

## Effect of spinal extension exercises on mechanical low back pain in work from home IT professionals in India

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### ABSTRACT

**Introduction:** Prolonged sitting with awkward posture and long working hours are the predisposing factors for developing Mechanical Low Back Pain (LBP) in IT professionals. Poor dynamic trunk extension performance is associated with back-related permanent work disability and recurrence of LBP. The purpose of this study was to find and analyze the effect of spinal Extension exercises on Mechanical Low Back Pain in work from home IT professionals.

**Methods:** In this comparative study, 50 work from home IT professionals from various companies were approached through emails. Subjects were randomized into two groups: Group A (n=25) was study group, and Group B (n=25) was control group. Subjects from both groups exercised three times per week for 4 months and followed the ergonomics. Pain intensity, functional disability, and strength of back extensor muscle were assessed at baseline and at the end of week 4.

**Results:** Group A had lower pain intensity ( $3.24 \pm 1.45$  vs  $4.76 \pm 1.53$ ) and functional disability ( $4.24 \pm 2.14$  vs  $11.44 \pm 1.75$ ) and significantly higher back extensor strength ( $25.44 \pm 4.3$  vs  $22.24 \pm 4.58$ ;  $P < 0.05$ ) than Group B at the end of week 4.

**Conclusion:** Spinal Extension Exercises should be incorporated in work from home IT professionals with mechanical low back pain to stabilize back muscles and improve physical functioning with minimal discomfort. In line with this, IT professionals should also be made aware of the risk factors associated with mechanical low back pain and should be encouraged for the maintenance of physical health and fitness.

**Key words:** Mechanical low back pain, Work from Home, IT professionals, Extension exercises, McKenzie regime of exercises, Spinal Extensor Strength.

### INTRODUCTION

Mechanical low back pain (LBP) is defined as pain not attributable to a recognizable known specific pathology. It is becoming a multifaceted and

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complex problem with increasing incidence, duration, costs, and escalating disability and co-morbidity during the second half of the 20th century, and now seems to be extending worldwide.<sup>1,2</sup> Estimation of low back pain is becoming more difficult as the incidence of first-ever episodes of low back pain is already high by early adulthood and symptoms tend to recur over time.

The lifetime prevalence of mechanical LBP is estimated at 60% to 70% in industrialized countries. Prevalence increases and peaks between the ages of 35 and 55.<sup>3</sup>

Factors contributing to mechanical low back pain in work from Home IT professionals: Incidence of Mechanical LBP has been found in Information



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Technology (IT) professionals as their work demands more of prolonged and sustained sitting posture, faulty posture, sedentary lifestyle and poor work-rest cycle. In the case of IT professionals, the further mentioned factors have a potential impact in causing MLBP.

**Awkward Posture:** Awkward posture sustained for a longer duration leads to the onset of symptoms due to anatomical and biomechanical stresses. It has been the most cited risk factor for MLBP in IT professionals. Many epidemiological studies have strongly reported the association of posture with mechanical changes in causing MLBP.<sup>(4)</sup> Spinal loading plays an important role in maintaining posture. Previous studies have documented that postural changes affect spinal loads.<sup>5</sup> IT professionals generally have a static or fixed posture for a sustained period. This attaining of sustained awkward postures result in prolonged muscle activity and increased spinal loading which then causes the localized muscle to fatigue, though the force of exertion in them is low. In addition to awkward postures, it was found that jobs that required sitting for prolonged periods were also at an increased risk of LBP.<sup>6</sup> The most commonly attained posture by IT professionals is forward-leaning which significantly increases discomfort in the low back region. Paraspinal muscle fatigue will affect the muscular support of the spine which can cause impairment of muscular control as well as increased mechanical stress on ligaments and intervertebral discs.<sup>7</sup>

**Type and Duration of work:** The amount of duration spent in continuous work has been considered as a risk factor for mechanical low back pain. A recent study concluded that different sitting postures influenced discomfort after 1 hour of sitting in the low back region.<sup>8</sup>

Physical discomfort may occur due to an overuse of low threshold muscle fibers which cause damage at the muscle cell level, which is known as the Cinderella hypothesis.<sup>9</sup> Work of IT professionals is characterized by prolonged and repetitive tasks with low external force demands. As per the Cinderella hypothesis, prolonged low-level static contraction during working recruits type I muscle fibers and may lead to chronic impairment of energy metabolism in selected muscle units.

