WEIGHT SHIFT FREQUENCY DURING STATIC SITTING IN OLDER ADULTS

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ABSTRACT

Weight shift is a natural response of our body against discomfort during static sitting. The trigger of weight shift movements could be due to fatigue of the muscles responsible for postural maintenance and/or from the external forces acting on the buttock tissues. In this work, we investigated the frequency of weight shift in older adults during video watching. It was found that on average, older adults shift weight and altered his/her posture every 2.5 minutes. Our result also indicated that interfacial pressure underneath the ischial tuberosities gradually increased with time during static sitting until a weight shift was triggered. Compared with similar study using younger subjects, older adults seem to have more frequent postural changes.

BACKGROUND

Sitting is never a static posture. For healthy individuals, we change our sitting posture from time to time. However, based on general observations; elderly tends to be less dynamic during prolonged sitting, especially for those with diminished pain sensations. This makes them more prone to the development of pressure ulcers.

In literature, limited information is available related to how frequent should someone change his/her posture during sitting. In clinical situation, nurses were told to turn bed bounded patients every 2 or 4 hours to prevent the onset of pressure ulcer. For wheelchair users, they were told to perform push-up every 15 minutes to avoid tissue distresses. Moreover, there is little scientific evidence supporting the selection of such timing.

Nowadays, with the increasing concern of healthy ageing, better realization of our weight shifting behavior can help us understand how our body response to prolonged static sitting. This knowledge can help designers/engineers to develop new products to achieve active sitting during daily activities. This could include new types of dynamic cushions, geriatric chairs or even "smart" chairs that can mimic the natural postural changes behavior adopted by healthy persons. Therefore, the purpose of this work is to measure the frequency of postural changes among older healthy adults sitting in a chair.

METHOD

Eleven healthy volunteers (Six males and six females; aged 51-75; BMI 21-30) without previously diagnosed injury in spine and pelvis were invited. The experiment was conducted in a room with temperature set to 25^0C. Informed consent was obtained from the subject before the experiment starts. The experimental chair was adjusted to fit the body dimension of the participant; with backrest, knee and ankle angles at 90 degree. A 1.5 inches foam cushion was used and a pressure mat was placed on top of the cushion. The subject was asked to select a 20 minute video to watch. Figure 1 shows the experimental setup.

To collect interface pressure data, a pressure mapping system (FSA, Canada) was used. The sampling rate is 30Hz. Postural changes were defined as a noticeable change of interface pressure underneath the ischial tuberosities. Average and Peak pressures at both tuberosities were calculated and monitored over time.

RESULTS

During the 20 minutes of video watching, these subjects performed 8±4 postural changes. Male subjects tend to have less weight shifting (7±2), whereas female subjects tend to perform weight shift more frequent (10±4).

Average Body Mass Index (BMI) of the male group and female group are the same (average BMI=25). Detail analysis of the collect data revealed that pressure underneath the ischial tuberosities generally showed an increasing trend before a weight shift was triggered. Figure 2 shows a typical pattern of pressure changes under the left and right ischial tuberosities during an experiment trial.

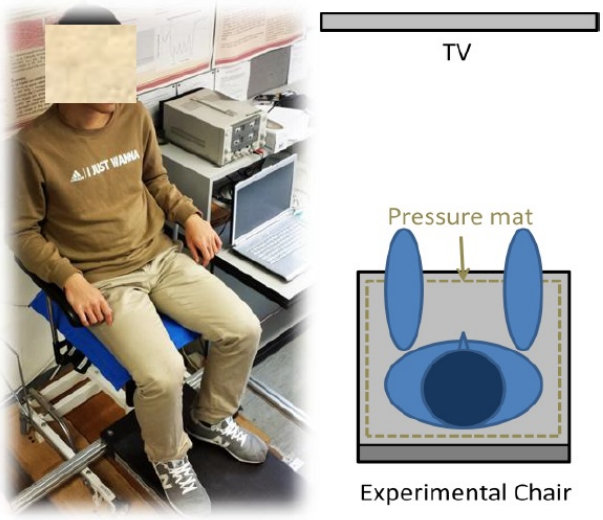

Fig. 1: Experimental setup showing subject sitting on the experimental chair.

DISCUSSION

This study aims to examine how frequent older healthy adults perform weight shifting during prolonged sitting. With the increasing number of modern design on dynamic chairs for sitting comfort, we need to understand how these technologies influence the seating behavior, especially on its ability to perform pressure relief. In general observation, it was perceived that older adults have diminished postural movement during prolonged sitting. Our results showed that on average an older adult has 8 repositioning actions during a 20 minutes video watching task. These weight shifts seem not related to the magnitude of pressure that the buttock tissues were subject to, nor related to a regular time interval. Within each weight shift, the interface pressure showed an increasing trend until a repositioning was triggered. However, there is no obvious relationship between time and pressure magnitude. Compared with a similar study conducted by Linder-Ganz [1] in 2007 with younger adults watch movie with duration of 90 minutes, our results showed a more frequent weight shift.

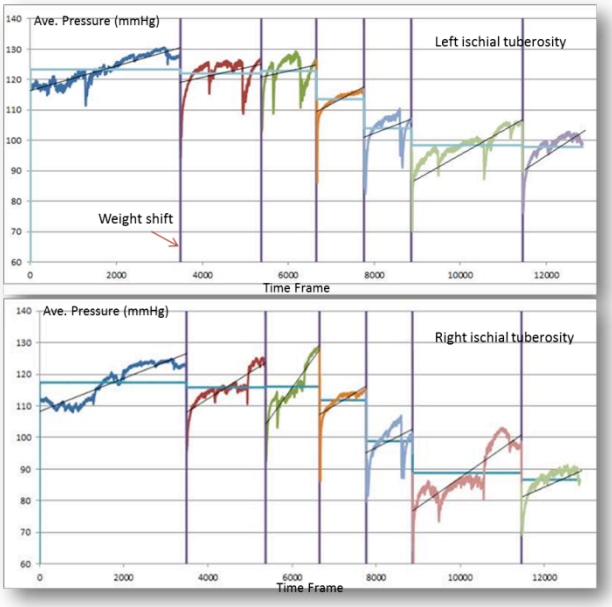

Figure 2: Changes of interface pressure underneath the left and right ischial tuberosities of one subject during experiment.

In Linder-Ganz's work, 10 healthy volunteers (5 males and 5 females; age 28 ± 3 years; average BMI 21) changed their posture every 9 ± 6 minutes in the sagittal plane, and independently, every 6 ± 2 minutes in the frontal plane. Surprisingly, older adults seem to have a more frequent weight shift than the younger aged adults. Comparing on their BMI, our older adults has a higher BMI than the younger adults. This suggested that BMI although closed related to peak seat interface pressure [2], may not be directly related to the onset of a weight shift. Further works are needed to elucidate the cause of this defensive trigger which protects our tissue from compressive injury.

ACKNOWLEDGEMENT

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