ORIGINAL ARTICLE

Joint perception after hip or knee replacement surgery

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KEYWORDS

Joint;
Arthroplasty;
Perception;
Hip;
Knee;
Satisfaction

Summary

Introduction: Knee and hip arthroplasties are recognized as being effective. However, subjects with a prosthetic joint rarely report returned sensation comparable to their native joint.

Hypothesis: Joint perception by patients following hip joint replacement is better than following knee replacement and in both cases this perception is directly related to the clinical results measured with currently validated scores.

Patients and methods: Patient joint perception in prosthetic reconstruction was evaluated in 347 patients, 46 who underwent unicompartamental knee arthroplasty (UKA), 119 tricompartamental knee arthroplasty (TKA), 93 hip resurfacing (HR), and 89 total hip arthroplasty (THA). The subjects’ joint perception, their satisfaction, and the WOMAC clinical score were recorded and compared.

Results: Joint perception was significantly worse for knee arthroplasties (TKA and UKA) compared to hip arthroplasties (THA or HR) (P < 0.001). The WOMAC score was also significantly less favorable for knee arthroplasties than for hip arthroplasties (P < 0.0001). However, there was no significant difference for the clinical scores between TKA and UKA as well as between HR and THA. Joint perception was strongly correlated with the WOMAC score for all groups (R² = 0.951).

Discussion: No difference was found after more conservative surgeries such as HR or UKA compared to traditional arthroplasty procedures (THA or TKA). Demonstrating inferior results in comparison to the hip, knee arthroplasties deserve particular attention and can still be improved. The assessment of joint perception used in this study can be considered a valuable clinical tool that is strongly correlated to validated, but more complex to apply, clinical scores.

Level of evidence: Level III prospective case — control study.

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Introduction

Total hip arthroplasty (THA) and total knee arthroplasty (TKA) are recognized as being effective procedures in terms of pain relief and functional improvement [1–3]. These interventions are currently in full expansion given the aging of the population [1]. In the past few years, interest has renewed in the less invasive surgical options (preserving bone stock) such as hip resurfacing (HR) [4] and unicompartmental knee arthroplasty (UKA) [5]. Even though the long-term survival of this type of surgery remains uncertain, studies have demonstrated at least identical improvement compared to conventional arthroplasties [4–9]. Many studies have assessed patient satisfaction after prosthetic surgery, but, to our knowledge, none has yet analyzed patients’ joint perception after such surgery.

In this perspective, we developed a questionnaire evaluating patient joint perception after arthroplastic surgery to determine whether they considered this joint as "natural" or "artificial" and whether or not they associated it with a notion of functional restriction. This questionnaire was administered to a group of patients who had undergone knee surgery (TKA or UKA) or hip surgery (THA or HR) [10]. We sought to compare patients’ joint perception after hip or knee replacement. The working hypothesis postulated that joint perception in the hip would be better than in the knee and that in both cases, this perception was directly related to the clinical results measured with validated scores.

Patients and methods

Patients

From 2003 to 2006, patients treated with knee or hip arthroplasty who accepted to participate in a study that evaluated perception in their operated joint were consecutively included in the study. This study was accepted by our institution’s ethics committee. One hundred sixty-five knees (46 UKAs and 119 TKAs) were included. To compare these data with the data of the patients undergoing hip surgery, we used a series of 182 hip arthroplasties (randomized for a HR [93 cases] or a metal-on-metal 28-mm total hip prosthesis [89 cases]) with 2 years minimum follow-up [10]. The descriptive data for each subgroup in clinical and demographical terms are summarized in Table 1. An age difference was found between the hip group (49.5 years) and the knee group (63.5 years) (P < 0.001). Similarly, there was a difference between the UKA (57.6 years) versus the TKA (69 years) subgroups (P < 0.0001).

Surgical technique

All the total knee prostheses were implanted according to the manufacturer’s recommendations, via a medial parapatellar arthroscopy approach. They were posterior-stabilized cemented implants (NexGen, Zimmer, Warsaw, IN, USA). For the unicompartmental knee prostheses, a parapatellar mini-arthroscopy was performed (cemented Accuris, Smith and Nephew, Memphis, TN, USA). All the hips were operated via a posterolateral approach. The HR implantation technique (Durom, Zimmer) has been described elsewhere [11]. The THA prostheses comprised a CTS stem combined with a cementless 28-mm metal-on-metal cup (Allofit and Metasul, Zimmer).

