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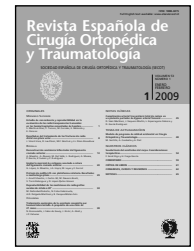

ORIGINAL PAPERS

LCS rotating Platform total knee replacement: medium to long-term results

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KEYWORDS
Knee;
Total knee replacement;
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Abstract
Purpose: To review the clinical and radiological results of a series of rotating platform knee arthroplasties with a follow-up of 6-12 years.
Materials and methods: This is a retrospective study of 133 arthroplasties implanted in our hospital between 1994 and 2001 using the original surgical technique. We applied the Knee Score and the Function Score of the American Knee Society in order to carry out the corresponding clinical assessment and radiological study.
Results: Six (4.5%) prostheses were totally or partially revised (2 cases of infection, 1 rotating platform spin out, one loosening of the tibial component, 1 instability and unidentifiable pain). Another 9 (6.7%) were operated without withdrawing any components (4 cases of soft tissue friction, one extra-articular infection, one femoral fracture, one bone calcification resection, one patellar prosthetization and one patellar fracture). All complications occurred before the third year. There was no component wear or any significant levels of osteolysis. Mean Knee and Function scores were very high: 90.6 and 86.5 respectively.
Conclusions: Clinical-radiographic medium- to long-term results for this rotating platform prosthetic design are highly satisfactory, albeit at the expense of a slight increase in the number of early complications.

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PALABRAS CLAVE
Rodilla;
Prótesis total de rodilla;
Plataforma rotatoria

Prótesis de rodilla LCS con plataforma rotatoria. Resultados a medio-largo plazo

Resumen
Objetivo: revisar los resultados clínicos y radiológicos de una serie de artroplastias de rodilla con plataforma rotatoria con un seguimiento de 6 a 12 años.
Material y método: estudio retrospectivo de 133 artroplastias intervenidas en nuestro centro, entre 1994 y 2001, mediante la técnica quirúrgica original. Aplicamos el Knee Score y Function Score de la American Knee Society para su valoración clínica y el estudio radiológico correspondiente.
Resultados: en 6 (4,5%) prótesis se realizó recambio total o parcial, 2 por infección, otra por luxación de la plataforma rotatoria, una por aflojamiento del componente tibial, una por inestabilidad y otra por dolor de causa incierta. En otras 9 (6,7%) se intervino sin retirar los componentes: 4 por fricción de partes blandas, una infección extraarticular, una fractura de fémur, una resección de calcificación ósea, una protetización de rótula y una fractura de rótula. Todas las complicaciones tuvieron lugar antes del tercer año. No hubo desgaste de los componentes ni osteólisis importantes. La puntuación media para la rodilla y la función fue muy alta (90,6 y 86,5).
Conclusiones: los resultados clínico-radiográficos a medio-largo plazo de este diseño protésico con plataforma rotatoria son muy satisfactorios, aunque a costa de un discreto incremento de complicaciones precoces.

Introduction

The LCS prosthesis is a knee arthroplasty that allows the preservation (mobile bearing) or the resection (rotating platform) of the posterior cruciate ligament. The LCS is a low-constraint implant that seeks to reduce polyethylene wear by dissipating the stresses experienced at the prosthesis-bone interface and to achieve an automatic correction of minor rotating alterations between the femoral and tibial components. Published results have so far been highly satisfactory in terms of survivorship[1,2]. The LCS prosthesis is the longest standing mobile bearing knee and the one that has had the longest follow-up[3,4]. This is probably the reason why this is a widely used knee implant; in some countries the most widely used one, according to the National Arthroplasty Registers[5,6]. Many of the hospitals use this implant for all their knee replacements, with the uncemented variant being used in the longest follow-up series[7]. Nonetheless, other authors have published early complications like osteolysis, breakage and instability especially in mobile bearing LCS prostheses[8,9]. In the present study we analyze the medium and long-term follow-up of 133 LCS PR® fully cemented prostheses, in a general hospital that also uses other primary total knee replacement systems.

The purpose was to analyze whether the risk of early potential complications inherent in a more demanding technique may be justified by an allegedly longer long-term survivorship.

