Iatrogenic Bone and Soft Tissue Trauma in Robotic-Arm Assisted Total Knee Arthroplasty Compared With Conventional Jig-Based Total Knee Arthroplasty: A Prospective Cohort Study and Validation of a New Classification System

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Abstract

Background: The objective of this study was to compare macroscopic bone and soft tissue injury between robotic-arm assisted total knee arthroplasty (RA-TKA) and conventional jig-based total knee arthroplasty (CJ-TKA) and create a validated classification system for reporting iatrogenic bone and periarticular soft tissue injury after TKA.

Methods: This study included 30 consecutive CJ-TKAs followed by 30 consecutive RA-TKAs performed by a single surgeon. Intraoperative photographs of the femur, tibia, and periarticular soft tissues were taken before implantation of prostheses. Using these outcomes, the macroscopic soft tissue injury (MASTI) classification system was developed to grade iatrogenic bone and soft tissue injuries. Interobserver and Intraobserver validity of the proposed MASTI classification system was assessed.

Results: Patients undergoing RA-TKA had reduced medial soft tissue injury in both passively correctible \( P < .05 \) and noncorrectible varus deformities \( P < .05 \); more pristine femoral \( P < .05 \) and tibial \( P < .05 \) bone resection cuts; and improved MASTI scores compared to CJ-TKA \( P < .05 \). There was high interobserver (intraclass correlation coefficient 0.92 [95% confidence interval: 0.88-0.96], \( P < .05 \) and intraobserver agreement (intraclass correlation coefficient 0.94 [95% confidence interval: 0.92-0.97], \( P < .05 \) of the proposed MASTI classification system.

Conclusion: There is reduced bone and periarticular soft tissue injury in patients undergoing RA-TKA compared to CJ-TKA. The proposed MASTI classification system is a reproducible grading scheme for describing iatrogenic bone and soft tissue injury in TKA.

Clinical Relevance: RA-TKA is associated with reduced bone and soft tissue injury compared with conventional jig-based TKA. The proposed MASTI classification may facilitate further research correlating macroscopic soft tissue injury during TKA to long-term clinical and functional outcomes.

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Total knee arthroplasty (TKA) is an established and highly effective treatment for end-stage knee osteoarthritis. The procedure is performed in over 90,000 patients per year within the United Kingdom [1]. The technical objectives of surgery are to replace diseased bone with artificial implants, restore alignment, preserve the joint line, balance flexion and extension gaps, and maintain the normal Q angle for patella tracking. To achieve these objectives, preservation of the surrounding soft tissue envelope during TKA is essential [2–7]. Inadvertent injury to the periarticular soft tissue structures such as the collateral ligaments, posterior cruciate...
ligament (PCL), or extensor mechanism may compromise postoperative clinical and functional recovery, reduce stability, and decrease implant survivorship [2,6–8].

In patients undergoing conventional jig-based total knee arthroplasty (CJ-TKA), correct alignment and soft tissue tensioning may be achieved using a measured resection technique or gap-balancing technique [9–12]. Bone resection is undertaken using intramedullary or extramedullary alignment guides with a manually controlled oscillating saw blade. Surgical instruments are often used to protect supporting ligamentous and neurovascular structures. Controlled selective or more aggressive soft tissue releases may be used to balance flexion and extensions gaps. However, manual error associated with inadvertent soft tissue release during preparation for implantation or tissue damage from the sawblade is an accepted risk of the procedure. In many cases, this subtle soft tissue injury is unnoticed or under-reported [13–19] and its long-term clinical and functional significance remains undetermined [19].

Recent advances in surgical technology have led to the development of robotic-arm assisted total knee arthroplasty (RA-TKA). This uses preoperative computerized tomography scans to create a patient-specific computer-aided design model of the knee joint. The surgeon uses this virtual 3-dimensional model to create a surgical plan for the desired bone coverage and limb alignment. Computer software calculates the optimal bone resection window and implant positioning for implementation of this plan, and an intraoperative robotic arm helps to execute this surgical plan with a high level of accuracy. Bone resection is limited to within the stereotactic boundaries of the predefined haptic bone window, which conceptually helps to limit bone and periaricular soft tissue injury [20]. To our knowledge, there are no existing clinical studies comparing bone and periaricular soft tissue injury in CJ-TKA vs RA-TKA and no existing classification systems for grading periaricular soft tissue injury in TKA. A validated grading system would help to standardize reporting of bone and soft tissue injury during TKA and facilitate future studies exploring the impact of bone and periaricular soft tissue injury on long-term clinical outcomes and implant survivorship.

