

Predictors of Knee Osteoarthritis Following ACL Reconstruction

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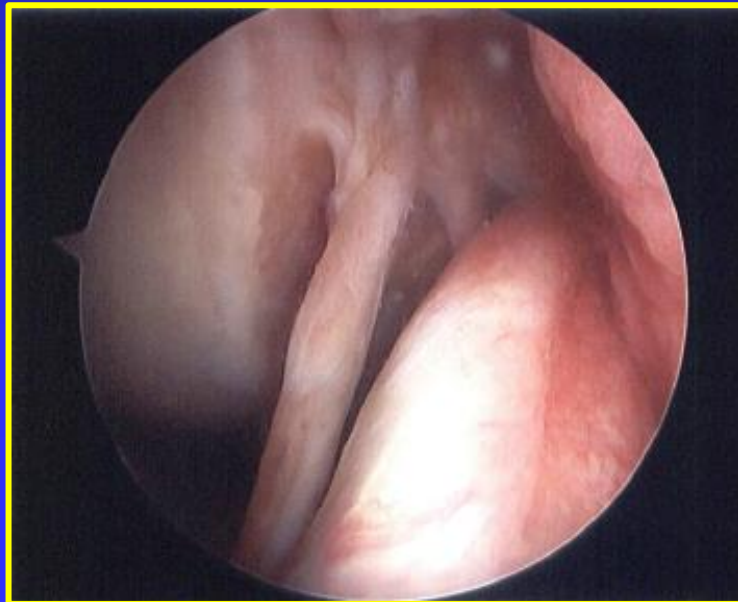
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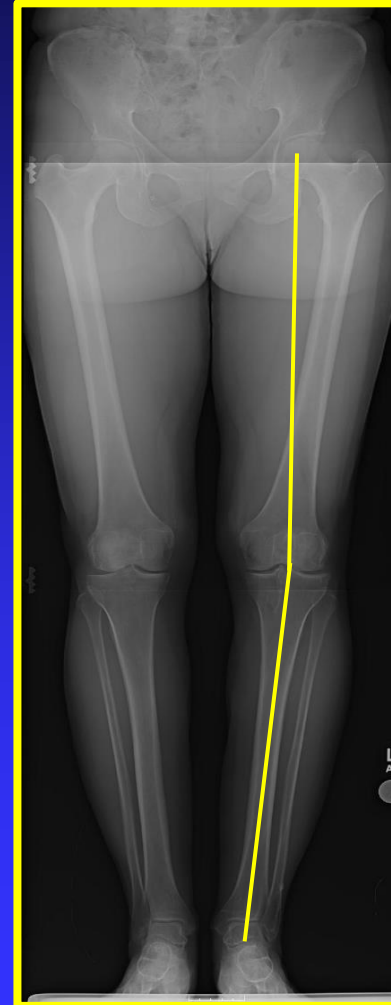


Disclosures

The author and co-authors have nothing to disclose.

