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No Functional Benefit After Unicompartmental Knee Arthroplasty Performed With Patient-specific Instrumentation: A Randomized Trial

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Abstract

Background Component alignment can influence implant longevity as well as perhaps pain and function after unicompartmental knee arthroplasty (UKA), but correct alignment is not consistently achieved. To increase the likelihood that good alignment will be achieved during surgery, smart tools such as robotics or patient-specific instrumentation (PSI) have been introduced.

Questions/purposes We hypothesized that UKA performed with PSI would result in improved level gait as ascertained with three-dimensional analysis, implant positioning, and patient-reported outcomes measured by a validated scoring system when compared with conventional instrumentation 3 months and 1 year after surgery.

Methods We randomized 60 patients into two groups using either the PSI technique or a conventional technique. All patients were operated on using the same technique and the same cemented metal-backed implant. Mean age of the patients was 63 ± 4 years (range, 54–72 years) and mean body mass index was 28 ± 3 kg/m^2. Patients were evaluated preoperatively, at 3 months, and 1 year after surgery by an independent observer blind to the type of technique. Gait parameters were assessed with three-dimensional analysis during level walking preoperatively and at 1 year, frontal and sagittal position of the implant was evaluated on full-length radiographs at 3 months, and subjective functional outcome and quality of life using routine questionnaires (SF-12, new Knee Society Score [KSS], Knee Injury and Osteoarthritis Outcome Score) at 3 months and 1 year. This study had 80% power to detect a 15% difference in walking speed at the $p < 0.05$ level.

Results One year after surgery, there were no differences between the two groups in the analyzed gait spatiotemporal parameters, respectively, for PSI UKA and conventional UKA : double limb support 31% (25%–54%) versus 30% (23%–56%; $p = 0.67$) and walking speed (1.59 m/s [0.86–1.87 m/s] versus 1.57 m/s [0.71–1.96 m/s]; $p = 0.41$). No difference was observed between the two groups in terms of lower limb alignment (PSI group 178° ± 3°, conventional group 178° ± 4°; $p = 0.24$) or implant positioning on mediolateral and anteroposterior radiographs. There were no differences in the functional score between the PSI and conventional TKA groups at 3 months and 1 year after surgery: KSS objective knee scores (PSI: 85 ± 8 points at 3 months, 87 ± 5 points at 1 year and conventional

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Each author certifies that his or her institution approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research, and that informed consent for participation in the study was obtained.
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instrumentation: 82 ± 8 points at 3 months 83 ± 6 points at 1 year; p = 0.10) and functional activity scores were similar in both group (PSI: 71 ± 12 points at 3 months and 74 ± 7 points at 1 year versus conventional group: 73 ± 11 points at 3 months and 75 ± 6 at 1 year; p = 0.9).

Conclusions Our observations suggest that PSI may confer small, if any, advantage in alignment, pain, or function after UKA. This argument can therefore not be used to justify the extra cost and uncertainty related to this technique.

Level of Evidence Level I, therapeutic study.

Introduction

Unicompartimental knee arthroplasty (UKA) can be a challenging procedure, and correct implant positioning is crucial to optimize postoperative function and implant survivorship [24]. Several studies have demonstrated a direct relationship among accurate implant positioning, survivorship, and functional postoperative outcomes [8, 11, 15]. Results from registries showed that the rate of revision increased when a surgeon performed fewer than 23 UKAs per year [5, 18, 24]. To improve implant positioning in UKA, computer-assisted surgery and then robotics have been developed with potential advantages in terms of implant positioning but with important drawbacks such as the cost and the time of surgery [12]. After the development of patient-specific instrumentation (PSI) in TKA, PSI has been developed for UKA with the goal of improving implant positioning and potentially functional outcomes. An MRI-based protocol is used to create the knee model and to develop the corresponding cutting blocks, which guide frontal and the sagittal cuts on the tibia as well as the distal femoral cut [10].

