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Soft Tissue Balancing in Robotic-Assisted Total Knee Arthroplasty

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Faculty Disclosure Information

- We have no financial relationships with any commercial interest related to the content of this activity

INTRODUCTION

➢ Robotic-assisted TKA

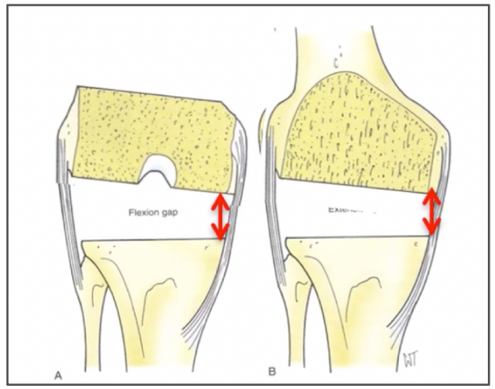
The ROSA (Robotic Surgical Assistant) Knee system (Zimmer Biomet, Warsaw, IN) for total knee arthroplasty (TKA) can be considered as collaborative robotics, where the surgeon remains in charge of the procedure and collaborates with a smart robotic tool, to perform the surgery with a high accuracy and reproducibility.

The concept of personalized robotic TKA is to recreate the patient anatomy, avoid ligament release, restore the joint line orientation and the limb alignment.

➢ Medial stabilizing technique

In total knee arthroplasty, achieving medial knee stability is reported to affect postoperative ambulation function and patient satisfaction.

To overcome the concerns of the gap balancing technique, medial gap technique has been developed and recently performed. Medial gap technique focuses on medial knee stability and allows lateral physiological laxity.



AIM

This report presents our experience with adjusting soft tissue balance focusing on medial knee stability using the ROSA Knee system.

MATERIALS & METHODS

➢ Patients

This study included 118 patients with varus osteoarthritis undergoing primary Cruciate-Retaining (CR) TKA in 62 knees and Posterior-stabilized (PS) TKA in 56 knees (Persona; Zimmer Biomet, Warsaw, IN) using the ROSA Knee system.

➢ Surgical Procedures

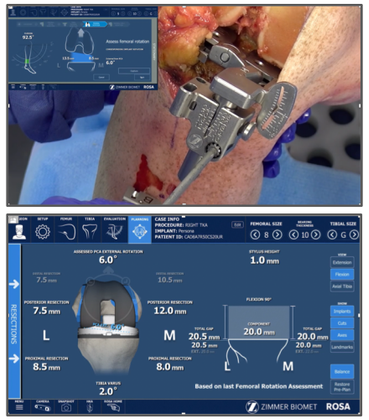
Medial parapatellar approach

The medial soft tissue release was limited by femoral and tibial osteophyte removal and deep medial collateral ligament release within 1cm from medial tibial plateau.

The femoral distal resection and tibial resection angles were determined based on mechanical alignment, with adjustments for varus-valgus alignment within 2 degrees according to the soft tissue balance.

➢ FuZion technique

The Zimmer FuZion Tensor was used to evaluate soft tissue balance between extension and flexion before posterior femoral condyle resection, determining the femoral rotation angle and implant size to achieve equal medial gaps.



➢ Evaluation order

Using ROSA Knee system, joint laxity was quantified after TKA.

