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Effect of Loss of Lumbar Lordosis on Spinal Flexibility and Function

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ABSTRACT

Lumbar lordosis, the natural inward curvature of the lower spine, is essential for balance and mechanical stress distribution. Loss of lumbar lordosis, or hypolordosis, can adversely affect spinal flexibility and function. This study examines the biomechanical and functional impacts of reduced lumbar curvature to inform clinical practices. This cross-sectional study included 60 subjects divided into three groups based on lumbar lordosis (LL) angles: Group A (LL < 10°), Group B (10° ≤ LL < 20°), and Group C (LL ≥ 20°). Inclusion criteria included adults aged 20-65 years with diagnosed hypolordosis, excluding those with severe spinal conditions, recent major spinal surgery, neurological disorders, severe comorbidities, and pregnancy. Clinical evaluations involved medical history, physical examination, and questionnaires (Visual Analog Scale for pain, Oswestry Disability Index). Radiographic measurements, Sit-and-Reach test for flexibility, Timed Up and Go (TUG) test, and 6-Minute Walk Test (6MWT) were conducted. Data were analyzed using ANOVA and Pearson's correlation coefficient. Significant differences were observed between the groups ($p < 0.001$). Group A had the highest pain (VAS: 7.2 ± 1.5), disability (ODI: 45 ± 10%), and lowest flexibility (Sit-and-Reach: 5.0 ± 2.5 cm) and functional capacity (TUG: 14.5 ± 2.0 seconds, 6MWT: 300 ± 50 meters). Group B showed intermediate values, while Group C had the lowest pain (VAS: 4.2 ± 1.0), disability (ODI: 25 ± 7%), and highest flexibility and functional capacity (Sit-and-Reach: 12.0 ± 3.5 cm, TUG: 9.5 ± 1.2 seconds, 6MWT: 400 ± 40 meters). Loss of lumbar lordosis significantly impacts spinal biomechanics and function, with greater loss linked to higher pain, disability, and reduced flexibility and function. Maintaining lumbar curvature is crucial for improving patient outcomes. Further research should explore long-term corrective interventions.

Keywords: Lumbar lordosis, hypolordosis, spinal flexibility, spinal function, pain, disability, biomechanics, clinical management

INTRODUCTION

Lumbar lordosis refers to the natural inward curve of the lower spine, crucial for maintaining balance and distributing mechanical stress during movement. This spinal curvature, typically ranging from 20 to 45 degrees, supports the body's weight and facilitates movement by acting as a shock absorber (Janssen et al., 2009). Loss of lumbar lordosis, also known as flatback syndrome or hypolordosis, can significantly impact spinal flexibility and overall function.

Several factors can contribute to the loss of lumbar lordosis, including degenerative disc disease, vertebral fractures, muscular

imbalances, poor posture, and surgical interventions such as spinal fusions (Aebi, 2005; Weinstein et al., 2006). When the natural curvature diminishes, the spine's ability to absorb shocks and maintain proper alignment is compromised, often leading to discomfort, pain, and reduced mobility (Glassman et al., 2005).

The implications of altered spinal curvature extend beyond localized pain. Studies have shown that a decrease in lumbar lordosis can affect overall spinal biomechanics, leading to compensatory changes in the thoracic and cervical regions, increased spinal stiffness, and altered gait patterns (Schwab et al., 2010; Kim et al., 2011). These changes can compromise an individual's functional capacity, limiting activities of daily living and reducing the quality of life (Vrtovec et al., 2009).

Understanding the effects of lost lumbar lordosis on spinal flexibility and function is essential for developing effective treatment strategies. This research aims to explore the biomechanical and functional consequences of reduced lumbar curvature, providing insights that could inform clinical practices and improve patient outcomes.

MATERIALS & METHODS

This study investigated the effects of loss of lumbar lordosis on spinal flexibility and function. A total of 60 subjects were enrolled and divided into three groups based on the degree of their lumbar lordosis: Group A (LL < 10°), Group B (10° ≤ LL < 20°), and Group C (LL ≥ 20°).