In a recent cross-sectional study, duration of computer use was identified as a risk factor for MLBP and other work-related musculoskeletal disorders. Each increased hour of computer use was associated with

an increased ratio of reporting symptoms.<sup>10</sup> Other studies supporting these results, suggested that the duration of computer use, particularly for more than 4 hours per day, was significantly associated with MLBP and other work-related musculoskeletal disorders.<sup>11</sup>

**Sedentary lifestyle:** A large part of the population lack physical fitness, don't exercise regularly and lack normal posture leading to a sedentary life which is the most common prevalent predisposing characteristics of mechanical low back pain. Core muscle weakness is affected in sedentary workers which can be a predisposing factor for mechanical low back pain.<sup>12</sup>

**Individual factors:** Individual factors associated with MLBP in IT professionals include gender, age, obesity, or habits.

**Current diagnostic and treatment approaches:** There are several physiotherapy treatments for managing mechanical low back pain which include exercise therapy, manual therapy techniques, ergonomic advice, electrotherapy, spinal manipulative therapy.<sup>13</sup>

Literature shows that the effect of exercise on low back pain has strong supporting evidence but there are no specific recommendations about the type of exercise. Core strengthening of abdominal and back muscles stability and stretching for flexibility are some general exercise interventions to prevent and treat low back pain.

The McKenzie method (Mechanical diagnosis and therapy) is the most commonly used physical therapy approach that uses a structured examination to classify patients with LBP, which helps identify those who will benefit from physical therapy and which treatment will provide the most benefit.<sup>14</sup>

It describes two key examination findings: the centralization phenomenon and directional preference.<sup>15</sup>

Back Extensor muscles are postural muscles that maintain an upright posture and control dynamic lumbar movements.<sup>16</sup> Previous literature has reported a significant decrease in back extensor muscle strength in patients with mechanical LBP.<sup>17</sup> It is considered that decreased back muscle strength causes muscle fatigue and overloading of soft tissue and passive structures of the lumbar spine which results in mechanical back pain.<sup>18</sup>

According to Williams' theory of LBP, prolonged sitting

causes back extensor muscle tightness, which then overstresses the lumbar spine resulting in mechanical LBP.<sup>19</sup>

Hence, a broad literature search has shown that poor dynamic trunk extension performance is associated with back-related permanent work disability and recurrence of low back pain, but there is no evidence which supports the effect of Extension-specific exercises on mechanical low back pain in IT professionals.

Therefore, this study would focus on analyzing the impact of workload-specific spinal extension exercises on mechanical low back pain in work from home IT professionals to build firmer scientific confirmation which addresses the optimal intervention for mechanical low back pain.

## METHODS

In this comparative study, work from home IT professionals from various companies were approached through emails. IT professionals working from home with mechanical LBP participated in this study based on a clinical assessment and following inclusion criteria: age between 25–35 years, LBP of mechanical origin, any gender, work duration of more than 5 hours. Subjects were excluded if they had a history of traumatic injuries or surgical interventions in the low back region; had chronic diseases affecting the musculoskeletal system or had any neurological disorders.

These subjects were then selected through a simple non-probability sampling method and were randomly divided into two equal groups using sequences of random numbers. Both Group A (study group) & Group B (control group) had 25 individuals each.<sup>20</sup> The intervention program consisted of 60 sessions for both groups, with the sessions performed 3 times per week for 4 months. Each session lasted for 45 to 50 minutes.

### *Outcome Measures*

Before and following the intervention, pain, disability, and back extensor strength were measured by numerical pain rating scale (NPRS), Roland Morris Disability Questionnaire (RMDQ), and, Biering Sorensen test, respectively.

### *Numerical Pain Rating Scale (NPRS)*

The NPRS was used for pain evaluation. In this scale, the levels of pain intensity perceived by the subject were measured using an 11-point scale that ranges

from 0 to 10, where 0 is classified as “no pain” and 10 is classified as “worst possible pain”<sup>21</sup> Subject was asked to mark the best number indicating the pain.

