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Isolated Medial Patellofemoral Ligament Reconstruction versus Tibial Tuberosity Transfer for Patellar Instability

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Summary:
A finite element model of the knee was used to study the biomechanical effect of Isolated MPFL reconstruction versus Tibial Tuberosity Transfer for patellar instability. Isolated MPFL reconstruction restores patellar contact mechanics but alignment should be corrected when TTTG is 22 mm to avoid focal patella overload.

Abstract:

Objectives: Objectives are: 1. to evaluate the biomechanical effect of isolated medial patellofemoral ligament (MPFL) reconstruction in the setting of increased tibial tuberosity-trochlear groove distance (TTTG), in terms of patella contact pressures, contact area and lateral displacement; 2. to describe the threshold of TTTG up to which MPFL reconstruction should be performed alone or in combination with tibial tuberosity transfer.

Methods

A finite element model of the knee was developed and validated. The model was modified to simulate isolated MPFL reconstruction, tibial tuberosity transfer and MPFL reconstruction combined with tibial tuberosity transfer for patella instability. Two TT-TG distances (17 mm and 22 mm) were simulated. Patella contact pressure, contact area and lateral displacement were analysed.

Results

Isolated MPFL reconstruction, at early degrees of flexion, restored normal patella contact pressure when TTTG was 17 mm, but not when TTTG was 22 mm. After 60° of flexion, the TTTG distance was the main factor influencing contact pressure. Isolated MPFL reconstruction for both TTTG 17 mm and 22 mm showed higher contact area and lower lateral displacement than normal throughout knee flexion. Tibial tuberosity transfer, at early degrees of flexion, reduced the contact pressure, but did not restore the normal contact pressure. After 60° of flexion, the TTTG distance was the main factor influencing contact pressure. Tibial tuberosity transfer maintained lower contact area than normal throughout knee flexion. The lateral displacement was higher than normal between 0° and 30° of flexion (< 0.5 mm). MPFL reconstruction combined with tibial tuberosity transfer produced the same contact mechanics and kinematics of the normal condition (figure 3).

Conclusion

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This study highlights the importance of considering to correct alignment in lateral tracking patella to avoid focal patella overload. Our results showed that isolated MPFL reconstruction corrects patella kinematics regardless of TTTG distance. However, isolated MPFL reconstruction would not restore normal patella contact pressure when TTTG is 22 mm. For TTTG 22 mm, the combined procedure of MPFL reconstruction and tibial tuberosity transfer provided an adequate patellofemoral contact mechanics and kinematics, restoring normal biomechanics.