CASE REPORT:

Correction of Severe Valgus Deformity with Non-Constrained Total Knee Arthroplasty Design

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ABSTRACT

An 82-year old female patient with a fixed 20 degree valgus deformity of her right knee underwent total knee replacement with complete deformity correction with a non-constrained knee design. Preoperatively, the patient's right knee range of motion was limited to 20 – 110 degrees of flexion with a 20 degree fixed valgus deformity. She was confined to minimal housebound ambulation with a walker. The pt underwent a total knee replacement under epidural anesthesia with intra-operative use of the eLIBRA® Soft Tissue Force Sensor to assist in soft tissue balancing. No lateral soft tissue releases were needed. The valgus deformity was corrected intra-operatively and ROM achieved 10 – 120 of flexion. By 6 months post-surgery, the patient had achieved 10 – 130 degrees of right knee flexion, and complete correction of her valgus deformity.

INTRODUCTION

Total Knee Replacement (TKR) is a highly successful procedure which can reduce pain and improve range of motion and function by correcting angular deformities and restoring the integrity of articulating surfaces.[1-3] TKR, however, is a misnomer as this operation does not actually "replace" the knee joint as is the case of Total Hip Replacement procedures. Rather it is more accurate to describe TKR as a re-surfacing of the knee joint. Classically, TKR was accomplished with bony cuts which may be supplemented with soft tissue releases, prior to affixing the component parts, by either cement or non-cement techniques, to the bony surfaces. Over the past three decades, instrumentation has been developed to make the outcome of a TKR more reproducible and predictable.[4] However, maximizing simultaneous restoration of range of motion (ROM) and stability has remained a significant challenge.

The knee is an inherently unstable articulation, with two large convex condylar surfaces resting on a relatively flat tibial plateau. Its stability, functionality and longevity are totally dependent upon soft tissues: ligaments, muscle-tendons and to a lesser degree the medial and lateral menisci.

In the knee there are four major ligaments (MCL, LCL, ACL and PCL) that form the static stabilizers of the joint. Each ligament is composed of two parts, one part maximally tightens at the extreme of flexion and the other at the extreme of extention. Compromise of the structural integrity of any of these major ligaments creates significant knee instability, accelerated wear and dysfunction of the articulation. In addition to these four major ligaments, there are many minor ligaments distributed about the perimeter of the knee. As well, there are transversely directed ligaments attached to the medial and lateral aspects of the distal femur which serve to stabilize the patella within the femoral trochlear groove.

The patella is a sesamoid bone imbedded within the quadriceps mechanism. As such, its tracking is determined by the anatomic relationship between the dynamic quadriceps muscle, the geometry of the trochlear groove and by the patello-femoral ligaments. The pelvis is wider than the distance between the knees and as a result the normal femur and tibia are not aligned in a straight line, but rather at a 5 – 7 degree valgus angle. This orientation of the bony structures results in a laterally directed force being applied to the patella with active contraction of the quadriceps. This laterally directed force is resisted by a combination of the oblique fibers of the vastus medialis muscle (VMO) dynamically, and statically by the medial retinaculum and the medial patello-femoral ligament.

The muscle-tendon structures at the knee provide dynamic stability, over which an individual may exert some measure of control. Anteriorly, the quadriceps-patellar tendon mechanism, with its broad retinacular expansion, is responsible for active extension and resistance of flexion of