The primary objective of this study was to compare intraoperative bone and soft tissue injury in CJ-TKA vs RA-TKA. We hypothesized that patients undergoing RA-TKA would have reduced iatrogenic bone and soft tissue injury compared with CJ-TKA due to the presence of stereotactic boundaries with robotic-guided surgery. The secondary objective was to develop a validated classification system for documenting and researching intraoperative bone and soft tissue injury during knee arthroplasty.

Materials and Methods

Patient Selection

This prospective cohort study included 60 patients with symptomatic knee osteoarthritis undergoing primary TKA between January 2016 and July 2017. This included 30 consecutive RA-TKAs and the preceding 30 consecutive CJ-TKAs before robotic-assisted TKA was fully introduced into the unit. The treatment group allocated to each patient was decided by the date of the surgery with operative procedures before September 2016 undergoing CJ-TKA and operative procedures after this date undergoing RA-TKA. All operative procedures were performed by the senior author (FSH) who is fully trained in CJ-TKA and has previously undergone cadaveric training in RA-TKA. The inclusion criteria for the study included: patients with knee osteoarthritis; patients greater than 18 years of age; both surgeon and patient agree that TKA is the most suitable treatment; patient is fit for surgery following review by an anesthetist and surgeon; patient has surgery performed using either CJ-TKA or RA-TKA. The exclusion criteria included the following: patient is unwilling to participate in the study; patient has diagnosis of inflammatory arthropathy or collagen disorders; patient undergoing revision TKA for failed unicompartmental arthroplasty or tibial osteotomy; and patient has surgery performed using an alternative surgical technique (e.g., computer navigation). Written informed consent was obtained from all patients included in this study. The proposed study was prospectively reviewed by the hospital board who confirmed further institutional research ethics board review was not required.

Preoperative Clinical and Radiological Data

Baseline characteristics relating to age, gender, body mass index, American Society of Anesthesiologists grade, laterality of surgery, preoperative range of movement, and varus or valgus alignment with degree of passive correction were prospectively recorded for each patient. Patients in both study groups had preoperative anteroposterior and lateral weight-bearing radiographs. In all patients undergoing RA-TKA, an additional CT scan of the knee joint was performed. This was used to create a patient-specific 3-dimensional model of the patient’s native knee anatomy and computer software was used to plan optimal bone resection and implant positioning for the desired bone coverage and limb alignment.

Surgical Technique

In both treatment groups, a tourniquet was applied but not inflated unless there were intraoperative concerns regarding hemostasis or obtaining a satisfactory bone-cement interface. A midline skin incision with medial parapatellar approach was used with preservation of a 3-mm cuff of quadriceps tendon attached to vastus medialis and a cuff of medial retinaculum to the patella to aid closure. The anteromedial capsule was released subperiosteally off the proximal tibia, patella everted, retropatellar fat pad excised, and anterior cruciate ligament resected. Medical and lateral menisci were excised, and osteophytes were removed using a bone nibbler and broad osteotome. In patients undergoing CJ-TKA, extraarticular referencing was used to perform the tibial bone resection. An oscillating sawblade and cutting block were positioned to perform the tibial resection perpendicular to the anatomical axis of the tibia in the coronal plan with an anteroposterior slope of 3° in the sagittal plane. Intraarticular referencing was used for the femoral resection with a varus angle of 5–9 degrees as guided by the preoperative imaging. Blunt Hohmann retractors were used to protect the soft tissues throughout. Following this, soft tissue releases were performed as required to ensure satisfactory balance of flexion and extension gaps. All soft tissue releases were recorded. In patients undergoing RA-TKA, femoral and tibial registration pins were inserted for the attachment of the femoral and tibial arrays, and the surgeon-controlled robotic arm was used to execute the planned bone cuts and guide implant positioning. The robotic arm had visual, auditory, and tactile feedback to ensure accurate bone resection within the stereotactic window and limit sawblade action outside of this field. The degree of accuracy for RA-TKA is 2 degrees/2 mm. Intraoperative dynamic referencing was used to assess on-table alignment, stability, and range of motion with live on-screen measurements. In both groups, the PCL was incised and later removed with the box cut.