Materials and methods

Between January 1994 and December 2001 138 LCS RP® knee prostheses were implanted in our Department by 4 surgeons. Mean age was 65.6 years (range: 54-91). At the beginning we used this prosthetic model only in patients under 65 years of age, but we then progressively raised the age threshold. Three patients died before the fifth year and another 2 were lost to follow-up, which left us with a total 133 prosthesis for study. Of these, 109 (82%) were women and 24 (18%) were men. In 126 (94,7%) cases, the diagnosis was primary osteoarthritis, in 5 (3,8%), rheumatoid arthritis and in 2 (1,5%), aseptic necrosis. On Insall's classification[10], 31 patients were type A (monoarticular); 96 type B (both knees), and 6 type C (multiarticular involvement). Mean follow-up was 7.81 years (range: 5-13).

Surgical technique

In all cases we carried out the femoral, tibial and patellar arthroplasties following the original technique, except for a few details that we shall describe in what follows. There were 12 (9%) uncemented arthroplasties (the initial ones), 22 (16.5%) hybrid arthroplasties, where the femoral component was not cemented, and 99 (74.4%) fully cemented arthroplasties. The patellar prosthesis used was the original rotating one in all cases, except for 2 cases of *patella infera* in which we used a patellar button. In 10 cases no patellar prosthesis was used. Ischemia was used in all the procedures, with the cuff being removed before closing the wound to achieve hemostasis. A classical anteromedial incision was performed in all cases, except for 4 cases in which an anterolateral incision was performed because of severe genum valgum. Both cruciate ligaments were sectioned in all cases, with the collateral ligaments and posterior capsule being released subperiostically as needed to obtain symmetrical flexion and extension gaps. We always used intramedullary alignment guides for the

femur and the tibia. We used drainage with no aspiration for 24 hours. Rehabilitation with walking and mobility was initiated at 48 hours, as tolerated by the patient. Antithrombotic prophylaxis was used with low molecular weight heparin in all cases.

Patients were followed up both clinically and radiologically before surgery, at 6 and 12 weeks and, if no problems were detected, once a year. Clinical and radiological evaluation was carried out following the criteria of the American Knee Society[10,11]. Clinically, these criteria make a distinction between objective and functional assessment, with a maximum 100 points for each. Scores between 90 and 100 are considered excellent; those between 80 and 89 good, those between 70 and 79 fair and those below 70, poor. Radiographic evaluation included weightbearing anteroposterior x-rays and lateral and axial patellar views. Periprosthetic radiolucencies were observed in different areas.

Results

From the clinical point of view, following the criteria of the American Knee Society, the mean score was 90.6/100 for the objective scale (knee score) and 86.5/100 for the functional scale (fig. 1). The same review had been performed 4 years before, when the score obtained for the same group of patients had been practically the same (0.58 points for the objective evaluation and 0.9 points for function).

Apart from revisions, we observed clinically asymptomatic radiolucencies smaller than 2 mm below the tibial component in 27 cases, and below the femoral component in 7. The number of radiolucencies Could have been higher, but the x-ray views are not always optimal, especially those of the femur.

Two fissures were caused in the tibia on implanting the component. No special measure was taken because we thought that cementing the component would provide enough stability. One of them evolved satisfactorily while the other, caused by a reoperation of an old tibial osteotomy, went on to develop a subclinical infection, which required a two-stage revision.

There was one case of pulmonary thromboembolism, which healed uneventfully and 2 cases of early deep venous thrombosis that occurred in spite of the prophylaxis: one resolved fully while the other led to a postphlebitic syndrome.

Three persistent wound seromas resolved uneventfully, except for one case that developed into a painful aseptic arthrofibrosis, which had to be debrided, with only partial success.

We carried out 2 manipulations under anesthesia due to early stiffness; one of them did not obtain the expected result.

We operated on 9 (6,7%) patients without component removal. The reasons were as follows: soft tissue friction (4 cases), extraarticular infection (1 case), femoral fracture (1 case), resection of bone calcification (1 case), placement of patellar prosthesis (1 case), patellar fracture (1 case). The patellar fracture was subsequently addressed with a prosthesis.

