

# Breaking the Stiffness Barrier: Bilateral Total Knee Arthroplasty of Extreme Knee Deformities in WISP3-Related PPRD

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## Background

Progressive Pseudo rheumatoid Dysplasia (PPRD) is a rare autosomal recessive skeletal dysplasia caused by WISP3 mutations, characterized by progressive cartilage degeneration, epimetaphyseal enlargement, and early-onset joint stiffness. Severe bilateral knee involvement can lead to extreme deformities, near-total immobilization, and profound functional impairment, presenting unique surgical challenges.

## Methods

A 22-year-old male with severe bilateral knee deformities and functional immobility secondary to PPRD was managed surgically after failed conservative measures. A staged bilateral total knee arthroplasty (TKA) using **progressive constrained kinematics** was performed to correct deformities, restore mechanical stability, and optimize knee function. Preoperative planning emphasized deformity analysis, alignment restoration, implant selection, and soft tissue balancing.

## Results

Postoperatively, the patient achieved near-normal knee range of motion, with flexion and extension approaching functional physiological limits. Objective gait assessment demonstrated restoration of symmetrical stride length, normalized stance-swing ratios, and balanced weight distribution. Radiographs confirmed mechanical alignment correction and implant stability. Functional evaluation revealed significant improvements in independent ambulation, mobility, and performance of daily activities. The staged TKA approach using progressive constrained kinematics represents a surgical innovation for managing extreme knee deformities in skeletal dysplasia.

## Conclusion

Staged TKA with progressive constrained kinematics is a feasible and effective strategy for extreme bilateral knee deformities in WISP3-related PPRD. Individualized surgical planning, innovative implant biomechanics, and staged correction facilitate restoration of knee mechanics, gait, and overall function in patients with severe skeletal dysplasia.