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Commentary

# An Overview on Physiological Knee Kinematics in Medial Pivot Motion

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## DESCRIPTION

The human knee joint is a complex structure that plays an important role in weight-bearing and movement. Among the various types of knee motions, medial pivot motion is a noteworthy aspect that has garnered attention in the field of biomechanics. This article explains the physiological knee kinematics associated with medial pivot motion, explore the intricate mechanisms involved in this particular type of knee movement.

### Medial pivot motion

Medial pivot motion is characterized by a unique pattern of rotation within the knee joint during flexion and extension. Unlike other types of knee motions, such as lateral pivot or rotational glide, medial pivot motion involves a rotational movement predominantly along the medial (inner) side of the knee. This distinctive rotation pattern is observed during various activities, including walking, running, and stair climbing.

### Anatomical basis of medial pivot motion

Understanding the anatomical structures contributing to medial pivot motion is fundamental in unraveling its physiological basis. The knee joint comprises the femur (thigh bone), tibia (shin bone), and patella (knee cap). Ligaments, tendons, and muscles surrounding the knee provide stability and control during movement. In medial pivot motion, the integral parts include the Medial Collateral Ligament (MCL), Posterior Cruciate Ligament (PCL), and the medial meniscus.

The MCL and PCL act as stabilizing structures, with the MCL preventing excessive lateral (outward) movement and the PCL limiting posterior (backward) translation of the tibia. These ligaments play an important role in facilitating controlled rotation during knee flexion and extension. The medial meniscus, a wedge-shaped cartilaginous structure on the inner side of the knee, acts as a cushion and provides additional stability.

### Kinematics of medial pivot motion

The kinematics of medial pivot motion involve intricate interplay between joint structures during various phases of movement. During knee flexion, the femur undergoes internal rotation, primarily along the medial axis. Simultaneously, the tibia experiences external rotation, resulting in a pivot-like motion centered on the medial aspect of the knee. This rotational movement allows for smooth and controlled articulation between the femur and tibia.

As the knee extends, the reverse rotation occurs, with the femur externally rotating and the tibia internally rotating. This coordinated movement minimizes stress on the joint surfaces and optimizes load distribution, contributing to the efficiency of medial pivot motion. It is important to note that deviations from this well-coordinated rotation pattern can lead to abnormal loading, potentially causing discomfort, instability, or injury.

### Clinical implications

Understanding the physiological knee kinematics associated with medial pivot motion has significant clinical implications, particularly in the context of knee pathologies and surgical interventions. Disorders affecting the ligaments, menisci, or overall joint structure can disrupt the natural kinematics of the knee, leading to altered pivot motion.

Orthopedic surgeons and researchers often explore surgical techniques that aim to restore normal knee kinematics, especially in cases of knee arthroplasty. Implant designs that replicate the natural rotational patterns of medial pivot motion have gained attention, as they aim to enhance joint functionality and longevity. However, a comprehensive understanding of individual variations in knee anatomy and biomechanics is important for modify interventions to each patient's specific needs.

The physiological knee kinematics involved in medial pivot motion are an intriguing aspect of biomechanics that influences various aspects of human movement. The coordinated rotation

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between the femur and tibia, facilitated by the MCL, PCL, and medial meniscus, plays a pivotal role in ensuring efficient and stable knee function. This understanding is not only valuable for researchers and clinicians in the field of orthopedics but also holds optimistic for the development of innovative surgical approaches and implant designs aimed at restoring and optimizing natural knee kinematics.