

# The influence of surgical techniques of high tibial osteotomy on kinematics -open wedge vs closed wedge.

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**INTRODUCTION:** High tibial osteotomy (HTO) is chosen as either open-wedge (OW) HTO or closed-wedge (CW) HTO depending on factors such as the size of the correction angle. However, there are few reports on biomechanical differences during walking due to the surgical methods. The purpose of this study is to elucidate the influence of surgical differences of HTO on walking.

## Methods:

The subjects were patients who underwent gait analysis before and one year after HTO for medial compartment knee osteoarthritis. Among them, we conducted a comparative study on 13 knees treated with OWHTO (OW group;  $60.2 \pm 6.3$  years) and 13 knees treated with CWHTO (CW group;  $60.3 \pm 4.8$  years), matched by age and post-operative alignment. This study was conducted with a prior approval from the institutional ethical review board, and all subjects were provided detailed explanation before undergoing any measurement. All patients were assessed while walking at a self-selected speed. Optical motion capture technology was used to measure the hip, knee, and foot kinematics. The lower limb segment angles were calculated from the position information of surface markers. Independent t-tests were used for between-group comparisons, and paired t-tests were used for pre-and post-surgery comparisons. The significance level was set at 5%.

## Results:

Leg alignment: Pre-operative HKA was significantly varus in the CW group (OW group;  $3.9 \pm 2.3$ , CW group;  $7.0 \pm 3.1^\circ$ ,  $p = ??$ ). After HTO, there was no significant difference in HKA (OW group;  $-3.8 \pm 1.0^\circ$ , CW group;  $-3.6 \pm 2.9^\circ$ ,  $p = ??$ ). Knee joint kinematics: There was no significant difference in post-operative knee joint kinematics (varus-valgus, flexion-extension, and internal-external rotation). Segment angle: There was no significant difference in the preoperative foot abduction angle during the weight-bearing phase between two groups. In the CW group, the post-operative foot abduction angle (approximately  $5^\circ$ ) was significantly smaller than pre-operative angle (approximately  $8^\circ$ ) during the single-leg stance phase (Figure 1). In the OW group, there was no significant difference between the preoperative and postoperative foot abduction angle (approximately  $9^\circ$ ). The postoperative foot abduction angle tended to be smaller in the CW group compared to the OW group. The postoperative femoral external rotation angle during the weight-bearing phase was significantly in external rotation in the CW group ( $p < 0.05$ ). For the tibial external rotation angle, the CW group showed an external rotation trend compared to the OW group ( $p = 0.05 \sim 0.24$ ).

## Discussion:

This study showed that the foot abduction angle significantly decreased, and both femur and tibia showed a trend of external rotation after CWHTO. These results indicated that the type of HTO might influence the postoperative kinematics. Potential reasons for this could include changes in torsion and leg length due to the surgery, as well as the influence on the ankle joint depending on the presence or absence of fibular osteotomy.

**SIGNIFICANCE:** The difference in the type of HTO affected the postoperative walking dynamics.

## IMAGES AND TABLES

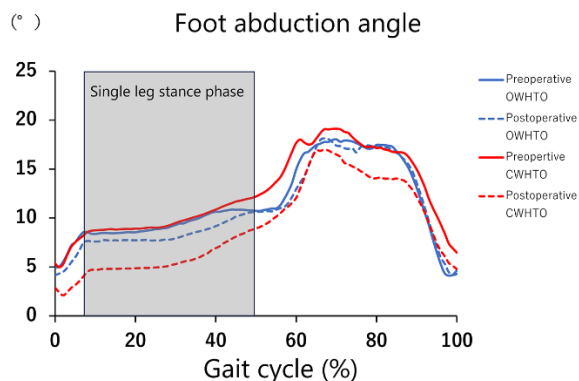


Figure 1. Foot abduction angle during gait