E-Poster

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Feasibility and Effectiveness of Real-Time Biofeedback for Maintaining Lumbar Lordotic Curvature Using Inertial Measurement System

Topic: Biomechanics

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BACKGROUND

Recent studies have shown that decreased lumbar lordotic curvature (LLC) is closely related to low back pain (LBP), leading to increased disc pressure, posterior migration of the nucleus pulposus, and eventually causing damage to the posterior annulus. By these mechanisms, activities that increase the frequency, duration, or magnitude of lumbar flexion, such as prolonged sitting or repetitive lifting, are known to elevate the risk of LBP. Recent advancements in inertial sensor have enabled the real-time monitoring of LLC, offering a promising solution to these limitations. This study aims to evaluate the feasibility and effectiveness of a real-time biofeedback system for preserving LLC using an inertial measurement system, comparing it with postural education and their combined effects.

METHODS

Ten male participants with LBP wore clothing equipped with two inertial sensors at T6 and S2 and performed four daily tasks, including sitting at a computer, mopping the floor, picking socks up from the floor, squat for exercise, across four sessions undertaken in two separate days, with varying combinations of auditory feedback and postural education. The relative angles from the sensors for the mediolateral axis were monitored in real-time as lumbar lordotic angle (LLA), with auditory alarms triggered when LLA dropped below set thresholds. Postural education was delivered using instructional leaflets. The average deviation in LLA (LLAdev) was extracted for each session and task, and regression analysis was used to analyze the impact of education and feedback on increasing LLAdev, which indicates preservation of LLC.

RESULTS

For sitting and mopping tasks, both feedback and education demonstrated significant effects with similar impacts. In the sitting task, auditory feedback and postural education increased an additional 10.2˚ and 10.1˚ of LLAdev, respectively ($p < 0.001$ for both). In the mopping task, postural education had a slightly greater effect, increasing LLAdev by 13.7˚ compared to the feedback's 10.5˚ ($p < 0.001$ for both). For picking up and squatting tasks, education had a greater impact. In picking up tasks, education significantly increased LLAdev by 11.7˚ compared to feedback's increase of 5.8˚ ($p < 0.001$ for both). In squatting, only education was effective, increasing LLAdev by 3.5˚ ($p < 0.001$).

CONCLUSION

The real-time biofeedback system employing two inertial sensors was found feasible and effective for LBP patients in preserving LLC across various tasks. The best preservation of LLC was observed when feedback was combined with postural education, which highlights the potential benefits of integrating real-time feedback and education with traditional treatments.

Statement of Disclosures

None

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