INTRODUCTION
Asymmetric loading of the knee joint has been assumed to contribute to the development of knee osteoarthritis [1]. Therefore orthopaedic surgeons aim for equal load distribution by avoiding varus or valgus malalignment. To determine the contact forces on the medial and lateral compartment, gait analysis and inverse dynamics are used in most studies. The majority of studies reported larger contact forces on the medial compartment, however the reported load distribution varies considerably. Using load data measured by an instrumented knee implant in vivo, Zhao et al. reported a medial to total force percentage of 53.4% at maximum load during gait [2]. Yet only data from a single patient was published. The goal of this study was to determine the contact forces on the medial and lateral compartment of an instrumented tibial tray during the whole stance phase of gait and to evaluate inter-individual differences of 4 patients.

METHODS
An instrumented tibial tray with telemetric data transmission was developed to measure six load components (3 forces and 3 moments) in vivo [3]. The implant is based on the INNEX™ System, Typ FXUC. Size 4M (Zimmer GmbH). After approval by the ethics committee and the patients’ informed consent, the prostheses were implanted in four patients with osteoarthritis (Table 1).

Table 1: Patient data
All measurements were taken during level walking at a self selected comfortable speed. Peak axial forces (Fz) and varus/valgus moments (My) from 15 gait cycles were averaged for each subject. As a simplification the moment My was assumed to be caused only by the total axial force acting with an offset (sx) in medio-lateral direction to the center of the implant (M = Fz*sx). Since an ultracongruent tibial inlay was used, it was furthermore assumed that the femoral condyles did not move in medio-lateral direction. The medial and lateral forces were then calculated using basic lever principle.

RESULTS
Each gait cycle showed typically two main axial force peaks during the stance phase, occurring at contralateral toe off (~20% gait cycle) and before contralateral heel strike (50-55% gait cycle). Peak axial forces were 2800N (K1L), 1950N (K2L), 2450N (K3R) and 3100N (K4R), peak negative moments My, i.e. adduction moments, were 38Nm (K1L), 37Nm (K2L), 30Nm (K3R) and 10Nm (K4R) (Fig.1).

DISCUSSION
Due to the assumptions that were made to determine the medio-lateral force distribution, the results should be taken as a first approach. However, it is obvious that the course of the axial force as well as the moment My and the load shift sx varies considerably between the patients. Whereas in patients K1L, K3R and particularly K2L the total axial force is passing mainly through the medial compartment, a more equal load distribution is seen in patient K4R. Since patient K4R has a valgus and patient K2L a pronounced varus alignment, these findings confirm that the medio-lateral force distribution is correlated to the knee alignment. Measurements with more patients are necessary to underline these findings.

REFERENCES

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