, muscle length and strength as compared to conventional treatment alone. It can be used as an effective treatment protocol in the management of Ergonomical backache withLCS. Findings of the present study recommend the conventional treatment in the management of ergonomically low back pain with Lower crossed syndrome. Lower crossed syndrome (LCS) is a consequence of imbalance in muscle length and strength, the manifestation of which is under appreciated in clinical practice. Largely the treatment for postural low back pain with Lower cross syndrome focuses on either strengthening or stretching exercises and fails to emphasize on the use of combination exercise protocol for effective management of postural low back ache which results in chances of recurrence. The aim of the present study was to evaluate the effectiveness of stretching and strengthening exercises with conventional treatment (heat therapy and core stability exercises) on postural low back pain using pain intensity, level of function, index of lordosis and muscle length and strength.A total of 200 male and female subjects were recruited in this randomized controlled trial based on the inclusion and exclusion criteria. Each group was then randomized into group A (control) and group B (experimental). Control group received Moist pack, Core stability exercises 20 repetitions with 8 second hold for 10 sessions and experimental group was subjected to conventional treatment along with Stretching exercise of iliopsoas, rectus femoris and erector spinae carried out with 3 repetitions with 30 seconds hold; and strengthening exercises for abdominals and gluteals carried out with 10 repetitions of 3 sets along with Hot Moist pack and core stability exercise 10 repetitions with 8 second hold and the duration of treatment was 10 sessions.

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