

Double-bundle ACL

Tim Rose

Transtibiale Technik



37 % der Patienten mit niedrigeren Sport-Level nach 1 Jahr !

Rose 2006 KSSTA

Table 3 Tunnel placement at the femoral site and at the tibial site measured using the x-rays

	Femoral zone (a.p. view) [28]	Femoral zone (lateral view) [15]				Tibial zone (lateral view) [15]				Impingement quotient [29]
	O'clock position 11:40 (± 30 min)	4	3	2	1	4	3	2	1	%
TF-group	11:40 (± 30 min)	32	6	0	0	0	36	2	0	43 (SD = 3.0)
BS-group	11:10 (± 30 min)	24	6	0	0	0	27	3	0	44 (SD = 4.0)
p	0.22	0.90				0.37				0.26

Biomechanic background



Single bundle - ACL



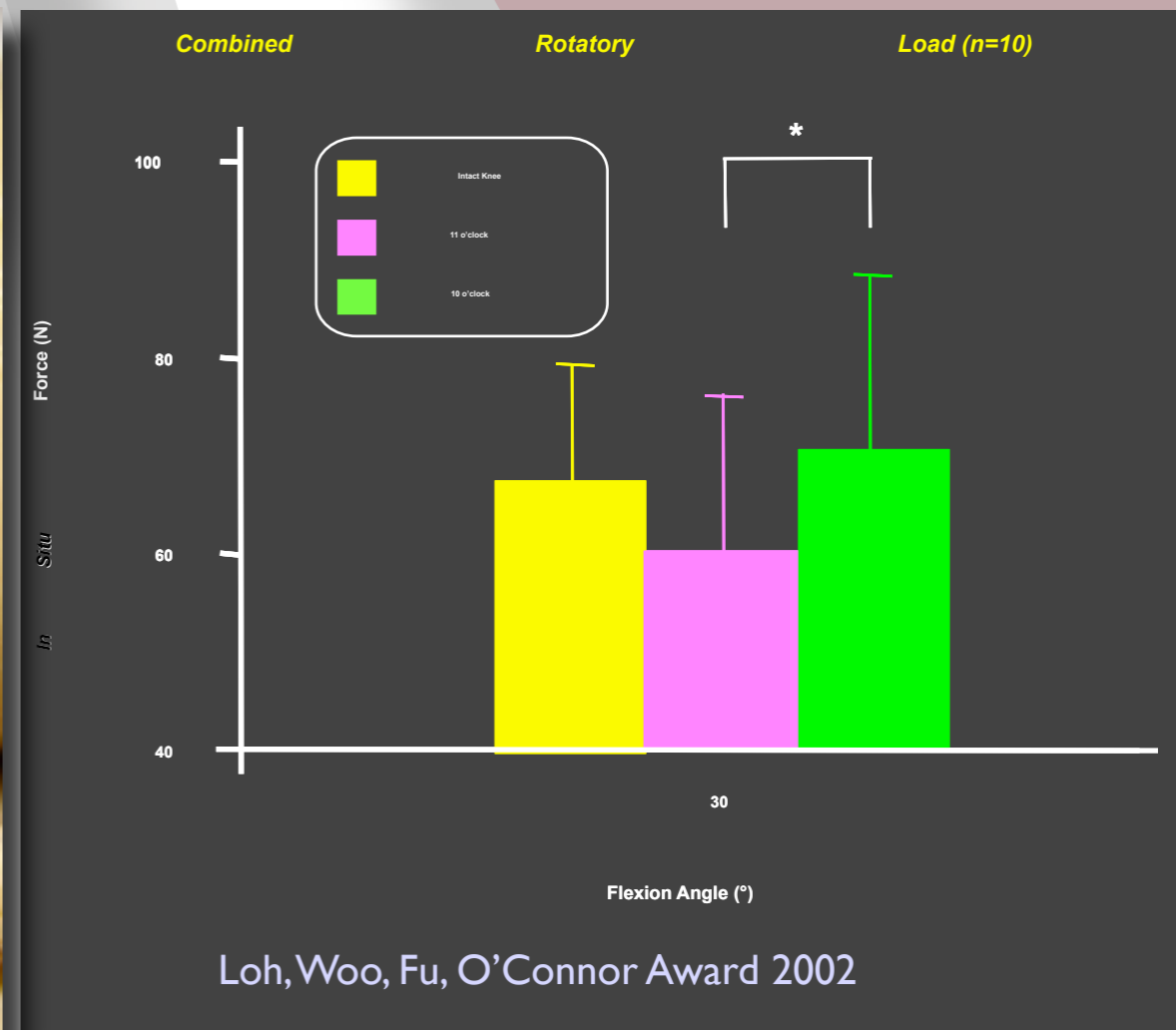
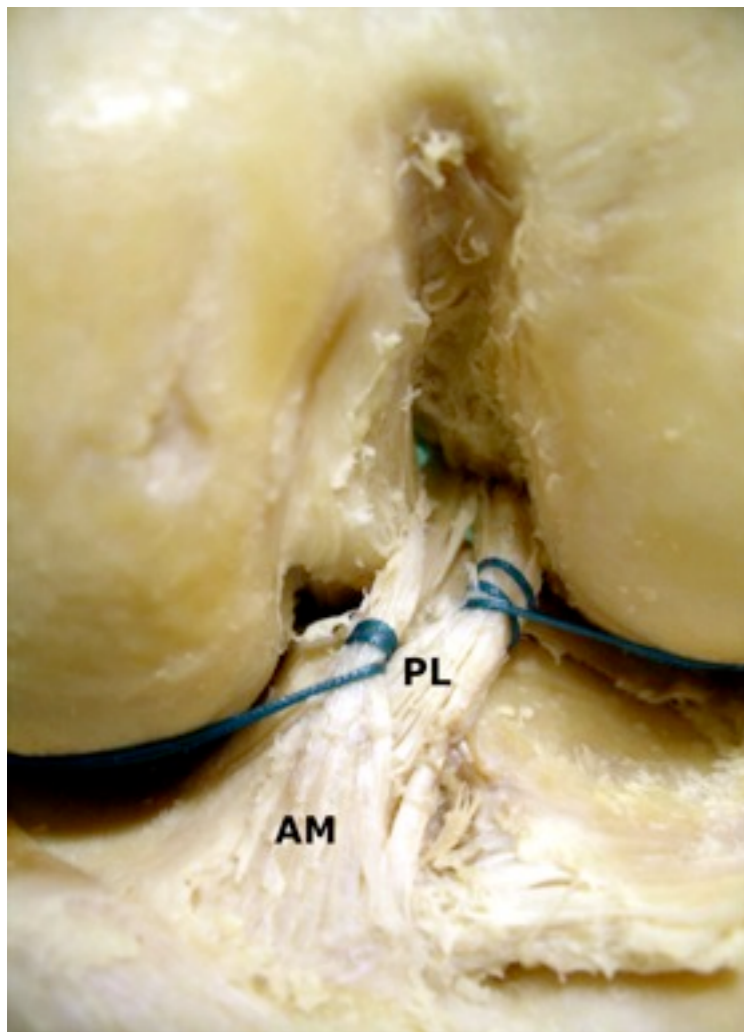
AP-Translation