### *Roland Morris Disability Questionnaire (RMDQ)*

Disability was evaluated through the Roland Morris Disability Questionnaire (RMDQ). The questionnaire is a 24-item self-report questionnaire designed to evaluate the level of function (disability) in activities of daily living for individuals rehabilitating for lower back pain. Each question is worth one point thus scores range from 0 (no disability) to 24 (severe disability). The RMDQ is scored by summing the number of items the patient ticked. The reliability and validity of the questionnaire have already been demonstrated in previous studies.<sup>22</sup>

### *Biering Sorensen Back Extensor Strength Test (BEST)*

The back extensor strength test by Biering Sorensen is a reliable method for the evaluation of the muscle strength of lumbar extensors.<sup>23</sup> The test consists of assessing how many seconds the participant can keep the unsupported upper part of the body (from the upper border of the iliac crest) horizontal while placed prone with the buttocks and legs fixed to the table bench by three wide canvas straps, with the arms across the chest. The test is continued until the participant could no longer control his/her posture for a maximum time.

The study protocol and informed consent were approved by the Ethics Committee of Krishna Institute of Medical Sciences Deemed to be University, KIMSDU/IEC/01/2021, with the approval date of February 17, 2021. All subjects were presented with the research objectives and provided their written informed consent to participate in the study before any study-related procedure was done.

Subjects in Group-A(Interventional group) received McKenzie Extension exercises without reproducing Lumbar pain. The exercise session included Warm-up exercises for 5 minutes, McKenzie Extension exercises which included Prone Lying, Prone Lying on Elbows, Prone Press-Ups, and Standing Extension Exercises. The exercises session was concluded with 5 minutes of the cool-down session.

Subjects in Group-B (Control group) received conventional physiotherapy treatment which included a hot moist pack or hot fomentation for 10 to 15 minutes. Later, ergonomic advice regarding appropriate workplace adjustment was explained to the subjects.

The ergonomics risk factors including working postures were thoroughly explained to the subjects. Suggestions on work equipment modification and task organization were given to subjects if required.

They were then evaluated for pain, disability and back extensor strength after 4 weeks.

For analyses, SPSS version 25 was used. The independent sample t-test was used for comparing the two groups. The paired-t-test was used to compare variables before and after the intervention program in each group. Statistical significance for all tests was accepted below the 0.05 level.

## RESULTS

Pain intensity significantly decreased in both groups post-treatment ( $p < 0.05$ ). The mean decrease in NPRS scores was significantly higher in Group A than in Group B ( $3.24 \pm 1.45$  vs  $4.76 \pm 1.53$ ). Moreover, there was a significant difference between both groups regarding pain scores post-treatment, being significantly lower in group A. [Table 1]

RMDQ scores showed a significant decrease in group A post-treatment ( $p < 0.0001$ ) indicating a decrease in functional disability. The mean decrease in RMDQ scores was higher in group A than group B ( $4.24 \pm 2.14$  vs  $11.44 \pm 1.75$ ). However, an extremely significant difference was detected between both groups regarding RMDQ scores post-treatment. [Table 2]

The strength of back extensors significantly increased in both groups post-treatment ( $p < 0.05$ ). The mean

of change in back extensor strength was significantly higher in group A than group B ( $25.44 \pm 4.3$  vs  $22.24 \pm 4.58$ ). However, there was a significant difference between both groups regarding the strength of back extensors post-treatment. [Table 3]

## DISCUSSION

With the beginning of this pandemic, everyone is well-versed with this new term “Work from home” or “remote working”; which existed back then but was not so popular in India. For most of the Indian employees, this has been a first experience of managing household chores as well as work. Although, there are some benefits with this pattern of work execution the list of drawbacks is becoming incessant.

In a recent cross-sectional study regarding the characterization of the home working population during the COVID-19 pandemic, it was observed that 41.2% of their participants reported Low Back Pain of which 38.1% reported an increase of LBP severity since they are working remotely.<sup>24</sup> The prevalence and incidence of LBP which has been recently documented ranged from 1.4% to 20% and from 0.024% to 7%, respectively, in computer workers.<sup>25</sup> Therefore, being a physiotherapist it is important to treat these individuals with the best treatment approach available.