In 6 of the 133 patients that were followed up it was necessary to revise at least one of the prosthetic components. One patient with Parkinson's disease had a flexum deformity and a genum valgum that made it necessary to release the posterior cruciate ligament and the posterolateral complex. At 3 weeks post-op the patient suffered a component spin

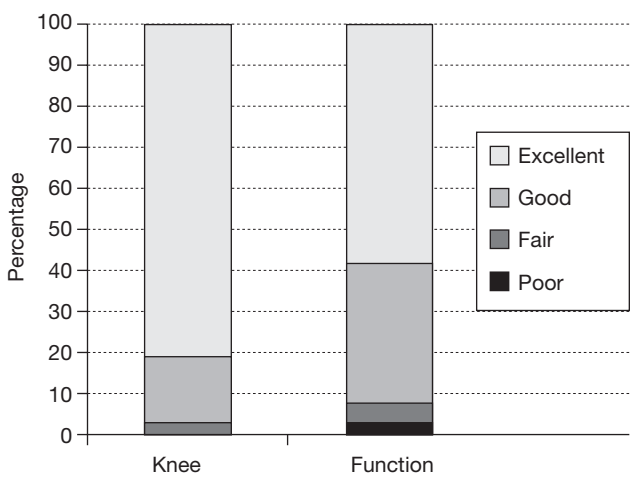

Figure 1 Results at the end of follow-up (man: 7.81 years). 1=Knee Score/100; 2=Function Score/100.

Figure 2 Radiographic image showing a case of spin-out.

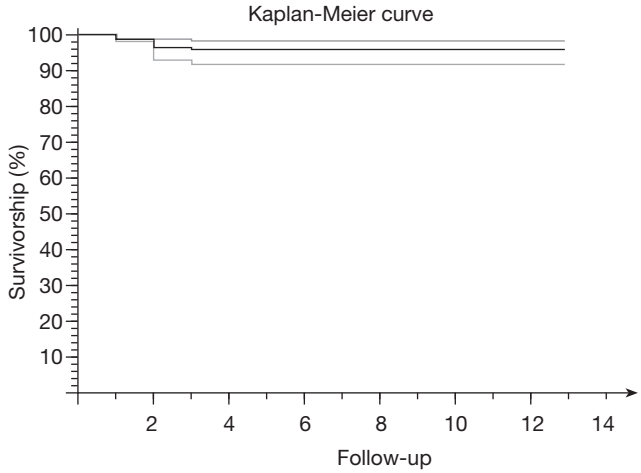

Figure 3 Survivorship curve of the rotating platform LCS prosthesis.

out on stressing her flexed knee (fig. 2), which prompted a revision surgery to implant a ticker polyethylene component that would enhance stability; although there have been no subsequent spin-outs, the functional result obtained is poor. Another 2 patients developed an infection (one of them with a prior surgery) and required a two-stage revision. Another patient was subjected to a single-stage revision for idiopathic pain, which improved satisfactorily. Another presented with tibiofemoral laxity, which led to exchanging her PE component for a taller one. The last case experienced aseptic loosening of the tibial component during the third year; the said component was exchanged for a long-stemmed one, with a good result. So over a mean follow-up of 7.8 years survivorship was 95.5%(fig. 3).

Discussion

The introduction of mobile bearings in knee replacement was aimed, in the first place, at reducing polyethylene wear by providing a larger contact area[1,12–14]. Furthermore, as mobile bearings do not constrain the action of ligaments or muscles on the joint, they are able to correct knee alignment, especially in the rotational axis, providing the patient with a greater feeling of comfort and propioception. Mobile bearing knees also partially dissipate stresses acting on the prosthetic-bone interface by permitting absorption of the said forces at the sliding planes of the prosthesis[13,15,16]. These designs also allow for mobility to occur between both the polyethylene and tibial components and the polyethylene and femoral components. The LCS prosthesis, the longest-standing implant of its kind, offers two options. The first is a design that preserves the posterior cruciate ligament with mobile bearings and permits both translation and rotation; the other has a rotating platform that requires resection of both cruciate ligaments and only allows rotational motion. The present study is based on the latter[17,18].

