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Navigated Tibia First Total Knee Arthroplasty Using a Ligament Tensioning Device, Clinical Results at 1Y Follow-up

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Abstract

The purpose of this descriptive study was to evaluate patient reported outcome at one year follow-up when performing TKA using a tibia 1*st* surgical workflow and a navigation system coupled to a ligament tensioning device, allowing taking knee laxities into consideration when doing the intraoperative femoral cut planning. Results suggest that the navigation allows more precision in bone cuts, saving the bone stock as much as possible, while intraoperative planning ensured medio-lateral gap balancing. Clinical results at one year were similar to those of equivalent studies, and patient satisfaction was very high.

1 Introduction

Instability after TKA, often caused by poor ligament balancing or malalignment, remains a leading reason for revision (1). Modern alignment techniques and precise surgical tools, such as robotics and navigation, are vital to optimize stability and improve outcomes (2). The choice of the surgical workflow may have an impact too. Indeed, while optimal TKA alignment and soft tissue balance have been associated with improved outcomes, these targets can be successfully achieved according to different surgical workflows. The recent possibility of reliably characterizing the soft-tissue envelope (3,4) enabled the development of techniques for TKA allowing the possibility of restoring the constitutional alignment of the limb while achieving proper soft-tissue balance.

The purpose of this descriptive study was to evaluate patient reported outcome at one year follow-up when performing TKA using a navigation system and a tibia 1*st* surgical workfkow. A ligament tensioning device, coupled to the navigation system, was used routinely to assess the knee laxities along the full arc of motion, allowing taking this information when doing the intraoperative femoral cut planning.

2 Material and Methods

De-identified records from a single navigation system (Exactech GPS, Blue-Ortho, France) and collected prospectively as part of clinical routine were reviewed retrospectively. All the patients were operated in a single center by the same surgeon using the same surgical workflow. All primary TKA were included

A mid vastus approach was performed. Then, the navigation trackers were fixed on the distal femur and the proximal tibia. The preparation of the proximal tibia was performed first, perpendicularly to the mechanical axis. At this stage, an intra-articular distractor (Newton, Exactech, U.S.A.) wirelessly integrated with the navigation system, was placed between the tibial cut and the native femur, in order to assess the joint laxity throughout the entire arc of motion. Next, femoral cut parameters were set up based on size, alignment, and soft-tissue considerations.

A web-based remote patient monitoring solution (Orthense, Digikare, France) was leveraged to collect patient reported outcomes measures (PROMs). Were assessed the following data:

- Demographic: patient age, sex, weight, height, body mass index;
- Component sizes for femoral and tibial implants;
- Pre-operative and at 1 year follow-up Knee Injury and Osteoarthritis Outcome Scores (KOOS) and Oxford Score (OKS);
- The Net Promoter Score (NPS) at 1 year's follow-up was assessed to capture patient satisfaction.

The results were presented for continuous variables in terms of mean ± standard deviation (range).

3 Results

54 patients were included between November 2022 and November 2023. Table 1 describe the cohort demographic data, the implanted material and the collected PROMs.

Patients	#54
Sex	
Women	28 (52%)
Men	26 (48%)
Age (years)	70.63±10.71 (40 - 94)
Height (cm)	1.68±0.1 (1.50 - 1.94)
Weight (kg)	80.83±16.78 (49 - 120)
BMI (kg/m^2)	28.61±5.58 (18.69 - 42.19)
Implanted Material	
Femoral component size	3.38±0.96 (1.5 - 5)
Tibia insert size	3.27±0.94 (1.5 - 5)
Tibia insert thickness	9.86±1.35 (9 - 15)
KOOS	
Preoperative	56.31±9.72 (28.2 - 89.5)
1 Year	80.61±13.99 (51.5 - 100)
Improvement	24.3±16.21 (-8.2 - 53.2)
OKS	
Preoperative	23.14±5.04 (14 - 36)
1 Year	43.95±5.01 (30 - 48)
Improvement	20.81±6.93 (4 - 32)
1 Year NPS	9.46±1.34 (4 - 10)

Table 1. Cohort demographic description, implanted material and patient reported outcome measures.

Discussion and conclusion

Despite the relatively large stature of the patients in the cohort, the size of the implanted components, particularly the tibial inserts, remained contained. This would suggest that the technology is well suited to assess joint laxity, allowing more precision in bone cuts(5) and therefore saving the bone stock as much as possible., while guaranteeing medio-lateral gap balancing.

Previous studies have shown good recovery kinematics in this group during the first 90 days. The mean improvement in KOOS scores at one year, 24.3±16.21, is more than double the minimal clinically important difference (MCID), evaluated at 12 in a recent meta-analysis (6). The same trend was found for OKS at one year, with a mean improvement value of 20.81±6.93, well above the MCID evaluated at 5 (6,7)

Jade P.Y. Ho et al. recently compared KOOS scores between navigated and robotically assisted cases (8). While the pre-operative values of our cohort are slightly lower than those reported in this work, the scores at one year are higher than its robotic group (80.61±13.99 versus 79.9±14.6) and lower than those navigated (80.61±13.99 versus 82.8±11.7).

Last, but not least, the NPS after one year, which measured patient satisfaction, was really high: 9.46±1.34 (on a scale of 0 to 10).

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