Clinical evaluation

To assess patient joint perception, a questionnaire was elaborated. The patient was asked to respond to a simple multiple-choice question: "How do you perceive your operated knee/hip?" The possible responses were:

- like a native or natural joint.
- like an artificial joint with no restriction.
- like an artificial joint with minimal restriction.
- like an artificial joint with major restriction.
- like a nonfunctional joint.

Clinical function was evaluated using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) [12] at a minimum follow-up of 1 year. The WOMAC score stratified the patients into three subgroups on the pain, stiffness, and function items. Each subgroup was represented by the sum of the items, a high score indicating mediocre function or a high pain level.

Statistical analysis

The two groups were compared using the Student t-test and the chi-square test for the continuous and categorical variables, respectively. The Anova and Fisher tests were used to compare the groups on multiple variables. The WOMAC score and assessment of perception were analyzed with the

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Patient descriptive data by type of prosthesis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of implant</td>
<td>UKA (n = 46)</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>57.6</td>
</tr>
<tr>
<td>Sex</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>F</td>
</tr>
<tr>
<td>Side</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>L</td>
</tr>
</tbody>
</table>

UKA: unicompartmental knee arthroplasty; TKA: total knee arthroplasty; HR: hip resurfacing; THA: total hip arthroplasty.
Anova test. The continuous variables are presented with their mean and standard deviation (SD). SPSS™ 15.0 software (SPSS Inc., Chicago, IL, USA) was used. The degree of significance was $P < 0.05$.

## Results

The TKA and UKA groups were compared at a mean follow-up of 35 months (range, 12–49 months), whereas the THA and HR groups were compared at a mean follow-up of 24 months (range, 20–30 months).

Patients’ perception of their operated joint was different in the hip and knee groups ($P < 0.001$, Table 2). In the knee subgroup, there were no differences between TKA and the UKA ($P = 0.471$). More than half (56%) of the hip group patients considered their joint as “natural” and 77% experienced no functional restriction. On the other hand, only 22% and 41%, respectively, of the knee group patients presented these results ($P < 0.0001$, Table 2). For 15% (24/165) of the patients with a knee prosthesis, the joint seemed “artificial with major restriction.” The same result in the hip group was found in only 0.6% (1/182) of the cases ($P < 0.0001$, Table 2).

The WOMAC score was analyzed in the four subgroups at the longest follow-up (Table 3). There was a significant difference between the hip and knee groups ($P < 0.0001$, Fig. 1), whereas there was no difference between the TKA and UKA groups ($P = 0.263$) and between the HR and THA groups ($P = 0.09$).

Patient perception of the joint was strongly correlated with the WOMAC score in the four subgroups (Pearson correlation = 0.975, $R^2 = 0.951$; Table 4 and Fig. 2).

## Discussion

The success of hip or knee arthroplasty can be assessed in various ways based on the surgeon’s or patient’s opinion [3]. No data have been reported in the literature on joint perception as evaluated by the patient. We believe that a simple question on how the patient perceives the joint is a highly instructive response. We found differences in terms of joint perception between knee and hip prostheses. Indeed, 77% of the patients operated on their hip (THA or HR) considered their hip to have no functional restriction, whereas only 41% of the patients operated on their knee (TKA or UKA) ($P < 0.0001$) felt the same way.

There are several limitations to this study. The patient groups differed in terms of age. In addition, for the knee group, the patients were not randomized for TKA or UKA. However, the better results expected for the UKA group compared to the TKA group were not confirmed. It may also be possible that the patients in the hip group (THA or HR) were more active than the patients in the knee group (TKA or UKA). However, the main question of this study on patient