However, studies differ as to whether PSI for UKA results in improved alignment [7, 14] and there are few data demonstrating whether any differences achieved in alignment will translate into clinically relevant differences that a patient might perceive [15]. To our knowledge, there are no randomized clinical trials on this important topic.

We hypothesized that UKA performed with PSI would improve implant positioning, patient-reported outcomes, and gait compared with a conventional technique. Therefore, we aimed to specifically compare in a randomized controlled study (1) radiological results based on the frontal and sagittal alignment of the implants on conventional radiographs; (2) functional outcomes using the new Knee Society Score (KSS) [19], the Knee Injury and Osteoarthritis Outcome Score (KOOS), and the SF-12 at 3 months and 1 year; and (3) three-dimensional (3-D) gait parameters at 1 year of patients operated on for a UKA with PSI versus patients operated on with standard instrumentation.

Patients and Methods

In this randomized controlled trial, 60 patients (30 in each group) undergoing unilateral primary medial UKA at our institution between January and April 2013 performed by the two senior authors (J-NA and SP together 200 medial UKA performed in 2013) were recruited.

The inclusion criteria were (1) isolated symptomatic medial femorotibial knee arthritis [2]; (2) with varus deformity; (3) age between 50 and 85 years; and (4) acceptance of a new technology protocol (including delay between MRI and surgery). Exclusion criteria were (1) ROM below 0° to 100° (extension to flexion); (2) unstable knees in frontal and/or sagittal planes; (3) a personal history of trauma, sepsis, tumor, inflammatory or skeletal disease (that could influence gait parameters); (4) previous lower limb joint (ankle to hip) surgery that could lead to an artifact effect on imaging; and (5) any contraindication to MRI. All patients who met the criteria were invited to participate; 60 patients agreed to participate representing 86% of the 69 patients meeting the named criteria during the inclusion period. No patients were lost to followup (Fig. 1). Institutional review board approval was obtained and all patients provided informed consent.

Patients were randomized to either the PSI or conventional instrumentation group by the hospital's informatics department using a previously described systematic sampling method [1]. No differences in terms of anthropometric and radiological (preoperative) parameters were found in the two groups (Table 1). For the patients allocated to the PSI group, MRIs were obtained after randomization. All patients had their MRI completed on the same machine (Philips™ Intera 1.5 Tesla; Koninklijke Philips NV, Best, The Netherlands) in the hospital's department of radiology using a standardized protocol validated by the protocol manufacturer (Materialise™, Leuven, Belgium). After segmentation, the engineers planned the UKA and submitted the plan to the surgeon. Based on the clinical examination and standing full-length hip-to-ankle radiographs, the plan was scrutinized and modified by the surgeon to set the appropriate depth of the distal femoral and tibial cuts, flexion of the femoral implant, and slope of the tibial plateau. The aim was to obtain a 3-mm cut based on the level of the lowest point on the tibial plateau with an angle of 90° according to the mechanical axis of the tibia and with a 3° posterior slope. On the femoral side, we were aiming for a 9-mm cut perpendicular to the mechanical axis of the femur.

