

# Best Graft for Patients With High Grade Laxity?



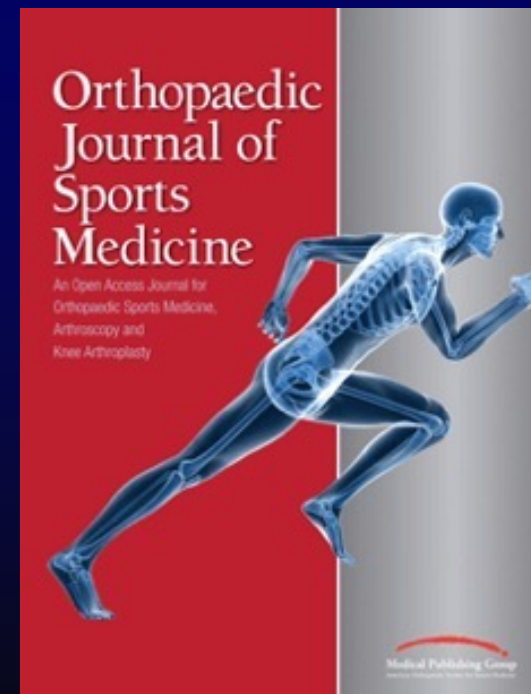
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University of New Mexico**

# Disclosures

- Fellowship Support
  - Arthrex
- Editorial Board
  - AJSM
  - J of Knee Surgery
- Board of Directors
  - ISAKOS

## Associate Editor



# What is “High Grade” Laxity?

## Grade D IKDC Evaluation

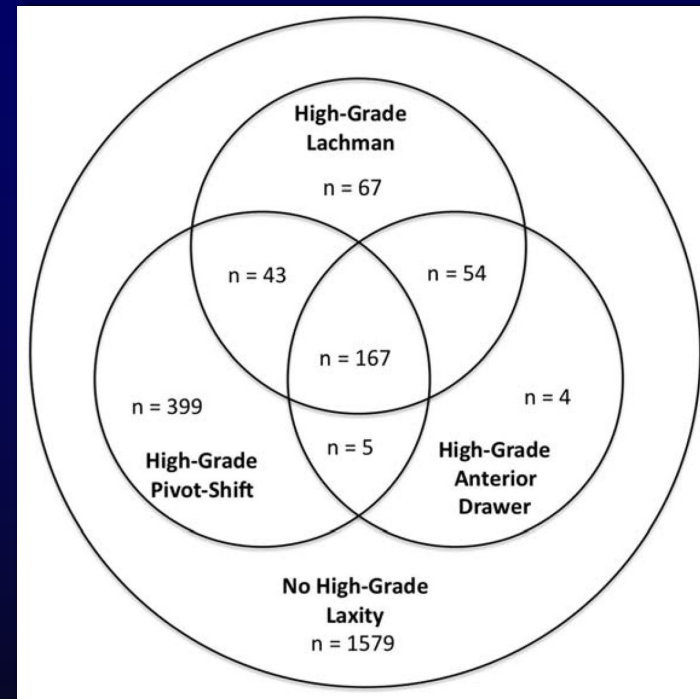
Lachman or  
Anterior Drawer > 10mm  
and/or  
3+ Pivot Shift



