

# The spinal movement of knee osteoarthritis patients walking on a treadmill

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## Introduction and Aim

Knee osteoarthritis (KOA) is widespread and causes high costs in Germany every year; in 2011 alone, almost 5 million days of incapacity to work occurred due to knee joint osteoarthritis [1]. In relation to the trunk, an upper body sideways tilt in gait is most commonly described [2], increased pelvic rotation [3] and a ventrally tilted trunk and pelvis have also been observed [4]. This work aims to investigate compensation mechanisms at the vertebral body level for the first time.

## Method

Adult KOA patients able to walk without walking aids were included in the study. 3 km/h surface topography (see Fig. 1) measurements were evaluated and compared with age-, sex- and BMI-matched healthy individuals; the arthritic or more severely affected leg was chosen as the reference leg.



**Fig. 1:** Illustration of the DIERS Formetric III 4 D™ system

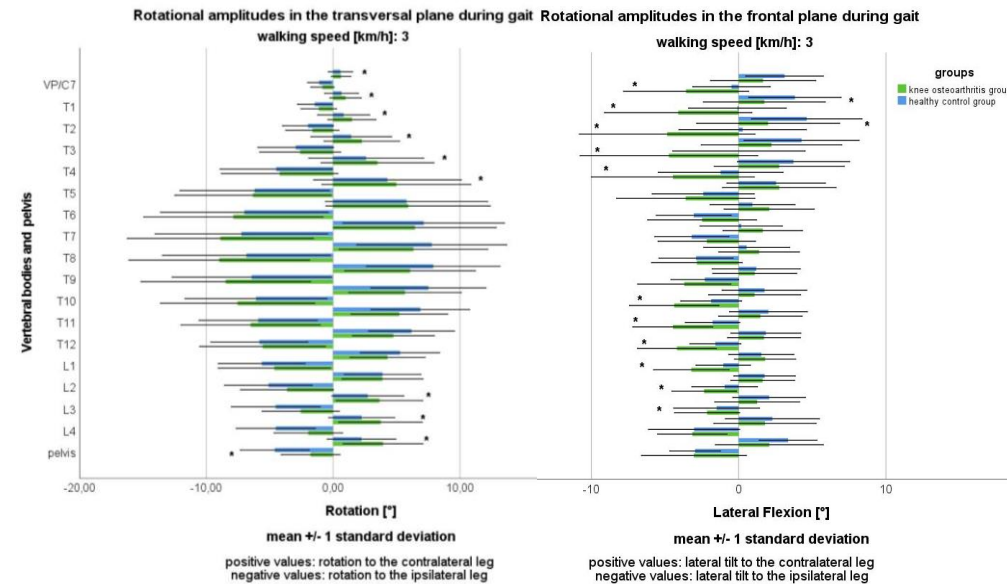
## Discussion and Outlook

Patients extend their ipsilateral step by means of increased contralateral pelvic rotation. Both, the lower lumbar vertebral bodies and the upper thoracic vertebral bodies rotate more than those of healthy subjects following a statistical trend. The middle thoracic vertebral bodies form a counter rotation. In addition, in the KOA group, there seems to be an upper body shift towards the ipsilateral leg. The pelvis was not tilted more ipsilaterally during the swing leg phase in this group, contrary to what has been commonly described previously [3, 5, 6].

Subsequent studies should investigate the influence of arthroplasty on compensatory movements.

## Results

The results of 29 patients (13/16 women/men; BMI  $25.76 \pm 2.20$  kg/m<sup>2</sup>; unilateral right/left 15/8, and 6 bilateral – 3/3 more right/left affected; TUG:  $9.14 \pm 1.67$ s) with a mean age of  $63 \pm 10$  years, were included. In the transverse plane, the patients rotated their pelvis more toward the contralateral and less toward the ipsilateral leg (site of pathology). Both groups (see Fig. 2) showed a pelvic rotation axis shift, which can also be seen in the overlying vertebral bodies. The upper (VP-T5 / VP-T4) or also lower (T9-L2, frontal) thoracic vertebrae as well as the lower lumbar vertebrae were on average about 2-4° more inclined ipsilaterally (frontal) and maximally rotated contralateral (L3-pelvis, transversal). In the sagittal plane, hardly any differences were evident.



**Fig. 2:** Mean values and standard deviations of the rotation amplitudes in degrees of all vertebral bodies and the pelvis of the knee osteoarthritis group (light green) and the healthy control group (light blue) at 3 km/h in the transverse (left) and frontal (right) plane. Positive values describe a rotation to the contralateral, negative to the ipsilateral leg; \*: trend describing differences in the Mann-Whitney U test.

## References

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