

DISCUSSION

I. Clarke¹ (written discussion)—Looking at your clinical X-rays, it occurred to me that one good thing about cement is that it is *easily discernible* in most X-rays. Stems with noncemented interfaces rely much more on X-ray techniques for consistent visualization. Based on your current work, what are the problems you've seen and what are your recommendations for others on the following problems:

- (a) stem rotation modifying/eliminating interface detail,
- (b) variations in X-ray density at different follow-ups, obfuscating trends, and
- (c) standardizing the anteroposterior X-rays?

T. A. Gruen (author's closure)—The absence of acrylic bone cement does indeed render interpretation of noncemented interfaces more difficult. There is no doubt that radiographic visualization of noncemented interfaces for detailed assessment could be improved with consistently precise radiological techniques. However, this requires cooperation between the radiologist and the technicians and the use of relatively simple patient positioning devices with appropriate compensatory adjustments in radiological exposures and processing techniques for each and every radiographic follow-up.

There is definitely a need for effective standardized radiological procedures and effective patient positioning devices to provide radiographs reliably for accurate measurements of interface radiolucencies or component migration or radiological density changes. There is often major variation within a large number of cases or in a multiple-center study. A major problem when assessing total hip replacements relates to the centering of the X-ray beam being offset by rotation of the femur or the pelvis. During radiographic review, the rotational effects can be easily assessed from reliable roentgenographic landmarks on the prosthetic component or the skeletal morphology, the latter being highly variable among hips being treated with arthroplasty procedures.

The best skeletal indicators for assessment of femoral rotation or flexion are the profiles of the greater and lesser trochanters. The obturator foramen profiles are similarly used for assessing pelvic rotational asymmetry.

Reproducible and reliable radiographic evaluations of sequential follow-up exposures are then subjected to another variable not previously mentioned, which is intraobserver and interobserver variability. Only recently, as far as I am aware, has the first published study appeared that indicated substantial interobserver variability in the interpretation of radiographic lucencies about *cemented* total hip replacements from a limited number of X-ray films².

Unlike clinical assessments, radiographs can be reviewed years later, and a consensus of basic terminology can be formed and more objective and accurate methods of assessment can be applied.

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² Brand, R. A., Yoder, S. A., and Pedersen, D. R., *Clinical Orthopaedics and Related Research*, Vol. 192, 1985, pp. 237–239.