In vivo knee kinematics of ACL-deficient patients after unicompartmental knee arthoplasty

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MAIN OBJECTIVE

- Compare the knee kinematics of ACL-deficient (ACLD) vs. ACL-intact (ACLI) patients after unicompartmental knee surgery using sagittal plane video fluoroscopy.

METHODOLOGY

Patient selection

Case-control study where first ACLD patients were recruited prospectively, then ACLI patients were matched and then recruited for the control group. All patients had undergone Oxford unicompartmental knee replacement on the medial side of their knee between January 2000 and June 2011. This study was granted ethical approval in January 2013. A summary of the ACLD and ACLI cohort groups are shown below:

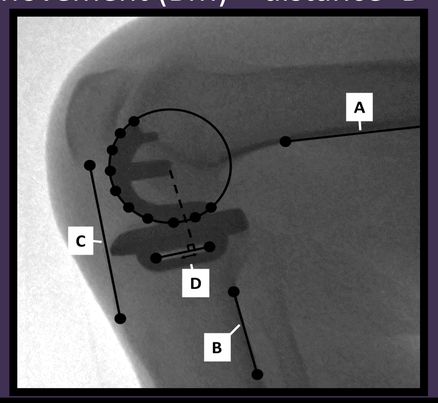
	ACLD	ACLI	*p*-value	Significance
# Knees	16	16		
# Patients	14	13		
Age	67.0 (50-87)	68.3 (49-86)	0.8046	NS
Follow-up Time	6.3 (1.3-12.8)	6.0 (2.6-11.0)	0.8209	NS
Gender	12 male, 2 female	12 male, 1 female	0.3173	NS
Oxford Knee Score	40.7 (20-48)	42.3 (32-48)	0.35	NS
ΔOxford Knee Score	15.9 (2-33)	12.9 (2-27)	0.57	NS
Tegner Activity Score	3.2 (2-5)	2.8 (0-5)	0.15	NS
VAS Pain Score	16.6 (0-70.3)	10.7 (0-85.9)	0.73	NS

Table 1. Description of the ACLD and ACLI patient cohorts. Data shown as: mean value (range). NS=not significant.

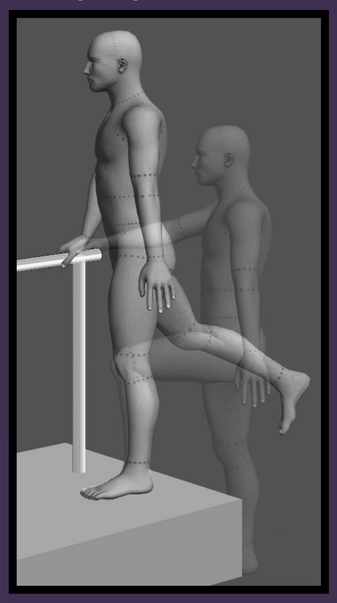
Measurements

The following measurements were manually made on each frame of every fluoroscopy video:

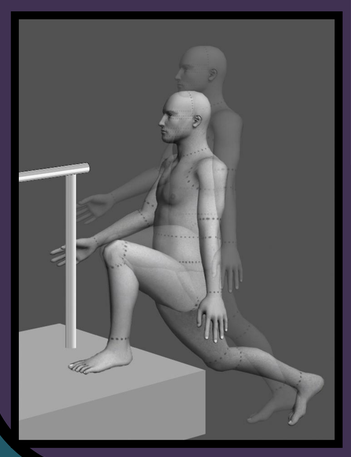
- Patellar Tendon Angle (PTA) = angle between axis 'C' and 'B'
- Knee Flexion Angle (KFA) = angle between 'A' and 'B'
- Bearing Movement (BM) = distance 'D'



Step-up Exercise



Knee Bend Exercise



Knee fluoroscopy

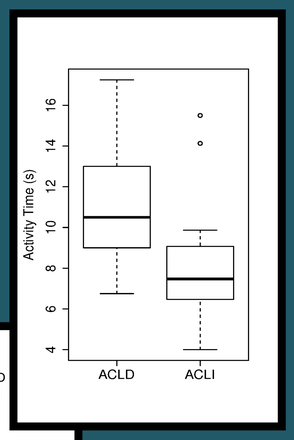
All patients were asked to perform two exercises while a sagittal plane knee fluoroscopy was taken; a step-up exercise and a knee bend exercise (see images shown to the right).

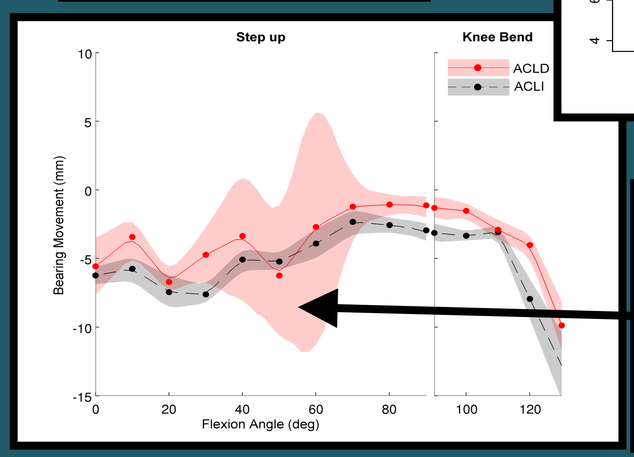
Patients were allowed to stabilise themselves during the exercise using a handrail with their arm contralateral to the knee being examined. Patients were allowed one practise run for each exercise, after which the fluoroscopy was taken.

After each exercise a static image was taken of a calibration grid to ensure any pin-cushion or barrel distortion effects were removed. Distortion was removed using MATLAB software (version 7.1, MathWorks Inc. MA, USA) with a weighted least-squares method [1].

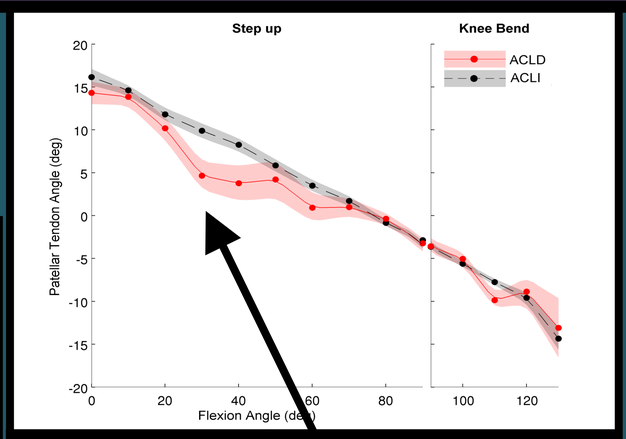
RESULTS

ACLD patients took ~3s longer to perform the exercises





Large anterior-posterior (AP) medial bearing movement observed in ACLD patients from 30-60 degrees of flexion



ACLD patients had a dip in PTA from 30-40 degrees of flexion

CONCLUSIONS

- Patients with ACL ligament deficiency after UKR have abnormal knee kinematics
- Differences were noticeable from 30-60 degrees of flexion and may relate to muscle imbalance [2]
- More variability was observed in AP bearing movement for ACLD patients
- The kinematics of ACLD-UKR knees were more normal than TKR, but less normal than ACLI-UKR and ACL-reconstructed-UKR knees [3].

[1] Goshtasby A. *Im. Vis. Comp.* 1988;6(4):255-61
[2] Berchuck M et al. *JBJS [Am].* 1990;72(6):871-7.
[3] Pandit H et al. *JBJS [Br].* 2005;87-B(7):940-5.

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