The implants used in both groups were the Triathlon Posterior stabilized (PS) implant (Stryker, Mahwah, NJ) which consists of a Triathlon PS femoral component, universal baseplate tibial component, and polyethylene insert. Patella resurfacing was performed in both treatment groups.
Baseline Characteristics

There were no differences in baseline characteristics between the 2 treatment groups in relation to age, gender, body mass index, American Society of Anesthesiologists score, laterality of surgery, and preoperative coronal or sagittal plane deformities (Table 1). Two patients in the CJ-TKA group had coronal deformities that were not passively correctable. There was no statistical difference in correctability of coronal plane deformities between the 2 treatment groups.

Intraoperative Clinical Photographs

Standardized intraoperative photographs with a 100-mm lens (EF 100 mm f/2.8 L Macro IS USM, Canon Inc., Ohta-ku, Tokyo, Japan) were obtained following femoral and tibial bone preparation to assess the iatrogenic bone and soft tissue injury. Five photographs were taken in each patient to assess the soft tissue condition within the medial, lateral, anterior (extensor mechanism), and posterior compartments. All photographs were taken from 1 meter to enable accurate and clear visualization of the bone and periarticular soft tissues whilst ensuring that the sterile surgical environment was not compromised. Six blinded fellowship-trained surgeons were given a tutorial on the proposed classification system. Each of the blinded observers individually reviewed the intraoperative photographs and allocated scores to the each of the 4 zones and an overall grade to each patient. Scores were compared between observers to assess interobserver reliability. Each of the 6 blinded observers were given the same clinical pictures and asked to score bone and soft tissue injury according to the proposed classification to determine interobserver reliability. The use of photographs allowed documentation and prevented exposure of the open knee wound to multiple observers.

Classification System

The proposed classification is called the macroscopic soft tissue injury (MASTI) score. The MASTI classification system is based on an intraoperative assessment of the soft tissue envelope in TKA. The classification system divides the knee into the 4 following zones: medial tibial zone; lateral tibial zones; anterior zone (the extensor mechanism, patella and quadriceps tendon); and posterior zone. The tibia is divided into a medial and lateral zone by a horizontal line from the PCL towards the most prominent point of the tibial tubercle (Fig. 1). The posterior zone includes the PCL and posterior capsule, which is most easily evaluated in deep knee flexion. The zones of the knee are evaluated for iatrogenic soft tissue injury. In our series, all cases were cruciate substituting prosthesis.

The macroscopic appearances of the soft tissue injuries in each of the 4 zones are evaluated. There are 6 potential soft tissue appearances, and the score designated to each zone reflects the most severe soft tissue injury within that zone. Different point values are assigned to the corresponding soft tissue macroscopic appearance for each zone (Fig. 2).

This includes:

1. Complete unintentional soft tissue detachment (superficial medial collateral ligament tear, lateral collateral ligament tear, partial or full patella tendon tear) (0 points)
2. Soft tissue cleavage (3 points)
3. Complete unintentional soft tissue detachment (superficial medial collateral ligament tear, lateral collateral ligament tear, partial or full patella tendon tear, extensor mechanism) (5 points)
4. Soft tissue contusion (7 points)
5. Planed soft tissue release (8 points)
6. Soft tissue fibrillation (macroscopic incomplete damage) (10 points)

Using this classification system, a maximum of 40 points may be awarded if there is no evidence of iatrogenic soft tissue injury in any of the 4 zones. If there is complete unintentional soft tissue detachment in any of the 4 zones, then the patient scores 0 points for all 4 compartments. The minimum score is therefore zero points. The grading system for each zone has been weighted to enable the total score of all 4 zones to accurately reflect the severity of periarticular knee injury and enable stratification of this information into 4 distinct groups (A-D) (Table 2).

Group A (34–40 points) indicates that the periarticular soft tissue envelope is well preserved with mild to no iatrogenic soft tissue injury in all 4 zones. Group B (25–33 points) indicates that there is moderate iatrogenic periarticular soft tissue injury with clear soft tissue injury in at least 2 zones. Group C (24–1 points) indicates more severe soft tissue injury with iatrogenic soft tissue injury to least 3 of the 4 zones. Group D (0 points) indicates surgical trauma or complete disruption that has resulted in defunctioning of the superficial medial collateral ligament, lateral collateral ligament, or the extensor mechanism (patella or quadriceps tendon) irrespective of the soft tissue appearance in any other corresponding compartment.