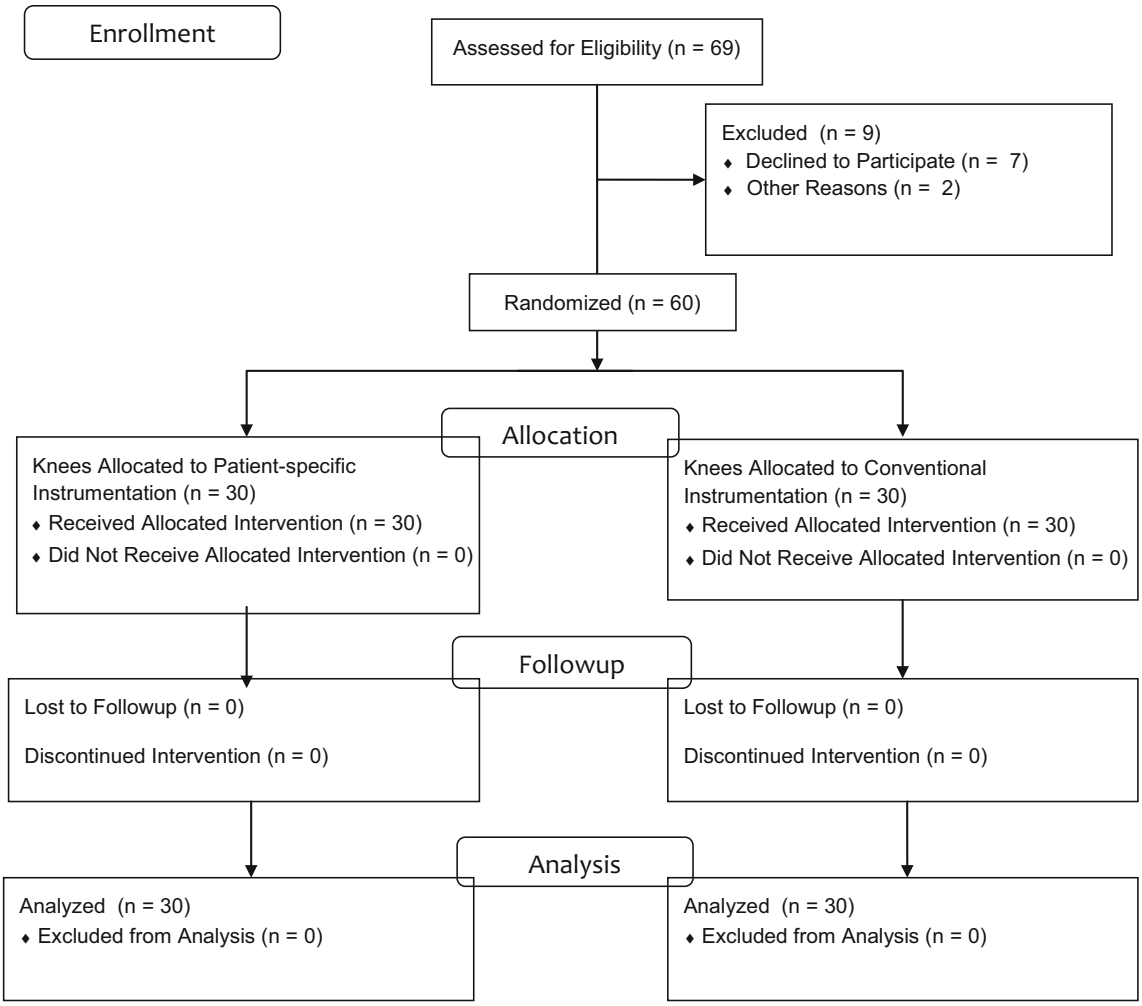

Fig. 1 A flow diagram illustrates patient enrollment, allocation, followup, and analysis.

Table 1. Preoperative demographic and radiographic data

Demographic	Patient-specific instrumentation (N = 30)	Conventional instrumentation (N = 30)	p value
Age (years)*	63 (55–83)	62 (55–81)	0.745
Sex ratio (female:male)	17:13	17:13	–
Body mass index (kg/m^2)*	27 (20–31)	28 (22–33)	0.623
Side (left/right)	18/12	18/12	–
ROM (°)*	127 (115–130)	125 (118–130)	0.719
Charnley classification			
A	28	29	–
B1	2	1	
Alignment			
Varus	20	20	–
Neutral	10	10	
Hip-knee angle (°)*	176 (172–179)	175 (173–179)	0.942
Tibial slope (°)*	5 (1–8)	6 (0–8)	0.607

* Values are represented as mean (range); the remaining values are expressed as number of patients.

The surgical exposure through a medial parapatellar arthrotomy was identical for both groups. For patients randomized to the PSI group, after exposure of the knee, the PSI jigs were carefully positioned over previously cleaned and dried articular surfaces, ensuring an accurate fit. Subsequently, guided by the PSI jig, drill holes and pins were placed in the cartilage surfaces, which then determined the orientation of standard cutting guides.