# Presentation of High Grade Laxity

**Isolated 3+ Pivot Shift  
More Common than  
Isolated Lachman > 10 mm**

**Isolated Anterior Drawer  
> 10 mm is Rare**





# Factors Associated with High Grade Lachman

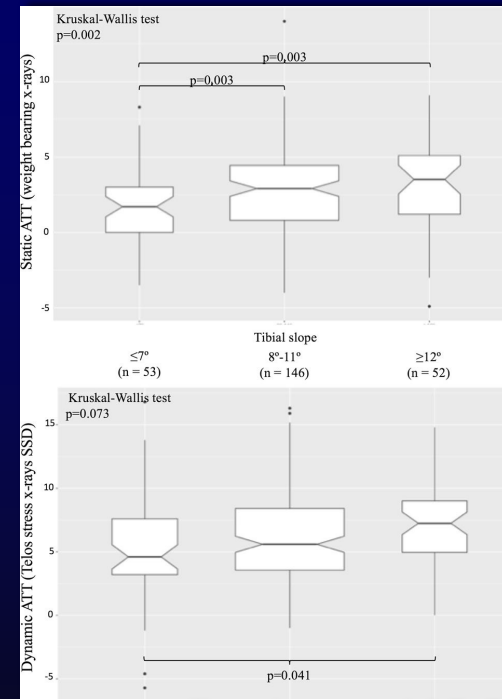
Risk Factor	Odds Ratio (95% CI)	Significance
Age less than 20 years	1.16 (0.86–1.56)	p = 0.33
Female Sex	1.14 (0.87 – 1.50)	p = 0.34
Body Mass Index over 25 kg/m <sup>2</sup>	0.99 (0.72 – 1.31)	p = 0.93
Generalized Ligamentous Laxity	2.33 (1.59 – 3.42)	p < 0.001
Medial Meniscus Tear	1.63 (1.25 – 2.13)	p < 0.001
Lateral Meniscus Tear	1.41 (1.07 – 1.84)	p = 0.013
Chronic (>6 months) Relative to Acute (<3 months) ACL Injuries	2.99 (2.20 – 4.07)	p < 0.001

# Factors Associated with High Grade Pivot Shift

Risk Factor	Odds Ratio (95% CI)	Significance
Age less than 20 years	1.34 (1.04 – 1.72)	p = 0.023
Female Sex	1.49 (1.18 – 1.88)	p = 0.001
Body Mass Index over 25 kg/m <sup>2</sup>	0.89 (0.69 – 1.13)	p = 0.33
Generalized Ligamentous Laxity	3.46 (2.38 – 5.05)	p < 0.001
Medial Meniscus Tear	1.53 (1.21 – 1.94)	p < 0.001
Lateral Meniscus Tear	1.27 (1.01 – 1.61)	p = 0.041
Chronic (>6 months) Relative to Acute (<3 months) ACL Injuries	2.71 (2.04 – 3.61)	p < 0.001

# Effect of Tibial Slope

**Greater Tibial Slope  
Increased Static  
And Dynamic  
Anterior Tibial Translation  
But Not Pivot Shift  
In ACL Injured Knees**



# Effect of Tibial Slope

**Posterior Slope**

**$> 9^\circ$**

**Had 2.35x Risk  
Of High-Grade  
Pivot Shift**

**(  $\geq 2+$  )**



# Role of Anterolateral Ligament

**ALL Injury is  
More Frequent in  
Patients With  
Higher Pivot Shift**

Positive ALL injuries		Negative ALL injuries	<i>p</i> value**
Overall ACL injuries			
Pivot shift grade			
0	13	22	0.0005
1	31	22	
2	50	13	
3	12	6	



