

A Review of Kinematics and Joint Load Forces in Total Knee Replacements Influencing Surgical Outcomes

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Abstract : A total knee replacement (TKR) is a surgical procedure necessary when there is severe pain and/or loss of function in the knee. Surgeons balance the load in the knee and the surrounding soft tissue by feeling the tension at different ranges of motion. This method can be unreliable and lead to early failure of the joint. The ideal kinematics and load distribution have been debated significantly based on previous biomechanical studies surrounding both TKRs and normal knees. Intraoperative sensors like VERASENSE and eLibra have provided a method for the quantification of the load indicating a balanced knee. A review of the literature written about intraoperative sensors and tension/stability of the knee was done. Studies currently debate the quantification of the load in medial and lateral compartments specifically. However, most research reported that following a TKR the medial compartment was loaded more heavily than the lateral compartment. In several cases, these results were shown to increase the success of the surgery because they mimic the normal kinematics of the knee. In conclusion, most research agrees that an intercompartmental load differential of between 10 and 20 pounds, where the medial load was higher than the lateral, and an absolute load of less than 70 pounds was ideal. However, further intraoperative sensor development could help improve the accuracy and understanding of the load distribution on the surgical outcomes in a TKR. A reduction in early revision surgeries for TKRs would provide an improved quality of life for patients and reduce the economic burden placed on both the National Health Service (NHS) and the patient.

Keywords : intraoperative sensors, joint load forces, kinematics, load balancing, and total knee replacement

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