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Session V: Revision Total Knee Replacement: An Overview

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Revision total knee surgery has evolved through the decade of the 1990s so that it has a predictable outcome if certain principles are observed. These principles include the understanding of the loss of biologic constraint of the knee by ligamentous instability and muscle function and the consequent choice of mechanical implant constraint; the compromise to the metaphyseal bone of the femur and tibia and the resultant necessity for the use of bone graft and stems; and the technical performance of the operation to optimize the function of the extensor mechanism.

Sharkey and colleagues stated that instability was the predominant cause for failure (Sharkey PF, Hozack WJ, Rothman RH, Shastri S, Jacoby SM: 15 year results with Total Condylar III implants in revision total knee arthroplasty. Presented at the American Association of Hip and Knee Surgeons Meeting, Dallas, TX, 2001). Instability can result from inequality of the flexion and extension gaps from inadequate correction of sagittal plane deformities, or the medial compartment-lateral compartment balance after releases for correction of coronal plane angulations. Instability after primary total knee replacement can be worsened with time such that, at the time of revision total knee replacement, equalization of the extension and flexion gap or mediolateral stability is not possible or is so compromised that mechanical constraint is needed to augment biologic constraint. This usually means that a constrained condylar knee design must be used.

Scuderi[8] agrees with the current author that instability of knees at the time of revision total knee replacement provides the indication for a CCK prosthesis. Trousdale et al reported that 80% of 20 Total Condylar-III (forerunner of the CCK) knee replacements still were intact at 15 years. (Trousdale RT, Beckenbaugh JP, Pagnano MW: Why are knee replacements failing today? Presented at the Annual Meeting of the American Academy of Orthopaedic Surgeons, San Francisco, 2001.) This finding agrees with the experience of the current author that technically correct CCK design knee prostheses have excellent durability.

Maximum mechanical constraint is a hinged designed knee prosthesis and the common indication for this is global instability of a knee, which includes bone loss including the ligamentous insertion (especially the medial collateral ligament), loss of the extensor mechanism in an unstable knee (including loss of muscle control), and a flexion gap so large that a CCK prosthesis cannot provide adequate stability.[1]

Springer et al[9] reported dismal results with the Kinematic Rotating Hinge (Howmedica, Rutherford, NJ) with a 27% rate of reopera-

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tions for severe complications at 6-year average followup. Of these patients, 14.5% had infection, 13% had patella complications, 10% had breakage of the components, and 10 of 69 had radiographic loosening with two patients having revision surgery. These data conflict with that of the current author who has had none of these experiences with the Kinematic Rotating Hinge and who has a suspicion that most of these complications, by the nature of them, are related to technique. Barrack[1] and Jones et al[7] report none of these complications using the S-ROM (Johnson & Johnson, Depuy, Warsaw, IN) hinged design, including no infection, which was a consistent complication with the use of hinges in the 1960s and 1970s. Hinged total knee replacement is an effective treatment when done technically correctly (rotational alignment of femoral and tibial components, correct polyethylene spacing, fixation, and extensor mechanism balance).

Metaphyseal bone of the femur and the tibia always is compromised at revision total knee replacement. Metaphyseal bone is, at the least, osteopenic and usually has defects of varying magnitudes. Primary knee replacement components used for revision total knee replacement have not provided reliable results because of this compromised bone. Bugbee et al[3] reported on 139 revision total knee replacements. Eleven (26%) done with primary components had revision; 42 operations done with modified primary components had six (14%) revisions; and 55 operations done with revision components, which included stems, had three (6%) revisions. Although noncemented stems have been very popular in the past 10 years, the current author continues to cement many stems in patients with osteopenic bone with wide intramedullary canals and in patients 70 years or older.

Using a technique that pressurizes the cement in the canal, just as with total hip replacements, is fundamental to durability of the cemented fixation. Jazwari et al[6] studied fixation in knees from cadavers and found the stability of knee revision components was the same with 75-mm cemented and 150-mm press-fit stems.

Damaged metaphyseal bone sometimes requires bone graft. Bulk allograft and morselized allografts have been used and have achieved union. Clatworthy et al[4] and Engh et al[5] provided data on bulk allograft and Benjamin et al[2] provided data on the use of morselized allograft. When necessary, bone graft performs well in revision total knee replacement.

Balance of the extensor mechanism often is the most difficult technical challenge of revision total knee replacement. The establishment of the joint line helps this balance, but does not always solve the balance challenge. Proximal realignment or distal tubercle transfer sometimes is required to prevent patellar dislocation or allow satisfactory flexion of the knee. The question as to whether to resurface the patella at revision total knee replacement requires knowledge and decision-making at the operation because not resurfacing the patella can result in greater anterior knee pain, whereas resurfacing the patella sometimes can cause plastic-on-plastic contact of the patella to the tibial plastic component.

These issues of revision total knee replacement are discussed in this session.

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