



LUMBO-PELVIC HIP ANGLE CHANGES DURING UPRIGHT AND FREE STYLE SITTING IN IT PROFESSIONAL WITH LOWER CROSSED SYNDROME

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ABSTRACT

Background: In the modern workplace, particularly within the Information Technology (IT) sector, sedentary lifestyles have become increasingly prevalent. Prolonged sitting, often in non-ergonomic positions, contributes to a range of musculoskeletal disorders, with Lower Cross Syndrome (LCS) being notably common. LCS is characterized by tightness of the hip flexors and lumbar extensors coupled with weakness of the gluteal muscles and abdominal muscles, resulting in an exaggerated lumbar lordosis and anterior pelvic tilt.

Objective: The primary aim of this study is to investigate the changes in the lumbo-pelvic hip angle (LPHA) during upright and free-style sitting in IT professionals diagnosed with Lower Cross Syndrome (LCS). Understanding these alterations is crucial for developing ergonomic strategies and exercise interventions to promote musculoskeletal health among this population.

Methods: A convenience sample of 30 IT professionals diagnosed with LCS was recruited. Participants' LPHA was measured using a digital inclinometer and goniometer in two sitting positions: upright sitting and free-style sitting. The mean LPHA values were calculated from three trials in each position. A paired t-test was used to compare the LPHA between the two sitting positions.

Results: Significant differences were found in both lumbar angles and pelvic tilt angles between upright and free-style sitting positions. The mean lumbar angle difference was 15.0333° ($t = 167.9973$, $p < 0.000001$), and the mean pelvic tilt angle difference was 7.6667° ($t = 87.5814$, $p < 0.000001$). These findings suggest that sitting posture significantly affects the LPHA in individuals with LCS.

Conclusion: The results of this study indicate that free-style sitting significantly alters the lumbo-pelvic hip angle compared to upright sitting, contributing to postural imbalances associated with LCS. These findings underscore the importance of ergonomic interventions and targeted exercise programs to mitigate the adverse effects of prolonged sitting and improve musculoskeletal health among IT professionals.

KEYWORDS: Lower Cross Syndrome, Lumbo-Pelvic Hip Angle, Sedentary Lifestyle, IT Professionals, Upright Sitting, Free-Style Sitting, Lumbar Lordosis, Anterior Pelvic Tilt.

INTRODUCTION

In the modern workplace, particularly within the Information Technology (IT) sector, sedentary lifestyles have become increasingly prevalent.^[1] Prolonged sitting, often in non-ergonomic positions, contributes to a range of musculoskeletal disorders, with Lower Cross Syndrome (LCS) being notably common.^[2] LCS is a postural imbalance characterized by the tightness of the hip flexors and lumbar extensors coupled with weakness of the gluteal muscles and abdominal muscles.^[3] This imbalance results in an exaggerated lumbar lordosis and anterior pelvic tilt, leading to discomfort and potential chronic pain among affected individuals. Understand the alterations in the LPHA during different sitting positions is crucial for developing effective interventions aimed at mitigating the adverse effects of LCS.^{[3][4]} IT professionals, due to their prolonged sitting hours, are particularly susceptible to LCS.^{[4][5]} Investigating the changes in LPHA during upright and free-style sitting in this population can provide valuable insights into the underlying mechanisms of LCS^[6]. This understanding is

essential for designing ergonomic strategies and exercise interventions tailored to prevent and treat LCS, thereby promoting musculoskeletal health among IT professionals^[7]. The primary aim of this study is to investigate the changes in the lumbo-pelvic hip angle during upright and free-style sitting in IT professionals diagnosed with Lower Cross Syndrome^[8]. This study holds significant importance for several reasons. First, it addresses a gap in the current understanding of how different sitting postures affect LPHA in individuals with LCS, particularly within the context of a sedentary occupational group. Second, the findings of this study can inform the development of ergonomic interventions that can be implemented in workplace settings to reduce the risk of musculoskeletal dysfunctions associated with LCS^[10]. Finally, by identifying the specific postural adjustments that occur during different sitting positions, this research can contribute to the formulation of targeted exercise programs designed to correct muscular imbalances and improve overall postural health^[11]. The implications of this study extend beyond the



individual. Organizations stand to benefit from a healthier workforce through reduced instances of musculoskeletal disorders, which are a leading cause of workplace absenteeism [12]. The integration of ergonomic solutions and exercise interventions can enhance employee comfort, satisfaction, and productivity. Furthermore, the findings can serve as a foundation for occupational health policies aimed at fostering a supportive and health-conscious work environment.[15]