The quality of the femoral and tibial bony surfaces is also evaluated and used to stratify the soft tissue injury score further. There are 3 distinct grades for the macroscopic appearance of the cut femoral and tibial surface. Grades are assigned to the femur (“F”) and tibia (“T”) based on the most injured part of the bone cuts. Grade A indicates that the cut bone surfaces are pristine and unblemished. Grade B indicates that the bony surfaces are

| Table 1 Baseline Characteristics for Patients Undergoing RA-TKA and CJ-TKA. |
|---|---|---|---|
| Age, y (range) | RA-TKA (n=30) | CJ-TKA (n=30) | P Value |
| Gender (M/F) | 14/16 | 13/17 | .272 |
| BMI (kg/m²) | 29.15 ± 4.5 | 30.68 ± 4.7 | .1 |
| Side (left/right) | 12/18 | 16/14 | .272 |
| Coronal deformity (mean ± SD) | 4.80 ± 5.718 | 3.04 ± 7.0 | .363 |
| Sagittal deformity (mean ± SD) | 5.75 ± 3.0 | 5.81 ± 4.3 | .958 |
| ASA grade (mode; range) | 2 (1-3) | 2 (1-3) | 1 |

ASA, American Society of Anesthesiologists; BMI, body mass index; CJ-TKA, conventional jig-based total knee arthroplasty; RA-TKA, robotic-arm assisted total knee arthroplasty; SD, standard deviation.
uneven or were inadvertently injured or damaged when performing the bone cuts. Grade C indicates that repeat bone resection may be necessary to improve the bony surface condition and that tibial and/or femoral wedges may be necessary to restore the joint line.

Statistical Analysis

All the data were analyzed with statistical IBM SPSS (IBM SPSS, V 24, Armonk, NY, IBM Corp) software package. Throughout the process, a tool for assessing reliability (Cronbach’s alpha >0.95) was used. All the variables were described by inputting the percentages and the number of cases as categorical variables. The quantitative variables were described as an average and a standard deviation. The suitability study was done by calculating the intraclass correlation coefficient (ICC), also denominated the “internal correlation coefficient” or “reliability coefficient”, with a confidence interval of 95%. The inference was studied using the chi-square test or Fisher’s exact test, as required. The inference was carried out using t test. The level of significance was set at \( P < 0.05 \).

Results

**MASTI Score**

The overall MASTI score was greater in patients undergoing RA-TKA compared with CJ-TKA (30.85 ± 3.1 vs 27.68 ± 3.9, respectively, \( P < 0.05 \)). Patients receiving RA-TKA had increased grade A scores (10/30 vs 2/30, \( P < 0.05 \)) and reduced grade C scores (0/30 vs 8/30, \( P < 0.05 \)) compared with CJ-TKA. There was no difference in RA-TKA and CJ-TKA in grade B scores (18/30 vs 20/30, \( P = 0.21 \)) and no patients in either group received grade D scores. The odds ratio showed RA-TKA was 5.6 times more likely to have a grade A score than CJ-TKA.

**Interobserver and Intraobserver Correlation**

There was high interobserver (ICC 0.92 [95% CI: 0.88-0.96], \( P < 0.05 \)) and intraobserver agreement (ICC 0.94 [95% CI: 0.92-0.97], \( P < 0.05 \)) between the 6 blinded observers in relation to the MASTI classification system.

**Bone Injury Score**

Intraoperative assessment of femoral and tibial bone resections followed a similar trend with reduced iatrogenic bone injury scores in RA-TKA compared with CJ-TKA. The use of RA-TKA was associated with more pristine type A femoral (30/30 vs 12/30, \( P < 0.05 \)) and tibia (26/30 vs 15/30, \( P < 0.05 \)) bone cuts compared with CJ-TKA. Type B bone cuts were less common in RA-KA for both femur (0/30 vs 18/30, \( P < 0.05 \)) and tibia (4/30 vs 15/30, \( P < 0.05 \)) compared to CJ-TKA. No patients in either group had type C femoral or tibial bone resection surfaces.

**Soft Tissue Injury**

In patients with both correctible and noncorrectible deformities, RA-TKA was associated with reduced medial soft tissue release compared to CJ-TKA (Table 3). Of note, none of the patients in the RA-TKA group required complete release of the posterior oblique ligament and posterior capsule compared with 10 patients in the CJ-TKA group.

