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Case Report

Concurrent femoral and tibial osteotomies versus soft tissue balance in total knee arthroplasty: A technical case report

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ABSTRACT

This case report outlines some of the challenges as well as limitations in correction of osteoarthritis of the knee in combination with extra-articular deformities,and provides a novel and straightforward surgical solution in overcoming these challenges. We describe the case of a 37-year-old male who suffered from advanced bilateral tri-compartmental knee arthritis due to untreated bloodstream-sourced osteomyelitis after birth. Radiographs and surgery confirmed extremely severe deformities. We performed two different surgical techniques in order to correct extra-articular deformities (one-stage approach of concurrent tibial and femoral osteotomy and total knee arthroplasty on one side, and soft tissue balancing with "pie-crusting technique" plus total knee arthroplasty on the other side), with description of subsequent results at 36-months follow-up.

1. Introduction

Total knee arthroplasty (TKA) is a successful procedure for pain relief and functional restoration in patients with advanced osteoarthritis. During the operation, there are many difficulties for the surgeon, due to the deformities of the bone and soft tissue, such as the restoration of the mechanical axis, the orientation of the components and the stability of the knee joint. Stability, through an accurate ligament balancing, is essential for an acceptable clinical outcome and longevity of TKA.[1,2] Two recent reports, which examined a little under 500 failed TKAs, instability was the cause of nearly 25% of all the total knee revisions performed.[1,3] To obtain a balanced knee in mediolateral ligamentous structures during TKA, release of contracted tissues and removal of peripheral osteophytes are necessary to correct deformity. However, severe bone defect and ligament insufficiency often occur in severe deformity of the knee joint, and soft tissue release is not an option for the best outcome.[4] If present, combined extra-articular deformity of the tibia and the femur can present a challenging reconstructive procedure for orthopedic surgery. Alternative methods to the conventional soft tissue release technique, namely pie-crust technique[5–7] and reduction osteotomy,[8,9] have been reported recently. These 2 alternative methods may reduce the possibility of ligament over-release, and obtain optimal ligament balancing and successful long-term stability. Moreover, in these cases, a posterior cruciate–retaining or a posterior cruciate–substituting knee implant might not be adequate, and a varus-valgus constrained design is mandatory to prevent instability and recurrent deformity.[10] Increased constraint may be required in patients with collateral ligament deficiency or major deformities (e.g. severe osteoarthritis, related to trauma, rheumatoid arthritis, neuropathic arthropathy, or sequelae of anterior poliomyelitis).[11,12] These implants have an acceptable survival rate at intermediate follow-up, but little is known about their performance at long follow-up.[13–16] There are some drawbacks of constrained design, such as an increased risk of mechanical loosening caused by the transmission of the varus-valgus stress to the bone-cement interface or the presence of polyethylene particle shedding, particularly by tibial post.[15] Furthermore the revision is difficult to perform, because of the potential risk of extensive bone loss. Other complications after use of constrained implants are unclear in clinical practice, as there is a scarcity of clinical studies in literature, especially in young active patients.

We describe a case of a 37 year old male with a past medical history of post-natal bloodstream-sourced osteomyelitis, presenting with bilateral complex deformity of their knees, and report the surgical technical procedure of a one-stage approach of concurrent

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tibial and femoral osteotomy and constrained total knee arthroplasty on the left side, and soft tissue balancing with "pie-crusting technique" and constrained total knee prosthesis on the right side.

2. Case report

In February 2012 we admitted to our Center (First Clinic – Rizzoli Orthopedic Institute, Bologna) a 37-year old caucasian male with a past medical history of untreated bloodstream-sourced osteomyelitis after birth, leading to severe deformities of his hips and his knees. The patient had undergone numerous corrective surgeries, including several knee arthroscopies, corrective osteotomy and autologus osteochondral transplantation. At that time, he reported increased pain which greatly limited his daily functional activities.

Clinically, the patient was able to walk independently without the aid of crutches, though with obvious antalgic lameness, instability and tendency to fall. Deambulation was hampered by attitude in supination of his feet and internal rotation of the tibia.

On examination, the valgus deformity of the left knee was significantly evident (12°) with important instability. The right leg was deformed in varus (17°), combined with posterior tibial subluxation and low mobility of the patella. Significant mediolateral instability with varus-valgus stress test was reported bilaterally. The overlying skin was normal with no signs of infection and no neurovascular deficit. The range of motion was bilaterally compromised: patient was able to bend the left knee up to 60° and the right one up to 70°, after that severe pain and mechanical stoppage limited further flexion.

Pre-operative Knee injury and Osteoarthritis Outcome Score [KOOS] were 19.0 for right knee and 25 for left knee.

The patient was taking on a daily basis etoricoxib and anxyolitic drugs (VAS score reported was 6).

New weight-bearing panoramic view X-rays (Fig. 1) were performed in order to evaluate lower limb alignment (mechanical and anatomical axis), measure the valgus and varus deformity and plan the amount of correction. New CT scan completed pre-operative study.

X-ray images showed an advanced degenerative joint disease of the knees on dysmorphic base, with femoral hypoplasya and tibial and peroneal hypermetry on the left side, and femoral hypermetry with posterior tibial subluxation and reverse tibial slope on the right side (Fig. 2), without significant dysmetria overall lower limbs. Moreover, marked degenerative aspects with severe joint deformity were reported, in particular procurvatum aspect of left femoral shaft, bilateral valgus femoral neck and joint subluxation of the right knee with flattening of the joint profiles and flaring of the same.

We decided to proceed, initially, with a diagnostic arthroscopy of the left knee, performing multiple biopsies for bacterial culture and sensitivity testing, in order to exclude active infectious arthritis. The surgeon reported severe three-compartmental osteoarthritis with multiple grade IV cartilage lesions (according to ICRS classification) of the femoral trochlea, instability of the central pivot and complete fibrosis of the retropatellar area with medial patellar luxation in "patella baja". Microbiological cultures did not show significant bacterial growth, furthermore all blood values of inflammation were negative: his complete blood count was normal, hemoglobin was 15.8 g/dl, Erythrocyte Sedimentation Rate was 5 mm/1 st h (range 0–20) and C-reactive protein was $< 0{,}1$ mg/dl (range 0–0,50). Therefore we considered the patient as not infected and proceeded with therapeutic protocol of secondary arthritis.

We planned an approach to bilateral knee arthroplasty, consisting: for the left knee in constrained arthroplasty and concomitant femoral and tibial osteotomies; after 6 months, for the right knee constrained arthroplasty with soft tissue balance.

Fig. 1. Weight-bearing long leg view X-ray. Valgus deformity of the left knee was estimated 12°; the right leg was deformed in varus (17°).

3. Surgical technique

The first knee prosthesis (left side) was performed in December 2012. Considering severe valgus deformities and great mediolateral instability, the senior surgeon chose to implant a constrained prosthesis (PFC® SIGMA® TC3 Knee System, DePuy, Warsaw, IN, USA) after performing tibial and femoral varus osteotomy in order to achieve better correction.

Under combined spinal-epidural anesthesia, with patient in supine position and using a tourniquet, a standard medial *para*-patellar approach was used to expose the knee. Extensive erosive