The Knee Society Total Knee Arthroplasty Roentgenographic Evaluation and Scoring System

Frederick C. Ewald, MD, on behalf of The Knee Society

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A roentgenographic knee evaluation system endorsed by The Knee Society is included in this year's proceedings to encourage uniform reporting of the results of total knee arthroplasty. No rating system is ideal, but if many surgeons and centers use the same reporting system, then relative comparisons will at least become possible. Agreement on a new system by many experienced surgeons and institutions with a large clinical volume represents a sacrifice because old rating system data will have to be discarded.

The Knee Society Roetgenographic Evaluation System was developed for uniform reporting of roentgenographic results of total knee arthroplasty so comparisons could be made not only between different institutions but also between different implants. The important aspects of successful arthroplasty are featured in the system, such as component position, leg and knee alignment, and the prosthesis-bone interface or fixation. The system is easy to use, fast, and is on one sheet of paper. In addition to measurement of knee alignment and component position, the system has a numerical score for the prosthetic interface that assesses the quality of fixation. Those features that convert an image into numbers will enable roentgenographic results to be stored in a data base along with the clinical results. Up to this time, most computerized total joint registries have only stored clinical results.

The main disadvantage to this system is standardization of roentgenograms for the proper position, rotation, and alignment of the knee. This positioning error can be reduced if the examiners use multiple sets of knee roentgenograms and select the most representative films from which to take measurements.

MATERIALS AND METHODS

The knee is positioned in a standard manner. A 101.6-cm tube-to-film distance is used. The consensus at two Knee Society meetings (February 20, 1986, and September 10, 1986) regarding fluoroscopic positioning and the use of 91.44-cm cassettes for alignment films was that these techniques are not mandatory. However, if they are used, it should be recorded.

The leg is positioned so the patella points directly toward the ceiling with the patient supine. For the anteroposterior (AP) view, the beam is directed perpendicular to the midshaft of the femur and tibia and pointing directly at the joint line, which is determined by palpation. For the lateral view, the knee and extremity are positioned in the same manner except the x-ray beam is directed laterally, 90 degrees to the AP view. The joint line is determined in the same way.

The tibial interface is to be examined and evaluated in the AP and lateral views and the femoral interface in the lateral view. The patella will be evaluated in the skyline or Merchant view. Standing views at a 101.6-cm tube-to-film distance or a 182.88-cm tube distance will not be used for the bone-cement evaluation because positioning of the prosthesis is often difficult.

In the AP view of the tibia, seven zones are delineated with Zones 5, 6, and 7 reserved for the fixation stem of any length or multiple stems if present. The consensus at The Knee Society meeting of September 10, 1986, was that the number and location of the zones to be examined will be established by the prime developers of any particular knee design. An example of a tibial plateau interface fixation zonal assignment system is seen in Figure 1.

In the lateral view of the femur, seven zones are evaluated with Zones 5, 6, and 7 representing the fixation stem or stems, whatever the length. With no stem, Zones 5, 6, and 7 represent the central area. An example of zone assignment for the lateral view of the femoral component is seen in Figure 2.

The patella is viewed in skyline or in the Merchant view. Three to five zones should be assigned with Zones 3, 4 and 5 representing the lug fixation, whether it is single or multiple lugs.

If any problems exist with the patellofemoral joint, then additional measurements should be taken, such as (1) the angle of prosthesis in the patellar body remnant: (2) prosthetic placement (mediolateral on skyline view and superoinferior on lateral knee view): (3) amount of subluxation on skyline: and (4) presence of complete dislocation on skyline. An example of zone systems for the patella is seen in Figure 3.

RESULTS

The scoring system for each of the three components is determined by measuring the width of the radiolucent lines for each of the zones in millimeters for each of the three components. The total widths are added for each zone for each of the three prostheses. The total produces a numerical score for each component. There may be five to seven zones assigned for the tibia and femur and three to five zones for the patella. This score can be rated as follows for a seven-zone tibial component: 4 or less and nonprogressive is probably not significant: 5-9 should be closely followed for progression; and 10 or greater signifies possible or impending failure regardless of symptoms.

DISCUSSION

A migrating or shifting prosthesis with or without disappearance of radiolucent lines or bone-prosthesis or bone-cement interface should be considered as a possible or impending failure regardless of the above score. Prosthetic position can be estimated by the enclosed system of angle measurements. Direct subsidence without angular movement cannot be detected because there is no reference point. Knee valgus can be measured by the longitudinal midmedullary lines of the tibia and femur on the AP, standing, or 91.44-cm cassette roentgenogram.

The silhouette of the prosthesis used by an institution can be substituted in Figure 4. Zones assigned by the developer then should be used by everyone evaluating that particular implant design.

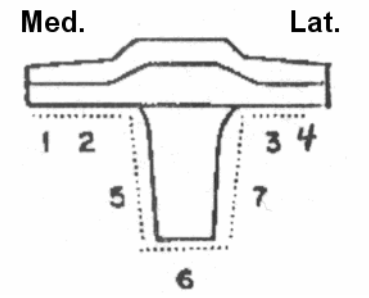

FIG. 1. AP view of representative tibial component. Other variations can be a flat tibial component and a long- or multiple-stem tibial component baseplate. Suggested guidelines for assignment of zone are: 1 and 2 for medial plateau, 3 and 4 for the lateal plateau, and 5–7 for the stem fixation. If there are no stems, then the central part of the tibial plateau should be assigned Zones 5-7.