# Summary of Risk Factors

**Chronic Injury (> 6 Months)**

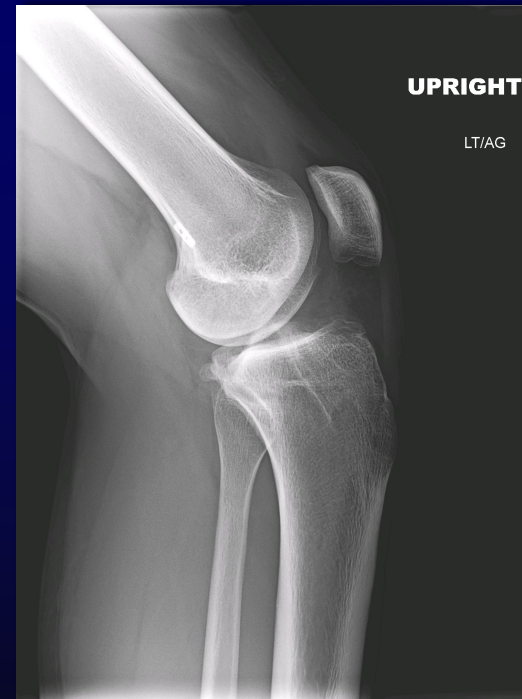
**Generalized Laxity**

**Meniscal Tear**

**(? Any, Ramp, Root)**

**Higher Posterior Tibial Slope**

**ALL Injury**



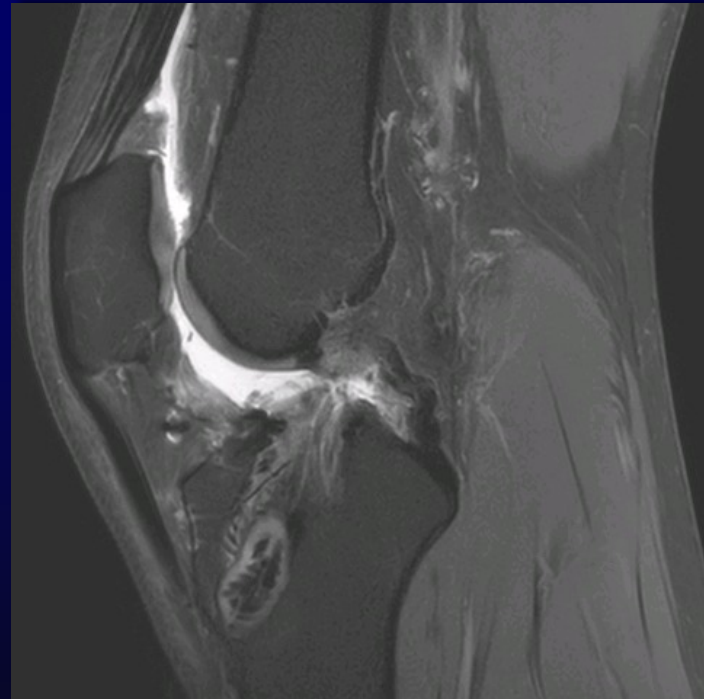
# Does Pre-operative Laxity Matter?

**YES!!!**  
**High Grade**  
**Pre-Operative Laxity**  
**Increased Risk of**  
**Revision Within**  
**6 Years**

High-grade laxity	Odds Ratio	95% Confidence Interval	Significance
3+ Pivot-shift	1.75	1.19 – 2.54	p = 0.002
Lachman > 10mm	1.76	1.10 – 2.80	p = 0.020
Anterior Drawer > 10mm	1.60	0.92 – 3.32	p = 0.098
Any one of the above	1.73	1.19 – 2.51	p = 0.004