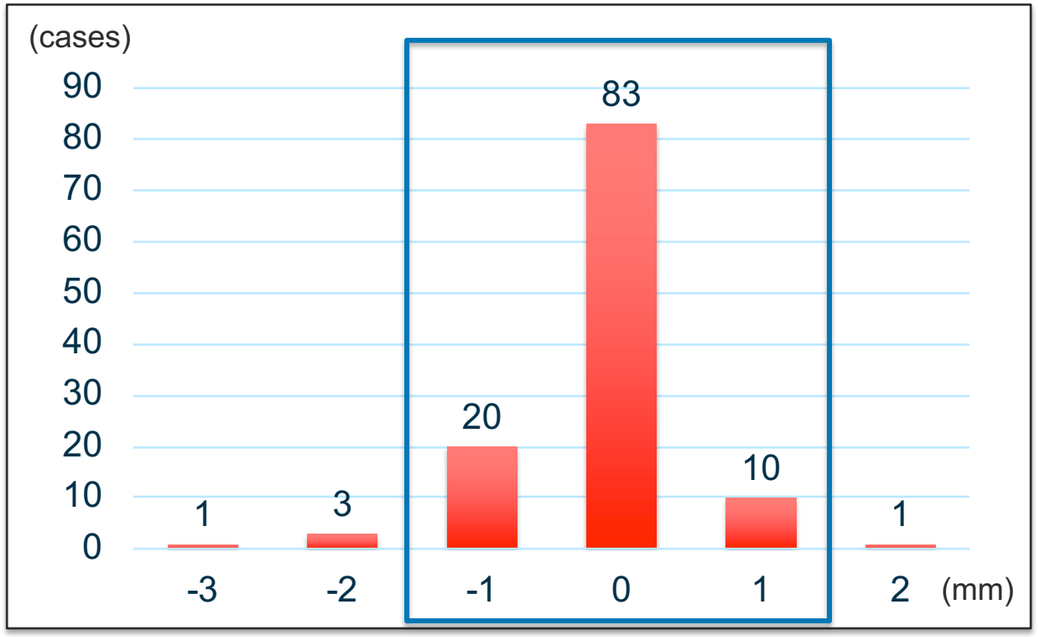
Varus-Valgus loadings to the examiner’s subjective endpoints were recorded to determine the medial and lateral implant gaps (MIG, LIG) at extension and flexion positions .

RESULTS

【The average values of implant gaps】

	Medial gap（MIG）	Lateral gap（LIG）
Extension	2.0 ± 0.9	3.2 ± 1.2
Flexion	1.8 ± 0.8	3.3 ± 1.6
Gap difference	0.6 ± 0.6	1.2 ± 1.2

【 The medial gap difference ; flexion MIG − extension MIG 】



The medial gap difference ≦ **1mm**

113/118 cases （95.8%）

DISCUSSION

➢ Soft tissue balance in TKA

Excessive intraoperative medial joint laxity of ≥ 4 mm at 90° flexion progressively decreased patient satisfaction for 1 year. (Azukizawa M, AOTS 2018)

Knees with medial joint laxity during flexion resulted in an inferior postoperative outcome, and lateral joint laxity did not influence patient satisfaction or function. (Tsukiyama H, Knee 2017)

Recreating greater forces in the medial compartment much like that of the native knee may yield improved patient-reported outcomes and increased patient satisfaction. (Jacbs CA, J Arthroplasty 2016)

Medial stability and lateral laxity at both knee extension and flexion had significant correlations with the higher patient satisfaction.

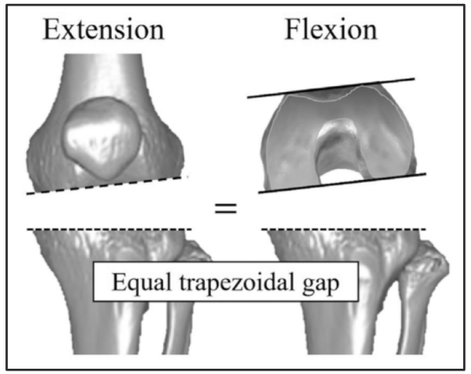
(Kamenaga T, J Arthroplasty 2018)

Surgeons should pay close attention to obtain medial stability with relative lateral laxity

➢ Medial preserving gap technique (MPGT)

(Tsubosaka M, J Arthroplasty 2018)

This procedure focuses on medial knee stability, essentially making not equal rectangular gaps but equal trapezoidal gaps in extension and flexion between the cutting surfaces of the femur and tibia.



➢ Personalized robotic TKA

(Batailler C, AOTS 2021)

The concept is to recreate the patient anatomy, avoid ligament release, restore the joint line orientation and the limb alignment.

The second parameter is the space in fexion intended to be trapezoidal with a perfectly stable medial compartment all along the arc of knee flexion

This procedure provides a safe and quantitative gap balancing technique using tensor measurements independent of surgeons' feels and experience.

CONCLUSION

- The ROSA knee system improves the accuracy and reliability of the bone resections and the ligament balancing.
- In robotic-assisted TKA, using a tensor to evaluate soft tissue balance allows for the adjustment of medial gaps between extension and flexion independent of surgeons' feels and experience.
- The ROSA knee system with FuZion technique was useful for performing medial preserving gap technique accurately.

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