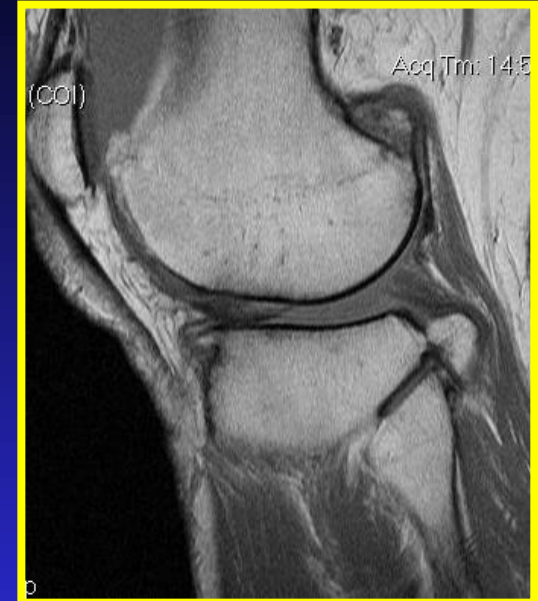
Osteoarthritis & The ACL

- **Radiographic OA Development**
 - ◆ 50-90% of Patients After ACL Tear¹
 - ✓ 7X More Likely To Require TKA³
 - ◆ After ACLR^{3,4}
 - ✓ Lower Percentage of OA
 - 23-79.2% Medial OA / 9-32% Lateral OA
 - ✓ Strongly Consider Reconstruction
- **Common Risk Factors For OA⁵**
 - ◆ Concomitant Meniscal Injury¹ - OR: 15.24
 - ◆ Alignment⁷ - Varus OR: 6.1 / Valgus OR: 5.0
 - ◆ Chondral Injury⁶ - OR: 2.31
- **Other Risk Factors For OA^{5,8}**
 - ◆ Higher BMI - OR: 1.05
 - ◆ Older Age at Reconstruction - OR: 4.6
 - ◆ Female Gender - OR: 1.7
 - ◆ Surgical Risk Factors
 - ✓ Timing Of ACLR (>1 Year Of Injury) - HR: 6.2⁹
 - ✓ Graft Choice (Allograft) - OR: 4.0¹¹
 - ✓ Surgical Technique (Transtibial)
 - 5-Year Incidence: 49.3%¹²



Purpose

- To Determine Predictors Of Symptomatic OA Development At Minimum 10-Year Follow-Up After ACL Reconstruction
- Hypothesis
 - ◆ Meniscal Injury, Cartilage Defects & Age at Surgery Are Predictors Of OA Development at Long-Term Follow-Up After ACLR



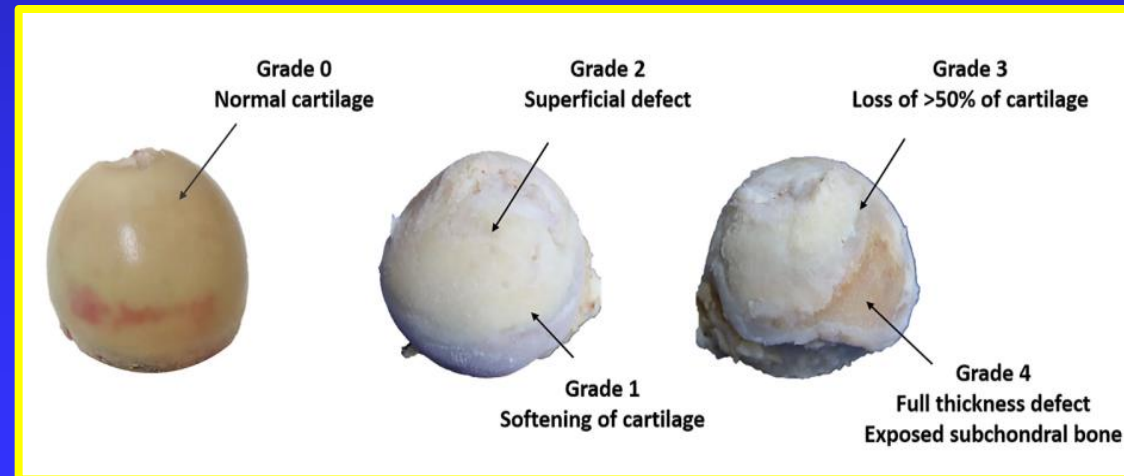
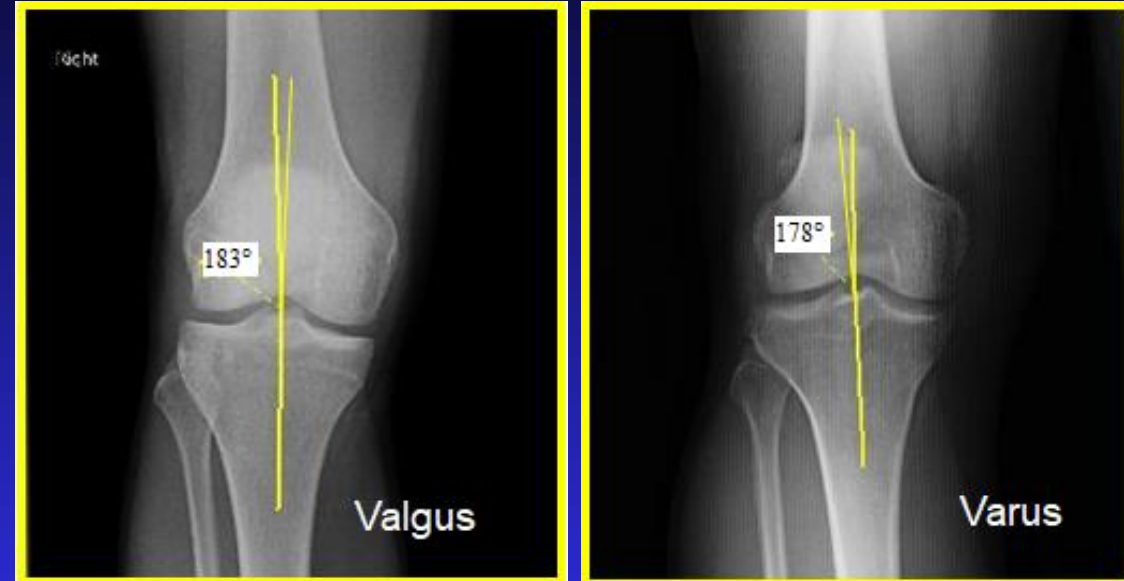
Methods