# Revision ACL

**Patients with  
Failed ACL Reconstruction  
Often Have  
High Grade  
Laxity**



# Ideal Graft

**Strong**

**Stiff**

**Rigidly Fixed**

**Quickly Incorporated**

**Durable**

**No Donor Site Morbidity**



# Graft Options

## Autograft

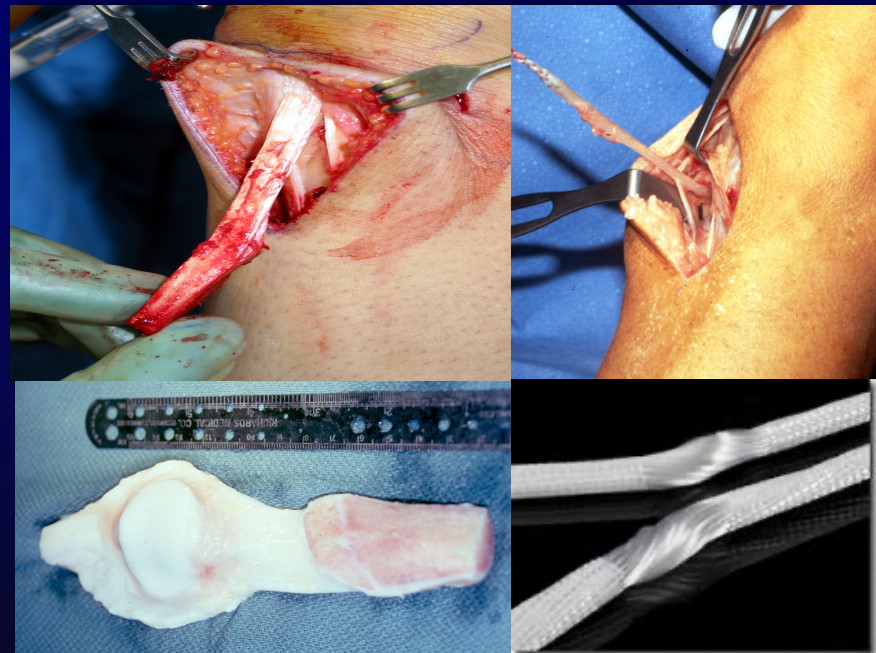
Bone-Patellar Tendon-Bone

Hamstring

Quadriceps Tendon

## Allograft

## Synthetic





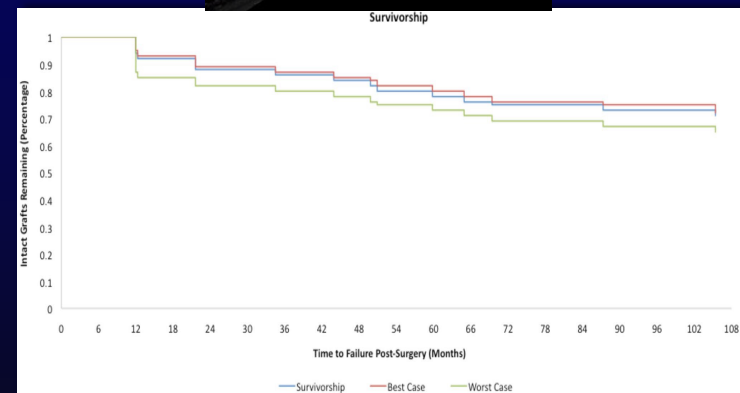
# Synthetic

Strong and  
No Need for Incorporation

Not Durable

**LARS - 33.3% Failure Rate**  
**At 7 year f/u**

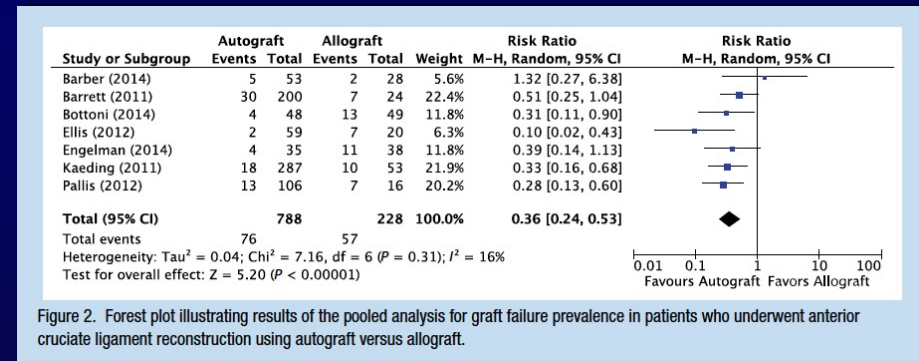
**Reactive Synovitis**  
**20%**



# Allograft

Large  
No Donor Morbidity

Processing Affects Strength  
Slower Incorporation  
Higher Failure Rate in  
Younger patients

