

## Seat Design, Spine Curvature and Intradiscal Pressure

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### Editorial

In nowadays digitalized and industrialized society, sitting is the most frequent posture at work, at school and also during the leisure time (surfing on the internet, gaming...). Because of gravity, the erect posture is associated with an increase of the lumbar intra-discal pressure, which has first been evidenced in the in vivo measurements of Nachemson [1-3]. In these studies, the authors depicted a rise of the intra discal pressure from lying supine to standing and to sitting. In addition, it has been shown that flexing forward while standing or sitting substantially increased intradiscal pressure [3], suggesting that its rise in the seated posture pertains to the flattening of the lumbar lordosis. Indeed, an extensive literature provides evidence that lumbar flexion and flattening of the lumbar curvature are associated with sitting. Ackerbom [4] reported an average lumbar flexion of 35° in people sitting upright, while Keegan [5] stated that it was impossible to seat in a standard chair without a considerable flattening of the lumbosacral curve. According to Schoberth [6], who used X-ray examination, sitting upright is associated with an average flexion of 60° in the hip joint and a 30° flexion in the lumbar region. Likewise, Lord [7] stated that lumbar lordosis while standing is nearly 50% greater on average than in sitting. For most authors, this phenomenon is the consequence of thigh flexion which drives the pelvis backward. In the study by Keegan [5], it has been shown that the flattening of the lumbar lordosis increases with thigh flexion from 0° to 130° in side-lying posture. The author presumed that it was related to the tension of the posterior thigh and gluteal muscles that tend to rotate the pelvis backward when the thighs are flexed. Eklund and Liew [8], who studied the effect of hip and knee flexion on the lumbar curvature in the lying and sitting posture, found similar results and stated that hip angle is a strong determinant of lumbar posture.

All these studies on intradiscal pressure and on the relation between hip flexion and lumbar curvature were used as a scientific basis by Mandal to support the use of sloping and higher seats, intended to reduce hip flexion and re-establishing the lumbar lordosis [9-11]. Comparison of spine posture between flat and sloping seat conditions supported this assumption [11-13], but the variations were not always significant [14]. Sloping chairs are also associated with a sliding down effect due to the additional tangential component of gravity, and a source of discomfort for the knee region [8]. Moreover, some studies have questioned the increase of intradiscal pressure in the seated posture. The survey from Sato et al. [15] showed that the lumbar intradiscal pressure was only 13% higher in the seated posture compared to standing, while in vivo recordings from Wilke [16] and stadiometric measurements from Van Deursen [17] reported lesser intradiscal pressure while sitting. In a review paper, Claus et al. [18] stated that intra-discal pressure is often similar in standing and sitting, and that the axial compression in sitting is unlikely to alter the non-degenerate disc.

Hence, the usefulness of “ergonomic seats”, aimed at re-establishing the lumbar lordosis in the seated posture to prevent back pain, seems questionable. It must also be kept in mind that spontaneous behaviour regularly produces a variety of postures [19], and that none of them can be maintained for a long period of time without discomfort [20]. Hence, the ideal ergonomic chair has to integrate this dynamic part of seated posture physiology, on not only favour a straightening of the spine.

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