### Table 2 Patient joint perception by type of implant.

<table>
<thead>
<tr>
<th>Perception</th>
<th>Type of prosthesis</th>
<th>$P$</th>
<th>HR (93)</th>
<th>THA (89)</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural joint</td>
<td>UKA (46)</td>
<td>0.408</td>
<td>49 (53%)</td>
<td>52 (58%)</td>
<td>0.179</td>
</tr>
<tr>
<td></td>
<td>TKA (119)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artificial with no limitations</td>
<td>11 (24%)</td>
<td>0.374</td>
<td>19 (20%)</td>
<td>19 (21%)</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artificial with minimal limitations</td>
<td>15 (33%)</td>
<td>&lt;0.0001</td>
<td>25 (27%)</td>
<td>17 (19%)</td>
<td>0.224</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Artificial with major limitations</td>
<td>17 (14%)</td>
<td>0.01</td>
<td>0 (1%)</td>
<td>1 (1%)</td>
<td>0.238</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonfunctional joint</td>
<td>1 (2%)</td>
<td>0.481</td>
<td>0</td>
<td>0</td>
<td>0.223</td>
</tr>
<tr>
<td></td>
<td>2 (1%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall UKP vs. TKA</td>
<td>0.447</td>
<td></td>
<td>Overall THA vs. HR</td>
<td>0.471</td>
<td></td>
</tr>
</tbody>
</table>

UKA: unicompartmental knee arthroplasty; TKA: total knee arthroplasty; HR: hip resurfacing; THA: total hip arthroplasty.

### Table 3 WOMAC score by type of implant.

<table>
<thead>
<tr>
<th>Type of implant</th>
<th>$N$</th>
<th>Mean WOMAC</th>
<th>Standard deviation of the mean</th>
<th>$P^a$</th>
<th>$P^b$</th>
</tr>
</thead>
<tbody>
<tr>
<td>UKA</td>
<td>44</td>
<td>20.4</td>
<td>17.5</td>
<td>0.263</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>TKA</td>
<td>119</td>
<td>24.2</td>
<td>19.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR</td>
<td>93</td>
<td>5.6</td>
<td>8.3</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>THA</td>
<td>89</td>
<td>8.2</td>
<td>11.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

UKA: unicompartmental knee arthroplasty; TKA: total knee arthroplasty; HR: hip resurfacing; THA: total hip arthroplasty; WOMAC: Western Ontario and McMaster Universities Arthritis Index [12].

$^a$ UKA versus TKA and HR versus THA.

$^b$ Hip versus knee replacements.
joint perception was designed to evaluate the degree of patient satisfaction (which is not necessarily correlated with pain, mobility, or function). Finally, we did not measure the reproducibility of the perception questionnaire on the entire population, but the patients who had undergone THA or a HR had a repeated evaluation of this perception [10,13,14], which showed no variation beyond the 6th postoperative month. Several studies found better functional scores (WOMAC, SF-36, etc.) after THA compared to TKA [15–18], notably because of the younger age of the patients operated for their hip [15,16]. It also seems that, whatever the location of the arthroplasty, the preoperative functional level preponderantly conditioned the level after surgery [16]. Noble et al. [19] analyzed patients’ activity after TKA compared to THA patients’ activity after TKA. Even though 40% of the functional restriction was attributable to age, arthroplasty itself appeared to have a negative influence, which suggests the importance of improving implant design and surgical technique [19]. Pollard et al. [6] observed a better UCLA and EuroQol activity score in patients with a HR implant compared to those with a THA. This was confirmed by Vail et al. [20], who also found better range of joint motion in the HR group. Similarly, Lavigne et al. [13] found a higher level of sports activity in the HR group than in the TKA group. However, selection bias may play a role in candidates for HR, who often have a higher preoperative activity level than candidates for a TKA [4,6,20].

The present study found no difference in joint perception between the HR and TKA groups. This is reinforced by an analysis of the spatiotemporal parameters during gait analysis comparing THA with HR patients, which found no significant difference [14]. In the end, patient selection and preoperative activity level seem to play a determining role in the final functional result.

Several studies have reported better clinical results with UKA compared to TKA [7,21,22]. One of the explanations advanced is better proprioceptive dynamics observed after UKA [7]. A study comparing UKA and TKA found that 54% of the UKA patients felt excellent stability climbing stairs versus only 15% of the TKA patients [21]. This is probably secondary to the fact that UKA allows better preservation of the joint kinematics [22], low perioperative morbidity [8], low blood loss, and rapid recuperation [5,8,21].