For patients randomized to the conventional instrumentation group, a traditional extramedullary guide was used for the tibial cut. The remaining procedure in both groups was completed as per our standard protocol [3, 4]. In both groups patients received the identical cemented metal-backed fixed-bearing medial unicompartmental prosthesis (ZUK^{TM}; Zimmer, Warsaw, IN, USA) [4]. In both groups, no tourniquet was used and patients received identical postoperative pain and blood management protocols. In addition, the same postoperative rehabilitation protocol was used for all patients.

In the PSI group, three intraoperative modifications after performing the cuts with the PSI jigs were performed (of 30 in this group; 10%). In these patients, the surgeon judged intraoperatively that these knees required an additional tibial resection of 2 mm.

Gait parameters were analyzed 1 year after surgery in our institutional gait laboratory. The laboratory is fitted with the 3-D Vicon^{TM} system (Viton, Denver, CO, USA), six cameras, and two AMTI^{TM} force platforms (Advanced Mechanical Technology Inc, Watertown, MA, USA) to calculate spatiotemporal and kinematic parameters [16, 21, 23].

In each group, the radiographic analysis included pre- and postoperative full-length standing radiographs, a mediolateral view of the knee, and a skyline view at 30° of flexion. For hip-knee angle, the radiological assessment was carried out by two independent observers (MO, AL) according to a previously described method [9] on full-leg weightbearing radiographs, AP and lateral views, and on skyline patellar views. The mechanical axis of the lower limbs was measured pre- and postoperatively based on the hip-knee angle evaluation and Kennedy and Wright classification [13], the frontal femoral and tibial component angle on mediolateral and AP views as well as sagittal femoral component angle and tibial slope.

Subjective and objective functional results were analyzed preoperatively, 3 months, and 2 year postoperatively using the (1) KSS; (2) KOOS; and (3) SF-12 [17, 19, 20].

Statistical Methods

The a priori sample size calculation assumed that a difference of walking speed of 0.2 m/sec was clinically relevant [23]. Assuming the variability of this value (comfortable walking speed after UKA 1.38 ± 0.2 m/s [23]), a power of 90%, and a significance level of 5%, the required sample size was 22 patients in each group.

Data that are descriptive statistics are presented as mean ± SD. Statistical analysis was performed with SPSS^{TM} 12.0 (IBM Corporation, Somers, NY, USA). Student's paired t-tests were used for intragroup comparison. Two-sample t-tests were used for intergroup comparisons, and multiple analyses of variance were used for multiple comparisons (functional score analysis: preoperative/3 months/1 year).

All patients provided written consent, and the study received authorization from our local ethics committee.

Results

Gait Analysis

One year after surgery, there were no differences between the two groups in the analyzed gait spatiotemporal parameters with, respectively, PSI UKA and conventional UKA: double limb support 31% (minimum-maximum, 25%–54%) versus 30% (23%–56%; $p = 0.67$), single limb support 69% (36%–75%) versus 70% (44%–77%; $p = 0.59$), and walking speed 1.59 (0.86–1.87 m/s) versus 1.57 m/s (0.71–1.96 m/s; $p = 0.41$). No difference was also found between groups regarding kinematic parameters with, respectively, PSI UKA and conventional UKA knee varus angle 1.8° (−2° to –3°) versus 1.3° (−1° to 2°; $p = 0.39$), knee valgus angle −2° (−4° to 4°) versus −2.4° (−5° to 3°; $p = 0.46$), knee varus moment 0.5 Nm/kg (0.3–0.8 Nm/kg) versus 0.5 Nm/kg (0.2–0.7 Nm/kg; $p = 0.71$), and knee valgus moment 0 Nm/kg (−0.1 to 0.2 Nm/kg) versus −0.1 Nm/kg (−0.2 to 0.3 Nm/kg; $p = 0.59$) (Table 2).