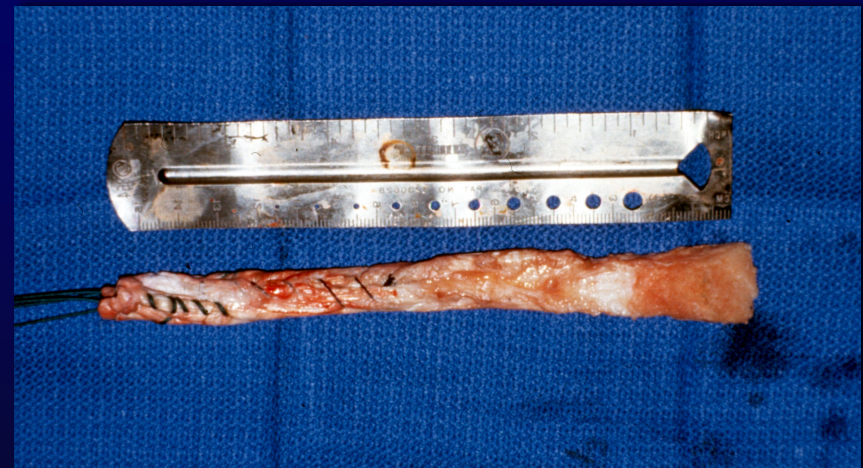


Autograft 9.8%  
Allograft 25.0%

# Hamstring

**Large Cross-Section**  
**Stiff & Strong**  
(If Quadrupled)

**Slower Incorporation**  
**Variable Size**  
**6.8 x Failure Rate**  
**With Size  $\leq$  8mm**



# Bone-Patellar Tendon-Bone

**Strong  
Stiff**

**Rapid Incorporation**

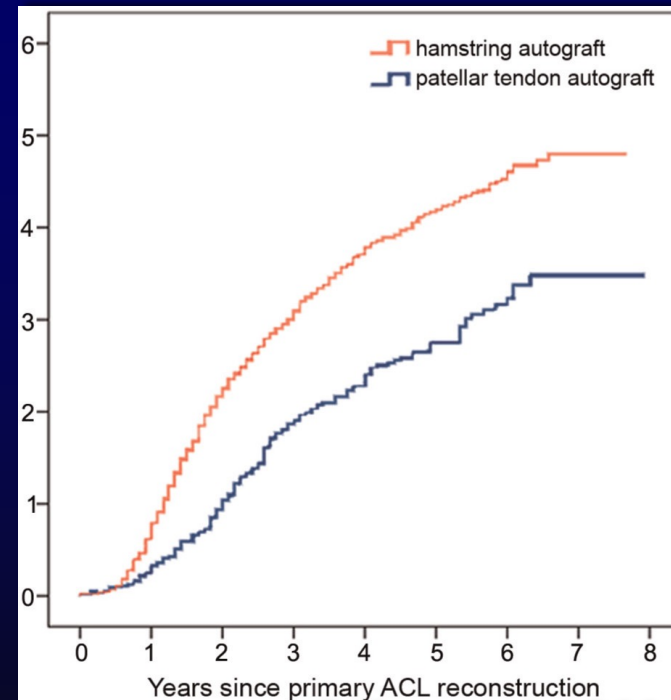
**Donor Site Morbidity**



# B-PT-B vs Hamstring

**Higher Failure Rate  
In Scandanavian Registries**

**MOON Group:  
Hamstring Failures  
2x in Young Active Patients  
When Controlling for Laxity**

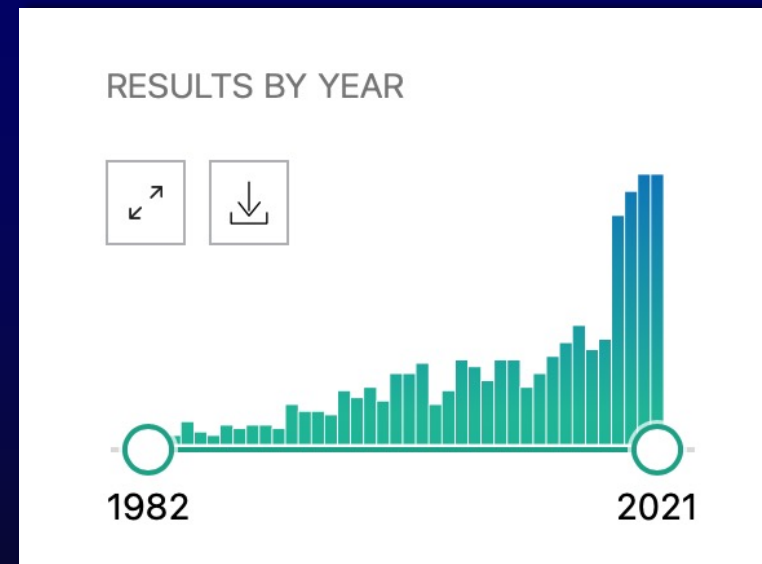




# Quadriceps Tendon Autograft

**Marked Increase  
In Usage Over  
Past 10 Years**

**Dissatisfaction with  
BTB or HS Grafts**



# Quadriceps Tendon

**Strong**

2,185 vs 1,580 N

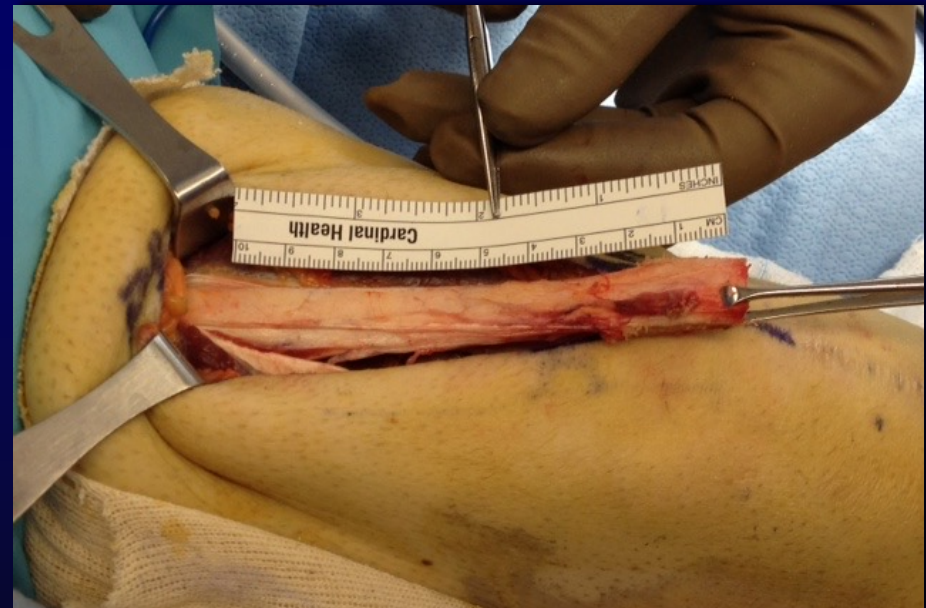
**Large Cross-Section**

91.2 vs 48.4 mm<sup>2</sup>

**Stiff**

466 vs 278 N/mm

**Less Donor Site Morbidity**



# QT-Bone vs. Soft Tissue QT

## Bone Versus All Soft Tissue Quadriceps Tendon Autografts for Anterior Cruciate Ligament Reconstruction: A Systematic Review



Raphael J. Crum, B.S., Jeffrey Kay, M.D., Bryson P. Lesniak, M.D.,  