- 72 Patients w/ ACL Reconstruction
 - ◆ Consecutive Series 1999-2012
 - ✓ Single Surgeon (KDP)
 - ◆ Medial and/or Lateral Meniscus Tear
 - ◆ Medial and/or Lateral Chondral Injuries
 - ◆ Bone Patella Tendon Bone ACLR
 - ✓ Transtibial Technique
- Exclusion Criteria
 - ◆ <10-Year Follow-Up
 - ◆ Multiligamentous Injuries
 - ◆ Staged ACLR & UKA Procedures
- Arthroscopic Examination
 - ◆ Presence Meniscal Pathology
 - ✓ Medial/Lateral Tear Type
 - ✓ Meniscal Treatment Type - Video/OP Report
 - ◆ Presence of Chondral Damage
 - ✓ Outerbridge Grading – Video/OP Report



Methods

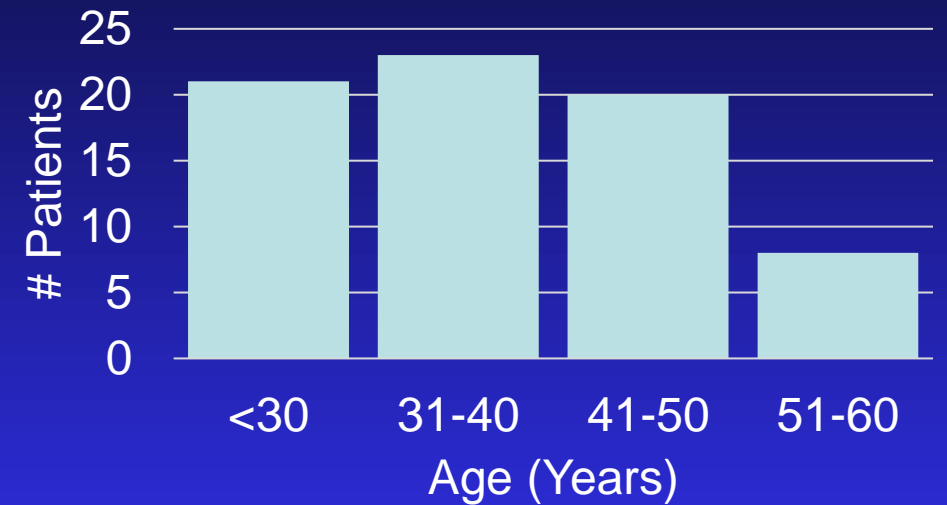
- Plain Radiographs
 - ◆ AP, PA (Rosenberg), Lateral
 - ◆ Preoperative Alignment
 - ✓ Tibiofemoral Angle Measured¹³
- Severity of OA
 - ◆ Kellgren-Lawrence Grading
- Definition
 - ◆ OA Development
 - ✓ KL Grade 3 or 4 At Follow-Up
 - ◆ Symptomatic
 - ✓ KOOS Pain <70
- Statistical Analysis (Mean ± SD)
 - ◆ Differences B/n Groups
 - ✓ Independent Samples T-test
 - ✓ Chi-Square Tests
 - ◆ Predictors of OA Development
 - ✓ Regression
 - ◆ Statistical Significance $p < 0.05$