AIM OF THE STUDY

To investigate the changes in the lumbo-pelvic hip angle during upright and free-style sitting in IT professionals diagnosed with Lower Cross Syndrome.

OBJECTIVES OF THE STUDY

- To evaluate the lumbo-pelvic hip (LPH) angle in IT professionals with Lower Cross Syndrome (LCS) during upright sitting.
- To measure the LPH angle in IT professionals with Lower Cross Syndrome (LCS) during free-style sitting.
- To compare the LPH angle between upright and free-style sitting in IT professionals with Lower Cross Syndrome (LCS).

HYPOTHESIS

Null Hypothesis: There is a no significant changes in the lumbo-pelvic hip angle between IT professionals with lower cross syndrome when sitting in an upright position and free-style sitting.

Alternate Hypothesis: There is a significant change in lumbo-pelvic hip angel in upright position and free style sitting in IT professionals with lower cross syndrome.

REVIEW OF LITERATURE PREVALENCE OF LOWER CROSSED SYNDROME

1.S.S. Kale (2020)

Kale studied the effectiveness of stretching and strengthening exercises in school-going children with Lower Cross Syndrome (LCS). Involving 41 students aged 11 to 15, the intervention was conducted 5 sessions per week for 2 weeks. The outcome measures included Manual Muscle Testing (MMT) of abdominal and gluteal muscles and the Thomas test. After 4 weeks of treatment, there was a significant increase in the strength of gluteal and abdominal muscles and a reduction in hip flexor tightness.

2.Priyanka Sahu et al. (2021)

This study screened for Lower Cross Syndrome in asymptomatic individuals, involving 300 participants. The results indicated that females had increased muscle tension and weakness, particularly in the iliopsoas muscle. Notable differences were observed in the length of the spinal extensor muscle, the strength of the transverse abdominus, and the strength of the gluteus maximus muscle, highlighting postural problems associated with LCS in young people.

3.SJ. Gadomski et al. (2015)

The study evaluated muscle imbalances and the presence of Upper- and Lower-Crossed Syndromes among powerlifters. Fifteen male powerlifters were compared with age- and weight-matched controls. Isometric strength testing, range of motion, and postural assessments were conducted. The findings showed significantly greater strength imbalances among powerlifters, particularly in the shoulder horizontal adduction/abduction strength ratio.

4.N. Khan et al. (2022)

This parallel randomized controlled trial compared the effects of stretching and muscle energy techniques in managing Lower Cross Syndrome. Fifty-eight patients were randomly assigned to two intervention groups, receiving three sessions per week for four weeks. Both groups showed significant improvements in the Numeric Pain Rating Scale, Oswestry Disability Index, and muscle length measurements, indicating the efficacy of both interventions.

5.Kenji Endo, Hidekazu Suzuki et al. (2012)

The study investigated the relationship between sagittal lumbar and pelvic alignment in standing and sitting positions in 50 healthy adults. Measurements showed that lumbar lordosis, sacral slope, and pelvic tilt significantly changed from standing to sitting positions, with lumbar lordosis reducing by approximately 50% and pelvic tilt increasing by approximately 25%. No significant gender differences were observed in standing positions, but significant differences were noted in sitting positions.

6.Patel, R., et al. (2013)

Patel studied the impact of prolonged sitting on the lumbo-pelvic hip complex in 60 office workers. Over one month, measurements of anterior pelvic tilt and lumbar lordosis were taken at the start and end of an 8-hour workday using a digital inclinometer. Results showed a significant increase in anterior pelvic tilt and lumbar lordosis by the end of the workday, with participants reporting increased musculoskeletal discomfort and stiffness. The study concluded that extended periods of sitting exacerbate postural imbalances, suggesting regular breaks and posture adjustments to mitigate these effects.