Rotation +
Pivot-Shift

Yagi, Fu, Woo 2001 AOSSM

ACL-double-bundle



Historie

Taf. V. Fig. 1. zeigt das Ligamentum cruciatum anterior des Kniegelenks. Der innere Condylus ist weggenommen, so dass der innere Condylus von seiner inneren, vorderen Seite sieht, und erkennt man den vorderen Kreuzband *ca* befestigt selbst, dass es bei gestrecktem Knie in einer senkrechten Linie *c'a'* verläuft. Zwei Reihen von Punkten zeigen die Lage des äusseren Seitenbandes an der äusseren Seite des Kniees hat, und wo seine obere Befestigung ist. Denkt man sich nun, dass das so gestreckte Bein um 90° gebogen würde, so wird sich zwar das von *a'* entspringende Bündel nach hinten, das von *c'* entspringende aber in gleichem Maasse nach vorn drehen, und folglich in dem Grade als ersteres erschlafft, letzteres sich spannen müssen. Fig. 2. zeigt diese veränderte Lage des Bandes.



Mechanik der menschlichen Gehwerkzeuge.

Eine
anatomisch-physiologische Untersuchung

von den Brüdern

Wilhelm Weber
Professor in Göttingen

und

Eduard Weber
Professor in Leipzig.

