The Influence of Chair Recline on Head, Neck, and Shoulder Kinematics

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Summary

Chronic neck pain, often linked to prolonged seated computer work, disproportionately affects females [1]. This study examined how chair recline angles (0°, 12°, 25°) during seated computer work impact head, neck, and shoulder kinematics in six female participants. Increased recline resulted in greater head extension, reduced neck flexion, and increased scapular protraction and elevation. These changes may be an attempt to alleviate but can potentially increase shared neck-shoulder muscle strain, highlighting the need for further research on the neuromuscular effects of recline to optimize ergonomics.

Introduction

Chronic neck pain is a leading cause of disability, affecting females more frequently and with lower resolution rates than males [1]. It is often linked to prolonged static positions, such as seated computer work [2]. Ergonomic interventions, including reclining the chair backrest, may potentially reduce upper trapezius activation and alleviate musculoskeletal strain by improving head and neck posture. We have shown that a 25° recline impacts head and neck kinematics and upper trapezius and sternocleidomastoid muscle elasticity during seated computer work [3]. However, the effects of chair recline on shoulder kinematics remain unclear, despite shared musculature between the neck and shoulder. This study aims to assess the influence of chair recline on head, neck, and shoulder kinematics during seated computer work in females. The findings will provide evidence of the safety and effectiveness of recline as an ergonomic adjustment for better workplace design and musculoskeletal health.

Methods

Six female participants (mean (SE): age:42.5 (6) years, height: 1.7 (0.02 m), weight: 73.5 (4.1) kg) participated in this study. Motion capture markers were placed on C-7 and bilaterally on the tragus, canthus of the eye, and scapular acromion angle. Participants were seated at a standardized computer workstation while seatback recline and head/neck posture were altered: six randomly presented work postures that combined three recline angles (0° (e.g., no recline), 12°, 25°) and self-selected or neutral head/neck postures. Each posture was held for ~4 minutes while motion data were collected. Head, neck, scapular protraction, and scapular elevation angles **(Figure 1)** were compared using repeated-measures ANOVAs with recline angle (0°, 12°, 25°), head/neck posture (self-selected, neutral), and side (dominant, non-dominant) as fixed factors. Significance was set at α=0.05.

Results and Discussion

There was a significant main effect of chair recline on head angle ($p = 0.046$) and neck angle ($p = 0.023$), with greater head extension and reduced neck flexion as recline increased **(Figure 1)**. There was also a significant main effect of recline on scapular protraction angle ($p=0.010$) and scapular elevation angle ($p=0.038$), where both protraction and elevation increased with increasing recline. There were no main effects of head/neck posture or side, nor interactions between any fixed factors (all $p>0.109$).

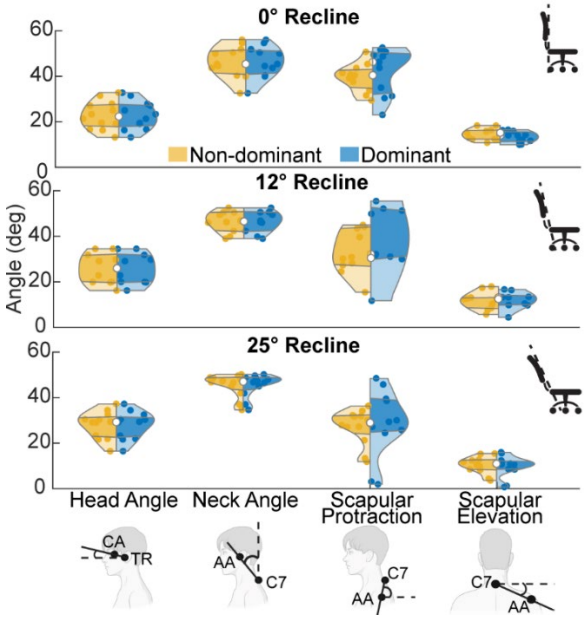

Figure 1: Violin plots showing head, neck, and shoulder kinematics across chair recline angles. The darker shaded region represents the first and third quartile of the median (white dot).

These adjustments may reflect a compensatory strategy to maintain visual alignment and access to the keyboard and mouse during seated computer work. However, the postural changes can either be supported by the chair or require muscular effort. Changes supported by the chair are likely less problematic than those relying on muscle contraction, which may increase strain and activation.

Conclusions

Optimizing chair recline during seated computer work may assist in improving neck position but could have consequential effects on shoulder kinematics, including increased scapular protraction and elevation. Our forthcoming research examines the relationship between neck and shoulder kinematics, muscle activation, and muscle elasticity during these tasks to assess their role in musculoskeletal demands during seated computer work.

References

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