Radiological Analysis

On the weightbearing full-length radiographs at 3 months, no hip-knee angle difference was observed between the two groups (PSI group 178° ± 3°, conventional group 178° ± 4°; $p = 0.24$). No difference was observed concerning the frontal and sagittal position of the implants on the mediolateral and AP radiographs (Table 2) with, respectively, PSI and conventional femoral frontal component angle: 89° ± 2° versus 90° ± 2° ($p = 0.16$), tibial frontal component angle: 89° ± 2° for both groups ($p = 0.31$), femoral sagittal component angle: 100° ± 2 versus 97° ± 2° ($p = 0.29$), and tibial slope: 4° ± 2° versus 5° ± 3° ($p = 0.23$) (Table 3).

Table 2. Comparison of postoperative (1 year) gait during level walking (between groups)

Parameter	Patient-specific instrumentation	Conventional instrumentation	p value
Spatiotemporal			
Double limb support (%)	31 (25–54)	30 (23–56)	0.67
Single limb support (%)	69 (36–75)	70 (44–77)	0.59
Walking speed (m/s)	1.59 (0.86–1.87)	1.57 (0.71–1.96)	0.41
Cadence (steps/m)	108 (91–128)	104 (74–125)	0.36
Stride length (m)	1.64 (1.25–1.85)	1.71 (1.13–1.87)	0.23
Kinematics/kinetics			
Knee varus angle (°)	1.8 (−2 to 3)	1.3 (−1 to 2)	0.39
Knee valgus angle (°)	−2 (−4 to 4)	−2.4 (−5 to 3)	0.46
Knee varus moment (Nm/kg)	0.5 (0.3–0.8)	0.5 (0.2–0.7)	0.71
Knee valgus moment (Nm/kg)	0.0 (−0.1 to 0.2)	−0.1 (−0.2 to 0.3)	0.59
Knee power generation (W/kg)	0.4 (0.1–0.5)	0.3 (0.1–0.5)	0.18
Ankle power generation (W/kg)	2.0 (0.5–3.0)	2.7 (1.4–4.0)	0.08

Values are represented as mean (range).

Table 3. Results of the postoperative radiological analysis

Radiological parameters	Conventional	PSI	p value
Lower limb mechanical axis HKA (°)*	178 (176–182)	178 (175–182)	0.24
Femoral frontal component angle (°)*	90 (88–93)	89 (88–91)	0.16
Tibial frontal component angle (°)	1 (−2–3)	1 (−3–2)	0.31
Kennedy zone (% in Zone 2 or C)	97 (29/30)	97 (29/30)	–
Tibial slope (°)*	5 (8–0)	4 (8–1)	0 .23
Femoral sagittal component angle (°)*	97 (94–101)	100 (95–102)	0.29

* Values are represented as mean (SD); the remaining values are expressed as percentage and number of patients; PSI = patient-specific instrumentation; HKA = hip-knee angle.

Patient-reported Outcome Measures

There were no differences in the functional score between the PSI and conventional TKA groups at 3 months and 1 year after surgery; for the KSS score, we found no difference between groups at 3 months and 1 year for objective knee scores (PSI : 85 ± 8 points at 3 months, 87 ± 5 points at 1 year and conventional instrumentation: 82 ± 8 points at 3 months 83 ± 6 points at 1 year; $p = 0.10$) or satisfaction scores (PSI: 32 ± 5 points at 3 months, 31 ± 4 points at 1 year and conventional instrumentation: 33 ± 7 points at 3 months and 33 ± 4 points at 1 year; $p = 0.08$). Expectation scores were also not different at 3 months (PSI: 12 ± 3 points, conventional: 13 ± 2 points) and 1 year (PSI: 12 ± 3 points, conventional: 12 ± 2 points; $p = 0.1$), and functional activity scores were similar in both group (PSI: 71 ± 12 points at 3 months and 74 ± 7 points at 1 year versus conventional group: 73 ± 11 points at 3 months and 75 ± 6 at 1 year; $p = 0.9$). No statistical difference was found for all the KOOS subscores at 3 months or 1 year (Fig. 2). Finally, physical SF-12 subscales at 3 months (PSI: 55 ± 7 points, conventional instrumentation: 55 ± 7 points) and 1 year (PSI: 78 ± 11 points and conventional instrumentation: 81 ± 12) and mental SF-12 subscales at 3 months (PSI: 58 ± 8 points, conventional instrumentation 58 ± 10 points) and 1 year (PSI: 63 ± 9 points and conventional instrumentation: 62 ± 9 points) were not different (respectively, all $p > 0.1$) in both groups (Tables 4–6).