Alan Getgood, M.Phil., M.D., F.R.C.S(Tr&Orth), DipS.E.M., Volker Musahl, M.D., and  
Darren de SA, M.D., F.R.C.S.C., M.B.A(c)

**Similar Outcomes**

**Higher Rate of + Pivot Shift in QT-B**

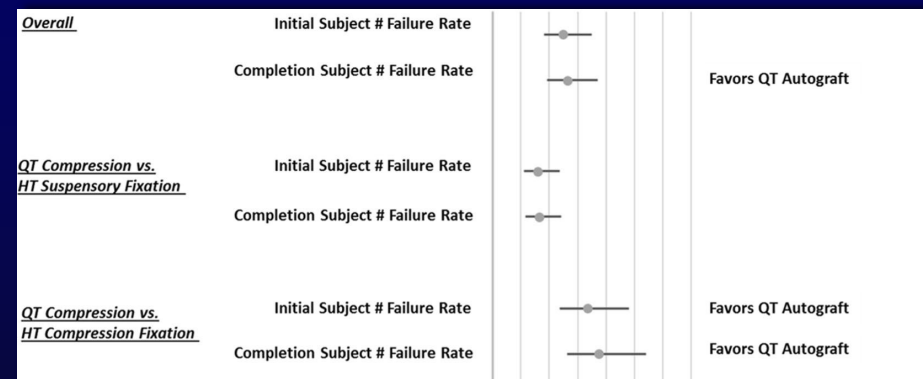
# Systematic Review: Quad Tendon vs. Patellar Tendon

	nQT:BPTB	Mean difference (95% CI)QT – BPTB	Risk ratio (95% CI)QT:BPTB	P value
Side-to-side difference, mean	248:311	–0.18 (–0.65 to 0.29)		0.45
Side-to-side difference >3 mm	518:413		0.77 (0.49 to 1.18)	.23
Lachman grade 0	390:316		1.02 (0.91 to 1.14)	.76
Lachman grade 0 or 1	390:316		1.00 (0.97 to 1.03)	.79
Pivot-shift grade 0	416:341		1.04 (0.98 to 1.1)	.23
Pivot-shift grade 0 or 1	390:316		1.00 (0.97 to 1.02)	.85
Lysholm score, mean	357:459	–0.81 (–1.77 to 0.15)		.10
Objective IKDC A or B	328:427		0.97 (0.92 to 1.02)	.20
Subjective IKDC, mean	168:252	2.08 (–2.38 to 6.55)		.36
Donor-site pain	439:287		<b>0.25 (0.18 to 0.36)</b>	<b>&lt;.00001</b>
Graft failure	439:287		0.72 (0.28 to 1.84)	.50

<sup>a</sup>IKDC, International Knee Documentation Committee. Bolded values indicate significant difference.