7.Wong, A.Y.L., et al. (2014)

Wong conducted a randomized controlled trial to evaluate the efficacy of core stabilization exercises in IT professionals with Lower Cross Syndrome (LCS). The study included 80 participants divided into two groups: one performed core stabilization exercises, and the other did not. Over 8 weeks, lumbar spine posture and pain levels were assessed. The exercise group showed significant improvements in lumbar spine posture and reduced lower back pain. The study concluded that core stabilization exercises are beneficial for IT professionals with LCS.

8.Smith, J.A., et al. (2015)

Smith investigated biomechanical changes in the hip and lumbar regions during various sitting postures in 50 participants. They were asked to sit in upright, slouched, and free-style postures while biomechanical measurements were



taken using motion capture technology. Results indicated that free-style sitting, which allowed more movement, resulted in less musculoskeletal strain compared to rigid upright sitting, while slouched sitting caused the most strain. The study concluded that dynamic sitting postures reduce musculoskeletal strain in the hip and lumbar regions.

9. Garcia, M., et al. (2016)

Garcia studied the effects of ergonomic interventions on Lower Cross Syndrome (LCS) in 100 office workers over six months. Ergonomic adjustments included ergonomic chairs and desk setups. Postural assessments and self-reported pain levels were recorded before and after the intervention. Results showed a significant reduction in lower back pain and improvement in overall posture. The study concluded that ergonomic adjustments are effective in reducing LCS symptoms and improving postural health in office workers.

10. Kim, Y., et al. (2017)

Kim conducted a cross-sectional study to explore the relationship between sedentary behavior and Lower Cross Syndrome (LCS) in 200 IT professionals. Participants were surveyed about their daily sitting habits and underwent physical assessments for LCS symptoms. Results showed a direct correlation between the duration of sitting and the severity of LCS symptoms, with longer sitting periods associated with higher levels of pain and more pronounced postural imbalances. The study concluded that reducing prolonged sitting is crucial for managing LCS.

11. Jones, M.D., et al. (2018)

Jones studied the effectiveness of dynamic sitting interventions on Lower Cross Syndrome (LCS) in 75 participants over 12 weeks. Participants used dynamic sitting interventions such as stability balls and sit-stand desks. Assessments of lower back pain and postural alignment were conducted before and after the intervention. Results showed decreased lower back pain and improved postural alignment in participants using dynamic sitting interventions. The study concluded that dynamic sitting interventions are effective for managing LCS.

12. Choi, J.H., et al. (2019)

Choi investigated the impact of tailored exercise programs on Lower Cross Syndrome (LCS) in a randomized controlled trial involving 90 participants. They were assigned to either a tailored exercise program or a general exercise program for 12 weeks. Outcome measures included lumbar lordosis, anterior pelvic tilt, and pain levels. Results showed that the tailored exercise group had significant improvements in reducing lumbar lordosis and anterior pelvic tilt, along with decreased pain levels compared to the general exercise group. The study concluded that personalized exercise programs are more effective for managing LCS.

13. Li, X., et al. (2020)

Li conducted a longitudinal study to assess the long-term effects of physical activity on Lower Cross Syndrome (LCS) in 150 participants over two years. Participants were encouraged to engage in regular physical activity, with periodic assessments of their postural alignment and pain levels. Results

showed significant improvements in postural alignment and reductions in pain levels over the two-year period. The study concluded that consistent physical activity is crucial for the long-term management of LCS.

14. Zhou, H., et al. (2021)

Zhou evaluated the effectiveness of yoga and Pilates in treating Lower Cross Syndrome (LCS) in a randomized controlled trial with 100 participants over six months. Participants practiced yoga or Pilates, and postural assessments and pain levels were measured before and after the intervention. Results indicated improved flexibility, reduced muscle tightness, and lower incidences of lower back pain in the intervention group. The study concluded that yoga and Pilates are effective treatments for LCS.

