# IN VIVO SPINAL POSTURE DURING SITTING UPRIGHT AND RECLINED IN AN OFFICE CHAIR

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## Introduction

Today, more than 75% of all employees in industrial countries have jobs that require working in a sitting position [Lis, 2007]. Prolonged static sitting increases the risk of musculoskeletal disorders in the back, neck, shoulders, arms and legs [Winkel, 1986]. Low back pain is particularly frequent, with most people subject to it at one time or another [Hoy, 2010]. Therefore, it is important that office chairs provide different sitting positions that allow the spine sufficient freedom to move and change the distribution of internal loading conditions. Moreover, ergonomists generally suggest that spinal health can be preserved by regular movement and varying the seating posture [Feldmann, 2000]. Since it remains unknown whether modification of seat tilt actually alters the posture of the spinal cord, and thus whether it can aid in spinal unloading, the aim of this study was to analyse the *in vivo* spinal geometry while sitting in an office chair in two different positions.

## Methods

Five subjects (2♀, 3♂, aged: 25-46 years, height: 1.60-1.86 m, weight: 55-96 kg) were analysed in an upright and reclined sitting position. A wooden chair model of a new prototype office chair (Vitra AG, Switzerland) was constructed to be analysed in an open, upright MRI (Fonar, USA). Sagittal images of the lumbar, thoracic and cervical spine were taken. Through determination of the midpoints of each vertebrae, the wedge angles, as well as the lumbar, thoracic and cervical curvature angles were determined [Baumgartner, 2012].

## Results

Changes in the position and shape of the spine occurred in all vertebral segments in all subjects when changing from an upright to a reclined sitting position. The reclined sitting posture resulted in very similar positions of the lumbar vertebrae for all subjects; however, large inter-subject differences could be found in the cervical spine for both the upright and the reclined positions. Changes of the wedge angles from the upright to the reclined position occurred in every vertebral segment and were also different between subjects. As a result, no uniform movement pattern could be identified.

The variability of the curvature angles was high between subjects (Fig. 1). However, two different movement strategies were detected, where subjects 2, 4 and 5 showed the same or a reduced lumbar curvature while reclining, while subjects 1 and 3 increased their lumbar curvature.

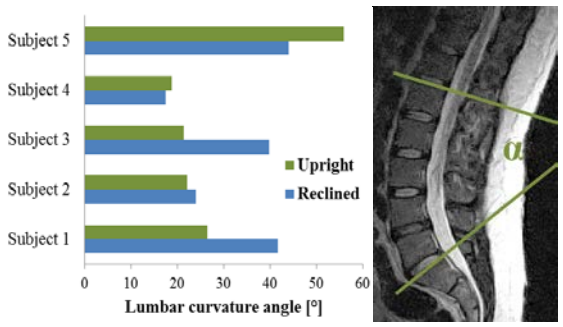


*Figure 1: Lumbar curvature angle α of the five subjects in the upright and reclined sitting position (left) and MR image of the lumbar spine in the upright sitting position (right).*

## Discussion

All intervertebral discs moved relative to one-another after a change in seating posture. While chair reclining resulted mainly from hip joint rotation in 3 subjects, 2 subjects presented largely lumbar segment movement. This suggests that a wide range of seating posture adaptation is possible through modification of chair posture, and may therefore be a key feature in reducing or even preventing back pain caused by prolonged static sitting.

## References

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