# Systematic Review: Quad Tendon vs. Hamstring

Quad Tendon Had  
Less Pivot Shift Laxity  
And  
Lower Failure Rates  
Especially if HS Femoral Fixation  
With Compression Screw

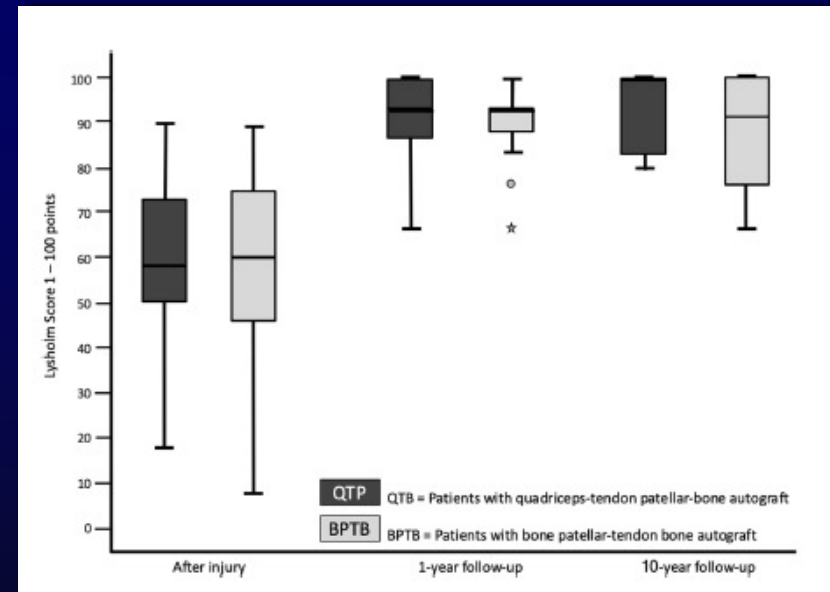




# B-PT-B vs Quad Tendon RCTs

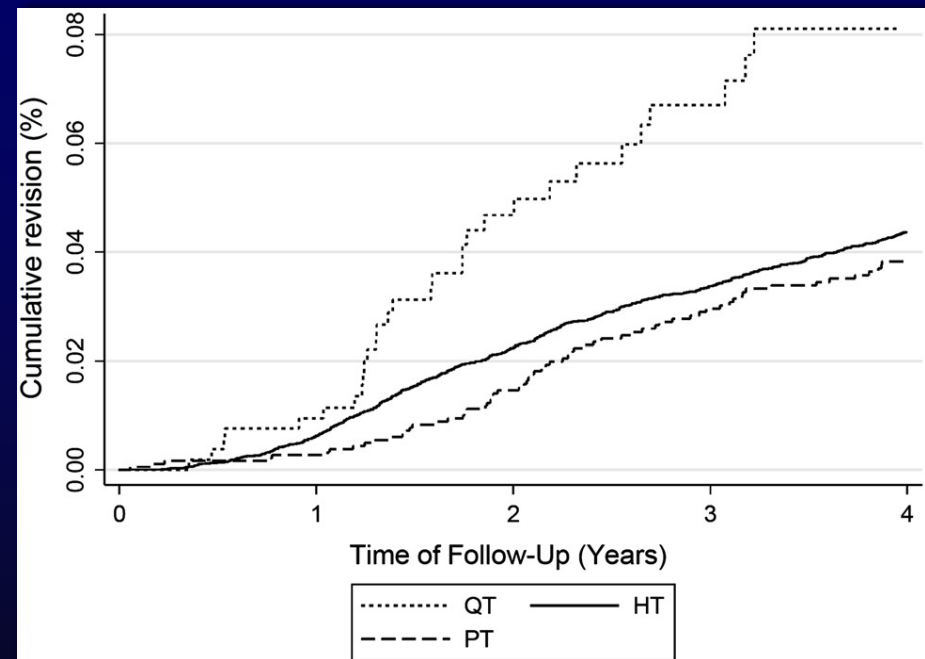
Equal Outcomes

Less Donor Site Morbidity



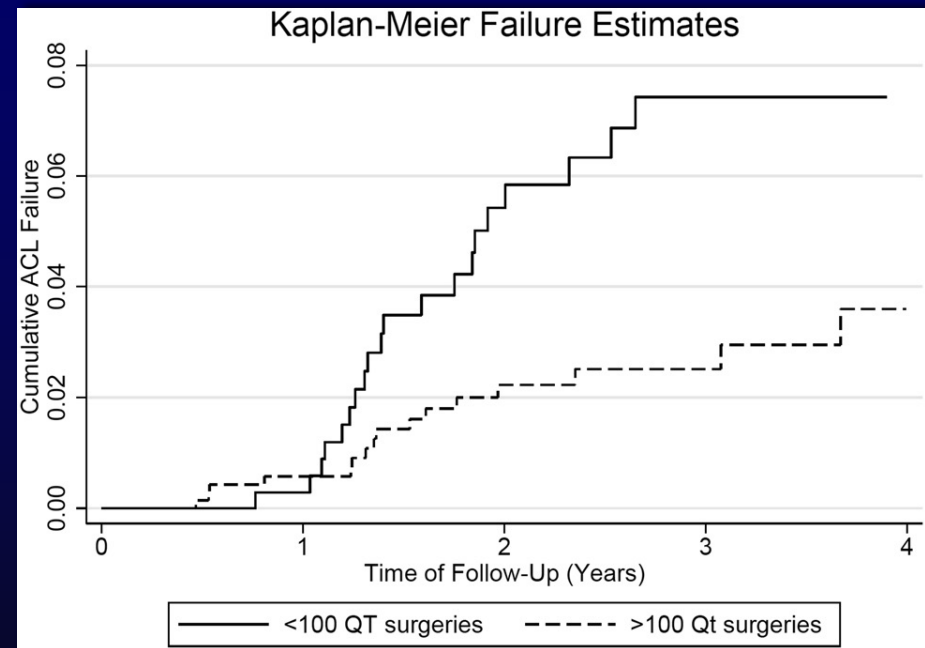
# Danish Knee Ligament Registry

Significantly Higher  
Revision Rate with  
QT Graft



