

Effect of a suspension seat support chair on the trunk flexion angle and gluteal pressure during computer work

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Abstract. [Purpose] We assessed the effects of a suspension seat support chair on the trunk flexion angle and gluteal pressure during computer work. [Subjects] Ten males were recruited. [Methods] The suspension seat support was developed to prevent abnormal gluteal pressure and a slumped sitting posture during computer work. The gluteal pressure was measured with a TekScan system and the trunk flexion angle was measured with a video camera, to compare the differences between a general chair and the suspension seat support. [Results] The gluteal peak pressures were decreased significantly in the suspension seat support versus the general chair. The trunk flexion angle was also decreased significantly in the suspension seat support compared with the general chair. [Conclusions] This study suggests that the suspension seat support chair contributes to preventing abnormal gluteal pressure and a slumped sitting posture.

Key words: Gluteal pressure, Seat support, Slump sitting

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INTRODUCTION

Prolonged sitting postures in combination with poor workstation ergonomics have been implicated in the development of musculoskeletal problems during visual display terminal work¹⁾. Theoretically, a flexed-relaxed posture results in a higher load at the spine and lower muscle activation of the trunk compared with sitting upright, which may lead to excessive stress on passive structures, such as ligaments and discs, and act as a risk factor for low back pain²⁾. Recent findings have indicated that a prolonged flexed-relaxed posture may provoke symptoms of low back pain and may also be associated with neck and shoulder pain³⁾. Thus, various ergonomic interventions have been suggested that help to maintain a neutral spinal alignment and prevent a slumped posture⁴⁾. Localized pressure on the skin surface is believed to cause blockage of capillary blood flow and subsequent ischemic damage⁵⁾. Localized stresses are generated even during contact with a deformable surface, such as an air cushion, and they cause deformation of soft tissues and exacerbation of pressure sores⁶⁾. Thus, in this study, we developed a suspension seat support for preventing abnormal gluteal pressure and a slumped sitting posture in computer work. The purpose of the study was to show the

effects of a suspension seat support chair on the trunk flexion angle and gluteal pressure during computer work.

SUBJECTS AND METHODS

The study subjects were 10 males aged 28.2±3.9 years (mean±SD) whose average height and weight were 175.7±4.7 cm and 68.1±6.3 kg, respectively. Subjects with conditions that might have affected trunk mobility, such as injuries or neurologic deficits of the hip and lower extremities during the previous year, were excluded from the study. Subjects received an explanation of the purpose and methods of the study prior to their participation and provided informed consent according to the ethical principles of the Declaration of Helsinki. The TekScan system was used to measure the location and magnitude of the peak pressures. The software supplied with the TekScan system was used to locate areas of interest, and display temporal forces and pressures on a monitor. We compared the mean peak pressures of left and right gluteal portions between a general chair and the suspension seat support chair during 30 min of computer work. The trunk flexion angle of each subject during the VDT work was measured using a single video camera. Three reflective markers 14 mm in diameter were placed by the same investigator. The trunk flexion angle was measured as the angle between the line of the left acromion to the L1 spinous process and the line from the L1 spinous process to the left greater trochanter. The values of the trunk flexion angles were measured and recorded by a digital camera, and the video motion analysis Pro-Trainer 10.1 software (Sports Motion, Cardiff, CA, USA) was used to analyze the kinematic data. Images were obtained at a sampling rate of

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30 Hz for digitalization. All subjects performed randomly two computer typing work periods, each of 30 min, using a general chair and the suspension seat support chair. To ensure that the hips and knees were flexed at 90°, an adjustable-height table and chair without a backrest were used to set the initial sitting posture. The general chair consisted of a 40 × 40 cm foam-cushion seat support, height-adjustable chair (D model of H company). We adjusted the distance from the seat surface to the floor using the height-adjustable seat support. The suspension seat support chair consisted of fabric textile materials. The suspension seat support chair is similar to side-X stools, but has a backrest. The suspension seat support was collapsed to align between the sidebars, either down between the front legs, or up to align between back-sidebars.

The paired t-test with the SPSS software (SPSS Inc., Chicago, IL, USA) was used to analyze the significance of differences between the general chair and the suspension seat support chair. The level of statistical significance was set at 0.05.

RESULTS

The mean peak contact pressure of the gluteal portion in the suspension seat support chair (32.1±10.0 mmHg) was decreased significantly compared with the general chair (48.4±12.9 mmHg; $p < 0.05$). The trunk flexion angle in the suspension seat support chair (19.8±10.4°) was decreased significantly compared with the general chair (29.9±13.6°; $p < 0.05$).

DISCUSSION

The purpose of this study was to evaluate the effects of a suspension seat support on the trunk flexion angle and gluteal pressure during computer work. The results showed that the gluteal peak pressure was decreased significantly in the suspension seat support, compared with the general chair. Localized stresses are generated even during contact with a deformable surface, such as a cushion, and they cause deformation of soft tissues and exacerbation of pressure sores⁵. Without dynamic pressure redistribution or repositioning, these areas, when in contact with dense materials, eventually

lose the ability to reduce the load and excessive load on soft tissue remains largely unrelieved⁶. The results here showed the effect of the suspension seat support chair on gluteal pressure reduction. This result indicates that the suspension seat support has the capability to reposition when computer workers 'swing' on the suspension seat support during computer work. The results also showed that the trunk flexion angle was decreased significantly in the suspension seat support compared to general chair. van Dieën et al. showed that dynamic office chairs potentially offer advantages over fixed chairs⁷. This led to suggestions that dynamic changes in the sitting position with frequent posture changes are beneficial⁸. Vergara and Page suggested that large changes in sitting posture are indicative of discomfort while small movements are necessary to alleviate pain caused by static lumbar and pelvic postures⁹. Thus, this study suggests that the suspension seat support chair contributes to preventing abnormal pressure in the gluteal and thigh portions and a slumped sitting posture.

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