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بسم الله الرحمن الرحيم

MONA MAGHRABY

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Metaphyseal Sleeves and Metaphyseal Cones in Revision Total Knee Arthroplasty

A Systematic Review

Submitted for Partial Fulfillment of
Master Degree in ***Orthopedic Surgery***

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Mohamed Ahmed Abdel-Fatah El Bahat

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List of Abbreviations

Abb.	Full term
ACL	*Anterior cruciate ligament*
AORI	*Anderson orthopaedic research institute*
CCK system	*Condylar constraint knee system*
LCL	*Lateral collateral ligament*
MCL	*Medial collateral ligament*
PCL	*Posterior cruciate ligament*
PS	*Posterior stabilizer system*
RTKA	*Revision total knee arthroplasty*
TKA	*Total knee arthroplasty*

INTRODUCTION

In revision total knee arthroplasty (TKA) cases, three difference zones of fixation are identified in both femur and tibia.

Zone one referes to epiphysis, joint surface and proximal cortical bone, zone two refers to metaphysis and zone three refers to diaphysis. In revision cases zone one always compromised while zone two and three should be structurally stable to support revision prosthesis. Zone one can be reconstructed by screws and polymethyl methacrylate (PMMA). Cement is utilized with defect less than 5-10 millimeters (mm). Zone two defects can be handled by prosthetic wedge and blocks. They are useful in 5-20 millimeter (mm) unicondylar defect and not sufficient for larger bone defect, while in zone three structural stability can be achieved by intramedullary fixation through stemmed componenent of various shape or length [(1)].

The complications of revision total knee arthroplasty can be divided into two major categoris, septic and aseptic failure, the latter, namely aseptic failure, includes instability, loosening, device fracture, osteolysis, wear and periprostehtic fracture [(2)].

The use of metaphyseal sleeves and cones has increased in revision total knee arthroplasty. Metaphyseal sleeves are able to provide axial support, rotation stability and bone fixation due to bone integration and they can be used in type two A, B and type three, Anderson orthopaedic research institute (AORI) classification [3].

Metaphyseal cones are considered to be effective option in management of bone defects in type two and three metaphyseal defects. Divided into titanium cones and tantalum cones, the advantage of tantalum cones that there are multiple shapes and sizes to accomoodate a large portion of bone defects in moderate to severe range of bone loss. While advantage of titanium cones include better axial alignment due to uses of intramedullary fixation guided bone preparation system [4].

AIM OF THE WORK

The purpose of this study is to evaluate the uses of metaphyseal sleeves and metaphyseal cones in revision TKA according to indications, AORI classification institute, technique difficulty, operative time and fixation durability (results and complications).

Chapter 1

ANATOMY AND BIOMECHANICS OF KNEE

A- Bone Anatomy of the Knee:

The articular surfaces of the knee are represented by the medial and lateral femoral condyles which are articulating with the corresponding tibial plateau. The medial tibial plateau is biconcave, unlike the lateral tibial plateau that is concave on the front plane and convex in the sagittal plane. However, both femoral condyles are convex in the frontal and sagittal plane. The two tibial surfaces are divided by the intercondylar eminence which contains two tubercles on which the cruciate ligaments have their origin, thus contributing to fix the femur on the tibia (fig. 1) [(5)].

Intra-articular structure

Consists of anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL), medial and lateral menisci.

Medial side of the knee

The medial collateral ligament (MCL) originates from the medial femoral epicondyle, anterioinferior border of the adductor tubercle and inserted into upper medial surface of the tibia and composed of two layers: superficial and deep. The superficial component of the MCL is the main structure that counteracts to the stresses in valgus and external rotation and it offers a weak resistance to anterior translation of the tibia. The posterior oblique and deep medial collateral ligament fibres seem to play a secondary role as stabilizers [(5)].