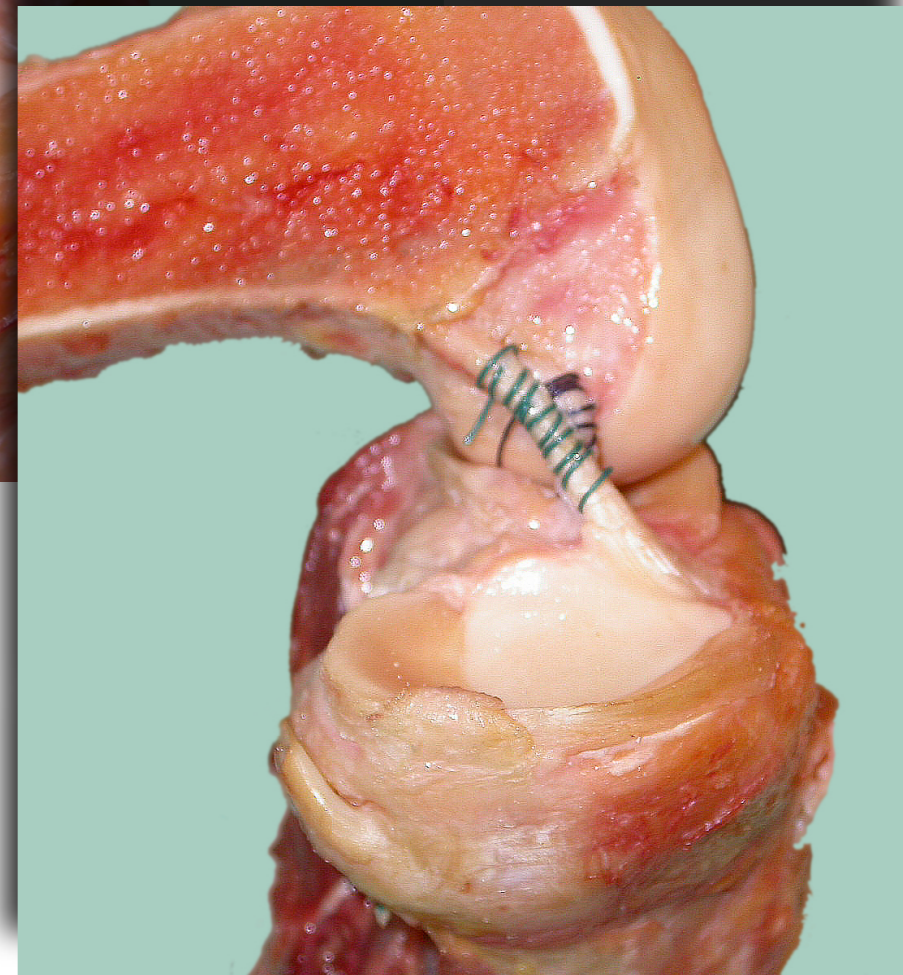
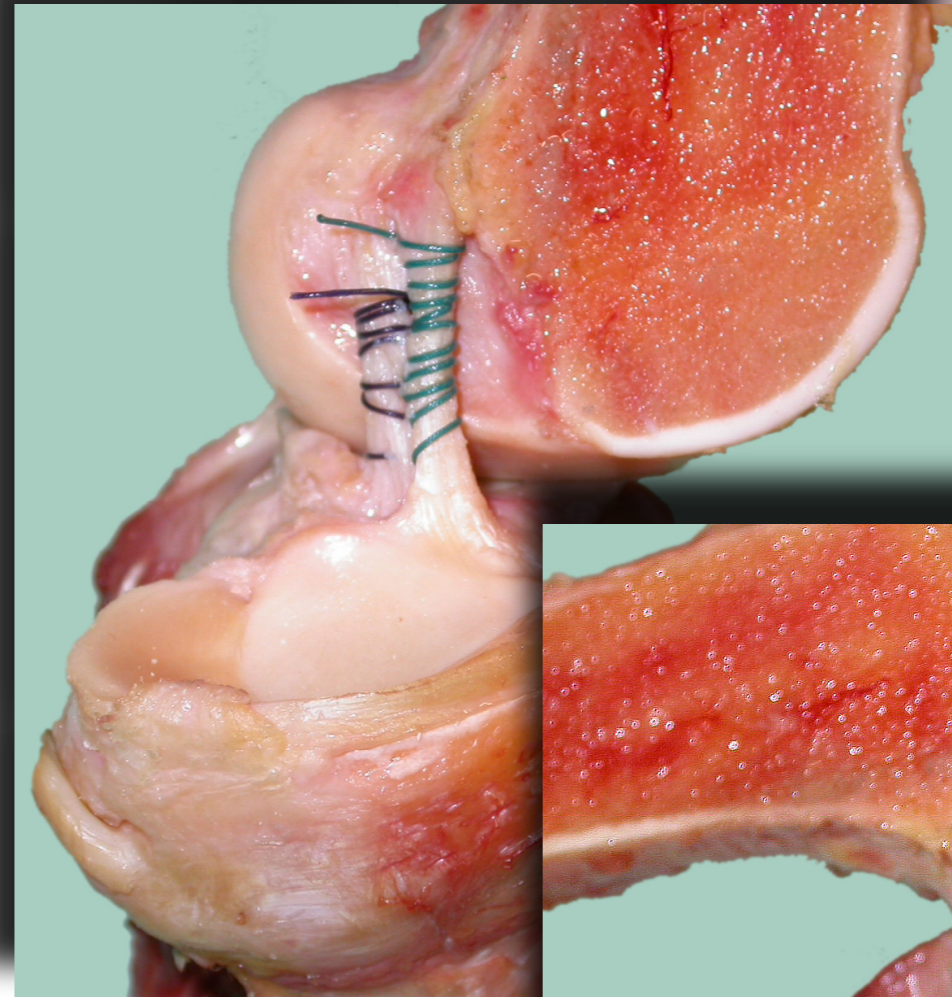