Results

- 72 Patients w/ ACLR
 - ◆ 42 Males, 30 Females
 - ◆ Avg. Age At Surgery: 36.7 ± 11.7 Years
 - ✓ Range: 16-59 Years
- 1.4% (1/72) Revision
 - ◆ Time To Revision: 5.4 Years
- 6.9% (5/72) Conversions
 - ◆ Mean Time To TKA/UKA: 7.7 ± 4.5 Years
 - ✓ 2 UKA, 3 TKA

Age Distribution At Surgery



	Age at ACLR	Graft	Arthroplasty	Time to UKA/TKA	KL Grade Medial	KL Grade Lateral	Medial Femoral Condyle ICRS Grade	Medial Tibial Plateau ICRS Grade	Lateral Femoral Condyle ICRS Grade	Lateral Tibial Plateau ICRS Grade	Medial Meniscus Tear	Lateral Meniscus Tear
Patient 1	53	BTB Allograft	TKA	11.5	2	2	3	3	4	2	Bucket Handle	Flap
Patient 2	49	BTB Allograft	Lateral UKA	7.6	0	1	2	2	4	4	Horizontal	Complex
Patient 3	44	BTB Allograft	Medial UKA	4.5	1	0	4	4	2	2	Complex	Horizontal
Patient 4	56	BTB Allograft	TKA	2.2	3	3	4	2	4	3	Flap	Complex
Patient 5	55	BTB Allograft	Medial UKA	12.9	3	1	2	4	2	0	Horizontal	Horizontal

Results

➤ Meniscus Pathology

- ◆ 10% No Tear (7/72)
- ◆ 18% Medial Only (13/72)
- ◆ 14% Lateral Only (10/72)
- ◆ 58% Medial & Lateral (42/72)

➤ 77.8% (56/72) w/ Medial Meniscus Tear

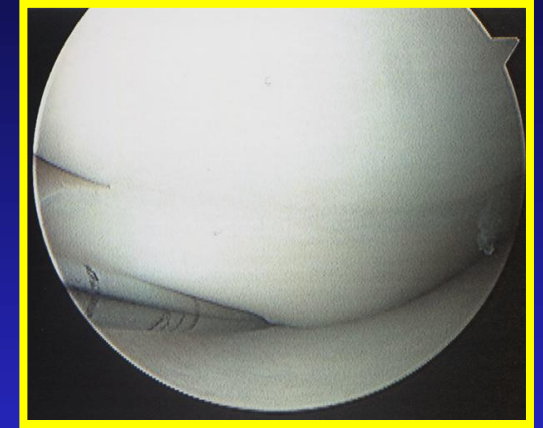
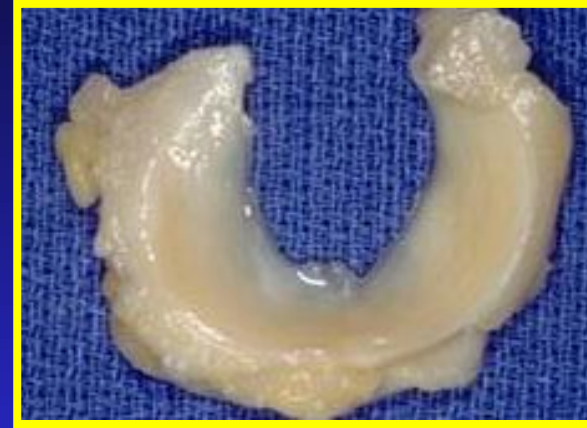
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|-----------------|------------------|
| 14 Longitudinal | 11 Bucket Handle |
| 13 Horizontal | 6 Complex |
| 8 Flap | 1 Unspecified |

➤ 72.2% (52/72) w/ Lateral Meniscus Tear

- | | |
|-----------------|-----------------|
| 13 Longitudinal | 2 Bucket Handle |
| 9 Horizontal | 8 Complex |
| 15 Flap | 4 Radial |

