Knee Cartilage Thickness Change within 5 Years after an ACL Tear:
With and without Reconstructive Surgery

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Background

- An ACL tear (ACLT) is a serious and common knee injury.
- It mainly affects young active adults.
- In the long term, the risk of OA incidence is increased:
  - due to the acute trauma
  - due to chronic unfavorable biomechanical conditions
- Little is known about the structural changes in cartilage following ACL injury.
The KANON Study

- 121 young adults: ACL tear after trauma to uninjured knee
- Primary analysis: comparison of clinical outcomes (KOOS) between patients randomized to:
  - Early ACL reconstruction and structured rehabilitation or
  - Structured rehabilitation with optional delayed ACL reconstruction
- No significant differences after 2 years (Frobell et al. N Engl. J. Med. 2010) or after 5 years (Frobell et al. BMJ 2013).
To determine rate of change in (subregional) cartilage thickness after ACL injury:

- in the early phase (BL → 2 y follow up)
- in an intermediate phase (2 → 5 y follow up)
- stratified by treatment group
Study Design

- **Demographics**
  - 24% female participants
  - Age: 26 ± 5 years
  - BMI: 24.2 ± 3.0 kg/m²

- **Sagittal FLASH (1.5T)**
  - 1.5mm x 0.29mm x 0.29mm

N= 107 (of 121) subjects with complete data
Methods

- Pair-wise segmentation of articular cartilages (blinding to tpt):
  - **Tibia**: Medial & lateral (MT/LT) each 5 subregions
  - **Femur**: central 75% of medial & lateral condyle (cMF/cLF) each 3 subregions
  - → Medial and lateral compartment (MFTC/LFTC) each 8 subregions

- Computation of cartilage thickness (ThCtAB)
Descriptive Results

Total Femorotibial Joint (FTJ)

Mean [95% CI] {SRM}

\[ \text{BL} \rightarrow \text{Y2}: \]
\[ +58 \mu m [1.0;116] \]
\[ +0.7\% \]

\[ \text{Y2} \rightarrow \text{Y5}: \]
\[ +95 \mu m [50;140] \]
\[ +1.2\% \]
Descriptive Results

\[ N = 107 \]

Error bars = 95% CIs

\[ \uparrow \text{MFTC} > \uparrow \text{LFTC} \]

**: p<0.01; ***: p<0.001 (paired t-test)
Medial femorotibial compartment (MFTC)

- crude test $p \geq 0.18$ t-test
- adjusted $p \geq 0.16$ ANCOVA adj. for age, sex & BMI

![Graph showing mean change ± 95% confidence intervals](image)

- N=57
- N=24
- N=25

- early ACLR
- Rehab only
- delayed ACLR

Mean change ± 95% confidence intervals

BL→Y2  Y2→Y5
Stratification / Treatment Group (OV1)

- OV1: Early ACLR >> rehab only / BL → Y2 (crude/adj.p=0.02/0.02)
- OV1: Early ACLR (> ) rehab only / Y2 → Y5 (crude/adj.p≥ 0.09/0.14)
- OV 1: Delayed ACLR (> ) rehab both periods (crude/adj. p>=0.08/0.09)

![Graph showing mean change and 95% confidence intervals for different groups with N values: 57, 24, 25.](image)
Stratification / Treatment Group (OV16)

- OV16: Early ACLR >> rehab only / BL → Y2 (crude/adj.p=0.04/0.03)
- OV16: Early ACLR = rehab only / Y2 → Y5
- OV 16: Delayed ACLR > rehab both periods (crude/adj. p>=0.07/0.04)
Conclusions & Discussion

- Increase in (MFTC) cartilage thickness observed over early (BL→Y2) and intermediate (Y2→Y5) follow-up
- Reasons for the (MFTC) cartilage thickness may be:
  - Cartilage swelling (early degenerative change)
  - Cartilage hypertrophy (tissue adaptation)
  - Normal growth? Healthy (young) reference group required!
- Greater magnitude of subregional cartilage loss in knees with early ACLR than in knees Rehab only (BL→Y2)
- Trend less clear @ Y2→Y5
- ACLR surgery may induce acute subregional cartilage thickness loss
- Based on the current data, no clinical or structural benefit of ACLR vs. Rehab only @Y2 or Y5
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