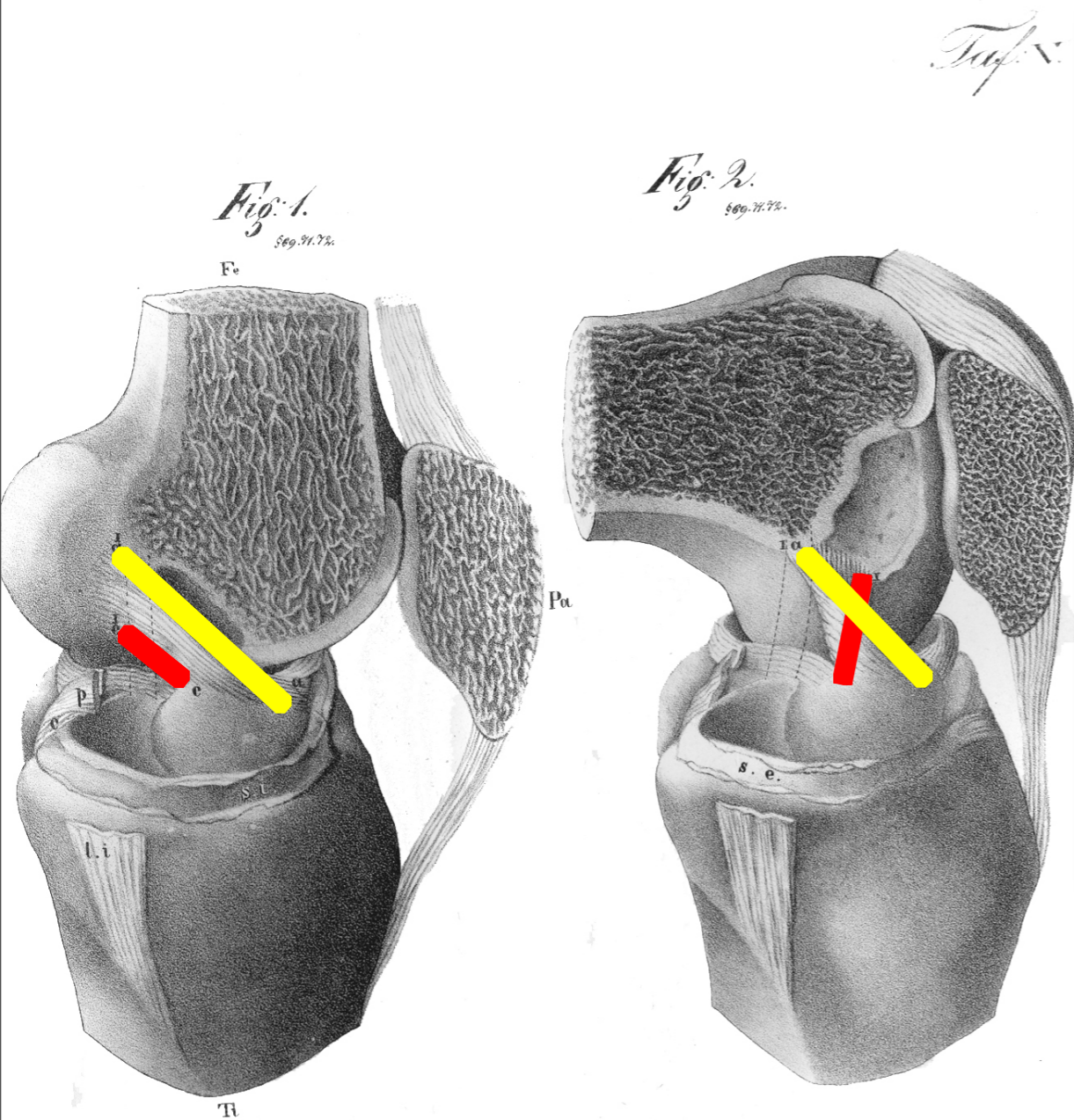
*Weber
Mechanik
d. menschl.
Gehwerkzeuge*

