



## Review Article

# Patient-specific instrumentation in total knee arthroplasty. Should we adopt it?☆

Ana Sofia Teles Rodrigues\*, Manuel António Pereira Gutierrez

Universidade do Porto, Faculdade de Medicina, Departamento de Ortopedia e Traumatologia, Porto, Portugal

### ARTICLE INFO

#### Article history:

Received 9 March 2016

Accepted 13 June 2016

Available online xxx

#### Keywords:

Arthroplasty

Replacement

Knee/instrumentation

Patient-specific modeling

Knee prosthesis

Prosthesis design

### ABSTRACT

Total knee arthroplasty (TKA) is a surgical procedure of paramount relevance that restores a substantial degree of function in arthritic knees. Increased consideration has been given to the influence of limb alignment on longevity after TKA, as errors in component placement can be associated with inferior function and compromised long-term performance. Consequently, numerous studies comparing patient-specific instrumentation (PSI) to standard instruments (SI) have been published. Patient-specific approaches use preoperative imaging to create specific materials for each patient's anatomy and were designed to achieve a higher rate of success in TKA, causing the entire procedure to be more efficient and cost-effective. However, it is not clear to what degree these studies support the potential advantages of PSI. Thus, the present study aimed to review the current evidence comparing PSI to SI, concerning alignment, cost-effectiveness, and postoperative functional evaluation.

© 2016 Published by Elsevier Editora Ltda. on behalf of Sociedade Brasileira de Ortopedia e Traumatologia. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### Instrumentação personalizada na artroplastia total do joelho. Devemos adotá-la?

#### RESUMO

A artroplastia total do joelho (ATJ) é um procedimento cirúrgico de fundamental relevância que restaura boa parte da função de joelhos artríticos. Maior atenção tem sido dada à influência do alinhamento do membro na longevidade após a ATJ, uma vez que erros no posicionamento dos componentes podem estar associados à uma menor função e comprometimento do desempenho a longo prazo. Consequentemente, vários estudos compararam a instrumentação personalizada para cada paciente (IPP) com a instrumentação padrão (IP). As abordagens personalizadas usam imagens pré-operatórias para criar materiais específicos para a anatomia de cada paciente e foram projetados para

#### Palavras-chave:

Artroplastia

Substituição

Joelho/instrumentação

Modelagem personalizada

Prótese do joelho

Desenho de prótese

☆ Work performed in the Universidade do Porto, Faculdade de Medicina, Porto, Portugal.

\* Corresponding author.

E-mail: [a.sofiateles@gmail.com](mailto:a.sofiateles@gmail.com) (A.S. Rodrigues).

<http://dx.doi.org/10.1016/j.rboe.2016.06.008>

2255-4971/© 2016 Published by Elsevier Editora Ltda. on behalf of Sociedade Brasileira de Ortopedia e Traumatologia. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

atingir uma maior taxa de sucesso na ATJ, tornando todo o processo mais eficiente e rentável. No entanto, não está claro até que ponto tais estudos respaldam as vantagens potenciais da IPP. Assim, o presente estudo teve como objetivo avaliar as evidências atuais, comparando IPP e IP em respeito ao alinhamento, relação custo-benefício e avaliação funcional pós-operatória.

© 2016 Publicado por Elsevier Editora Ltda. em nome de Sociedade Brasileira de Ortopedia e Traumatologia. Este é um artigo Open Access sob uma licença CC BY-NC-ND (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Introduction

Total knee arthroplasty (TKA) is considered a successful orthopedic procedure in the management of degenerative joint disease based on the rate of revision. It represents one of the most regularly performed musculoskeletal procedures, restoring, in most cases, a substantial degree of function in arthritic knees. One can anticipate an increase in TKA in the future, given estimated enlargement in population size and longevity. Therefore, perfecting surgical technique is of paramount relevance, as errors in component placement can be associated with inferior function and compromised long-term performance.<sup>1,2</sup>

