



Does prolonged sitting with limited legroom affect the flexibility of a healthy subject and their perception of discomfort?

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ABSTRACT

This study examined for differences in subjective ratings of discomfort and comfort (Numerical Rating Scale) and objective measures of hamstring (Sit–Reach test), lumbar (Schöber's test) and neck (Cervical Range of Motion) flexibility in healthy young subjects ($n = 24$) following 4 h of sitting on stacking chairs with or without limited legroom.

When comparing the limited and unlimited legroom groups for differences in subjective and objective measures over 4 h, no significant findings were seen at the 5% level of confidence. However, differences in buttock, neck, shoulder and average discomfort were significantly negatively correlated to differences between post-warm up Sit–Reach scores (Correlation Co-efficients: $-.763$, $-.434$, $-.408$, and $-.445$; p values of $.004$, $.034$, $.048$, and $.029$, respectively). The difference in buttock discomfort was significantly negatively correlated to the difference between pre-warm up Sit–Reach scores (Correlation Coefficient: $-.750$; $p = 0.005$), post-sitting/pre-warm up and pre-sitting/post-warm up Sit–Reach scores (Correlation Coefficient: $-.756$; $p = 0.004$), and Schöber's tests (Correlation Coefficient: $-.578$; $p = 0.049$).

Although the above results suggest a relationship between a loss in flexibility and an increase in discomfort, the mechanism influencing this relationship is not clear from this study. What does appear clear is that the limiting of legroom to the parameters used in this study does not seem to exacerbate change in flexibility and discomfort which are a consequence of prolonged sitting.

Relevance to industry: Many forms of public transport provide limited legroom for their passengers, which may have an adverse affect on the user's flexibility or experience of discomfort. Determining which objectively measurable parameters are associated with the subjective level of discomfort during sitting should allow for a greater appreciation of the changes that underpin such subjective perceptions.

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1. Introduction

Prolonged sitting in a constrained or fixed posture exposes a person to long term static loading of the body which is generally seen as a risk factor for the development of musculoskeletal complaints and discomfort (Fazlollahtabar, 2010; Luttmann et al., 2010). Common examples of prolonged sitting involving a restricted space include commercial travel, office work, or driving.

Restricted space, in relation to sitting for prolonged periods, has been identified and set for the major industries for people transportation: airplanes, coaches, buses and railways. The UK Civil Aviation Authority Airworthiness Notice 64 regulates the minimum

seat space dimensions for all UK registered aircraft over 5700 kg MTWA which carry 20 passengers or more (UK Civil Aviation Authority Airworthiness Notice., 2001; Quigley et al., 2001), with 26 inches (660 mm) being the minimum required distance between the back support cushion of a seat and the back of the seat or other fixed structure in front (UK Civil Aviation Authority Airworthiness Notice., 2001). Similar requirements for the above minimum distance exist in the UK for coaches (650 mm), buses (650 mm) and rail (660–680 mm) vehicles (Quigley et al., 2001, DETR, 1999, DETR, 1998); indicating some degree of coherence between the groups rather than them all adopting the same distance. In line with a background trend towards increasing body dimensions within the European population, it has been recommended that the minimum distance be increased to 711 mm to ensure that the knees do not contact the seat in front and to improve postural flexibility (Quigley et al., 2001). Although this review focused on the safety issues associated with seating

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