

The Effects of the developed sofa on back pain, alignment, and muscle fatigue during prolonged sitting

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Summary

This study aimed to prevent low back pain during prolonged sitting on the sofa. We compared the developed sofa, which can lead to the appropriate pelvic anterior tilt and lumbar lordosis, with a conventional sofa about an alignment, intensity of low back pain and fatigue of back muscle. As a result, the developed sofa offered more appropriate alignment than a conventional sofa and inhibited worsening of low back pain associated with prolonged sitting.

Introduction

Prolonged sitting causes low back pain [1]. It causes a slumped posture, with the spine more flexed and the pelvis tilted posteriorly than in an anatomical position, which contributes to low back pain by putting mechanical stress on the spine [2]. Also, sitting on a sofa causes a slumped posture even more because the seat of a sofa is softer than that of a desk chair. Therefore, we developed a new sofa that makes the pelvis anterior tilt and the lumbar lordosis appropriate and investigated the differences in the effects of the developed sofa and conventional sofa on the intensity of low back pain, alignment, and muscle activity after 30 minutes in individuals with low back pain and healthy individuals.

Methods

This study included 19 individuals with non-specific chronic low back pain and 19 healthy individuals. 8 Miquis Video cameras (Qualisys, Sweden) measured pelvic tilt angle and trunk flexion angle in the sagittal plane. Wireless surface electromyography (Cometa Systems, Italy) measured the multifidus (MF) and erector spinae (ES) activity. These data were measured at 0 minutes (the timing of starting to sit) and at 30 minutes. The video data were processed using markerless motion capture systems (Theia markerless, Inc., Canada), and exported for analysis in Visual3D (C-Motion, USA). We used the pelvic tilt angle and trunk flexion angle related to the global system and modified the pelvic tilt angle by the angle of the sofa's seat. The muscle activity at 30 minutes was normalized muscle activity at 0 minutes. Also, the intensity of low back pain was recorded at 0 minutes and at 30 minutes on a Numerical rating scale (NRS). We used a linear mixed model and set time (0 minutes and 30 minutes), sofa type (developed sofa and conventional sofa), and the interaction (time and sofa type) as a fixed factor, health condition (low back pain and no-low back pain) as a covariance, subject as a variable factor, and pelvic tilt angle, trunk flexion angle, and NRS as the dependent variable. For

the statistical analysis of muscle activity at 30 min, a linear mixed model with health condition as a covariate was used.

Results and Discussion

There was a significant main effect of sofa type and time on pelvic anterior tilt ($P < 0.001$, $P = 0.008$) (Figure 1). A significant interaction between sofa type and time was found in trunk flexion angle ($P = 0.018$). When using the developed sofa, unlike the conventional sofa ($P = 0.002$), the trunk did not flex even after 30 minutes ($P < 0.001$). Health condition did not significantly influence the results of the kinematics data. Muscle activity results showed that low back pain significantly affected (MF: $P < 0.001$, ES: $P = 0.022$) and intensified muscle activity, with no significant differences between sofas after adjustment. We found the significant effect of health conditions ($P = 0.013$) and a significant interaction between sofa type and time ($P = 0.034$) on the NRS. NRS using the developed sofa was lower than the conventional sofa at 30 minutes ($P = 0.004$). Therefore, sitting with the pelvis and trunk upright using the developed sofa prevents worsening of low back pain associated with prolonged sitting unless with low back pain or without low back pain by preventing increased internal disc pressure and reducing tensile stress on the posterior tissues.

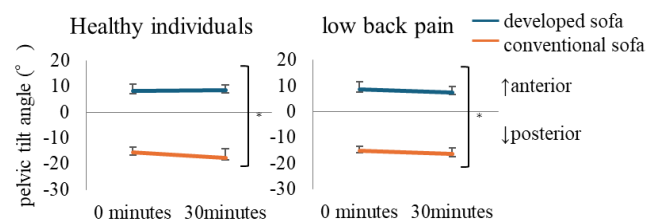


Figure 1. Time course of pelvic tilt angle for each sofa. Left: healthy individuals. Right: individuals with low back pain.

Conclusions

The developed sofa was made to keep the alignment appropriate during prolonged sitting unless with low back pain or without and prevented the worsening of low back pain.

Acknowledgments

This study was supported by a joint research grant from MTG Co., Ltd.

References

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