# Experience Matters

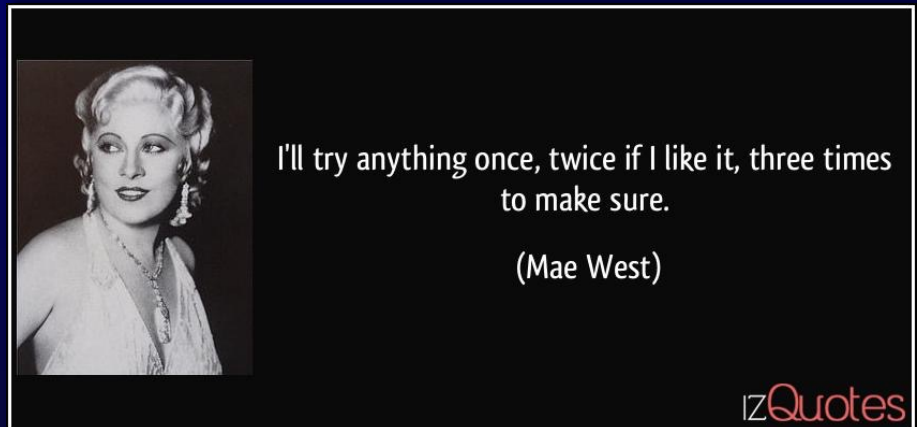
**Much Higher  
Revision Rate for  
QT ACLR  
In Centers That  
Performed Fewer Than  
100 QT Surgeries  
Over 8 Year Period**



# My Recommendations

- **Treat Associated Lesions (ALL, Menisci)**
- **Never Use Synthetic or Allografts**
- **Avoid Hamstrings in High Grade Laxity**
- **B-PT-B or Quad Tendon for Most**
- **Quad Tendon for Revisions or Kneelers**

# Quadriceps Tendon



# Merci Beaucoup !!