Nebst einem Hefte mit 17 Tafeln anatomischer Abbildungen.

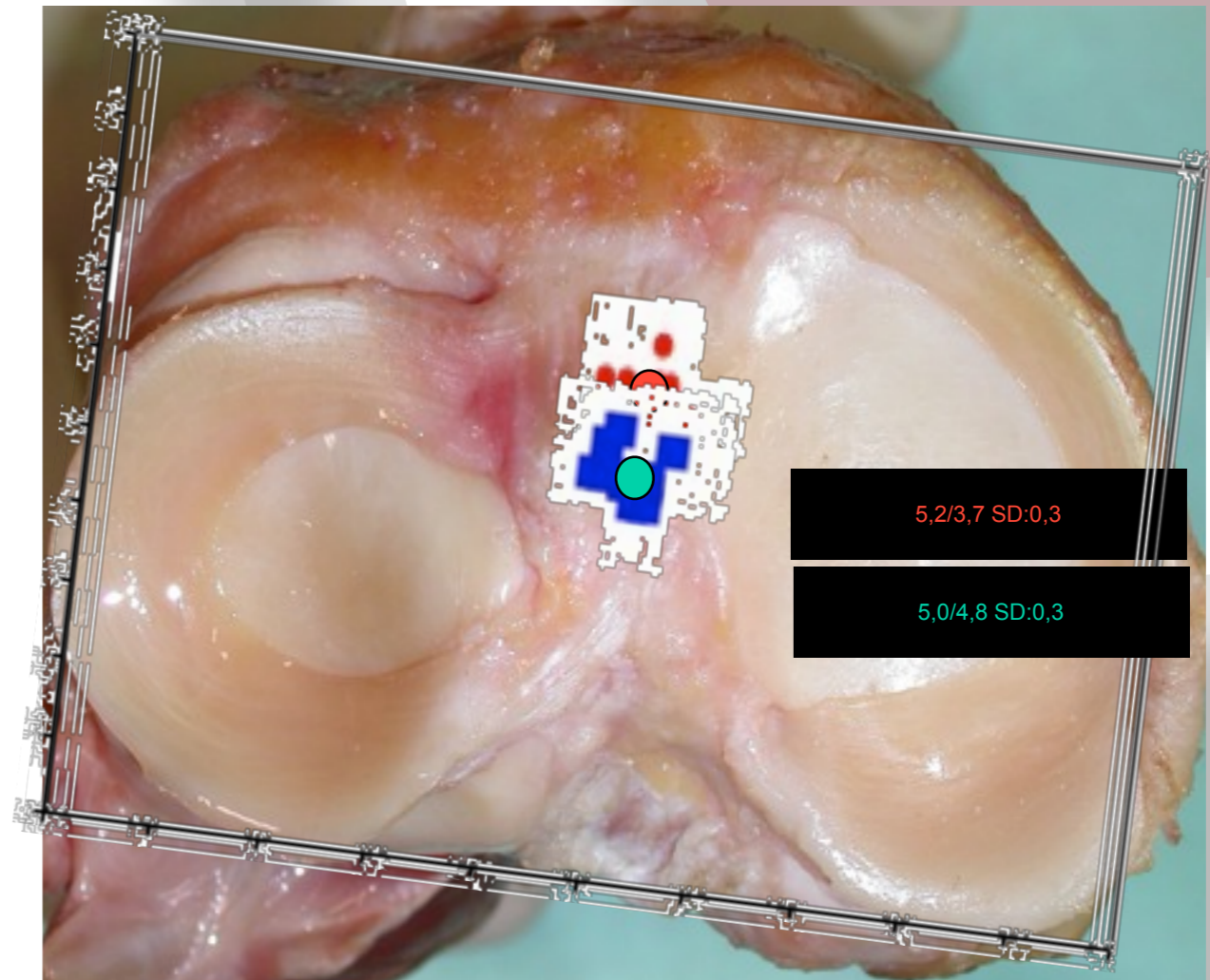