We found no differences for the WOMAC score between the UKA and TKA groups. This was confirmed by Amin et al. [9], who observed no difference for the knee society score and joint range of motion in two paired UKA and TKA groups. Return to sports activities seems facilitated after implantation of a unicompartmental knee prosthesis via a minimally invasive approach compared to a total knee

<table>
<thead>
<tr>
<th>Table 4</th>
<th>WOMAC score versus patients’ joint perception.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients’ perception</td>
<td>N</td>
</tr>
<tr>
<td>Natural joint</td>
<td>141</td>
</tr>
<tr>
<td>Artificial with no limitations</td>
<td>69</td>
</tr>
<tr>
<td>Artificial with minimal limitations</td>
<td>114</td>
</tr>
<tr>
<td>Artificial with major limitations</td>
<td>26</td>
</tr>
<tr>
<td>Nonfunctional joint</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>352</td>
</tr>
</tbody>
</table>

WOMAC: Western Ontario and McMaster Universities Arthritis Index [12].
Joint perception after hip or knee replacement surgery

prosthesis [23]. However, this result is tempered by Wyld et al. [24], who found no difference in terms of sports activities between their TKA, UKA, THA, and HR groups. Ultimately, even though it seems that the activity level and the final clinical result are better after UKA than after TKA [7,21,22], initial patient selection bias (as for HR) may explain this difference [23].

One of the most interesting results of the present study is the correlation established between patient joint perception and the functional scores, identical to the correlations already found between the degree of satisfaction and SF-36 and/or Oxford type scores [25]. Moreover, in light of our results, it seems that function is a vital factor in joint perception. On the other hand, although the surgical technique and the implants are different, it does not seem that these factors played a role in patients’ perception. This raises the question of knowing whether a simple questionnaire such as the one established in the present study would be sufficient to assess the functional result of an arthroplasty.

The rate of dissatisfaction observed after arthroplasty of the lower limb varied from 8 to 30% [26] and appeared to be multifactorial (residual pain, activity limitation, unrealistic expectations on the part of the patients). For Gandhi et al. [25,26], the satisfaction rate was not correlated with the WOMAC score. In contrast, patients presenting a high preoperative WOMAC score, poor joint range of motion at the follow-up, advanced age, and a high preoperative pain rate were more at risk of developing dissatisfaction after surgery [25–28]. Conversely, the factors of arthroplasty success were age under 60 years at surgery, absence of residual pain and functional restriction, and similar expectations and results [29]. Patient satisfaction after TKA is closely related to patients’ expectations and not to their level of activity [30]. A TKA today does not restore perfect knee kinematics and some daily activities may be limited compared to healthy subjects [19]. However, it is interesting to observe that 48.3% of dissatisfied patients after TKA are correlated with prosthetic problems, but that in 51.5% of cases, the symptoms are not related to the surgical site itself [27]. It therefore seems vital before THA to evaluate the adjacent joints and/or lumbar problems that may result in residual dissatisfaction. This does not seem to be necessary in hips, for which the satisfaction rate after a HR is more than 95% at 7 years of follow-up [31]. It therefore seems difficult to confidently isolate a predictive factor for success in this surgery [28,32]. Proceeding to surgery relatively quickly before too great a decline in function develops seems to be associated with better results [33].

The ultimate objective of an arthroplasty is to obtain a natural joint corresponding to item one of our questions. Although the joint may seem artificial, this does not necessarily mean restriction of activities (item two or three). We believe that patients classified as grades 1, 2, or 3 can be considered surgical successes. However, the onset of severe restrictions (grade 4) or the presence of a nonfunctional joint (grade 5) are both failures.

Conclusion

The evaluation of joint perception used in this study can be considered a valuable clinical tool because it is strongly correlated to validated clinical scores, which are more complex to administer. This study (perceptions and validated scores) found no advantage after HR or UKA compared to traditional surgery (THA or TKA). Compared to hip arthroplasties, knee arthroplasties deserve greater attention and further research aiming to improve their results so as to more closely imitate the physiological joint.

Disclosure of interest

Dr. P.-A. Vendittoli is a consultant for Wright Medical, Zimmer, Stryker, and Biomet. Dr. M. Lavigne is a consultant for Wright Medical, Zimmer, Stryker, and Biomet. Julien Girard is a consultant for education and research at Zimmer and Wright Medical.

References