Inclusion Criteria

- Age between 20 and 65 years
- Diagnosed with loss of lumbar lordosis (lumbar curvature <20 degrees)
- Symptom duration of at least six months
- Willingness to participate and provide signed informed consent

- **Exclusion Criteria**
- Presence of other severe spinal conditions (e.g., scoliosis >10 degrees, spondylolisthesis, acute fractures)
- Major spinal surgery within the past year (excluding minor procedures like discectomy)
- Neurological disorders affecting gait and balance (e.g., multiple sclerosis, Parkinson's disease)
- Severe comorbidities (e.g., uncontrolled diabetes, severe cardiovascular diseases)
- Pregnancy

PROCEDURE

The study employed a cross-sectional design to assess the impact of reduced lumbar curvature on spinal biomechanics and functional capacity. Subjects were recruited from orthopedic and rehabilitation clinics, and those meeting the inclusion criteria were allocated into one of three groups based on their lumbar lordosis measurements obtained from radiographic images.

Upon enrollment, each participant underwent a comprehensive clinical evaluation, which included the collection of medical history, physical examination, and the completion of questionnaires to assess pain and functional status. Pain levels were measured using the Visual Analog Scale (VAS), and functional disability was assessed using the Oswestry Disability Index (ODI).

Radiographic measurements were obtained using standardized lateral radiographs of the lumbar spine, focusing on the Cobb angle from L1 to S1 to quantify the degree of lumbar lordosis.

Spinal flexibility was evaluated using the Sit-and-Reach test, where subjects were asked to sit on the floor with legs extended and reach forward as far as possible. Functional capacity was assessed through two tests: the Timed Up and Go (TUG) test, which measured the time taken to stand up from a seated position, walk three meters, turn around, walk back, and sit down again, and the 6-Minute Walk Test (6MWT), which measured the distance walked in six minutes.

STATISTICAL ANALYSIS

Statistical analysis was performed to compare the results across the three groups. Continuous variables were compared using ANOVA, while categorical variables were analyzed with chi-square tests. Pearson's correlation coefficient was used to examine the relationships between lumbar lordosis angle and functional outcomes.

RESULT

The statistical analysis revealed significant differences in spinal flexibility and functional capacity between subjects with varying degrees of lumbar lordosis. The data is summarized in the table below.

Parameter	Group A (LL < 10°)	Group B (10° ≤ LL < 20°)	Group C (LL ≥ 20°)	p-value
Number of Subjects	20	20	20	
Mean Age (years)	45 ± 10	44 ± 11	43 ± 12	0.85
VAS Pain Score	7.2 ± 1.5	5.8 ± 1.2	4.2 ± 1.0	< 0.001**
ODI (%)	45 ± 10	35 ± 8	25 ± 7	< 0.001**
Sit-and-Reach Test (cm)	5.0 ± 2.5	8.5 ± 3.0	12.0 ± 3.5	< 0.001**
TUG Test (seconds)	14.5 ± 2.0	12.0 ± 1.5	9.5 ± 1.2	< 0.001**
6MWT (meters)	300 ± 50	350 ± 45	400 ± 40	< 0.001**

Note: LL = Lumbar Lordosis, VAS = Visual Analog Scale, ODI = Oswestry Disability Index, TUG = Timed Up and Go, 6MWT = 6-Minute Walk Test. **p-value < 0.05 considered statistically significant.

The results indicated significant differences in pain levels, functional disability, flexibility, and overall functional capacity between subjects with different degrees of lumbar lordosis. Group A, with lumbar lordosis less than 10 degrees, reported the highest pain scores (VAS: 7.2 ± 1.5) and the highest disability index (ODI: 45 ± 10%). This group also showed the poorest performance in flexibility (Sit-and-Reach: 5.0 ± 2.5 cm) and functional capacity (TUG: 14.5 ± 2.0 seconds, 6MWT: 300 ± 50 meters).

Group B, with lumbar lordosis between 10 and 20 degrees, exhibited moderate pain levels (VAS: 5.8 ± 1.2) and disability (ODI: 35 ± 8%). Their flexibility and functional capacity were intermediate, with Sit-and-Reach test results of 8.5 ± 3.0 cm, TUG test times of 12.0 ± 1.5 seconds, and 6MWT distances of 350 ± 45 meters.

Group C, with lumbar lordosis of 20 degrees or more, demonstrated the lowest pain scores (VAS: 4.2 ± 1.0) and disability index (ODI: 25 ± 7%). This group performed best in flexibility (Sit-and-Reach: 12.0 ± 3.5 cm) and functional capacity tests (TUG: 9.5 ± 1.2 seconds, 6MWT: 400 ± 40 meters).

Statistical analysis using ANOVA showed that the differences between the groups for all measured parameters were highly significant ($p < 0.001$).

