Letter to the Editor

Increased Anteversion of Press-Fit Femoral Stems Compared with Anatomic Femur

Michael Wettstein MD, Elyazid Mouhsine MD

Published online: 24 April 2012
© The Association of Bone and Joint Surgeons® 2012

To the Editor

We read the article “Increased Anteversion of Press-fit Femoral Stems Compared With Anatomic Femur” by Emerson with interest [4].

Emerson studied the antetorsion of femoral stems compared with the anatomic antetorsion, based on preoperative MRI studies. However, he does not state specifically how the measures were done. Figure 1 suggests the reference plane is defined as a transverse plane of the pelvis, which is acceptable for measuring anteversion of the acetabulum, but not for antetorsion of the femur. Femoral antetorsion is defined as the angle between the posterior bicondylar plane of the femur and the axis of the femoral neck and therefore needs images at the level of the femoral condyles and the femoral neck to be adequately measured [3]. This technique also was used in a recently published study which compares CT with MRI antetorsion values [2].

Furthermore, the method of measurement used during operations is subject to multiple errors, even if the position

of the lesser trochanter is used classically as a reference for femoral torsion during intramedullary nailing [9]. In addition, it seems difficult to correlate MRI values and intraoperative values as the measures are not based on the same reference points.

In the Discussion, Emerson stated that “Because this study is looking at the differences between the preoperative and postoperative angles, the actual angles are not important. Of importance is how the two compare and whether ‘natural anteversion’ has been restored”. However, this statement seems questionable, as it is recognized that antetorsion of the prosthetic femoral neck should be between 10° to 30° to avoid impingement and instability [2, 4, 6]. Hisatome and Doi stated “The best amount of femoral anteversion for the total hip stem has not been determined, although it is generally agreed to be between 10° to 20° [4] and 10° to 30° [2]” [6]. Furthermore, antetorsion is variable among individuals and therefore, only restoring individual antetorsion with the femoral stem may lead to instability of the hip if the patient initially has excessive antetorsion or retrotorsion [1, 2, 5, 8, 12]. Therefore, we think that an analysis of restoration of preoperative antetorsion is of marginal interest and one rather should aim at restoration of physiologic relationships between femoral neck orientation and acetabular orientation [6].

Emerson described what he called “head antetorsion”, which in fact represents the neck antetorsion, and an “anatomic antetorsion”, which was called “helitortion” in previous studies [5, 8]. The normal values of antetorsion and helitortion vary widely among individuals depending on the underlying disorder, and it was shown that the value of femoral torsion, or helitortion, influences orientation of the stem in terms of antetorsion [1, 5, 8]. This explains why Emerson finds differences between the preoperative and the

(Re: Emerson RH Jr. Increased anteversion of press-fit femoral stems compared with anatomic femur. *Clin Orthop Relat Res*. 2012;470:477–481.)

Each author certifies that he or she, or a member of their immediate family, has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and Related Research* editors and board members are on file with the publication and can be viewed on request.

M. Wettstein (✉), E. Mouhsine
Orthopaedic and Trauma Surgery, Hirslanden Clinique
Bois-Cerf, 1006 Lausanne, VD, Switzerland
e-mail: michael.wettstein@hirslanden.ch

postoperative antetorsion values. To adequately analyze antetorsion and helitorsion of each patient, use of a preoperative CT scan is mandatory [8, 10]. For this reason, we suggest the use of three-dimensional (3-D) planning of total hip prostheses based on a dedicated CT scan protocol to be able to analyze the particular anatomy of each patient and to adequately reconstruct the hip on an individual basis is an interesting alternative to standard planning, which ignores the femoral torsion problem as it is based on two-dimensional rather than 3-D analysis [11]. If a routine CT scan for every patient may seem impractical, its cost and radiation have been evaluated [7]. For us, the important additional information gained with the CT scan largely outweighs the potential negative effects of this examination.

References

1. Akbar M, Aldinger G, Krahmer K, Bruckner T, Aldinger PR. Custom stems for femoral deformity in patients less than 40 years of age: 70 hips followed for an average of 14 years. *Acta Orthop*. 2009;80:420–425.
2. Botser IB, Ozoude GC, Martin DE, Siddiqi AJ, Kuppuswami S, Domb BG. Femoral anteversion in the hip: comparison of measurement by computed tomography, magnetic resonance imaging, and physical examination. *Arthroscopy*. 2012: doi.org/10.1016/j.arthro.2011.10.021. [Epub ahead of print].
3. Deghrar A, Ruis A, Doursounian L, Touzard RC, Denormandie PH. The real measurement of anteversion of the femoral neck by computed tomography (CT scan). *Eur J Orthop Surg Traumatol*. 1997;7:277–280.
4. Emerson RH Jr. Increased anteversion of press-fit femoral stems compared with anatomic femur. *Clin Orthop Relat Res*. 2012; 470:477–481.
5. Flecher X, Argenson JN, Parratte S, Ryembault E, Aubaniac JM. [Custom cementless stem for osteoarthritis following developmental hip dysplasia] [in French]. *Rev Chir Orthop Reparatrice Appar Mot*. 2006;92:332–342.
6. Hisatome T, Doi H. Theoretically optimum position of the prosthesis in total hip arthroplasty to fulfill the severe range of motion criteria due to neck impingement. *J Orthop Sci*. 2011;16: 229–237.
7. Huppertz A, Radmer S, Asbach P, Juran R, Schwenke C, Diederichs G, Hamm B, Sparmann M. Computed tomography for preoperative planning in minimal-invasive total hip arthroplasty: radiation exposure and cost analysis. *Eur J Radiol*. 2011;78:406–413.
8. Husmann O, Rubin PJ, Leyvraz PF, de Roguin B, Argenson JN. Three-dimensional morphology of the proximal femur. *J Arthroplasty*. 1997;12:444–450.
9. Krettek C. Intraoperative techniques for the control of alignment. In: Rüedi TP, Murphy WM, eds. *AO Principles of Fracture Management*. Stuttgart, Germany: AO-Publishing and Thieme Verlag; 2000:211–213.
10. Rubin PJ, Leyvraz PF, Aubaniac JM, Argenson JN, Esteve P, de Roguin B. The morphology of the proximal femur: a three-dimensional radiographic analysis. *J Bone Joint Surg Br*. 1992; 74:28–32.
11. Sariali E, Mouttet A, Pasquier G, Durante E, Catoné Y. Accuracy of reconstruction of the hip using computerised three-dimensional pre-operative planning and a cementless modular neck. *J Bone Joint Surg Br*. 2009;91:333–340.
12. Wettstein M, Mouhsine E, Argenson JN, Rubin PJ, Aubaniac JM, Leyvraz PF. Three-dimensional computed cementless custom femoral stems in young patients: midterm followup. *Clin Orthop Relat Res*. 2005;437:169–175.