QUANTITATIVE GAIT ANALYSIS AFTER UNILATERAL KNEE ARTHROPLASTY FOR PATIENTS WITH BILATERAL KNEE OSTEOARTHRITIS

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INTRODUCTION
Today elderly people live longer and also represent an increasing percentage of individuals with symptomatic end-stage arthritis of both knees. Many of them may benefit from total knee replacement (TKA). However, the surgeon and patient are faced with the decision of whether to proceed with a staged bilateral TKA, done as two unilateral TKA procedures performed on different days, or a simultaneous bilateral TKA. Previous studies have demonstrated a shorter stride length and a reduction in knee flexion angle during stance, and abnormal patterns of flexion-extension knee moments following total knee arthroplasty [1-10]. However, there are few data about the influence of operated knee on the adjacent joint movements, especially for the patients who had severe bilateral knee osteoarthritis and underwent unilateral TKA.

The purpose of this study was to investigate gait symmetry during walking in 12 patients who had undergone unilateral knee arthroplasty for patients with bilateral knee osteoarthritis.

METHODS
All 12 patients had achieved a successful recovery and were tested at least 1 year after surgery. In all patients, the same prosthesis was used, and all procedures were performed by the same experienced knee surgeon. To be included, patients had to have no impairment of the hip or ankle joints. However, all patients had to have severe OA of the contralateral knee. Successful outcome was evaluated based on the clinical criteria of no or minimal pain, good stability, and good range of motion, with a Knee Society Knee Rating Score of 80 or greater. In addition, 15 age-matched healthy subjects with no symptoms of lower limb joint were recruited as the control group.

Gait analysis was conducted during self-selected comfortable conditions using a 3-dimensional motion analysis system at a sampling frequency of 60 Hz. Markers was placed on the sacrum, bilaterally on the anterior superior iliac spines (ASIS), lateral femoral condyles, lateral malleoli, the space between the first and second metatarsal heads, the heels, and on 10 cm wands placed at mid-thigh and mid-shank. The 3-dimensional coordinates of each marker were used to calculate joint angles at the hip, knee, and ankle. The ground reaction force was recorded by force plate.

The laboratory procedures were approved by the Ethics Committee at Kaohsiung Medical University. All subjects were informed of the nature of the experiment, and written consent was obtained. Subjects performed a practice trial of walking to allow familiarization with the equipment. Finally, temporal, spatial, kinematic and kinetic data were collected during 5 walking trials.

RESULTS AND DISCUSSION
Results showed that patients decreased their walking speed by 35% by decreasing both stride length and cadence, especially on the operated side. The result also showed an increased double support time for the operated limb. All patients walked with a less flexed knee and showed a biphasic pattern of flexion-extension motion in a narrow range about the treated knee compared with the contralateral limb and with normal controls. The small amount (about 7 degrees) of plantarflexion at the ankle during the push-off phase was seen in the treated limb compared with the contralateral limb and with normal controls. Gait analysis revealed poor knee and ankle kinetics on the operated side during gait compared to age-matched healthy people and with the contralateral limb. However, poor knee and ankle kinetics was compensated for by larger hip extension moments. There is a chance that the fatigue symptoms of hip extensors may peak early on the surgical limb, which was related to poor gait kinetics and kinematics.

CONCLUSIONS
Our results suggest that abnormal gait patterns may persist at least one year after surgery. The gait pattern is characterized by temporal and spatial gait asymmetry with a hip compensation strategy in the treated limb for poor knee mechanics. Gait asymmetry compensated by greater hip extensor moments and demonstrated slower gait speed with prolonged double support time, especially on the operated side.

REFERENCES