The volumetric wear that results from the mobile bearings of this design is, in general terms, lower than the wear generated by fixed bearings. Bourne et al[19] carried out a study on a different Mobile bearing knee implant and found that when the movement is unidirectional (rotation) the amount of debris generated is one-third of that produced when the motion is multidirectional (rotation + translation) and one-fifth of that generated by metal-PE bearing hip arthroplasties with a 28 mm femoral head.

Nevertheless, particle size is smaller with the LCS, which means that the degree of osteolysis will be higher. We could expect the osteolysis generated by the LCS implant to be similar to that of hip arthroplasty, which is the most conforming prosthetic design in existence. Huang et al[8] studied a group of failed knee arthroplasties. The incidence of osteolysis was higher in the LCS prostheses than in those with fixed bearings. This paper was not *post mortem* and the causes leading to failure were highly heterogeneous. However, cemented cases in both designs presented with less osteolysis. Specifically, uncemented LCS implants presented with 3 times more osteolysis than cemented LCS implants. It therefore seems that sealing of the prosthesis-bone interface offers some sort of protection against osteolysis[1,2,20] and in our cases there were no problems of this nature.

Our results concerning the survivorship of the LCS prosthesis have been highly satisfactory and in line with those published in the literature[1,2,13,14,18–20]. Of the 6 revisions, one was clearly motivated by a misguided indication of the prosthesis due to inexperience. It was the second prosthesis we implanted and it was the only dislocation we had (there was a genum valgum of 25° and we performed a release of the lateral collateral ligament, the posterolateral capsule and the popliteus tendon). We had only one instance of aseptic loosening in a very obese patient, which resolved with a revision of the tibial component. The causes of the remaining revisions were the same as those of other prosthetic designs.

The number of reoperations without revision ws higher than expected, especially as regards the 4 cases where soft tissue friction was observed (1 in the patellofemoral area and 3 on the anterolateral aspect), which have only been reported for LCS prostheses with sliding bearings[21]. The radius of curvature of the posterior condyle is smaller than that of the distal portion. In full extension the femoral and tibial components are fully congruent, but this is not the case in flexion. If Hoffa's fat pad has not been sufficiently resected, it could penetrate the joint space when the knee is in flexion and could be caught between the distal part of the femoral component (the one with a larger radius) and the polyethylene component when extending the knee. This could cause pain, especially when standing up from a chair. In fact, the 2 patients made a full recovery when these soft tissues were resected. The manufacturer has recently modified the design of the anterior portion of the polyethylene component to provide more room for Hoffa's fat (LCS Complete®). This, together with a greater resection of the soft tissues, has prevented this complication in the last few years.

In our patients, variations in terms of function have been related, above all, with multi-articular and neurological involvement rather than with the prosthesis itself.

Except for the early instance of spin-out mentioned above[22,23], we did not observe any instance of the anterior

subluxation of the tibial component that is usually seen in the long-term in some posterior cruciate ligament retaining prostheses and which causes heavy loads to act on the posterior tibial component. In the LCS RP®, a greater degree of tibiofemoral conformity produces lower stress in the soft tissues, at the cement-bone interface and at the polyethylene component itself[24]. Results in terms of function and pain have been highly satisfactory and, more importantly, they have not deteriorated with time. All the prostheses that reached their third year in good condition have performed satisfactorily to date (fig. 3).

To conclude, the LCS rotating platform prosthesis requires greater accuracy during surgery and, in a small number of cases, can present problems related to soft tissue friction. Nevertheless, it boasts excellent medium and long-term outcomes, with little osteolysis if components are cemented and high comfort levels for the patient. For that reason, we believe that the LCS is a good option for knee prosthetic surgery, especially for young patients.

Conflict of interests

The authors have not received any financial support in the preparation of this article. Nor have they signed any agreement entitling them to receive benefits or fees from any commercial entity. Furthermore, no commercial entity has paid or will pay any sum to any foundation, educational institution or other non-profit-making organization to which they may be affiliated.

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