PATIENT-SPECIFIC TEMPLATES FOR TOTAL KNEE REPLACEMENT. ANALYSIS OF THE LEARNING CURVE IN AN ACADEMIC DEPARTMENT.

Jean-Yves JENNY MD [1], Marco DE GORI MD [1], Yann DIESINGER MD [1]

[1] Hôpitaux Universitaires de Strasbourg, Centre de Chirurgie Orthopédique et de la Main, 10 avenue Baumann, F-67400 Illkirch-Graffenstaden (France), Tel +33388552145, Fax +33388552357, E-mail jean-yves.jenny@chru-strasbourg.fr

INTRODUCTION

An appropriate positioning of a total knee replacement (TKR) is a prerequisite for a good functional outcome and a prolonged survival (1). Navigation systems may facilitate the proper positioning of the implants (2). Patient specific templates have been developed to achieve at least the same accuracy than conventional instruments at a lower cost (3). The learning curve of such systems has not yet been evaluated. We hypothesized that there was no learning curve at our academic department when using patient specific templates for TKR instead of the routinely used navigation system.

MATERIAL

The first 20 patients operated on for TKR at our academic department using a patient specific template entered the study. All patients were scheduled for a TKR because of end-stage knee osteoarthritis. All patients had a pre-operative CT-scan evaluation. The planning of the bone resections was defined by the operating surgeon on the CT-scan views with a dedicated software (Figure 1).

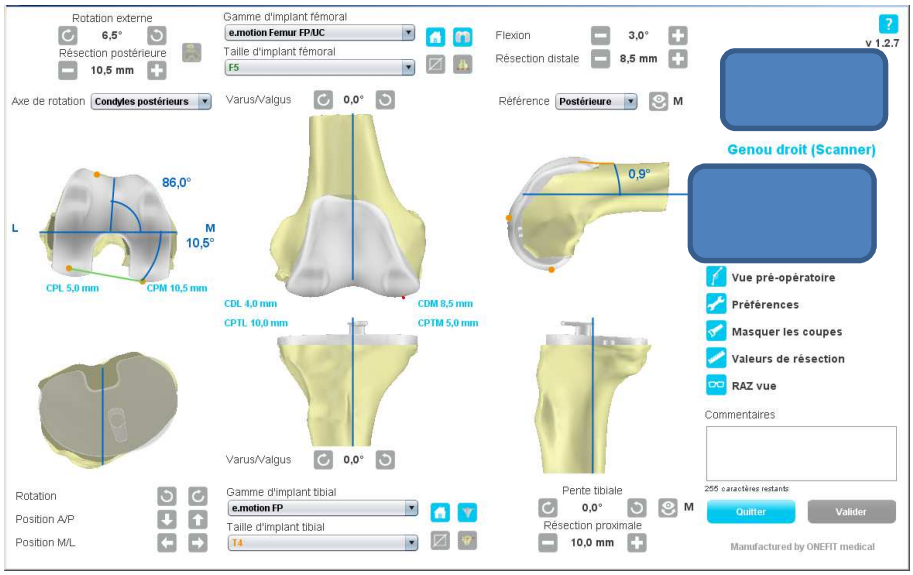

Figure 1: Pre-operative CT-based planning

The patient specific templates were positioned on the bone according to the best fit technique (Figure 2).

Figure 2: Tibia patient-specific template

The position of the templates was controlled at each step of the procedure by the navigation system, and eventually corrected according to the navigated measure to achieve the expected goal. The discrepancy between the initial and the final positioning was recorded for each direction of resection. The paired difference between each set of measurement was analyzed with appropriate statistical tests at a 0.05 level of significance.

RESULTS

The mean difference between the initial positioning of the tibia template in the coronal plane was 3° ± 4° ($p<0.01$); 5/10 cases were off the expected range. The mean difference between the initial positioning of the tibia template in the sagittal plane was 4° ± 3° ($p<0.001$); 6/10 cases were off the expected range. The mean difference between the initial positioning of the femur template in the coronal plane was 2° ± 2° ($p<0.01$); 3/10 cases were off the expected range. The mean difference between the initial positioning of the tibia template in the sagittal plane was 3° ± 3° ($p<0.01$); 4/10 cases were off the expected range. After correction of the position according to the navigation system, all templates were placed in the expected range in all directions. There was a trend to improve the initial positioning of the templates at the end of the study, especially for the femoral template.

DISCUSSION

The global accuracy of the system tested was less than optimal when compared to the navigated reference. The current system should not be used without extensive intra-operative control of the positioning of the templates. This result confirms some other reports in the literature (4, 5). However, when the positioning of the templates was adequate, the orientation of the resection was correct. We conclude that the planning and manufacturing process may be adequate, but the question of the intra-operative positioning should be addressed. As the results about positioning improved during the time of the study, one might argue that one of the relevant question is the learning curve of the surgeon when using such templates. The present study is currently going on to further document this point.

REFERENCES

1. Argenson JN, Boisgard S, Parratte S, Descamps S, Bercovy M, Bonnevialle P, Briard JL, Brilhault J, Chouteau J, Nizard R, Saragaglia D, Servien E; French Society of Orthopedic and Traumatologic Surgery (SOFCOT). Survival analysis of total knee arthroplasty at a minimum 10 years' follow-up: a multicenter French nationwide study including 846 cases. Orthop Traumatol Surg Res 2013;99:385-390.
2. Jenny JY, Clemens U, Kohler S, Kiefer H, Konermann W, Miehlke RK. Consistency of implantation of a total knee arthroplasty with a non-image-based navigation system: a case-

control study of 235 cases compared with 235 conventionally implanted prostheses. J Arthroplasty 2005;20:832-839.

3. Renson L, Poilvache P, Van den Wyngaert H. Improved alignment and operating room efficiency with patient-specific instrumentation for TKA. Knee 2014;21:1216-1220.
4. Scholes C, Sahni V, Lustig S, Parker DA, Coolican MR. Patient-specific instrumentation for total knee arthroplasty does not match the pre-operative plan as assessed by intra-operative computer-assisted navigation. Knee Surg Sports Traumatol Arthrosc 2014;22:660-665.
5. Abane L, Anract P, Boisgard S, Descamps S, Courpied JP, Hamadouche M. A comparison of patient-specific and conventional instrumentation for total knee arthroplasty: a multicentre randomised controlled trial. Bone Joint J 2015;97B:56-63.

DISCLOSURE

JYJ receives royalties from the Company Aesculap.