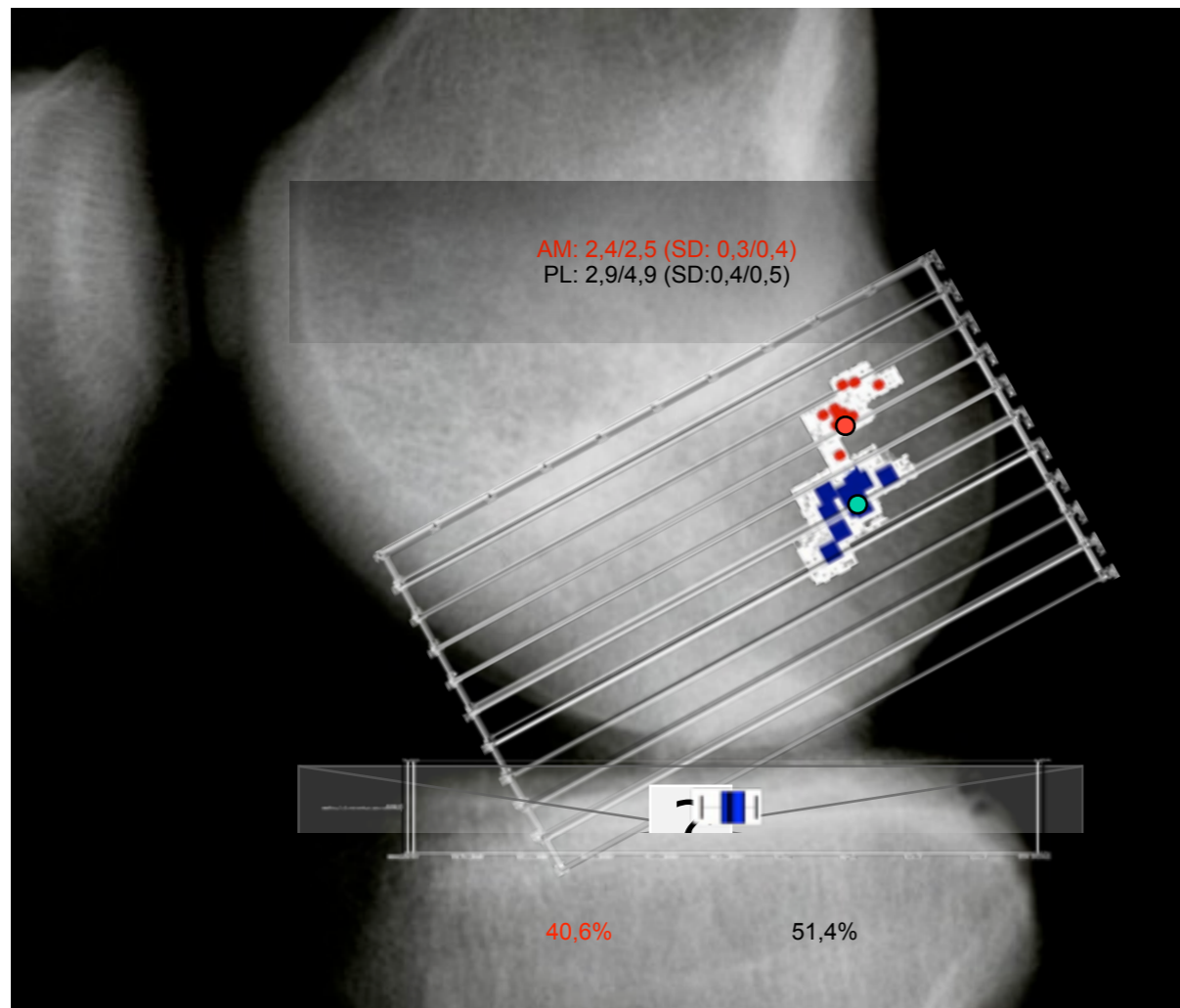
Göttingen,
in der Dieterichschen Buchhandlung.
1836.

