Using a Remote Patient Monitoring Digital Solution Shows the Impact of Total Knee Arthroplasty Surgical Workflow on Short Term Knee Function Recovery

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INTRODUCTION: Up to 20% of total knee arthroplasty (TKA) patients are unsatisfied with their clinical outcome. While the reasons are supposed to be multifactorial, including patient expectations, 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, such as measured resections (MR) or gap balancing (GB).
Since the pandemic, digital solutions such as remote patient monitoring (RPM) have gained adoption. Because they do not require the patient to travel to the hospital, they can be used routinely, enabling the evaluation of the TKA patient rehabilitation kinetic during the first 90 days.
The purpose of this retrospective comparative study of prospectively collected records in clinical routine was to leverage a digital RPM solution to assess the impact of the surgical workflow on short-term recovery. We hypothesized that switching from MR to GB technique improves short-term knee function, patient quality of life, and satisfaction.

METHODS: From July 2019 until February 2023, patients indicated for primary TKA in a single centre were prospectively included when operated following an MR or a GB technique. For the MR group, the full femur was prepared first. For the GB group, the tibia was prepared first and an intra-articular distractor, wirelessly integrated with a navigation system, allowed the characterization of the joint laxities and intraoperative femoral planning. A web-based RPM solution was leveraged to collect data related to pain, functional capacity, quality of life, and satisfaction from the enrolled patients. Pain, gait, and range of motion were assessed through weekly questionnaires from D+7 to D+28. Resumption of driving was collected from D+35 to D+90 to evaluate the quality of life. Patient satisfaction was evaluated through a Net Promoter Score (NPS) collected at D+90. The following intraoperative parameters were obtained through the operative reports: surgery duration, implant size, and ligament release. Finally, regarding clinical score, the Knee injury and Osteoarthritis Outcome Score – Physical Shortform (KOOS-PS) was collected pre-operatively and at D+90.
The results were presented for continuous variables in terms of mean ± standard deviation. Independent samples Student t-test was used to compare continuous variables between groups when assuming equal variance and corrected t-test (Welch test) when assuming unequal variances. Chi-square tests were performed to compare categorical variables. Values of two side's $p<0.05$ were considered to be significantly different.

RESULTS SECTION: A total of 54 patients were included in this study, 31 in the MR group and 23 in the GB group. Baseline data showed no significant differences between the groups in terms of age (p=0.2076), sex (p=0.6558), body mass index (p=0.5063), and Pre-OP KOOS-PS (p=0.9575).
Surgery procedures recordings showed no significant differences between the two groups for the operating time (p=0.6894) and the size of the components, except for the tibial insert thickness (10.6±1.7 mm for MR and 9.3±0.8mm for GB, p=0.0007).
The kinetic of rehabilitation is shown in Figure 1, displaying walking and flexion abilities. During the first month, it was observed that a higher percentage of GB patients than MR patients could walk without aids and flex the knee above 90°. Driving recovery is later for the GB Group.
At D+90, no differences were shown for the NPS (p=0.8332) and the KOOS-PS (p=0.4503).

DISCUSSION: If at D+90, clinical outcomes and patient satisfaction are not showing statistically significant differences between the groups; this study shows that functional recovery during the first month is faster for the GB group, whose patients report better weight-bearing proprioception and better walking capacity. The operative time is similar between the groups, and while the size of the tibial implant is equivalent, the width of the tibial insert is not, and its standard deviation is much lower for the GB group, thanks to a more reproducible bone-cutting technique which preserve the bone capital. However, the resumption of driving occurs later for group GB with recrudescence of pain between D+14 and D+35, which is probably related to faster recovery of autonomy and flexion > 90°. This study has some limitations. First, the 1st group is non-homogeneous in terms of used implants. Second, KOOS-PS and NPS are subjective scores, and the cohort size is low for such data. Finally, D+90 is a short follow-up for patient outcomes, but the study's first aim was to compare short-term recovery kinematics.
By allowing TKA patient monitoring at short period intervals, RPM solutions have the potential to provide perspectives that are not captured using traditional clinical follow-up performed during on-site postoperative visits. If we cannot conclude on short-term patient quality of life and satisfaction improvements, this study shows that switching from MR to GB technique improves short-term knee function recovery.

SIGNIFICANCE/CLINICAL RELEVANCE: This study demonstrated that RPM solution shows the impact of the surgical workflow for TKA on short term knee function recovery. Longer follow-up may show that this these RPM tools make it possible to accurately characterize the benefits of surgical techniques for the patient.

IMAGES:

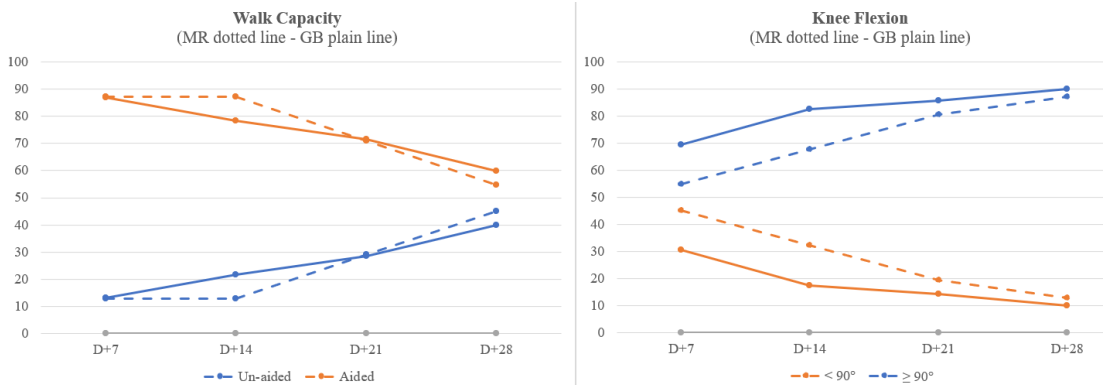

Figure 1 Walking and flexion abilities for both groups during the first month after surgery