THE ROLE OF THE CAM MECHANISM IN POSTERIOR STABILIZED TKR: AN ANALYSIS OF 75 RETRIEVED COMPONENTS

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Introduction:
The posterior stabilized design of total knee prostheses was developed with an integral cam within the femoral component. This mechanism was designed to articulate with a post extending out of the tibial component to provide rollback of the femur with flexion. Despite the theoretical benefits of this design feature, few studies have examined the biomechanical performance of implants of this design. The present study was undertaken to determine whether the posterior-stabilizing mechanism functions in practice and whether contact at the cam/post interface leads to significant wear of the prosthetic components.

Materials and Methods:
Seventy-four posterior-stabilized knee prostheses of 7 different designs (IBII: 56; NexGen: 5; IBF: 5; Series 7000: 4; AMK: 3; Maxim: 1) were retrieved at revision knee replacement for examination. The majority of components were of the Insall-Burstein II PS and CCK designs. The most common causes of failure of the primary procedure were aseptic loosening (46%), infection (23%) and pain with weight-bearing (16%). No components were revised for wear or osteolysis.

The components were retrieved from 35 males and 39 females with an average age of 65 years at revision arthroplasty (range: 32 to 84 years) after implantation periods ranging from 0.5 to 180 months. Five components were retrieved at less than 6 months after implantation. Each component was cleaned and scrubbed. The cam and post were stained with India ink and examined at 20X under stereomicroscopy to allow identification of areas of contact. The spatial distribution of surface features was evaluated by dividing each of the four aspects (anterior, posterior, medial, lateral) of the post into 9 zones, equally spaced along the height and width of each face. Evidence of burnishing, scratching, pitting, delamination and surface deformation was classified in terms of area of coverage and severity, on a 4 point scale according to the system of Hood et al (1983).

Results:
There was evidence of contact between the post and the cam in 86% of all cases reviewed. Burnishing over some part of the surface of the post occurred anteriorly and over its four corners leading to significant localized deformation. These areas of localized deformation were present across the anterior face of the post in 66% of all components, and corresponded to hyperextension of the knee joint causing impingement of the post against the anterior edge of the housing box.

Conclusions:
1. The tibial post of the posterior stabilized knee prostheses comes into contact with the femoral component in almost all cases examined.
2. The post is subjected to large contact stresses anteriorly and over its four corners leading to significant localized deformation.
3. In the vast majority of cases, the posterior surface of the post contacts the cam within the femoral component. This is expected to cause femoral rollback, as originally intended.
4. Given the extent of surface damage observed on the tibial posts of many PS tibial components, long term failure of the posterior stabilized knees may occur through wear, delamination, or fatigue fracture of the tibial component.

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