### Table 2

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description of Soft Tissue Preservation</th>
<th>Points</th>
<th>MASTI Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Excellent</td>
<td>&gt;34</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Average</td>
<td>25-33</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Poor</td>
<td>&lt;24</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Defunctioned knee</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

LCL, lateral collateral ligament; MASTI, macroscopic soft tissue injury; MCL, medial collateral ligament.

Fig. 2. Intraoperative photographs showing soft tissue injury for each grade of MASTI classification system. No type 6 injuries were observed in this study. LCL, lateral collateral ligament; MCL, medial collateral ligament.
Revision surgery increased the risk of implant wear, instability, aseptic loosening, and extension gaps in TKA. Suboptimal soft tissue balancing may lead to tensioning, which are fundamental to achieving well-balanced soft tissue injury with different surgical techniques to long-term during TKA and facilitate further research correlating periarticular bone and soft tissue injury during TKA and facilitate further research correlating periarticular bone and soft tissue injury during TKA. To our knowledge, this is the only grading system providing a structured and systematic approach to reporting bone and periarticular soft tissue injury during TKA. The MASTI classification system may be used as a guide to standardize data collection between treatment centers; correlate periarticular injuries to long-term clinical results, functional outcomes, or long-term implant survivorship. Furthermore, patients undergoing RA-TKA had improved MASTI scores compared to CJ-TKA, but the clinical significance of the difference in mean scores between the 2 treatment groups is unknown at this stage. Studies have reported improved accuracy of implant positioning and short-term functional outcomes in RA-TKA compared to CJ-TKA [31–35], and the results of further higher quality studies comparing clinical outcomes, patient-reported outcome measures, complications, cost-effectiveness, and implant survival between the 2 surgical techniques are still awaited.

The MASTI classification system provides a structured and systematic approach to reporting bone and periarticular soft tissue injury during TKA. To our knowledge, this is the only grading system for recording periarticular injury in TKA. Despite its shortcomings in these early stages, this objective and validated classification system assesses a comprehensive range of outcomes from the soft tissue envelope and stratifies femoral and tibial bone injury. The high interobserver validity of the classification will also aid the adoption and integration of this grading system into clinical practice. The MASTI classification system may be used as a guide to analyze and record periarticular injury during TKA in more detail; standardize data collection between treatment centers; correlate postoperative pain, rehabilitation, and inflammatory response to the extent of soft tissue releases; and facilitate further research comparing the invasiveness of different surgical approaches to long-term clinical outcomes and implant survivorship. There are several limitations to this study which need to be considered when interpreting the findings. First, the MASTI score provides a general grade for bone and soft tissue injury during TKA with limited information on the state of the individual compartments of the knee joint. Second, the classification system was constructed using cruciate-sacrificing implants and further modifications may subsequently be required with cruciate-retaining implant designs. Third, clinical photographs were used for assessment and determination of the grade of soft tissue injury as

**Table 3**

<table>
<thead>
<tr>
<th>Medial Soft Tissue Releases in Study Patients With Correctable and Noncorrectable Coronal Deformities.</th>
<th>RA-TKA</th>
<th>CJ-TKA</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noncorrectable coronal deformity</td>
<td>15</td>
<td>12</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Medial zone soft tissue release</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>8</td>
<td>2</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>&lt;50%</td>
<td>7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Complete</td>
<td>0</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Release of POL and posteromedial capsule</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correctable coronal deformity</td>
<td>15</td>
<td>18</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Medial zone soft tissue release</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>&lt;50%</td>
<td>12</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Complete</td>
<td>0</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

CJ-TKA, conventional jig-based total knee arthroplasty; RA-TKA, robotic arm–assisted total knee arthroplasty; POL, posterior oblique ligament.

**Alignment and Fixed Flexion Deformity (FFD)**

In the cohort of patients who underwent RA-TKA, there was no correlation between preoperative FFD and the proposed MASTI score (Pearson’s coefficient = −0.29, P = .2). The extent of preoperative malalignment did not correlate with the proposed MASTI score (Pearson’s coefficient = −0.21, P = .36). The clinical correction ability of preoperative malalignment did not have an impact on the soft tissue classification score (Pearson’s coefficient = −0.17, P = .41). In the cohort that underwent CJ-TKA, the extent of FFD weakly correlated with proposed MASTI score (Pearson’s coefficient = −0.35, P < .05). In this group, there was a stronger correlation between the extent of preoperative malalignment and proposed MASTI score (Pearson’s coefficient = −0.73, P < .05).