Discussion

Component alignment can influence implant longevity as well as perhaps pain and function after UKA [11, 15], but correct alignment is not consistently achieved. To increase the likelihood that good alignment will be achieved during surgery, smart tools such as robotics or PSI have been introduced [10]. However, very limited scientific data are

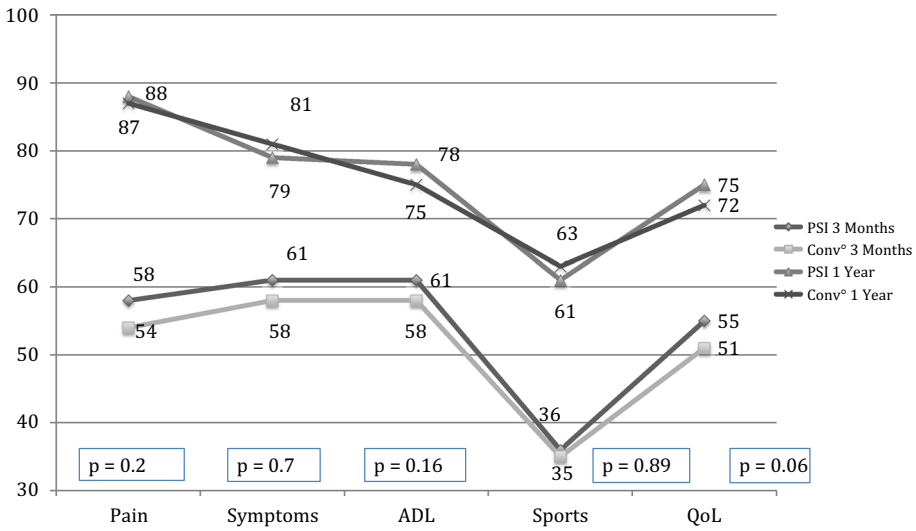

Fig. 2 The results of the KOOS subscore analysis are presented (multiple analysis of variance). ADL = activities of daily living; QoL = quality of life; Conv° = conventional instrumentation group.

Table 4. Comparison of preoperative and postoperative functional scores between groups

Score (points)	Preoperative		3 months		1 year		ANOVA	
	PSI	Conventional	PSI	Conventional	PSI	Conventional	p value	Percent of variation
New Knee Society knee score								
Objective knee score (/100)	61 ± 12	62 ± 8	85 ± 8	82 ± 8	87 ± 5	83 ± 6	0.10	0.55
Satisfaction score (/40)	20 ± 4	22 ± 6	32 ± 5	33 ± 7	31 ± 4	33 ± 4	0.08	1.04
Expectation score (/15)	9 ± 4	10 ± 2	12 ± 3	13 ± 2	12 ± 3	12 ± 2	0.10	1.19
Functional activity score (/100)	45 ± 11	42 ± 12	71 ± 12	73 ± 11	74 ± 7	75 ± 6	0.9	0
KOOS								
Pain (/100)	35 ± 11	34 ± 9	58 ± 12	54 ± 12	88 ± 10	87 ± 9	0.2	0.17
Symptoms (/100)	38 ± 9	40 ± 7	61 ± 10	58 ± 9	79 ± 9	81 ± 7	0.79	0.007
ADL (/100)	48 ± 12	47 ± 9	61 ± 14	58 ± 12	78 ± 9	75 ± 11	0.16	0.51
Sports (/100)	23 ± 12	21 ± 10	36 ± 18	35 ± 17	61 ± 20	63 ± 19	0.89	0.005
QOL (/100)	40 ± 9	38 ± 8	55 ± 13	51 ± 10	75 ± 13	72 ± 11	0.06	0.71
SF-12								
Physical subscale (/100)	40 ± 7	43 ± 5	55 ± 7	55 ± 7	78 ± 11	81 ± 12	0.11	0.31
Mental subscale (/100)	50 ± 6	52 ± 5	58 ± 8	58 ± 10	63 ± 9	62 ± 9	0.78	0.03

