THE EFFECT OF OBJECTIVELY MEASURED SITTING TIME DURING WORK AND LEISURE ON BACK FUNCTION AND PERCEIVED LOW BACK PAIN

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Summary

This study examined how prolonged sitting at work affects low back pain (LBP) and spine posture. 30 office workers wore activity sensors to track sitting behavior, spine posture and movement during work and leisure time. Pain developers spent more time sitting and showed less postural variation, whereas those without pain moved more. Post-work back function changes were similar in both groups, but recovery patterns in some measures differed between the groups.

Introduction

Existing evidence on the sitting-LBP association is inconclusive, and largely relies on subjective measures [1]. Objective quantification of sitting exposure (behavior and posture) and response (temporally related measures of perceived pain and back function) in real-world settings, both at work and leisure, is required.

Methods

Sitting exposure and time-varying spine posture were objectively measured for 30 office workers using GT9X ActiGraph sensors (Pensacola, FL, USA) affixed at L1, S2, and thigh with waterproof medical tape. Participants wore sensors continuously and performed their usual activities during working and leisure hours, and completed activity diary and pain surveys (11-point NPRS) at three time points during the day. Participants were classified as Pain Developers (PDs) by ≥2 points increase from baseline otherwise Non-Pain Developers (NPDs). ActiGraph data were used to identify different postures spent by the participants using a validated custom MATLAB script, which analyzed thigh and S2 sensor angles. Back function was assessed with lab-based tests (back muscle reflex, spine range of motion, spine height, back muscle endurance, and calf circumference) before (baseline) and after work and the next morning. Continuous variables were presented as Mean (SD) or Median (IQR). The independent sample t-test for normally-distributed data and Mann-Whitney U test for non-normally distributed data were conducted to examine group differences with significance at $p < 0.05$.

Results and Discussion

PDs spent more time sitting during work hours (80.81% vs. 65.65%, p = 0.107) and less time standing/walking (14.92% vs. 24.52% p = 0.149). During leisure, PDs sat less (9.18% vs. 12.95%, p = 0.074) but spent more time lying down (77.75% vs. 72.38%, p = 0.081), suggesting compensatory rest (Figure 1). After work, PDs had reduced flexion (-2.42˚) and extension (-3.31˚) compared to their baseline, while NPDs exhibited minimal changes in flexion (0.61˚) and extension (-0.25˚). By the next morning, PDs had greater recovery in flexion (3.31˚), with group differences nearing significance (p = 0.05). Lateral bending and twisting showed minimal changes in both groups after work, but recovered overnight, where PDs showed greater recovery in lateral bending compared to NPDs (p = 0.05). The sit-and-reach test showed improved flexibility in both groups at the end of the workday, with NPDs having greater improvement (p = 0.041). Overnight, PDs regained stiffness, while NPDs maintained enhanced flexibility, resulting in significant group differences (p = 0.033). Other back function tests showed minimal changes both at the end of the workday and overnight, with no significant differences between groups. Moreover, PDs exhibited lower lumbar flexion change across all percentiles, indicating reduced postural variability and greater static posture maintenance. Confidence bands were narrower in PDs, suggesting more uniform movement patterns between individuals, while NPDs showed greater postural variation.

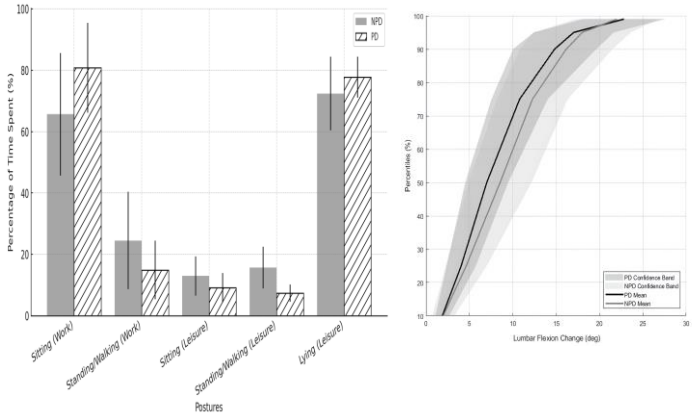

Figure 1: Percentage (Median and IQR) of Time Spent in Different Postures (left); Cumulative Probability Distribution of Lumbar Flexion Change (right).

Conclusions

This study shows potential associations between prolonged sitting, reduced postural variability, and perceived back pain. However, a large-scale study with an extended exposure assessment period is required.

Acknowledgments

WorkplaceNL Research Grant and NL SUPPORT.

References

[1] Bontrup et al. (2019). *Applied Ergonomics*, **81**:102894.