➤ Cartilage Defects

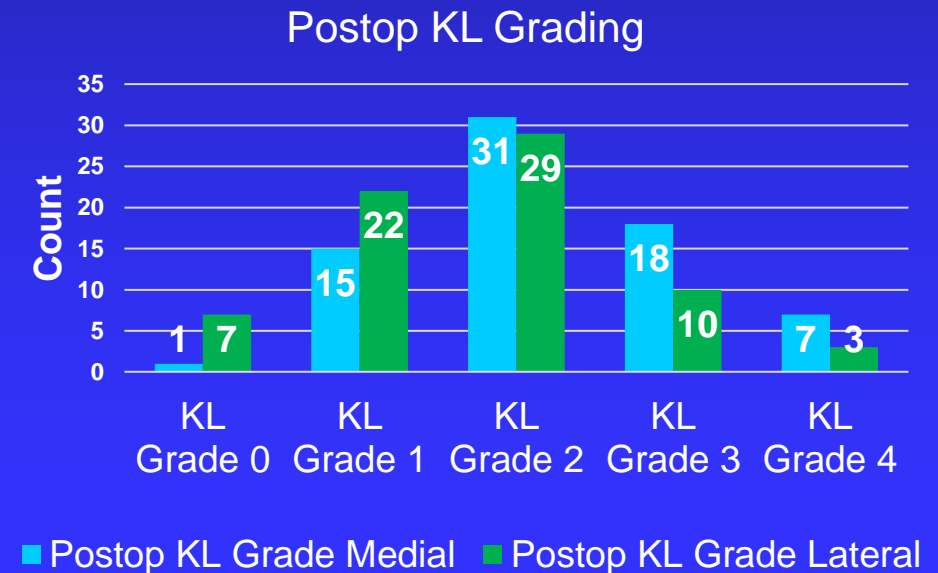
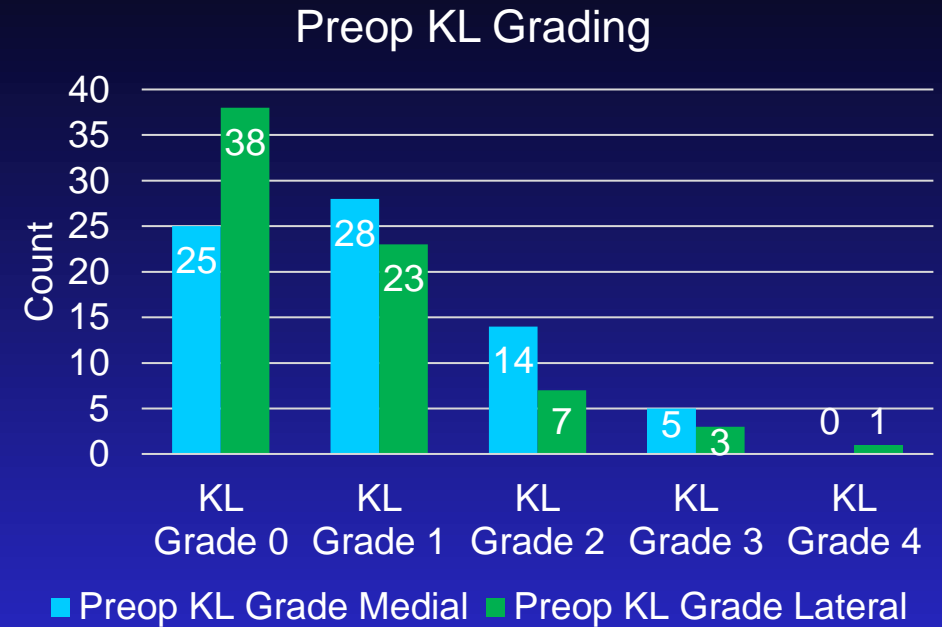
- ◆ 61% (44/72) No Cartilage Defects
 - ✓ Outerbridge Grade 0-2
- ◆ 18% (13/72) Medial Only Defects
 - ✓ 38% Symptomatic OA at F/u (5/13)
- ◆ 4% (3/72) Lateral Only Defects
 - ✓ 0% Symptomatic OA at F/u (0/3)
- ◆ 17% (12/72) Medial & Lateral Defects
 - ✓ 50% Symptomatic OA at F/u (6/12)



Outerbridge Grade	Medial Femoral Condyle	Medial Tibial Plateau	Lateral Femoral Condyle	Lateral Tibial Plateau
Grade 0	26	23	31	22
Grade 1	13	18	24	23
Grade 2	9	21	7	19
Grade 3	7	5	1	1
Grade 4	15	3	7	5

