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Evaluating the Accuracy of Imageless Robotic Assistance in Total Knee Replacement: A Study of Mechanical Axis Correlation with Postoperative Radiographs

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Faculty Disclosure Information

- The author, Rodrigo Olivieri, reports speaking fees from Johnson & Johnson Medtech.
- The author, Nicolás Gaggero, reports speaking fees from Johnson & Johnson Medtech, and Smith+Nephew.
- The remaining authors declare no conflicts of interest.

Introduction

- Use of Robotic Assistance in TKA → progressive increase in recent years
- Associated with: improved soft tissue balance, reduced hospital stay and decreased surgical outliers.
- It may enhance the accuracy of component alignment, although the evidence on this point remains controversial.

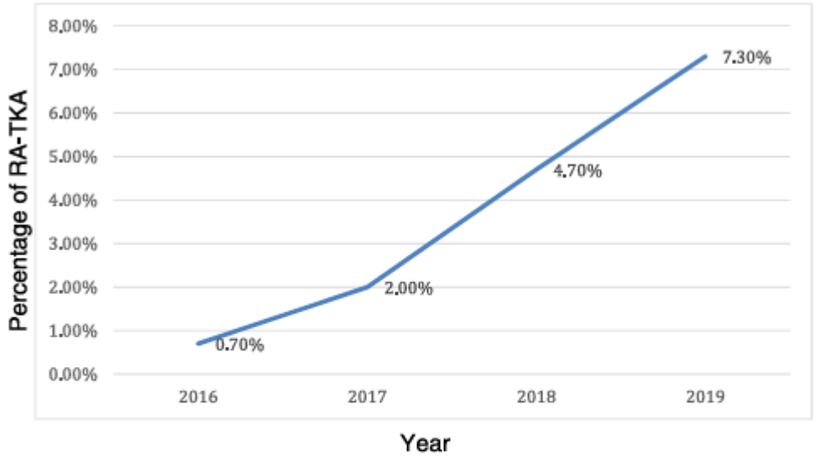

FIGURE 1 Percentage of robotic-assisted total knee arthroplasty (RA-TKA) based on the total number of TKA procedures (2016–2019). This figure illustrates the percentage of RA-TKA procedures relative to the total number of TKA procedures performed annually between 2016 and 2019.

Maman D, Knee Surg Sports Traumatol Arthrosc. 2024 Dec

Objective

To **compare** the correlation between the **intraoperative mechanical axis** calculated during **imageless robotic-assisted** knee replacement surgeries using the **CORI** Surgical System (Smith & Nephew®, Memphis, Tennessee) and the **mechanical axis assessed in postoperative weight-bearing long-leg radiographs** of the same patients

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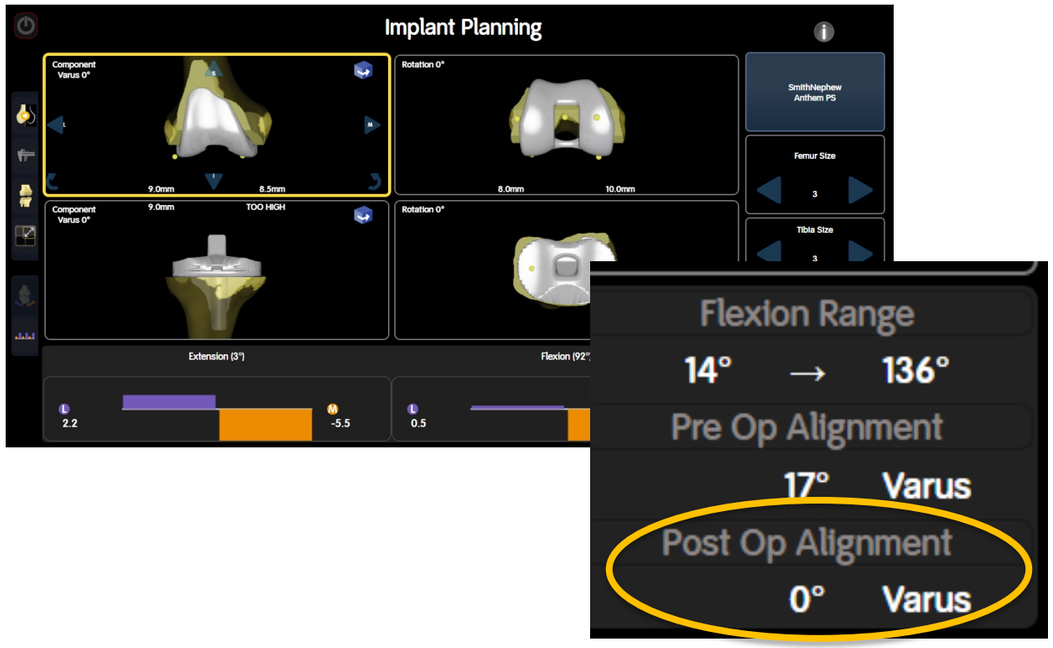
Methods

- A **cross-sectional observational imaging study** was conducted at a single center involving **patients over 18 years old** who underwent **imageless robotic-assisted TKR surgery** between April and July 2023.

- Demographic data were collected from clinical records.

Methods



The intraoperative lower limb mechanical axis achieved, as reported by the RA after TKR implantation, was recorded.

Two orthopedic surgeons, specialized in knee surgery (evaluators 1 and 2), independently and blindly determined the mechanical axis on postoperative full-length standing radiographs taken between the first and third months post-surgery.

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Methods

- A blinded **third evaluator** analyzed the results, determining the **intraclass correlation coefficient (ICC)** for absolute agreement using a **two-way random effects model** for the **mean between the RA-reported axis and each evaluator**, as well as **analysis of variance (ANOVA).**

- A **post hoc Tukey test** was performed **to assess any differences between the three measurements**

Results

- 21 robotic-assisted knee arthroplasties.
- 12 females (57.1%).
- 9 right knees (42.9%).

Results

Average lower limb **mechanical axis** reported by:

Robotic assistance (RA)	Evaluator n°1 on full-leg postoperative radiographs	Evaluator n°2 on full-leg postoperative radiographs
0.52° of varus (SD 3.12°)	0.45° of valgus (SD 3.03°)	0.88° of valgus (SD 2.98°)

Intraclass correlation between**:**

- **RA** and **Evaluator n°1** = 0.49 (95% CI 0.12-0.76) → **poor correlation**
- **RA** and **Evaluator n°2** = 0.61 (95% CI 0.27-0.82) → **moderate correlation**
- Evaluators **n°1** and **n°2** = 0.94 (95% CI 0.85-0.97) → **excellent correlation**

Results

Average lower limb **mechanical axis** reported by:

Robotic assistance (RA)	Evaluator n°1 on full-leg postoperative radiographs	Evaluator n°2 on full-leg postoperative radiographs
0.52° of varus (SD 3.12°)	0.45° of valgus (SD 3.03°)	0.88° of valgus (SD 2.98°)

After ANOVA and post-hoc Tukey:

- **RA** and **Evaluator n°1**→ Statistically significant differences ($p < 0,05$)
- **RA** and **Evaluator n°2** → Statistically significant differences ($p < 0.05$).
- Evaluator **n°1** and **n°2** → **NO** statistically significant differences ($p = 0.89$)

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Conclusions

- ✓ The **intraoperative mechanical axis reported by imageless RA** in TKR within this cohort shows **only a poor to moderate correlation with the actual mechanical axis measured in postoperative weight-bearing long-leg radiographs** of the same patients, with **statistically significant differences** observed in the average mechanical axes

- ✓ Future prospective studies with a larger number of patients are needed to confirm these findings.

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