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FLUOROSCOPIC ANALYSIS OF IN VIVO MOVEMENT OF THE INSERT IN ROTATING PLATFORM TKA

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ABSTRACT

Objective: To confirm by fluoroscopic analysis the rotational movement of the polyethylene insert in rotating platform total knee arthroplasty (TKA) after a minimum postoperative time of six months. Fifteen knees submitted to rotating platform TKA with the LEPINE NEW WAVE prosthesis were studied. **Methods:** A fluoroscopic appliance in an anterior-posterior view of the proximal tibia was used to evaluate the rotation of the polyethylene insert, with the knee at a 90° flexion. If the image of the polyethylene radiopaque marker remained unchanged, i.e. if it accompanied the femur, then it was considered that rotation was occurring between the insert and the tibial component. **Results:** Of the fifteen knees analyzed,

fourteen displayed demonstrable movements of the polyethylene insert, totaling 93.3%. For the rotating platform TKA to maintain its potential, the rotating movements of the polyethylene insert must be maintained over time. **Conclusion:** The study of this sample demonstrated that the rotation is consistently maintained (93%). This confirmation suggests that rotating platform TKA effectively has the potential to present lower polyethylene wear due to the higher articulation congruence, compared with fixed support TKA, besides having the additional advantage of self-alignment of the extensor mechanism.

Keywords: Knee Arthroplasty. Knee Replacement. Osteoarthritis. Knee Prosthesis.

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INTRODUCTION

Total knee arthroplasty (TKA) is a traditional procedure, having considerably improved the quality of life of a large quantity of patients, with a wide range of pathologies.¹

However, despite its proven efficacy, it still presents problems in its long-term follow-up, with issues such as aseptic loosening, wear and tear of the polyethylene and osteolysis.¹⁻³

Several studies of implants with the rotating tibial platform arose in the evolution of TKA.³ The biomechanical justification for the use of implants with rotating platform is based on the theory that this movement reduces the wear and tear of polyethylene^{1,2} and allows greater mobility for the knee.³ Some studies demonstrated a reduction of the wear and tear of polyethylene with the use of this kind of implant in relation to fixed platform implants,^{1,2} while there are various studies in literature demonstrating no difference in the wear and tear of polyethylene.^{1,2}

The maintenance of the rotation property of polyethylene on the tibia over the years is relevant for the maintenance of the mechanical properties, and a necessary premise when discussing the functioning of mobile platform TKA.^{1,2} Accordingly, it is discussed whether the movement between the polyethylene and the tibial base continues or disappears over the years.¹⁻³ Loss of mobility among components is a possible occurrence with mobile TKA,^{2,3} which might present loss of the biomechanical advantages of this platform and even impairment of the mobile platform in relation to the fixed platform as a consequence.¹⁻³

In this regard, as moving platform prostheses are developed and designed observing the principle of rotation between the polyethylene and the tibial base.¹⁻³ In vivo studies analyzing preservation of this property are extremely pertinent.

It is necessary to observe the rotational movement of the polyethylene insert, with the help of fluoroscopy, in patients undergoing TKA over 6 months into the postoperative period.

All the authors declare that there is no potential conflict of interest referring to this article.

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MATERIAL AND METHODS

Of the total knee arthroplasties performed between January 2006 and March 2007, the NEW WAVE - Groupe Lépine model was used in 65 cases, with the metallic pin in 22 cases.

Such a model is used in cemented form, with routine sacrifice of the posterior cruciate ligament (PCL), and with a rotating platform. Patella replacement was performed in all the cases, as a standard conduct of our service.

This prosthesis model is characterized by presenting a radiopaque marker in the polyethylene insert, which made this study possible.

The patients in prosthesis follow-up were all invited to take part in the study. Of all the operated cases, 13 agreed to participate (5 women and 8 men), totaling 15 knees (two patients underwent bilateral arthroplasty, at different surgical times). (Figure 1)

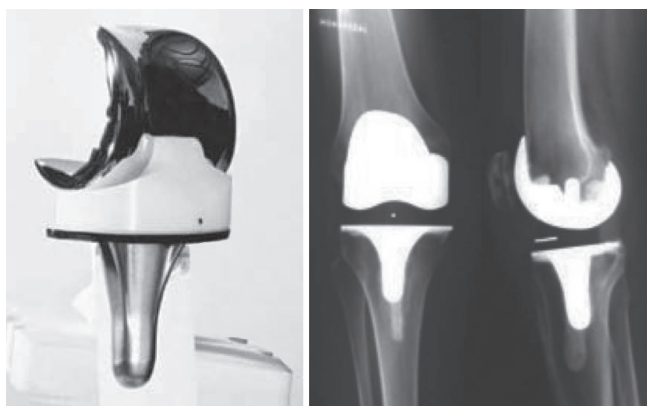


Figure 1 - Implant (right), Radiography of the implant (left).

