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Exploring Biomechanical and Muscle Activation Pattern Changes in Different Grades of Osteoarthritis Knee: A Narrative Review

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ABSTRACT

Knee osteoarthritis (KOA) is a prevalent degenerative joint disease that severely limits functional movement, especially during sit-to-stand (STS) tasks. The biomechanical changes that accompany KOA development affect joint moments, muscle activation, and movement choices. Understanding these alterations is critical for developing effective rehabilitation methods.This narrative review aims to synthesise studies on the biomechanical and muscular activation aspects of the STS task in individuals with varied degrees of KOA. It focusses on discovering compensating methods, kinematic and kinetic differences, and how these relate to treatment therapies. A literature search was conducted across multiple databases, including PubMed, Scopus, and Web of Science, focussing on studies published between 2016 to 2024. Keywords such as “knee osteoarthritis,”“biomechanics,”“sit-to-stand task,” and “muscle activation” were used to identify relevant articles. Inclusion criteria involved studies that analysed kinematic and kinetic parameters during the STS task in KOA patients. Data from selected studies were reviewed and synthesised to identify key findings Depending on the severity of the disease, KOA patients use a variety of compensatory techniques throughout the STS task.Patients with mild KOA have decreased knee-ankle angular velocity, increased pelvic Range of Motion (ROM), and changed sagittal plane motions. Muscle activation patterns show that the vastus lateralis and gluteus medius are less engaged, while the biceps femoris is more activated in response. Severe KOA patients showed trunk flexion, trunk obliquity, and execution time variation indicating functional constraints and compensatory strategies. The hip joint contributes significantly to the overall support moment during the STS activity in both mild and moderate KOA. Patients with moderate KOA show increased trunk flexion and decreased knee joint contribution, which suggests a knee load reduction strategy.The reviewed studies demonstrate how biomechanical abnormalities in KOA evolve from mild to severe phases, highlighting the significance of individualised rehabilitation techniques. Increased trunk flexion and modified joint contributions are examples of compensatory mechanisms that are essential for reducing knee load and controlling pain.

Keywords: Biomechanics, Knee osteoarthritis, Kinematics, Pain, Range of motion.