Values are mean ± SD; PSI = patient-specific instrumentation; Conventional = conventional instrumentation; KOOS = Knee Injury and Osteoarthritis Outcome Score; ADL = activities of daily living; QOL = quality of life; p and percentage of variation (column factor) results of multiple analyses of variance (ANOVAs).

available concerning PSI UKA in the literature. Studies have disagreed about whether PSI improves alignment in patients undergoing UKA [16, 21], but to our knowledge, no study has specifically evaluated whether PSI will result in better functional outcomes compared with traditional surgical approaches. We hypothesized that UKA performed with PSI would improve implant positioning, patient-reported outcomes, and gait compared with the conventional technique. In this randomized clinical trial comparing PSI versus conventional instrumented UKA, we found no benefit in any radiological or functional outcomes and no difference in gait parameters when PSI was used.

There are limitations to the current study. First, the sample size is small with 30 patients per group. However, the preoperative power analysis, similar nature of the two

Table 5. Comparison of preoperative and postoperative functional scores for the PSI group

Score (points)	Patient-specific instrumentation			
	Preoperative	3 months	1 year	p value
New Knee Society knee score				
Objective knee score (/100)	61 ± 12	85 ± 8	87 ± 5	< 0.0001
Satisfaction score (/40)	20 ± 4	32 ± 5	31 ± 4	< 0.0001
Expectation score (/15)	9 ± 4	12 ± 3	12 ± 3	< 0.0001
Functional activity score (/100)	45 ± 11	71 ± 12	74 ± 7	< 0.0001
KOOS				
Pain (/100)	35 ± 11	58 ± 12	88 ± 10	< 0.0001
Symptoms (/100)	38 ± 9	61 ± 10	79 ± 9	< 0.0001
ADL (/100)	48 ± 12	61 ± 14	78 ± 9	< 0.0001
Sports (/100)	23 ± 12	36 ± 18	61 ± 20	< 0.0001
QOL (/100)	40 ± 9	55 ± 13	75 ± 13	< 0.0001
SF-12				
Physical subscale (/100)	40 ± 7	55 ± 7	78 ± 11	< 0.0001
Mental subscale (/100)	50 ± 6	58 ± 8	63 ± 9	0.0044

Values are mean ± SD; PSI = patient-specific instrumentation; KOOS = Knee Injury and Osteoarthritis Outcome Score; ADL = activities of daily living; QOL = quality of life; p results of the multiple analyses of variance.

Table 6. Comparison of preoperative and postoperative functional scores for the conventional instrumentation group

Score (points)	Conventional instrumentation			
	Preoperative	3 months	1 year	p value
New Knee Society knee score				
Objective knee score (/100)	62 ± 8	82 ± 8	83 ± 6	< 0.0001
Satisfaction score (/40)	22 ± 6	33 ± 7	33 ± 4	< 0.0001
Expectation score (/15)	10 ± 2	13 ± 2	12 ± 2	< 0.0001
Functional activity score (/100)	42 ± 12	73 ± 11	75 ± 6	< 0.0001
KOOS				
Pain (/100)	34 ± 9	54 ± 12	87 ± 9	< 0.0001
Symptoms (/100)	40 ± 7	58 ± 9	81 ± 7	< 0.0001
ADL (/100)	47 ± 9	58 ± 12	75 ± 11	< 0.0001
Sports (/100)	21 ± 10	35 ± 17	63 ± 19	< 0.0001
QOL (/100)	38 ± 8	51 ± 10	72 ± 11	< 0.0001
SF-12				
Physical subscale (/100)	43 ± 5	55 ± 7	81 ± 12	< 0.0001
Mental subscale (/100)	52 ± 5	58 ± 10	62 ± 9	0.033