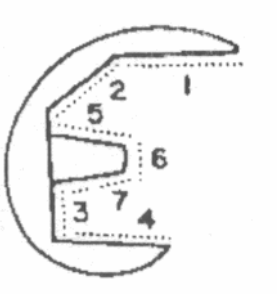

FIG. 2. Lateral view of a representative femoral component. Other variations can be represented by a long stem or no stems. Suggested zone assignment is for Zones 1-2 to be reserved for the anterior flange, Zones 3-4 for the posterior area, and Zones 5-7 for either the stem or the central portion if there is no stem.

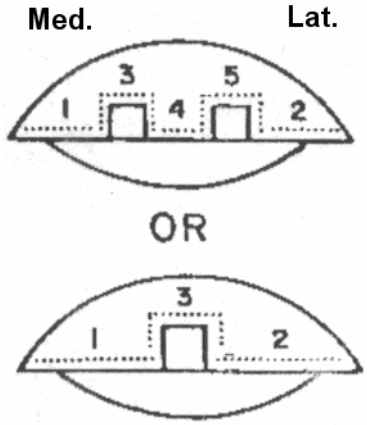

FIG. 3. These diagrams represent patellar skyline view with Zone 1 representing the medial side and Zone 2 the lateral, Zones 3-5 are reserved for fixation lugs or the central part of the patellar component. The designer-developer should use his or her discretion to establish appropriate zones using these guidelines for the design.

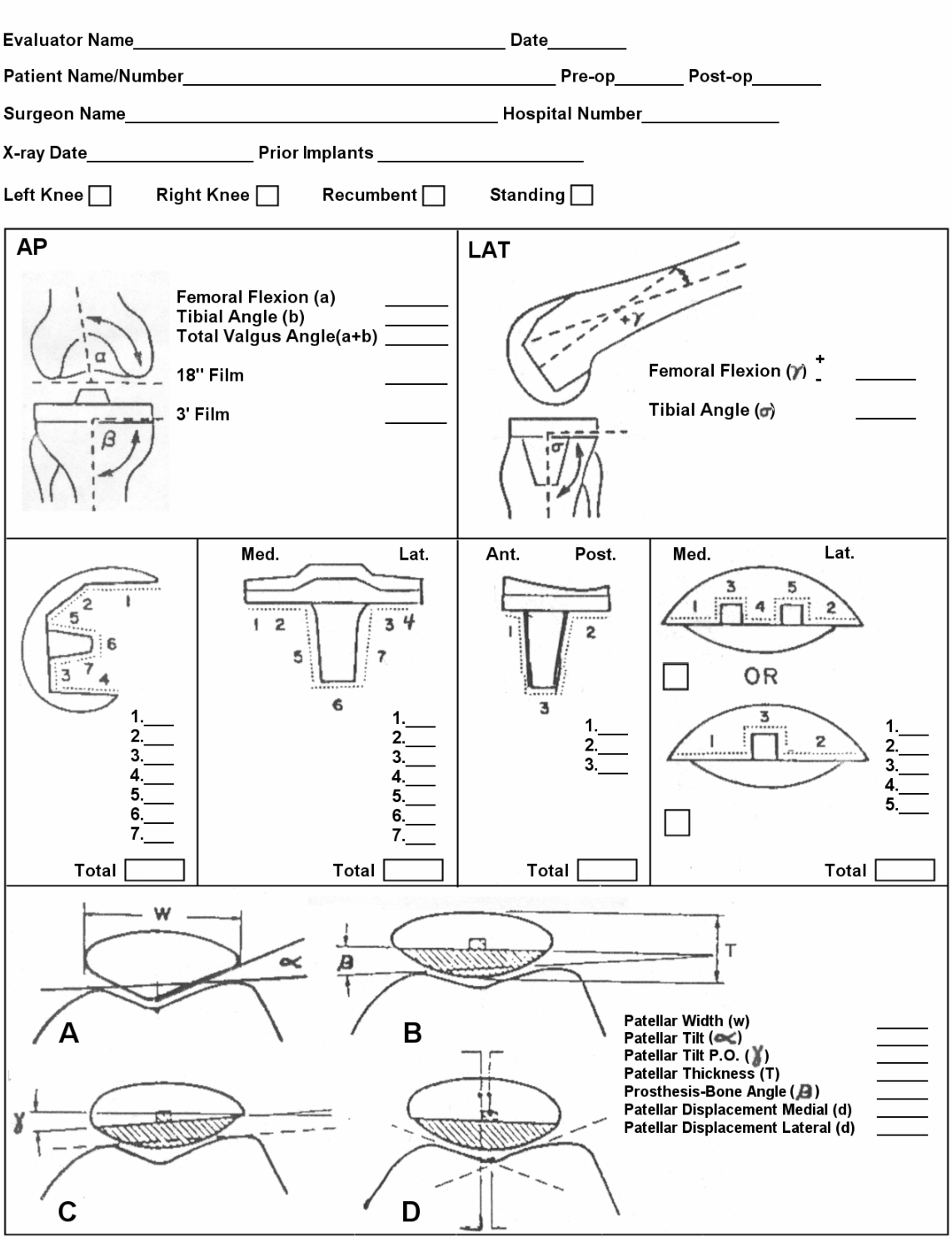

FIG. 4. One–page Knee Society Roentgenographic Evaluation and Scoring System. Individual designer-developers should substitute their own prosthetic silhouette and assign zones at the bottom of the form.