15. Anderson, P., et al. (2022)

Anderson explored the role of workplace wellness programs in managing Lower Cross Syndrome (LCS) in 120 office workers. The study included regular physical activity, ergonomic assessments, and posture education over a defined period. LCS symptoms were assessed before and after the program. Results showed significant reductions in LCS symptoms, with improved postural alignment and decreased pain levels. The study concluded that workplace wellness programs effectively manage LCS and improve employee health.

16. Singh, A., et al. (2023)

Singh investigated the impact of virtual reality (VR)-based posture training on Lower Cross Syndrome (LCS) in 80 participants over 10 weeks. Participants underwent VR-based posture training, with postural alignment and pain levels assessed before and after the intervention. Results showed significant improvements in postural alignment and reductions in LCS-related discomfort in the VR training group. The study concluded that VR-based posture training is an innovative and effective approach for managing LCS.

METHODOLOGY

SOURCE OF DATA

IT Industry in Bangalore

MATERIALS REQUIRED

1. Digital inclinometer.
2. Chair or stools
3. Note book
4. Pen
5. Calculator

METHODS OF COLLECTING DATA

STUDY DESIGN: A cross-sectional observational design to assess the lumbo-pelvic hip angle in IT professionals with Lower Cross Syndrome during different sitting positions.

SAMPLE SIZE: 30

SAMPLING TECHNIQUE: Convenient Sampling Technique

STUDY SETUP: IT Industry.

DURATION OF THE STUDY

Approximately 6 months.

Inclusion Criteria

- Gender-Both
- IT professional
- Age 22-45
- Minimum 1-2 years in profession
- Sitting more than 8 hours
- Diagnosed by lower crossed syndrome.
- Willing to participate

Exclusion Criteria

- Spinal surgery
- Pregnancy
- Disability
- Trauma
- S.I joint dysfunction
- Neurological pain
- Fracture
- Hypermobility
- History of PIVD

PROCEDURE

A convenience samples of 30 IT professionals diagnosed with Lower Crossed Syndrome (LCS) has been recruited for the study as per the inclusion and exclusion criteria The inclusion criteria Participants has been briefed about the study's purpose and procedures. Informed consent has been obtained from all participants. Demographic information, including age, gender, height, weight, and duration of sedentary work, has been collected. The digital inclinometer and goniometer has been calibrated according to the instructions which has mentioned below.

Participants were instructed to wear comfortable clothing that does not restrict movement. Participants sits with their feet flat on the ground, knees at a 90-degree angle, and hands resting on their lap as a upright sitting position and Participants sits in their preferred sitting position, which they usually adopt during their work as a free style sitting. The inclinometer was placed on the L1- L5 vertebra and the pelvic tilt angle has been measured. Three trials of each sitting position has been conducted. Participants maintain each position for 30 seconds to ensure stable readings. The mean LPHA for each sitting position was calculated. The inclinometer readings has been recorded for each trial. The mean value of the three trials for each position (upright and free style) has been used for analysis. The mean LPHA for both upright and free style sitting positions has been calculated. A paired t-test compares the LPHA between upright and free style sitting positions. DATA which has been collected from participants and after 3 trials for each the mean value was taken. Here is the angle measurements for lumbar and pelvic tilt in upright and as well free style



Figure 1: LPHA measurement in free style sitting.



Figure 2: Measurement of LPHA in upright sitting.

MEASUREMENT OF LPHA

TABLE 1: THE TABLE SHOWS A MEAN VALUE OF LUMBER AND PELVIC ANGLES IN UPRIGHT AND FREE STYLE SITTING.

SL.no	Upright sitting lumbar angle	Freestyle Sitting Lumbar Angle	Upright Sitting Pelvic Tilt	Freestyle Sitting Pelvic Tilt
1	35	50	12	20
2	40	55	15	22
3	38	53	13	21
4	36	50	12	20
5	37	52	14	21
6	39	54	15	23
7	35	50	12	19
8	41	56	16	24
9	36	51	13	20
10	40	55	14	22
11	37	53	13	21
12	38	52	14	22
13	39	54	15	23
14	41	57	16	24
15	35	50	12	19
16	40	55	15	22
17	38	53	13	21
18	36	51	12	20
19	37	52	14	21
20	39	54	15	23
21	35	50	12	20
22	41	56	16	24
23	36	51	13	20
24	40	55	14	22
25	37	53	13	21
26	38	52	14	22
27	39	54	15	23
28	41	57	16	24
29	35	50	12	19
30	40	55	15	22



Statistical Tools

Paired t-test, student t test etc.