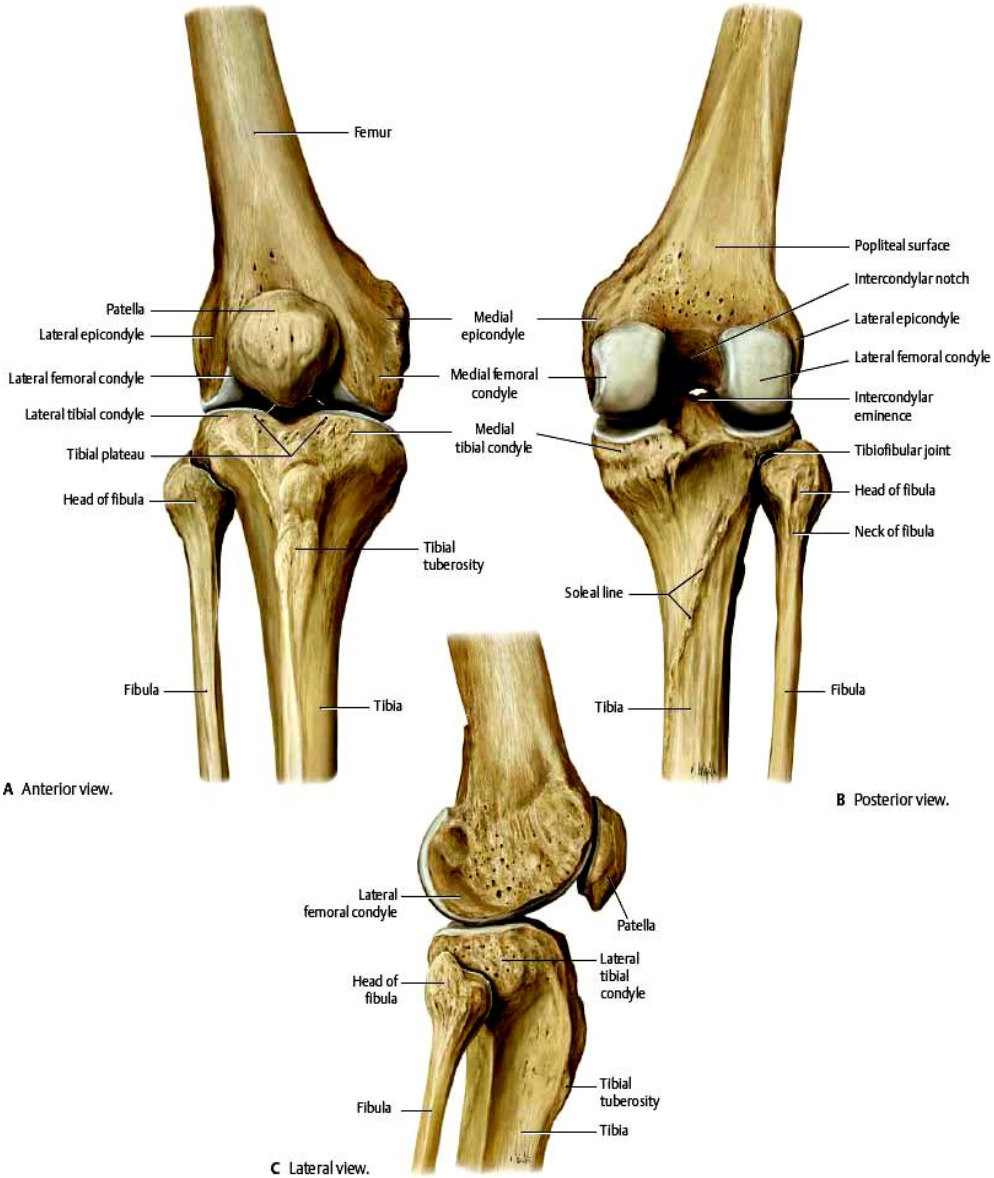

Figure 1: Anatomy of the knee. **(A)** Anterior view, **(B)** Posterior view, **(C)** Lateral view [(5)].

Lateral side of the knee

The lateral collateral ligament (LCL) originates from the lateral femoral epicondyle and has an oblique course joined by the biceps femoris tendon forming the conjoint tendon, which inserts at the head of the fibula. It prevents the deviation in varus as well as the excessive external rotation of the knee. The LCL is tight when the knee is extended; as consequence varus laxity increases when this joint is flexed (5).

The popliteus muscle originates from the lateral condyle of femur by a strong tendon called popliteus tendon and inserted on posterior surface of the proximal tibia (medial two-thirds) above the soleal line. It's function is playing a role, together with the LCL in stabilizing the posterolateral corner against varus movements and tibial external rotation (5).

Biomechanics of total knee arthroplasty

These are determined by a combination of the alignment of the components and by the musculotendinous structures. The axes used for reference include the mechanical axis and the anatomical axis (6).

The mechanical axis of the lower limb is a straight line drawn from the centre of the femoral head to the centre of the ankle. The femoral mechanical axis is a straight line drawn from the centre of the femoral head to the centre of the intercondylar region. The mechanical axis of the tibia is a straight line drawn