Effects of Cervical Stabilization Exercise on Cervical Stability during High-velocity Small-amplitude Arms Movement in Patients with Chronic Neck Pain

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Summary

The prevalence of chronic neck pain (CNP) has increased in recent years, especially among individuals in overhead and upper extremity-manipulated occupations. Cervical stabilization exercise has been shown to benefit patients with CNP in pain, disability, and range of motion. However, their effects on cervical spinal stability remain unclear. Therefore, this study introduced a challenging upper extremity oscillation task to determine the effects of stabilization exercises. Fourteen patients with CNP participated in a 6-week stabilization exercise program. Pain and disability were significantly improved after the intervention. The head angle during the oscillation task demonstrated a smaller range of motion and reduced variability, suggesting enhanced cervical spine stability after the cervical stabilization exercises.

Introduction

Chronic neck pain (CNP) is recognized as an occupational-related health issue, and has become one of the most prevalent musculoskeletal disorders in recent years. Individuals engaged in overhead or upper-extremity-intensive occupations such as teachers and spinal neurosurgeons, exhibit a higher prevalence of CNP [1-2]. Several systematic reviews have demonstrated that deep neck flexor control training, commonly referred as cervical stabilization exercise, effectively alleviates sensorimotor impairments in patients with CNP [3-4]. However, most studies have focused on pain, disability, and range of motion with limited explorations of their effects on cervical spine stability. Given that CNP is often occupationally related, particularly in overhead work, this study aimed to investigate the effects of cervical stabilization exercise on pain, disability, and cervical stability during repetitive, high-velocity small-amplitude arms task in patients with CNP.

Methods

Individuals aged 20 to 60 years experiencing neck pain for at least 3 months were eligible to participate in this study. Kinematic assessment was performed pre- and post-intervention. During data collection section, participants were asked to perform repetitive, high-velocity small-amplitude arms oscillation movement for 100 times (Hundred task) to evaluate the cervical spine movement (stability). Between 2 data collection sessions, participants completed a 6-week supervised cervical stabilization exercise program. Pain, disability, and cervical stability were assessed using a visual analog scale (VAS), the neck disability index (NDI), and an optical motion analysis system with the Plug-in-Gait model. The kinematic outcomes of the head and neck angle during the first 10 repetitions included angular variables presented in **Figure 1**, and the variability indicated by the standard deviation (Std). A higher head angle indicated greater upper cervical extension, while a higher neck angle reflected increased lower cervical flexion. Paired-*t* test was used for statistical analysis.

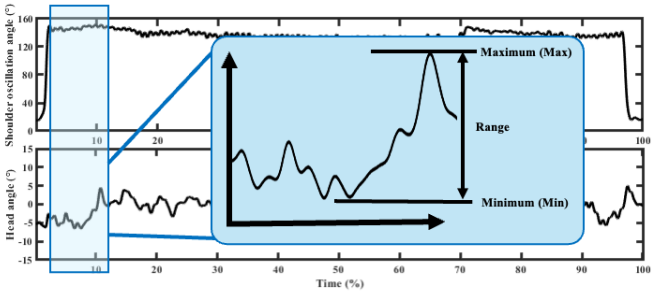

Figure 1 Kinematic outcomes during the Hundreds task

Results and Discussion

Fourteen patients with CNP participated in this study. After a 6-week cervical stabilization exercise, both pain and disability were significantly improved, decreasing by 23 millimeters and 9.43% respectively (both $p < 0.001$). The results of the motion analysis showed a significant reduction in angle range (0.64 degrees, $p = 0.018$) and standard deviation (0.19, $p = 0.026$), indicating increased stability in the upper cervical movement within a smaller range. However, no significant differences were found in the neck angle.

Conclusions

During the more challenging upper extremity task, the 6-week stabilization exercise significantly improved cervical spine stability, as evidenced by reduced movement variability and a smaller range of motion in the upper cervical region. Additionally, it effectively alleviated clinical symptoms, with notable reductions in pain and disability. These findings suggest that cervical stabilization exercises may enhance neuromuscular control and provide functional benefits for individuals with CNP, particularly those engaged in occupations requiring repetitive upper extremity movement.

References

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