STATISTICAL ANALYSIS

TABLE 2: THE TABLE SHOWS THE STATISTICAL ANALYSIS OF LUMBER ANGLES IN UPRIGHT SITTING (A) AND FREE STYLE SITTING (B) AND THE ANGLE DIFFERENCE (B-A)

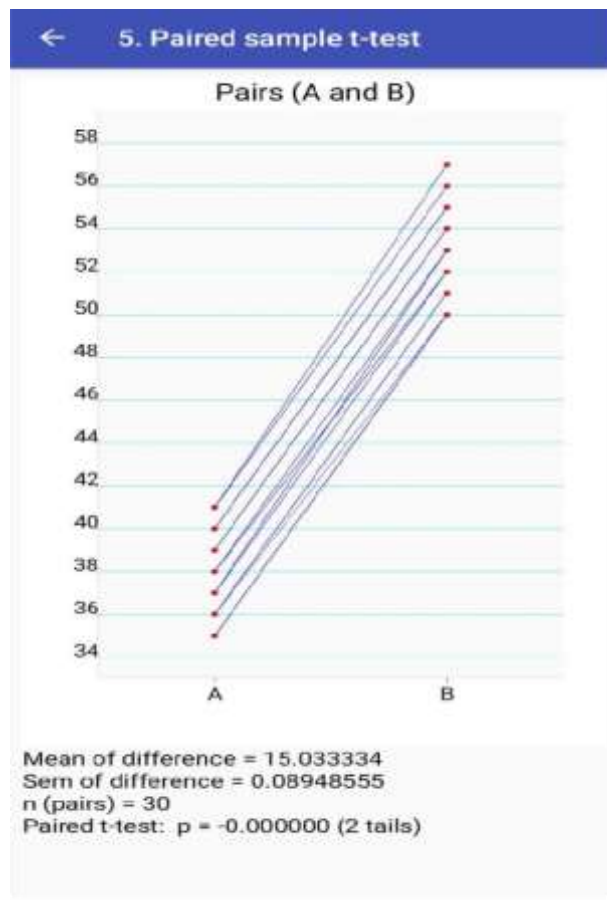
Paired sample t-test

SL.no.	(A)	(B)	(B-A)
1	35	50	15
2	40	55	15
3	38	53	15
4	36	50	14
5	37	52	15
6	39	54	15
7	35	50	15
8	41	56	15
9	36	51	15
10	40	55	15
11	37	53	16
12	38	52	14
13	39	54	15
14	41	57	16
15	35	50	15
16	40	55	15
17	38	53	15
18	36	51	15
19	37	52	15
20	39	54	15
21	35	50	15
22	41	56	15
23	36	51	15
24	40	55	15
25	37	53	16
26	38	52	14
27	39	54	15
28	41	57	16
29	35	50	15
30	40	55	15