The present study focused on analyzing the impact of Spinal Extension exercise based on McKenzie’s extension regime on mechanical low back pain in work from home IT professionals to build firmer scientific confirmation which addresses the optimal intervention

**Table 1:** Comparison of mean scores of NPRS within and between both the groups

RMDQ	PRE	POST	p value	t value	Inference
Group A	11.840 ± 1.864	4.240 ± 2.146	< 0.0001	10.676	Extremely significant
Group B	11.00 ± 2.598	11.440 ± 1.758	0.0384	2.191	Considered significant
Inference	Not significant	Extremely significant			

**Table 2:** Comparison of mean scores of RMDQ within and between both the groups

NPRS	PRE	POST	p value	t value	Inference
Group A	6.44 ± 1.446	3.240 ± 1.451	< 0.0001	7.216	Extremely significant
Group B	6.16 ± 1.795	4.760 ± 1.535	0.0127	2.694	Considered significant
Inference	Not significant	Very significant			

**Table 3:** Comparison of mean of BEST within and between both the groups

BEST	PRE	POST	p value	t value	Inference
Group A	18.920 ± 4.329	25.44 ± 4.302	< 0.0001	11.175	Extremely significant
Group B	19.32 ± 4.470	22.240 ± 4.585	0.0013	3.651	Very significant
Inference	Not significant	Very significant			

for mechanical low back pain.

The study was conducted among 50 IT professionals diagnosed with mechanical low back pain and fulfilled the inclusion criteria. The outcome measures were the Numerical Pain Rating Scale, Back Extensor Strength Test, and Roland Morris Disability Questionnaire to evaluate pain, Lumbar Extensor muscle strength, and disability respectively. Subjects were randomly divided into Group A (Interventional Group) and Group B (Control Group).

Our study showed that there were considerable changes with significant differences seen in pain in the subjects of Group A than Group B. Apart from the observed significant changes of back extensor strength of both the groups in this study, the Group A treatment program led to a higher significant improvement on back extensor strength along with a reduction in pain. These findings are consistent with a previous study conducted by Waqqar S. who has stated that the McKenzie Extension exercise program is clinically slightly more effective in the management of pain and disability as compared with Mulligan.<sup>26</sup> These results may be related to the type of exercise done, the number of repetitions, and its frequency and intensity.

M. Reza Nourbakhsh in their study concluded that the endurance of the back extensor muscles is one of the mechanical factors which is highly associated with LBP.<sup>27</sup> Some other studies also showed a significant decrease in back Extensor muscle endurance in patients suffering from chronic LBP which was the reason for considering back Extensor muscle strength in the current study as a measure.<sup>28</sup> Previous researchers have indicated that back muscle strength training increases muscle strength, muscle endurance, and spine ROM in patients with chronic low back pain.<sup>29</sup> There was an observable reduction of Roland Morris's score in both the groups which was considered significant.

During this study, no subject was found to have an exaggeration of symptoms such as pain and discomfort before or after performing the exercises. Also, some subjects from GROUP A expressed ease at work and motivated them to do exercises regularly after completion of all 12 sessions.

Back Extensor strength is the most commonly affected factor in IT professionals with mechanical low back pain. However, their job demands and workload require prolonged stresses acting on back extensors.

In the present study, post-exercise, Group A subjects were able to fulfill job demands, reduce work stress and reduce discomfort.

The basic motive of the study researchers was to target back extensor muscles and analyze the effect of activation of these muscles on work from home IT professionals with mechanical LBP. Therefore, now there is evidence which promises that spinal extension exercises help in stabilizing muscles and also reduce mechanical loading on the lumbar spine. As work from home IT professionals are overloaded with mental and physical exertion, these spinal extension exercises have not only proven to be beneficial in improving pain and discomfort status but have also provided relaxation to these subjects. This study also played an important role in encouraging sedentary workers towards physical health and fitness to prevent and control musculoskeletal disorders.

This study showed that spinal extension exercises had a clinically beneficial impact on pain and back Extensor strength of IT professionals suffering from MLBP but there is not much impact on disability. And results were found statistically significant for pain and back Extensor strength for Group A post-treatment but not much significant for disability.

Thus, this study accepts the alternate hypothesis i.e., there is a significant effect of spinal Extension exercises on mechanical low back pain in IT professionals.

## CONCLUSION

In this study, based on statistical analysis, presentation, and interpretations it was concluded that Spinal Extension Exercises has shown significant improvement and clinically beneficial impact on pain relief, improvement in back extensor strength and reduction in disability of IT professionals suffering from mechanical low back pain.

Thus, the study provided evidence to support that spinal extension exercises play an important role in reducing pain, disability and help in increasing strength.

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