By means of fluoroscopy, the position of the marker was observed in the antero posterior view. Considering that the knee allows rotational movements mainly in flexion, the angulation of 90 degrees was chosen as the most easily reproducible. While one examiner kept the thigh stable, the other applied external and internal rotation movements on the tibia. If the radiopaque marker of the insert were to continued with the same image in neutral position or during the rotations, this would mean its stability with the femur, in other words, that the rotation would be occurring between the tibial component and the insert; otherwise, if a change were to occur in the insert position, this insert would be considered to be accompanying the tibia, in other words, that the desired rotation would not be occurring. (Figure 2)

Therefore, it is a qualitative study, attempting to find out whether the rotation occurs or not, without the intention of measuring its quantity.

RESULTS

Of the 15 knees examined, polyethylene mobility was observed in 14 of them. The only knee in which we verified the absence of mobility between polyethylene and the tibial component of the arthroplasty, belonged to a patient that had just one of his knees operated. (Chart 1)



Figure 2 - Image of the prosthesis during fluoroscopic analysis.

Chart 1 - Patients Operated

Patients operated with the NEW WAVE - Lépine model prosthesis	22
Patients in the study	13
Knees evaluated	15

Of the knees examined, we obtained 93.3% of preservation of polyethylene rotation in relation to the tibial component. (Figure 3)

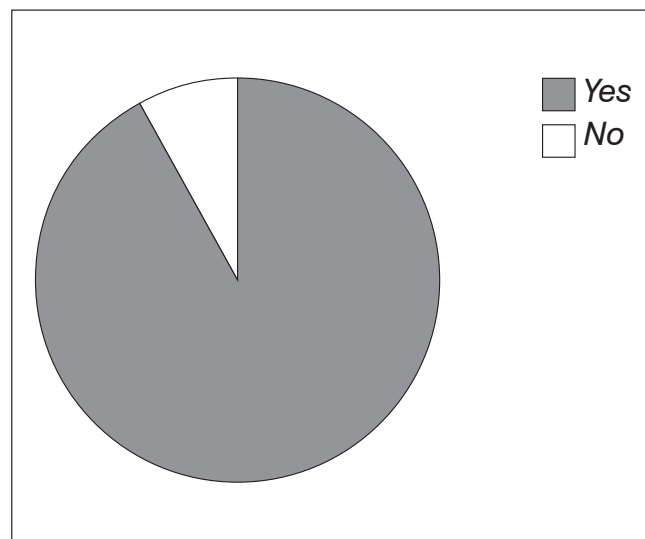


Figure 3 - Rotation of the polyethylene.

DISCUSSION

The evaluation of the mobility of the polyethylene insert in relation to the tibial component in TKA with 6 months of minimum postoperative time is aimed at proving the maintenance of the characteristic of the prosthesis (of mobility between the polyethylene insert in relation to the tibial component) and possible relationship between maintenance of mobility of the polyethylene and functional result in the patient.⁴⁻⁸

Some issues of importance in the analysis of the rotation of the polyethylene insert aim to evaluate whether this insert would lose its movement (would lock) in the position in which it was placed in the surgery,^{7,8} or would be locked in a more biomechanically satisfactory position,⁶⁻¹⁰ or individualized for each patient with its biomechanical characteristics.¹¹⁻¹³

Bourne et al.¹ have already shown the possible benefits of the rotating platform in TKA but, like an old question present in partial bipolar arthroplasties of the hip,^{14,15} it would be important to evaluate the mobility/biomechanical impact of the rotating platform (moving or not) in relation to the functional result/gait, as already demonstrated in bipolar hip prostheses.^{9,14,15}

Dennis quantitatively studied the mobility of the tibial insert in patients up to 2 years into the postoperative period and verified rotation differences between the prosthesis models and the postoperative time,^{7,16} which suggests to us that studies with a longer follow-up time are important to evaluate the real maintenance of the insert rotation on the long term and its functional impact. The method employed in the study also interferes in the possibilities of quantitative measurement of the rotation of components.¹⁷

Technically some factors hinder this kind of long-term study with the loss of patient follow-up (due to change of address or death)

and the shortage of prosthesis models that contain the metallic pin in the mobile polyethylene insert as well as NEW WAVE - Groupe Lépine. Another obstacle that may interfere in the study result is that only the patients that agree to take part are included in the study, whereas the result does not represent the true maintenance of the rotation of the insert in the surgeries performed.

Generally speaking, the evaluation of the biomechanical characteristic arouses the interest of the general orthopedic surgeon and particularly of the knee surgery specialist. Studies with a higher number of patients, longer follow-up time and with the possibility of quantitative measurement of the mobility or non-mobility of the polyethylene insert of the tibial component in different prosthesis models would be important for confirmation of the method. This evaluation may produce an important impact on the indication of types of prosthesis and suggest biomechanical advantage in their application.

CONCLUSION

Rotating platform total knee arthroplasty (NEW WAVE - Groupe Lépine) maintains the rotation of the polyethylene in the medium-term postoperative period.

As a downside, we can emphasize that only patients that volunteered for the study were analyzed, which can present a bias. Moreover, the fact that the study is qualitative does not reveal the magnitude of the rotation found. Additional studies are necessary, with other type of methodology, to quantify such movement. Since the rotation occurs consistently, the rotating platform total knee arthroplasty is truly expected to behave in a manner different from fixed support arthroplasty on the long term, with potential repercussion on its clinical evolution.

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