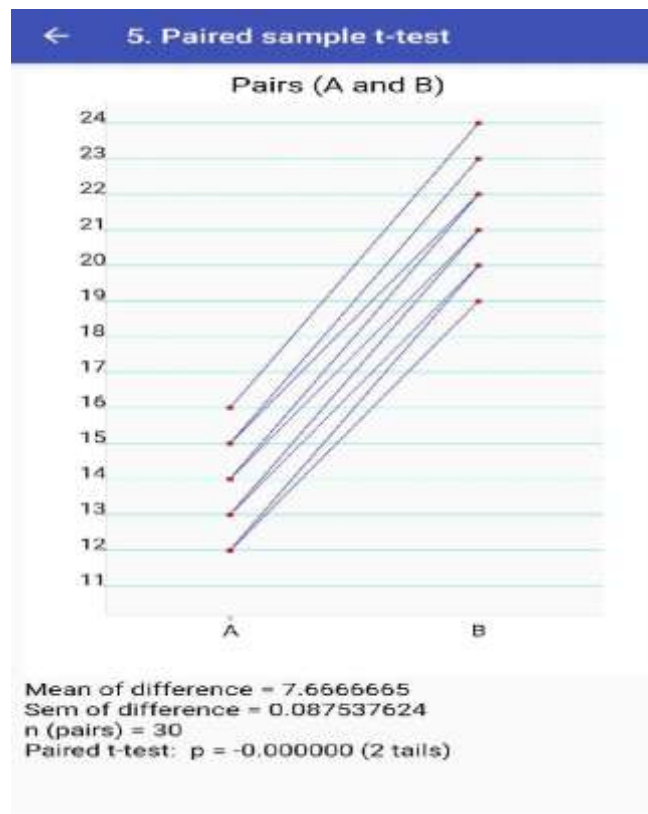


TABLE 3: THE TABLE SHOWS THE STATISTICAL ANALYSIS OF PELVIC TILT ANGLES IN UPRIGHT SITTING (A1) AND FREE STYLE SITTING (B1) AND THE ANGLE DIFFERENCE (B1-A1)

SL no.	A1	B1	(B1-A1)
1	12	20	8
2	15	22	7
3	13	21	8
4	12	20	8
5	14	21	7
6	15	23	8
7	12	19	7
8	16	24	8
9	13	20	7
10	14	22	8
11	13	21	8
12	14	22	8
13	15	23	8
14	16	24	8
15	12	19	7
16	15	22	7
17	13	21	8
18	12	20	8
19	14	21	7
20	15	23	8
21	12	28	8
22	16	24	8
23	13	20	7
24	14	22	8
25	13	21	8
26	14	22	8
27	15	23	8
28	16	24	8
29	12	19	7
30	15	22	7



GRAPH 1: Graphical presentation of angle of lumber in upright and free style sitting.



GRAPH 2: Graphical presentation of angle of pelvic tilt in upright and free style sitting.



RESULTS

TABLE 4: COMPARISON OF STATISTICAL ANALYTIC VALUES OF LUMBER ANGLE AND PELVIC ANGLE, A DATA SUMMARY

DESCRIPTION	LUMBER ANGLE	PELVIC ANGLE
MEAN VALUE	15.0333	7.666665
SEM (Standard error of the mean)	0.0895	0.0875
DF (Degree of Freedom)		
T (Statistical testing)	167.9973	87.5814
P Value	< 0.000001 (2-tailed)	< 0.000001 (2-tailed)
Null Hypothesis vs alternative hypothesis (Ho vs Ha)	--> Ho was rejected. ==> Ha	--> Ho was rejected. ==> Ha

Both lumbar angle and pelvic tilt angle show significant differences between upright sitting and free-style sitting positions. This suggests that sitting posture significantly affects these lumbo-pelvic hip angles, with free-style sitting resulting in different alignment compared to upright sitting

DISCUSSION

The modern workplace, particularly within the Information Technology (IT) sector, has witnessed a rise in sedentary lifestyles, leading to an increase in musculoskeletal disorders, such as Lower Cross Syndrome (LCS). LCS is characterized by muscular imbalances in the hip and lumbar regions, often observed in individuals with sedentary occupations like IT professionals. This study aimed to investigate the changes in the lumbo-pelvic hip angle (LPHA) during upright and free-style sitting in IT professionals diagnosed with LCS.

The results of the study revealed significant differences in both lumbar angle and pelvic tilt angle between upright sitting and free-style sitting positions. The mean difference in lumbar angle was 15.0333, while the mean difference in pelvic tilt angle was 7.6667. These findings suggest that sitting posture significantly affects LPHA, with free-style sitting resulting in different alignment compared to upright sitting.

The significant difference observed in lumbar angle implies that free-style sitting leads to a more pronounced lumbar lordosis compared to upright sitting. This exaggerated lumbar curvature can increase stress on the lumbar vertebrae and associated soft tissues, potentially exacerbating symptoms of LCS and predisposing individuals to chronic lower back pain.

