Annals of Physical and Rehabilitation Medicine 58 (2015) 151–156

Available online at
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com

Original article

Effect of a kneeling chair on lumbar curvature in patients with low back pain and healthy controls: A pilot study[☆,☆☆]

Matthieu Vaucher [a], Marie-Eve Isner-Horobeti [b], Christophe Demattei [c], Sandrine Alonso [c], Christian Hérisson [d], Pascal Kouyoumdjian [e], Jaap H. van Dieën [f,g], Arnaud Dupeyron [a,*,h]

[a] Fédération de médecine physique et de réadaptation, GHU Carémeau, université de Montpellier 1, place du Pr. Robert-Debré, 30029 Nîmes cedex 9, France
[b] Département de médecine physique et de réadaptation, institut universitaire de réadaptation Clémenceau (IURC), 67082 Strasbourg, France
[c] Département de biostatistiques, épidémiologie, santé publique et information médicale (BESPIM), université de Montpellier 1, Nîmes, France
[d] Service central de rééducation, CHU Lapeyronie, université de Montpellier 1, 34295 Montpellier, France
[e] Département de chirurgie orthopédique, GHU Carémeau, université de Montpellier 1, 30029 Nîmes, France
[f] MOVE research institute Amsterdam, faculty of human movement sciences, VU university Amsterdam, Amsterdam, Netherlands
[g] King Abdulaziz University, Jeddah, Saudi Arabia
[h] Movement to Health Laboratory (M2H), Montpellier-1 University EuroMov, 34090 Montpellier, France

ARTICLE INFO

Article history:
Received 17 July 2014
Accepted 18 January 2015

Keywords:
Low back pain
Lumbar lordosis
Sitting
Chair

ABSTRACT

Background: The concept of an ideal sitting posture is often used in practice but lacks a basis in evidence.
Objective: We designed a cross-sectional, comparative, matched study to determine the effects of chair and posture on lumbar curvature in 10 patients with chronic non-specific low back pain (CLBP; mean pain duration 24 ± 18 months) and 10 healthy matched controls.
Methods: Pelvic incidence, sacral slope and lumbar curvature were measured on computed radiographs by 2 blinded clinicians for subjects in 2 postures (upright vs slumped sitting) and on 2 chairs (usual flat chair vs kneeling chair).
Results: The reliability of measures was excellent (intraclass correlation coefficient > 0.9). As hypothesized, the expected sacral slope and lumbar lordosis changed between standing and sitting on a kneeling chair as compared with a usual chair ($P < 0.0001$) and less in patients than controls ($P = 0.046$) for lordosis only. In addition, as expected, changes were more pronounced with slumped than upright sitting ($P < 0.0001$). An interaction between chairs and postures for lumbar lordosis ($P = 0.02$) indicated more pronounced effects of the chair in slumped sitting. Therefore, lumbar lordosis was reduced less when sitting on a kneeling chair as compared with a usual chair.
Conclusions: Although healthy subjects showed more reduction in lordosis between standing and sitting, the chair effect was found in both CLBP patients and healthy subjects.

1. Introduction

The concept of an optimal or ideal sitting posture is often used in practice but lacks a basis in evidence. When moving from standing to sitting, a posterior pelvic tilt is associated with reduced lordosis. The lumbosacral joint can even reach maximum flexion in slumped sitting [1]. Some authors consider that correct sitting is achieved when the lordosis is similar to that in a standing position [2]. However, no study has demonstrated that such sitting postures prevent disc degeneration or low back pain (LBP) [3,4].

Preferred postures in sitting appear to differ between healthy people and patients with chronic LBP (cLBP). Patients could be classified into groups with less or more lordosis than healthy subjects and patients with less-modulated lumbar curvature when instructed to move from upright to slumped sitting [5].

The angle of the acetabulo-femoral joint affects pelvic rotation and hence lumbar curvature during sitting [6,7]. Thus, ergonomic chairs, such as the kneeling chair, aim to limit hip flexion and promote lumbar lordosis [8]. Whether these chairs can be recommended to prevent or alleviate LBP is unclear. Moreover, non-specific LBP can represent several sources of pain that may

☆ Clinical trials number: NCT01323127.
☆☆ The study was performed in the Physical Medicine and Rehabilitation Department, Carémeau University Hospital of Nîmes, University of Montpellier I.
* Corresponding author.
E-mail addresses: arnaud.dupeyron@univ-montp1.fr, arnaud.dupeyron@gmail.com (A. Dupeyron).

http://dx.doi.org/10.1016/j.rehab.2015.01.003

even affect sitting behavior in various ways. However, in most cases, the source of pain is not actually known. For a start, whether lordosis is indeed affected by the chair, throughout a range of postures, from upright to slumped sitting, needs to be determined as does whether this effect is present in CLBP patients and healthy people alike. Numerous studies have explored the effect of different sitting positions on lumbar curvature with external measures (inclinometers or external markers) [8,9], but we have no data from radiologic measures including pelvic parameters.