**Discussion**

This study showed that RA-TKA was associated with reduced bone and periarticular soft tissue injury compared with CJ-TKA. The MASTI classification system had high interobserver and intraobserver reliability for reporting the extent of iatrogenic bone and soft tissue injury during TKA. This proposed classification system may help to standardize reporting of bone and soft tissue injury during TKA and facilitate further research correlating periarticular soft tissue injury with different surgical techniques to long-term clinical outcomes and implant survivorship.

Accurate bone resection, implant positioning, and ligamentous tensioning are fundamental to achieving well-balanced flexion and extension gaps in TKA. Suboptimal soft tissue balancing may lead to increased risk of implant wear, instability, aseptic loosening, and revision surgery [31–35]. However, there is no uniform consensus on the sequence or extent to which these soft tissue releases should be performed to achieve balanced flexion and extension gaps, with some authors suggesting that all TKAs performed without navigation should undergo ligamentous releases, whereas others suggest that soft tissue balancing may only be appropriate in 50%-76% of cases [24–26]. In this study, intraoperative dynamic tracking enabled the surgeon to assess on-table alignment through the arc-of-motion, stability, range of movement, and laxity with varus and valgus straining. None of the patients undergoing RA-TKA required release of the posterior oblique ligament or postero-medial capsule and overall RA-TKA had reduced medial soft tissue releases compared with those undergoing CJ-TKA, despite no difference between the 2 groups relating to preoperative alignment and passive correctability. In the RA-TKA group, intraoperative manipulation and modifications to femoral and tibial bone cuts based on live onscreen changes in alignment and stability helped to achieve balanced flexion and extension gaps, without the need for extensive soft tissue releases.

Bone resection in RA-TKA was performed using an oscillating saw with visual, auditory, and tactile feedback. The sawblade in RA-TKA was only active within the confines of the stereotactic boundaries, which may have helped to better protect the periarticular soft tissue envelope compared to the manually controlled sawblade in CJ-TKA. Our findings are in keeping with a previous cadaveric study in which 6 blinded observers reported soft tissue trauma in cruciate-retaining TKAs and found RA-TKA was associated with reduced PCL injury, tibial subluxation, and patella ever-sion compared with CJ-TKA [20]. In our study, there was no gross ligamentous disruption in either treatment group, and the soft tissue trauma may be considered subtle subclinical findings, but previous studies on knee arthroplasty have shown that even limited soft tissue releases may promote changes in local and systemic inflammatory responses, leading to increased pain and delayed postoperative rehabilitation [26–29]. Siebert et al [30] retrospectively reviewed 70 patients who underwent RA-TKA and 50 who had CJ-TKA and reported that soft tissue swelling was far less in the former. The authors also reported that sawblade action confined to the boundaries of the stereotactic window in the robotic group may have helped to better control bone resection and limit injury to the periarticular soft tissue envelope.

In this study, we found that the conceptual benefits of the stereotactic window in RA-TKA were transferrable to clinical practice with reduced bone and soft tissue injury compared to CJ-TKA, but these findings should be interpreted with caution as there is no existing evidence correlating these periarticular injuries to long-term clinical results, functional outcomes, or long-term implant survivorship. Furthermore, patients undergoing RA-TKA had improved MASTI scores compared to CJ-TKA, but the clinical significance of the difference in mean scores between the 2 treatment groups is unknown at this stage. Studies have reported improved accuracy of implant positioning and short-term functional outcomes in RA-TKA compared to CJ-TKA [31–35], and the results of further higher quality studies comparing clinical outcomes, patient-reported outcome measures, complications, cost-effectiveness, and implant survival between the 2 surgical techniques are still awaited.
opposed to determining injury at the time of the surgical procedure. Fourth, the impact of this periarticular injury on the systemic inflammatory response, which can affect postoperative pain, and early functional recovery was not assessed in this study. Fifth, the majority of arthroplasty surgeons currently use CJ-TKA and so any potential benefits of this RA-TKA on bone and soft tissue injury may be purely academic until further studies correlating these benefits to long-term clinical outcomes are published.

Conclusion

Patients undergoing RA-TKA had decreased bone and periarticular soft tissue injury compared to those undergoing CJ-TKA. The proposed MASTI classification system had high interobserver and intraobserver reliability for assessing bone and soft tissue injury during TKA and may facilitate further research comparing and correlating the invasiveness of different surgical techniques to long-term clinical outcomes and implant survivorship.

References