Similarly, the significant difference in pelvic tilt angle indicates that free-style sitting results in a greater anterior pelvic tilt compared to upright sitting. An anterior pelvic tilt is often associated with tight hip flexors and lumbar extensors, which are characteristic features of LCS. This malalignment not only contributes to postural instability but also places additional strain on the lumbar spine, further exacerbating symptoms of LCS.

The findings of this study underscore the importance of considering sitting posture in the management and prevention of LCS among IT professionals. Ergonomic interventions aimed at promoting neutral spinal alignment during sitting, such as adjustable chairs and workstation modifications, may help alleviate the musculoskeletal strain associated with LCS. Additionally, targeted exercise programs focusing on

strengthening the gluteal and abdominal muscles while stretching the hip flexors and lumbar extensors can help correct muscular imbalances and improve overall postural health.

Furthermore, the results of this study contribute to the existing body of literature by providing insights into the underlying mechanisms of LCS within the context of a sedentary occupational group. By elucidating the relationship between sitting posture and LPHA, this research highlights the importance of considering occupational factors in the assessment and management of musculoskeletal disorders.

SUMMARY

In the modern workplace, particularly within the Information Technology (IT) sector, sedentary lifestyles have become increasingly prevalent, leading to a rise in musculoskeletal disorders. One such disorder, Lower Cross Syndrome (LCS), is characterized by tightness in the hip flexors and lumbar extensors, coupled with weakness in the gluteal and abdominal muscles, resulting in exaggerated lumbar lordosis and anterior pelvic tilt.

This study aimed to investigate the changes in the lumbo-pelvic hip angle (LPHA) during two distinct sitting positions—upright sitting and free-style sitting—among IT professionals diagnosed with LCS. Understanding these alterations is essential for developing ergonomic strategies and exercise interventions that promote musculoskeletal health in this population.

A convenience sample of 30 IT professionals with diagnosed LCS was recruited. The LPHA was measured using a digital inclinometer and goniometer in both sitting positions, with mean LPHA values calculated from three trials per position. A paired t-test was employed to compare the LPHA between the upright and free-style sitting positions.

The results revealed significant differences in both lumbar angles and pelvic tilt angles between the two sitting positions. Specifically, the mean lumbar angle difference was 15.0333° (t = 167.9973, p < 0.000001), and the mean pelvic tilt angle difference was 7.6667° (t = 87.5814, p < 0.000001). These findings indicate that sitting posture significantly affects the LPHA in individuals with LCS.

The study concludes that free-style sitting significantly alters the lumbo-pelvic hip angle compared to upright sitting, contributing to the postural imbalances associated with LCS.



This underscores the importance of ergonomic interventions and targeted exercise programs to mitigate the adverse effects of prolonged sitting and improve musculoskeletal health among IT professionals.

CONCLUSION

In conclusion, this study investigated the changes in lumbo-pelvic hip angle during upright and free-style sitting in IT professionals diagnosed with Lower Cross Syndrome. The results demonstrated significant differences in lumbar angle and pelvic tilt angle between the two sitting positions, indicating that sitting posture significantly affects LPHA in individuals with LCS.

These findings have important implications for the development of ergonomic interventions and exercise programs aimed at preventing and treating LCS among IT professionals. By promoting neutral spinal alignment and addressing muscular imbalances, such interventions have the potential to mitigate the adverse effects of prolonged sitting and improve musculoskeletal health in this population.

Overall, this study contributes to our understanding of the relationship between sitting posture and musculoskeletal health, highlighting the importance of considering occupational factors in the assessment and management of LCS. Further research is warranted to explore additional interventions and strategies for promoting postural health in sedentary occupational groups.

LIMITATIONS OF THE STUDY

The convenience sampling method may limit the generalizability of the findings. Self-reported free style sitting positions may introduce variability. The study does not account for the long-term impact of sitting posture on LCS symptoms.

RECOMMENDATIONS

- Study can be further done by taking large number size
- Duration of the study can be increased
- Educate the population about the posture while working.
- Further study can be done to see the angle.

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