

# Preoperative prediction of gap balance based on the radiographic flexion and extension laxities in robotic total knee arthroplasty

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**Purpose:** To predict the flexion-extension gap balance in robotic total knee arthroplasty(TKA) preoperatively is difficult when robotic TKA underwent preoperative planning. We develop the new method to predict the intraoperative flexion-extension gap balance using varus stress radiograph during the preoperative planning. The purpose of this study is to evaluate the effectiveness of the new method to achieve balanced flexion-extension gaps in robotic TKA.

**Materials & Methods:** From August, 2008 to August, 2011, one hundred and forty eight osteoarthritic patients with varus deformity undergoing cruciate retaining total knee arthroplasty using Robodoc® and followed-up for more than 1 year, were included into this study. Patients using posterior cruciate ligament stabilized implant were excluded for evaluating intraoperative gap balance. 92 patients who underwent preoperative planning based on the amount of lateral laxity in full extension and 90 degree flexion using varus stress radiograph, were classified as group A, and 56 patients who didn't undergo the procedure were classified as group B. The depth of cutting thickness of femur and tibia were determined based on the laxity difference between full extension and 90 degree flexion of varus stress radiograph in Group A. Group B was planned based on femoral and tibial implant thickness. After complete milling by robot and soft tissue balancing, intra-operative extension and flexion gaps were measured using a tensor. We classified results of the intra-operative gap balance as acceptable (0-3mm larger in flexion than extension gaps), tight (larger extension than flexion gaps) or loose (more than 3mm larger in flexion than extension gaps) based on the difference between extension and flexion gaps. To evaluate the clinical results, we measured HSS and WOMAC score on last follow-up.

**Results:** On knee full extension, the medial gap was  $21.6 \pm 1.6$  mm on group A and,  $21.8 \pm 3.1$  mm on group B ( $p=0.22$ ). Lateral gap was  $22.4 \pm 1.7$  mm on group A, and  $22.8 \pm 2.5$ mm on group B ( $p=0.47$ ). On 90 degrees flexion, the medial gap was  $23.4 \pm 2.0$  mm on group A, and  $23.7 \pm 2.9$ mm on group B ( $p=0.07$ ). Lateral gap was  $24.3 \pm 2.0$ mm on group A, and  $24.6 \pm 3.0$ mm on group B ( $p=0.12$ ). In group A, "Acceptable" were 88 cases(95.7%), "Tight" were 4 cases(4.3%), and in group B, "Acceptable" were 48 cases(85.7%), "Tight" were 6 cases(10.7%), "Loose" were 2 cases (3.6%). The intra-operative medio-lateral gap balance in flexion showed significant better result in Group A than Group B ( $p=0.03$ ). Knee joint range of motion was improved from 122.8 degree, preoperatively to 131.2degrees postoperatively on group A. In group B, the range of motion was also improved from 124.5degrees preoperatively to 129.7degrees postoperatively. HSS score was increase from 61.7 to 93.5 points in group A, and from 63.8 to 93.6 points in group B. WOMAC score was decreased from 60.4 to 27.6 points in group A, and was decreased from 61.2 to 28.2 points in group B.

**Conclusion:** The new method for prediction of flexion-extension gap balance based on the laxity using a varus stress radiograph showed excellent agreement with intra-operative flexion-extension gap balance. We concluded varus stress radiograph might be useful tool to predict the intraoperative gap balance and help to achieve the precise gap balance in robotic TKA.

## References

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