These findings suggest that a greater loss of lumbar lordosis is associated with higher pain levels, increased disability, reduced spinal flexibility, and lower functional capacity. Maintaining lumbar curvature is crucial for minimizing pain and disability and for preserving spinal flexibility and function.

DISCUSSION

The results of this study demonstrate a clear correlation between the degree of lumbar lordosis and spinal flexibility, pain levels, and overall functional capacity. Subjects with greater loss of lumbar lordosis (Group A) exhibited higher pain scores, greater disability, and reduced flexibility and functional capacity compared to those with less loss of lumbar lordosis (Groups B and C). These findings are consistent with previous research, highlighting the critical role of lumbar curvature in maintaining spinal health and function.

Pain and Disability

Our study found that subjects with a lumbar lordosis angle of less than 10 degrees reported significantly higher pain levels and disability scores. This aligns with findings from Aebi (2005) and Weinstein et al. (2006), who noted that reduced lumbar lordosis increases mechanical stress on the spine, leading to pain and functional limitations. The high Visual Analog Scale (VAS) scores and Oswestry Disability Index (ODI) percentages in Group A underscore the substantial impact of hypolordosis on daily living activities and quality of life.

Flexibility and Functional Capacity

The Sit-and-Reach test and the Timed Up and Go (TUG) test results indicated that reduced lumbar lordosis is associated with decreased spinal flexibility and slower functional performance. Group A subjects had significantly lower flexibility (5.0 ± 2.5 cm) and longer TUG times (14.5 ± 2.0 seconds) compared to Group C (12.0 ± 3.5 cm and 9.5 ± 1.2 seconds, respectively). These findings are consistent with Schwab et al. (2010) and Kim et al. (2011), who reported that lumbar lordosis plays a vital role in maintaining spinal mobility and efficient movement patterns.

The 6-Minute Walk Test (6MWT) results further support these findings, with Group A walking significantly shorter distances (300 ± 50 meters) than Group C (400 ± 40 meters). This reduction in functional capacity reflects the broader impact of lumbar hypolordosis on overall physical performance, as supported by Vrtovec et al. (2009).

The significant differences observed between the groups suggest that maintaining or restoring lumbar lordosis should be a priority in clinical practice. Interventions aimed at improving lumbar curvature could potentially reduce pain, enhance flexibility, and improve functional outcomes for patients with hypolordosis. Glassman et al. (2005) emphasized the importance of sagittal balance in spinal disorders, highlighting that achieving and maintaining proper lumbar lordosis is crucial for optimal spinal health.

While this study provides valuable insights, it has limitations. The cross-sectional design does not allow for causality inference, and the sample size, though adequate, could be expanded for more generalizable results. Future research should focus on longitudinal studies to examine the long-term effects of interventions aimed at restoring lumbar lordosis. Additionally, investigating the underlying mechanisms of how lumbar lordosis affects spinal biomechanics could further inform treatment strategies.

CONCLUSION

This study demonstrates a significant relationship between the degree of lumbar lordosis and spinal flexibility, pain levels, and functional capacity. The findings indicate that a greater loss of lumbar lordosis is associated with higher pain levels, increased disability, reduced spinal flexibility, and lower functional capacity. These results highlight the importance of maintaining lumbar curvature in clinical management to improve patient outcomes and quality of life. Further research is warranted to explore the long-term effects of interventions aimed at restoring lumbar lordosis.

Declaration by Authors

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REFERENCES

1. Aebi, M. (2005). "The adult scoliosis." European Spine Journal, 14(9), 925-948.
2. Glassman, S. D., et al. (2005). "Sagittal balance in spinal disorders." Spine, 30(6), 707-714.
3. Janssen, M. M., et al. (2009). "Normal Sagittal Spinal Alignment: Analysis of the Normal Spine in the Growing Child." Spine, 34(17), 1770-1777.
4. Kim, Y. B., et al. (2011). "Comparative Analysis of Sagittal Spinopelvic Alignment

and Balance in Asymptomatic Adults and Patients with Adult Spinal Deformity." Journal of Korean Neurosurgical Society, 50(6), 546-552.
5. Schwab, F., et al. (2010). "Adult spinal deformity." Spine, 35(25), 2213-2217.
6. Vrtovec, T., et al. (2009). "A review of methods for evaluating the quantitative parameters of sagittal pelvic alignment." Spine Journal, 9(10), 864-872.
7. Weinstein, J. N., et al. (2006). "Surgical vs Nonoperative Treatment for Lumbar Disk Herniation." JAMA, 296(20), 2441-2450.

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