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Original Article

Total knee arthroplasty with computer-assisted navigation: an analysis of 200 cases☆,☆☆

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ABSTRACT

Objective: to evaluate the results from surgery with computer-assisted navigation in cases of total knee arthroplasty.
Method: a total of 196 patients who underwent total knee arthroplasty with computer-assisted navigation were evaluated. The extension and flexion spaces (gaps) were evaluated during the operation and the alignment after the operation was assessed. The Knee Society Score (KSS) questionnaire for assessing patient's function was applied preoperatively and postoperatively after a mean follow-up of 22 months.
Results: in all, 86.7% of the patients presented good alignment of the mechanical axis (less than 3° of varus or valgus in relation to the mechanical axis) and 96.4% of the patients presented balanced flexion and extension gaps. Before the operation, 97% of the patients presented poor or insufficient KSS, but after the operation, 77.6% presented good or excellent KSS.
Conclusion: the navigation system made it possible to achieve aligned and balanced implants, with notable functional improvement among the patients. It was found to be useful in assessing, understanding and improving knowledge in relation to performing arthroplasty procedures.

Artroplastia total do joelho auxiliada por navegação: análise de 200 casos

Palavras-chave:
Artroplastia de substituição

RESUMO

Objetivo: avaliar os resultados das cirurgias assistidas por navegação (CAN) nas artroplastias totais de joelho.

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Joelho
Cirurgia assistida por computador

Método: foram avaliados 196 pacientes submetidos à artroplastia total de joelho com auxílio da navegação por computador. Avaliados no intraoperatório os espaços (*gaps*) de extensão e de flexão, o alinhamento pós-operatório e o questionário funcional da Knee Society Score (KSS) pré-operatório e pós-operatório com seguimento médio de 22 meses.
Resultados: dos pacientes, 86,7% apresentaram bom alinhamento do eixo mecânico (dentro de 3° de varo ou valgo em relação ao eixo mecânico) e 96,4% apresentaram ambos os *gaps* de flexão e extensão balanceados. No pré-operatório, 97% dos pacientes apresentavam KSS funcional ruim ou insuficiente, no pós-operatório 77,6% apresentavam KSS funcional bom ou excelente.
Conclusão: a navegação proporcionou a obtenção de implantes alinhados e balanceados com importante melhoria da função nos pacientes. Foram evidenciados sua utilidade no estudo, o entendimento e o aperfeiçoamento do conhecimento na execução das artroplastias.

Introduction

Total knee arthroplasty (TKA) is a safe and effective treatment for restoring function and relieving pain in patients with gonarthrosis (knee osteoarthrosis). With the aging of the population, there has been a tendency toward increasing numbers of patients with this pathological condition and greater demand for TKA. Within this scenario, searching for new options that might contribute toward improving the results and refining the procedure is very valuable.

Success in knee arthroplasty is influenced by factors relating to the patient, type of implant and surgical technique. In relation to the procedure, adequate positioning of the components and consequent good alignment of the limb are important prognostic factors. Incorrect positioning may affect implant functioning, increase the wear on the material and cause loosening of the prosthesis. Studies have demonstrated that aligning the components within 3° of the normal mechanical axis diminishes the risks of irregular wear and early loosening.[1]

The development of instruments with intramedullary and extramedullary guides has increased the accuracy of implant alignment, but alignment errors still occur. Tibial component alignment errors exceeding 3° with the use of an extramedullary guide were described in 21.3% of the cases in one series.[2]

Navigation was developed as a tool to increase the precision of correct positioning of the implants in total knee arthroplasty. It is a reproducible and precise method for bone resection and ligament balancing, and is also accurate for evaluating limb alignment.[3] A survey conducted among members of the European Society of Sports Traumatology, Knee Surgery and Arthroscopy and the Swiss Orthopedic Society showed that 33.1% of surgeons use navigation in at least 50% of TKA procedures and 25% use it in more than 75% of them.[4]

In this study, we discuss the short-term results from primary total knee prostheses that were implanted with the aid of computer-guided navigation, including evaluations of the postoperative mechanical axis and postoperative function over the short term.

Methods

Study design and sample characteristics

After approval by the Research Ethics Committee of Hospital São Paulo (Unifesp), 200 patients were selected consecutively to undergo TKA. All the patients presented indications for arthroplasty in conformity with the inclusion and exclusion criteria described below. This study was thus characterized as a prospective case series.

Patients with a radiographic diagnosis of primary osteoarthrosis who had not presented improvement in their pain and functional conditions after a minimum of six months of conservative treatment were included. Revision arthroplasty patients and those with active infection or loss of extensor mechanism function were excluded.

Surgical technique

After a median longitudinal skin incision had been made, medial parapatellar arthrotomy was performed. After the joint had been exposed, pins with passive reflective sensors were implanted in the anteromedial region of the distal femur and proximal tibia, for the navigator to read. The reference points requested by the navigator were then gathered (femoral intercondylar center, center of hip rotation, internal and external rotation of the tibia, knee range of motion between 0° and 90°, center of ankle rotation, posterior limits of the femoral condyles, anterior femoral cortical bone, center of the medial and lateral plateaus, center of the proximal tibia, center of the ankle, centers of the lateral and medial malleoli and joint inclination of the femur). The information relating to the patient's anatomy and joint ranges of motion were then input to the software.

After data-gathering had been concluded, the patient's initial mechanical axis was informed by the system. Cuts were then made, firstly in the tibia, always orthogonal to its mechanical axis and without posterior inclination. Before femoral cuts were made, the ligaments were balanced in flexion and extension, by means of laminar tensioners under the control of the navigator on a millimeter scale. These data on the gap (space) in flexion and extension were filed by the system and registered as initial data. After this step, planning for