Results

- Avg. Follow-Up: 13.6±3.4 Years
 - ◆ Range 10-23
 - ◆ Avg. Age At F/U: 50.3±12.7 Years
- OA Development (KL Grade 3-4)
 - ◆ Medial Compartment: 35% (25/72)
 - ✓ 56% (14/25) Asymptomatic
 - ✓ 44% (11/25) Symptomatic
 - 45% (5/11) Underwent TKA/UKA
 - ◆ Lateral Compartment: 18% (13/72)
 - ✓ 60% (9/15) Asymptomatic
 - ✓ 40% (6/15) Symptomatic
 - 50% (3/6) Underwent TKA/UKA



Results - Predictors of Symptomatic Medial OA

➤ Predictors of Medial OA

- ◆ Age (p=0.003)
 - ✓ $\beta=0.022$
- ◆ Medial Meniscus Tear (p=0.225)
 - ✓ $\beta=3.04$
- ◆ ACLR Timing (p=0.084)*
 - ✓ $\beta=0.001$
- ◆ Medial Meniscus Treatment (p=0.106)
 - ✓ $\beta=1.181$
- ◆ Medial Femoral Condyle Defect (p=0.644)
 - ✓ $\beta=0.077$
- ◆ Medial Tibial Plateau Defect (p=0.056)*
 - ✓ $\beta=0.637$

➤ Age & Trend Towards Medial Tibial Plateau Defects Independent Predictors of Symptomatic Medial OA

➤ Predictors of Lateral OA

- ◆ Age (p=0.004)
 - ✓ $\beta=0.018$
- ◆ Lateral Meniscus Tear (p=0.998)
 - ✓ $\beta=37.05$
- ◆ ACLR Timing (p=0.522)
- ◆ Lateral Meniscus Treatment (p=0.999)
 - ✓ $\beta=18.26$
- ◆ Lateral Femoral Condyle Defect (p=0.042)
 - ✓ $\beta=0.861$
- ◆ Lateral Tibial Plateau Defect (p=0.534)
 - ✓ $\beta=0.336$

➤ Age & Lateral Femoral Condyle Defects Independent Predictors of Symptomatic Lateral OA

*Trend

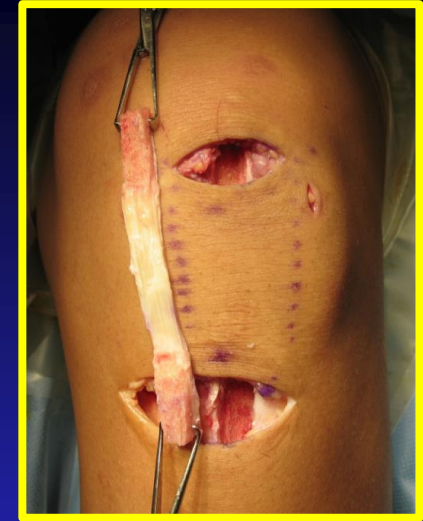
Results - No Meniscus Tear, No Cartilage Defects

- 6 Patients **No Meniscus Tears & No Cartilage Defects**
 - ◆ None Developed Radiographic or Symptomatic OA
- 7 Patients **No Meniscus Tears**
 - ◆ None Developed Radiographic or Symptomatic OA
- 44 Patients **No Cartilage Defects**
 - ◆ 12 Developed Radiographic OA - 27%
 - ✓ 7 Medial Only, No Lateral Only, 5 Medial & Lateral
 - ◆ 3 Developed Symptomatic OA - 25%
 - ✓ 2 Medial Only, No Lateral Only, 1 Medial & Lateral (Meniscal Tear Present)



Conclusion

- 38% Patients Develop Radiographic OA After ACLR at Avg 13.6 Years
 - ◆ 35% Develop Medial OA
 - ◆ 18% Develop Lateral OA
- 15% Patients Develop Symptomatic OA
 - ◆ 7% Underwent TKA/UKA
- Characteristics Associated With OA
 - ◆ Older Patients
 - ◆ Longer Time To ACLR
 - ◆ Meniscal Tears - ns
 - ◆ Chondral Defects - Independent Predictor
- Age, Medial Tibial Plateau & Lateral Femoral Condyle Defects Are Independent Predictors of Symptomatic OA
- Restore the Cartilage at the Time of Primary ACLR!



Thank You

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