Sitting on a sloping (or kneeling) chair may promote an anterior pelvic tilt and enhance lumbar lordosis as compared with sitting on a flat chair, probably for both slumped (relaxed) and upright (active) sitting. Moreover, CLBP patients may modulate lumbar lordosis less between sitting and standing than healthy controls. In this study, we aimed to study pelvis orientation and lumbar curvature with radiographs from patients with non-specific CLBP and matched controls when sitting upright and slumped on 2 types of chairs: a usual chair (“flat chair”), with a horizontal seat, and a kneeling chair (“sloping chair”). The radiography protocol we used did not allow for investigating large cohorts without formal indications of the usefulness of this method for this goal (pelvic variables in a sitting position for LBP). We therefore studied a relatively small cohort as a pilot study to determine whether CLBP patients responded differently from healthy subjects.

2. Methods

2.1. Subjects

We recruited 10 CLBP patients (mean pain duration 24 ± 18 months) and 10 healthy matched controls from our hospital between April and December 2011. All subjects gave their signed informed consent to be in the study. The study was approved by the local ethics committee and registered at http://www.ClinicalTrials.gov (NCT01323127).

We included LBP patients with pain provoked by or aggravated by mechanical loading for more than 3 months, with degenerative changes of at least one disc as determined by imaging, and excluded children and adolescents < 18 years and patients who had spine surgery or were pregnant. Controls were excluded if they had a history of LBP. We also excluded subjects with any condition that might interfere with sagittal balance of the spine (lumbopelvic malformations or hip disease), having had more than 2 radiographs of the trunk or high-risk scans over the previous year and routine (professional or leisure) exposure to radiation.

3. Radiography

A digital radiography system (Definium 6000, GE Healthcare) was used. The effective radiation dose for the 4 radiographs was 1.8 mSv. Radiographs were captured directly onto a computer. Lateral static computed radiographs of the lumbar spine and pelvis were obtained at a set distance of 180 cm from the X-ray source and centered on L4. One radiograph was taken with the subject standing up (Figs. 1A, 2A) and 4 radiographs were taken with the subject seated in 2 postures in each of 2 chairs: flat chair (height 45 cm, 0° seat inclination; Fig. 1B1, 2, Fig. 2B1, 2) and sloping chair (height 40 cm, 20° forward sloping seat inclination, 20° backward sloping knee support inclination; Fig. 1C1, 2; Fig. 2C1, 2) and upright posture (Fig. 1B1, C1; Fig. 2B1, C1) and slumped posture (Fig. 1B2, C2; Fig. 2B2, C2). Before the experiments, subjects were instructed to maintain postures without touching the back of the chair. Furthermore, they were instructed to obtain the slumped posture by rounding the spine and relaxing the back muscles and put their hands on their thighs.

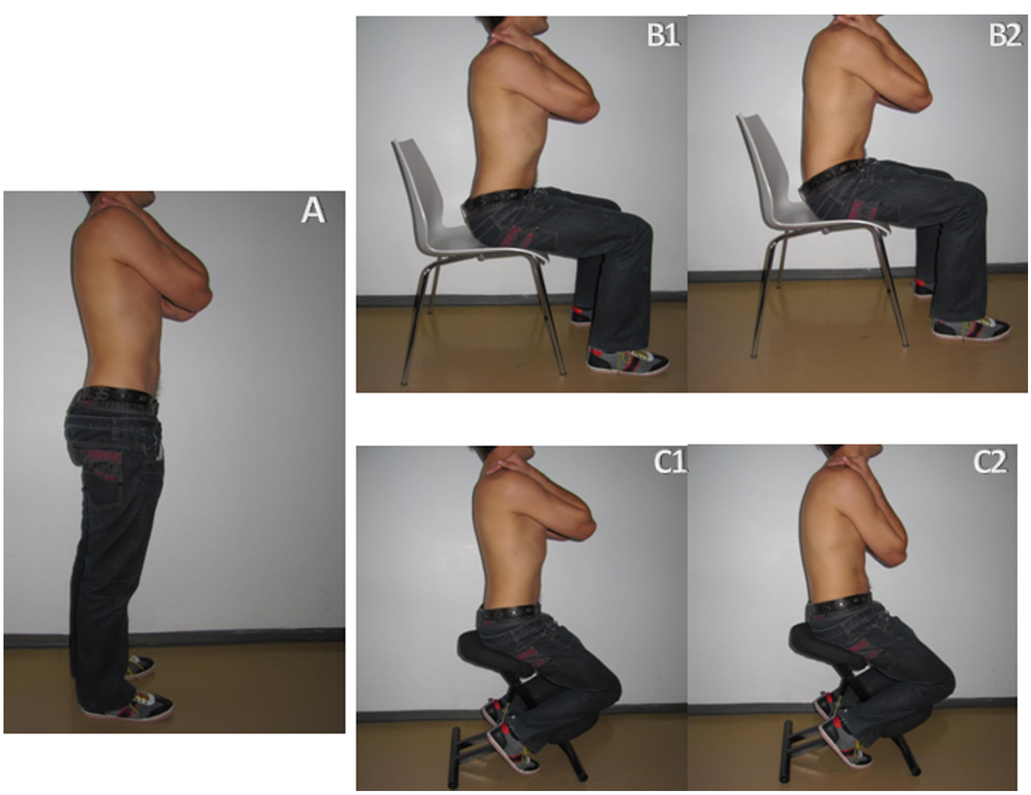

Fig. 1. Standing position and the 4 sitting conditions analysed (B1: flat chair, upright; B2: flat chair, slumped; C1: sloping chair, upright; C2: sloping chair, slumped).