

# Robotic Arm–Assisted Patellofemoral Arthroplasty for Post-Traumatic Patellofemoral Ankylosis

## Background

Post-traumatic patellofemoral ankylosis is a rare and severely disabling condition resulting from high-energy knee trauma and multiple surgical interventions. Management is technically demanding due to grossly distorted anatomy and loss of conventional landmarks, with no established standard of care. Conventional surgical options often compromise extensor mechanism function and yield inconsistent functional outcomes. The role of robotic arm–assisted patellofemoral arthroplasty (RA-PFA) offers the potential to accurately reconstruct severely distorted Anatomy.

## Methods

A 21-year-old male with complete loss of active knee motion and a fixed flexion deformity following multiple surgeries for an open distal femur fracture was treated with RA-PFA combined with quadriceps-plasty. Pre-operative planning was performed using CT-based three-dimensional imaging with en-bloc segmentation of the femur and ankylosed patella to accurately delineate the true trochlear surface. Intraoperative robotic assistance enabled real-time cartilage mapping, controlled bone resection, and reproducible implant positioning within biomechanically validated safe zones despite gross anatomical distortion.

## Results

At two-year follow-up, the patient achieved independent ambulation with substantial improvement in pain and knee function. Active knee range of motion improved to 0°–80° with no extension lag. Functional outcome scores demonstrated marked improvement, with Kujala score increasing from 39 to 78, Oxford Knee Score from 22 to 41, and Visual Analog Scale for pain decreasing from 7 to 1. Radiographs confirmed accurate implant positioning without evidence of loosening or complications.

## Conclusion

Robotic arm–assisted patellofemoral arthroplasty is a safe, effective, and reproducible joint-preserving solution for post-traumatic patellofemoral ankylosis in carefully selected patients with preserved tibiofemoral compartments. Integration of CT-based three-dimensional planning with real-time robotic execution enables precise reconstruction of distorted anatomy, transforming a technically prohibitive procedure into a controlled and predictable intervention. This case demonstrates that robotic technology can meaningfully expand the indications of patellofemoral arthroplasty to complex post-traumatic knees, delivering reliable functional recovery and pain relief.