A number of studies suggest improved biomechanical and clinical results when ACL grafts are placed anatomically. Worldwide, the most common transtibial (TT) technique has been shown less anatomic than an anteromedial portal (AM) technique, though is much more familiar and less technically challenging. A hybrid transtibial approach (HT) utilizing an AM portal guidance of a flexible transtibial guidewire—may offer anatomic graft placement while maintaining the relative ease of a transtibial technique. Our objective is to evaluate the anatomic and biomechanical performance of HT, when compared to TT and AM approaches.

### METHODS

A total of 36 paired, fresh-frozen human knees were used: 24 knees (12 pairs)—each using a standard tibial tunnel—underwent all three techniques (TT, AM, HT) for femoral tunnel placement, with direct measurement of femoral insertional overlap and femoral tunnel length for each technique. The remaining 12 knees (6 pairs) were used to evaluate graft kinematics and tunnel orientation. Among these knees, 3 size-matched groups (four specimens each) were assigned to each of TT, AM and HT techniques. Specimens were tested in quad-load induced extension from 90º to 10º of flexion with a distal weight used to simulate half-shank, ankle and foot passive load. Bone kinematics were assessed using a trakSTAR motion tracking system with three sensors installed in each femur and tibia. After femoral tunnel preparation, two sensors were installed in each tunnel to relate tunnel orientation and tunnel inlet location within the joint to the sensors used for motion tracking for the femur and tibia of each specimen. Bone-patellar-bone autografts were harvested from each specimen and used for the assigned reconstructive technique. Analysis included determination of ACL graft length changes, ACL-to-femoral tunnel angle and ACL-to-tibial tunnel angle at five flexion/extension angles. Data was analyzed for three flexion/extension tests on each specimen.

### RESULTS

- **Mean ACL percent increase in length at 10º of flexion was significantly greater in HT constructs compared to TT (30.1% vs. 8.5%).**
- **HTI constructs also exhibited a significantly lower mean ACL-to-femoral tunnel angle vs. TT constructs at 10º flexion (150.6º vs. 160.8º).**
- **AM constructs demonstrated significantly lower mean ACL-to-femoral tunnel angles vs. TT constructs at 30º, 50º and 70º of flexion.**
- **All other comparisons between the three construct types at the reported flexion angles were statistically similar.**

### DISCUSSION

- Our findings suggest highly anatomic femoral tunnel apertures are achieved with this hybrid transtibial technique, yet with the advantage of long femoral tunnels and minimal tunnel angulation comparable to a traditional transtibial technique.
- Further, grafts placed with this hybrid transtibial technique demonstrated more normal, anisometric behavior.

### SUMMARY

The Hybrid Transtibial Technique

- May offer a more anatomic alternative to an AM portal approach
- While maintaining the technical ease and familiarity of a traditional transtibial technique.