For the past few years, increased consideration has been placed on the influence of limb alignment and component position on longevity and outcomes after TKA, reviewing the survivorship and postoperative performance of the procedure.<sup>3-5</sup> It has been established that neutral mechanical alignment is critical in the overall success of the surgical technique.<sup>2,6</sup> Consequently, tibial and femoral component malalignment remains a significant concern, as deviations exceeding 3° of varus/valgus in the mechanical axis have been related with poor survivorship due to the accelerated wear resultant of abnormal stresses at the bearing surfaces. Accordingly, tibial and femoral components are needed to be placed as precisely as possible and preventing malalignment may prove to be cost-effective.

That being said, two technological advancements, aiming at improving the likelihood of achieving neutral TKA alignment, have emerged: computer-assisted navigation and patient-specific instrumentation (PSI).<sup>7</sup> Recently, numerous comparative studies and randomized controlled trials that compare patient-specific cutting blocks to conventional instruments have been published. However, it is not clear to what degree these studies support the potential advantages of PSI.<sup>8-10</sup> For that reason, the purpose of the present study is to perform a review of the current evidence comparing PSI to SI, concerning alignment, cost-effectiveness and postoperative functional evaluation. Existing information concerning computer-assisted navigation will not be assessed in this review.

## Patient-specific instrumentation

Aiming at enhancing the outcomes of the surgery, the manufacturing process for knee implants has improved over the years, involving, lately, patient-specific approaches. The

purpose was to get the most accurate positioning for the tibial and femoral components.<sup>3,11</sup> This technology employs the generation of a preoperative image of the knee, along with hip and ankle images for the evaluation of the overall alignment of the limb, most commonly computed tomography (CT) or magnetic resonance imaging (MRI). Computer software is used to generate an ideal three-dimensional (3D) model of the patient's lower limb anatomy, allowing the anatomical landmarks of the knee to be easily identified, and to create the 3D models of the femoral and tibial components with optimal size, position and alignment. A preoperative plan proposed with bony resections is generated and provided to the operating surgeon, who is then able to assess the 3D planning of the knee implant with the proposed bony resections and with the final implants in place. At this point, the surgeon is expected to approve or review the preoperative plan, adjusting as required bony resection. When approved, generally within 3 weeks, the manufacturer fabricates a corresponding set of custom cutting blocks individualized to the patient's native anatomy.<sup>1,3</sup> These cutting jigs are expected to not only determine the proper coronal orientation, but also set the depth of femoral and tibial resection, anteroposterior position, rotation, and slope based on the preoperative prototype. Alterations in preoperative scheduling are inevitable with the implementation of PSI: first, the planning process has to be anticipated, since, as mentioned above, at least 3 weeks are necessary to fabricate the cutting blocks; second, the 3D imaging studies mandatory preoperatively were not typically performed previously for conventional TKA. At last, manufacturer and surgeon must cooperate for the elaboration and approval of the preoperative plan, ensuring that the guides are available by the time of the procedure.<sup>7,12</sup>

Patient-specific instrumentation was designed to achieve a higher rate of success in TKA, decreasing the odds of revision. The anticipated benefits of this technology are numerous, causing the entire procedure to be more efficient and cost-effective.<sup>7,13,14</sup>

First, being the patient-matched technology potentially more precise and accurate, with a reduction in the number of outliers expected to be significant, neutral postoperative alignment would be more reproducible with the use of patient-specific jigs when compared to standard alignment techniques.<sup>12</sup> Second, the surgeon has preoperative data regarding the size and location of the bony resections, along with implant sizing and rotation information. This way, it is possible to intraoperatively determine if the surgery is proceeding as expected. Third, as fewer instruments trays are required per procedure, the sterilization costs would be reduced.<sup>12,15</sup> Fourth, a more efficient surgery is predicted with

Download English Version:

<https://daneshyari.com/en/article/8600199>

Download Persian Version:

<https://daneshyari.com/article/8600199>

[Daneshyari.com](https://daneshyari.com)