Restricted mouse locations impact upper extremity postures and muscle activity during computer tasks

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Summary

Many office workers spend approximately 37.5 hours a week on their computers, with greater than 4 hours per day increasing risk of injury [1,2]. Due to work-from-home and mobile workstations, many workers have restricted desk space. The purpose of this study was to evaluate muscle activity and posture while performing computer tasks in restricted environments. Four mouse locations were used in both restricted and un-restricted environments across 18 healthy participants. Upper/middle trapezius and supraspinatus muscles demonstrated significant muscle activity across all locations and conditions, especially in the front and keyboard location. Overall, restricted workspaces increased muscular requirements, joint angles, and mouse performance.

Introduction

Office workers experience approximately 1800 hours of total screen time annually [1]. It has been suggested that greater than 4 hours of daily computer use can increase musculoskeletal disorder risk, such as carpal tunnel syndrome [2]. Traditional office work is changing, and many people now have mobile work-from-home computer configurations, which often result in more confined/restricted environments. Computer mouse location can create shoulder postures that deviate from neutral, and greater shoulder muscle activity, which may produce occupational risk scenarios [3]. The purpose of this work was to quantify upper extremity muscle activity and posture during computer tasks when exposed to restricted and unrestricted environments across mouse locations.

Methods

18 healthy university-aged participants (8 Male, 10 Female) were recruited. Participants attended one two-hour session and were outfitted with surface electromyography on 16 muscles of the trunk/right upper extremity (Bortec Biomedical Ltd, Calgary, Canada), and 13 reflective motion capture markers (Vicon, Oxford, UK). Participants completed two computer mouse tasks using AimLab (State Space Labs, Inc, New York, USA): 1) point-and-click (PC) task (Participant clicked on targets as they appeared at random), 2) mouse tracking (TR) task (tracking a target on the screen as it moved at random). Both tasks were completed in four mouse locations (Front, Deep, Keyboard, Right-edge) in both restricted and unrestricted boundaries (Rest: 8" x 9" mouse pad with a 3D printer border; Un-rest: 11" x 12" mouse pad with no border). 5th, 50th, 95th APDF percentiles were calculated across locations and conditions.

Results and Discussion

Upper (UPTR) and middle (MTRP) trapezius, and supraspinatus (SUPR) demonstrated significant muscle activity changes across tasks (Figure 1). Right middle (SUPR: 64.1 ± 17.2 %MVC; UPTR: 3.5 ± 0.8 %MVC; MTRP: 12.9 ± 4.4 %MVC), and keyboard (SUPR: 71.5 ± 19.6 %MVC; UPTR: 3.5 ± 0.7 %MVC; MTRP: 16.0 ± 5.3 %MVC) locations produced the greatest activity across all locations. Mouse accuracy (hit %) was greatest in the restricted condition (PC: 96 ± 5.3%; Track: 84.9 ± 10.7%) compared to unrestricted (PC: 95.4 ± 5.8%; Track: 81.4 ± 8.9%). Significant differences were not reported for kinematics. Lateral/deep mouse locations produced more shoulder extension and abduction; due to the extended reach [4]. Restricted conditions produced an increase in shoulder flexion (3.8º) and abduction (1.8º) when compared to un-restricted conditions. Elbow flexion (0.5º) and forearm pronation (0.8º) increased compared to un-restricted. Wrist extension and ulnar deviation increased in restricted scenarios compared to un-restricted.

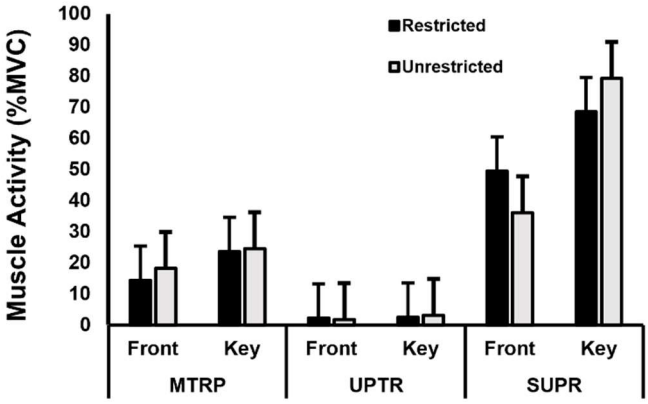

Figure 1: APDF 50th %tile for the MTRP, UPTR, and SUPR in the front and keyboard mouse locations.

Conclusions

Restricted workspaces increase muscular requirements, increase joint angles, and increase mouse performance. Having an increase in shoulder flexion and abduction may not be suited for longer work periods.

Acknowledgments

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References

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