Values are mean ± SD; KOOS = Knee Injury and Osteoarthritis Outcome Score; ADL = activities of daily living; QOL = quality of life; p results of multiple analyses of variance.

populations preoperatively, and randomized clinical study design help mitigate this issue. In addition, we have only focused on the first year postoperatively, and the results cannot be extrapolated to longer-term followup. However, it was our intention to focus on the immediate postoperative rehabilitative period and short-term followup until 1 year because limited differences may be seen at longer term when no difference was observed initially. In addition, our study was limited to some degree by the intrinsic limitations common to all motion analysis studies, including variability in gait measurements resulting from body anthropometrics, independent skin motion, and

definition of the neutral position [22]. Finally, we have chosen to focus on clinical results in terms of clinical outcomes and gait analysis, but blood loss, time of surgery, and cost-effectiveness analysis are mandatory to completely evaluate UKA PSI potential.

In 2013, Dao Trong et al. [7] investigated the tibial component alignment of 28 medial UKAs implanted using patient-specific cutting blocks. CT analysis of implant positioning showed a high accuracy of coronal tibial implant position (0.3° ± 1.7°), posterior slope (1.1° ± 2.6°), and external rotation (1.5° ± 3.3°). There was no control group in this study. Jaffry et al. [11] investigated implant positioning among PSI UKA, conventional instrumented UKA, and robotic-assisted UKA; their results showed that PSI UKA provided more accurate positioning than conventional instrumentation, no difference between robot and PSI UKA, and finally concluded that PSI UKA took half the time as robotic-assisted UKA to implant. Recently, Kerens et al. [14] compared radiographic positioning of implants in 30 conventional Oxford UKA (Biomet Inc, Warsaw, IN, USA) compared with 30 patient-specific guided Oxford UKA. They found no statistically differences between the two groups, except for the positioning of the femoral component in the frontal plane (better in the PSI group). Our results sustained those of this previous randomized controlled study because we did not find any differences in terms of lower limb mechanical axis or component alignment in frontal and sagittal planes. However, we have limited our radiological analysis to postoperative radiographic analysis and an analysis of the rotational positioning of UKA implant should be performed based on CT or MRI evaluation.

To our knowledge, PSI UKA clinical outcomes have never been compared with conventional instrumentation devices in a randomized controlled fashion and only one study reported the early clinical outcomes of 44 PSI UKA (41 patients) [6]. Those authors reported improved Oxford knee score and Forgotten Joint Score without any complication at a mean followup of 24 months. However, there was no control group and such improvements would be expected even without the use of PSI. More, the authors of this study had to modify PSI planning intraoperatively 19 times for 44 cases (43%), which may limit the interpretation of their functional results. In our study, improvement was observed in both groups at 3 months and 1 year without any difference between the two groups. We had to recut the tibial plateau in 10% of our PSI UKA cases; this number is lower than in the Bell et al. [6] series reporting 43% of perioperative modifications, but higher than the Kerens et al. series (no perioperative modification in 30 PSI UKA) [14]. The number of intraoperative changes in our experience was limited but not null, and this may be related first to the time spent by the surgeon on edition and validation of the preoperative planning and second to the fact that we would not accept intraoperatively an inappropriate cut.

Although this study is to our knowledge the first to describe gait analysis of PSI UKA compared with conventional UKA, our results are generally similar to those of other studies evaluating gait after UKA. Webster et al. [21] presented in their series of 12 UKAs (12 patients; mean age 69 ± 8 years) their spatiotemporal results (velocity 1.38 ± 0.2 m/s, cadence 118 ± 7.5 step/min, stride 1.70 ± 0.14 m) at a mean followup of 22 months were similar to those we found 1 year after UKA. In our series, we did not find any difference at 1 year between the two groups.

To conclude, our observations suggest that PSI does not provide better component positioning accuracy in frontal or sagittal planes. Additionally, PSI in UKA does not confer any substantial advantage in function after UKA. These arguments can therefore not be used to justify the extra cost related to this technique.

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