57 BS dir

Anatomie



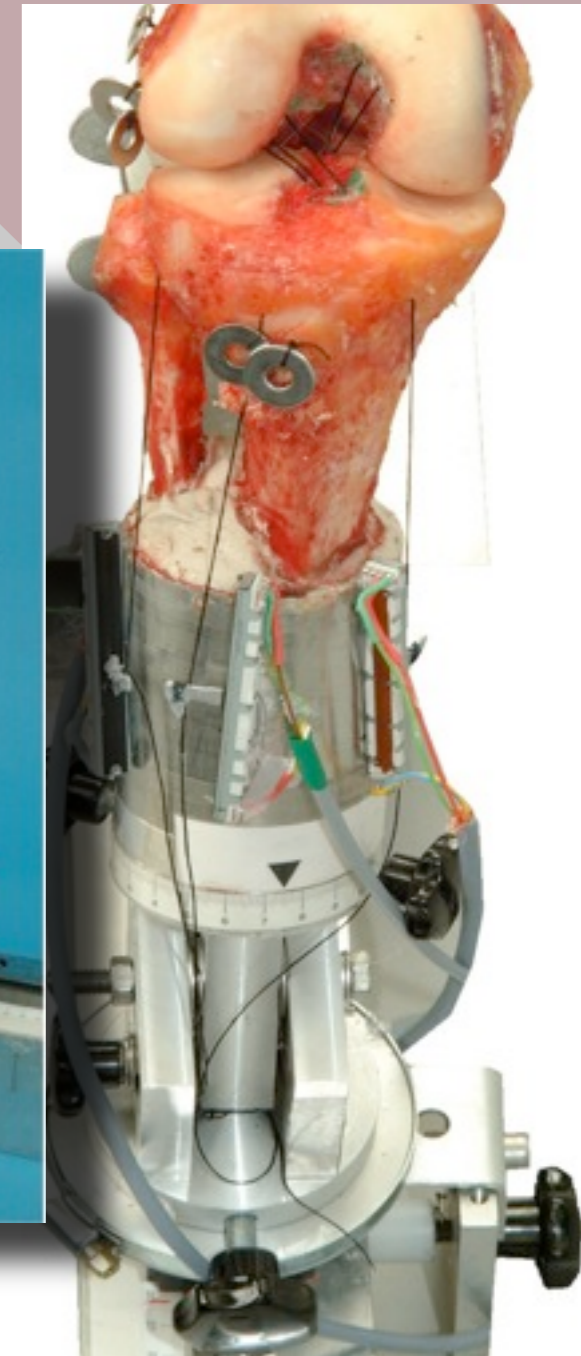
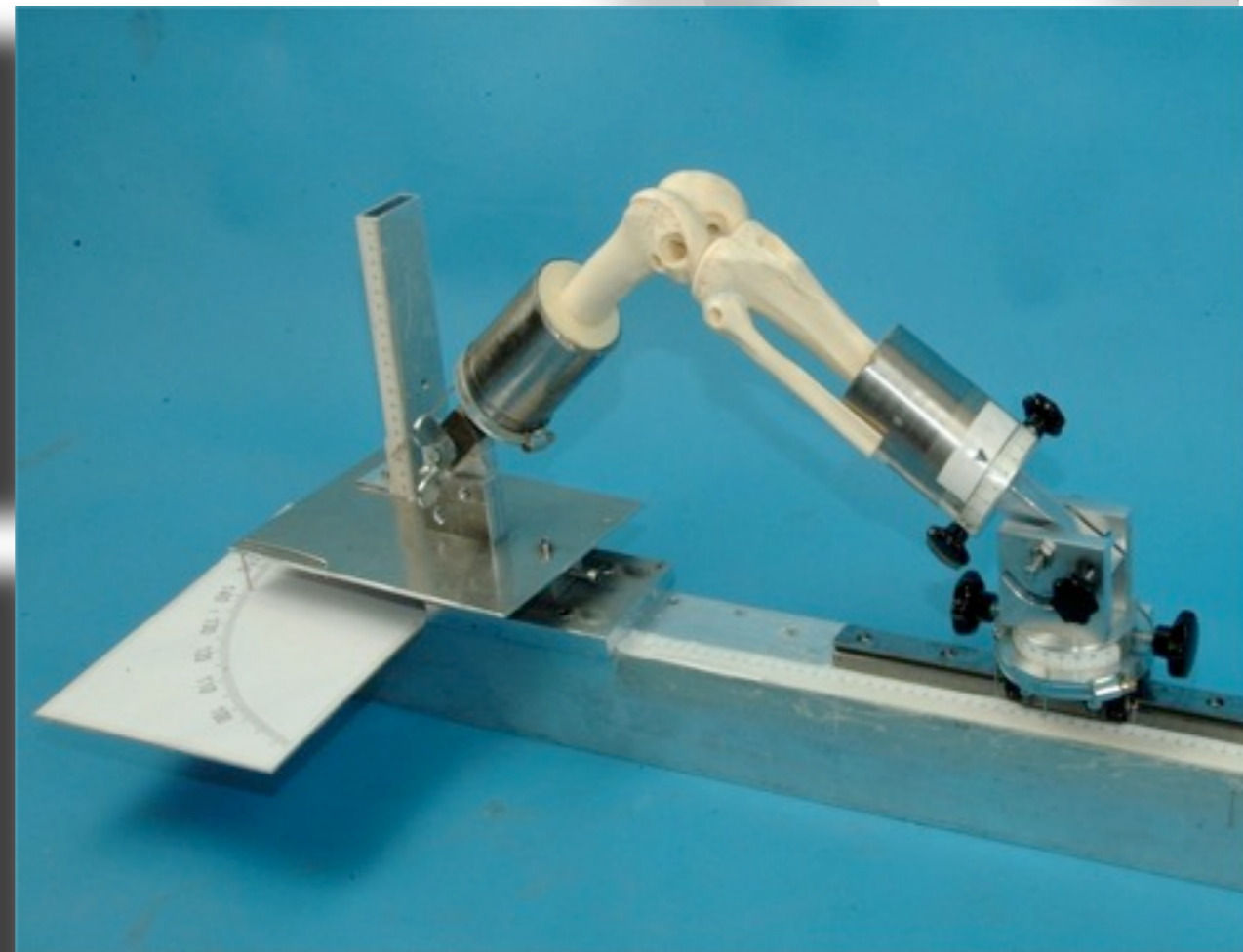
Insertion area



Definition des Gravitationszentrums der funktionellen Bündel

7 Präparate, fresh frozen

Prüfgerät mit 6 Freiheitsgraden



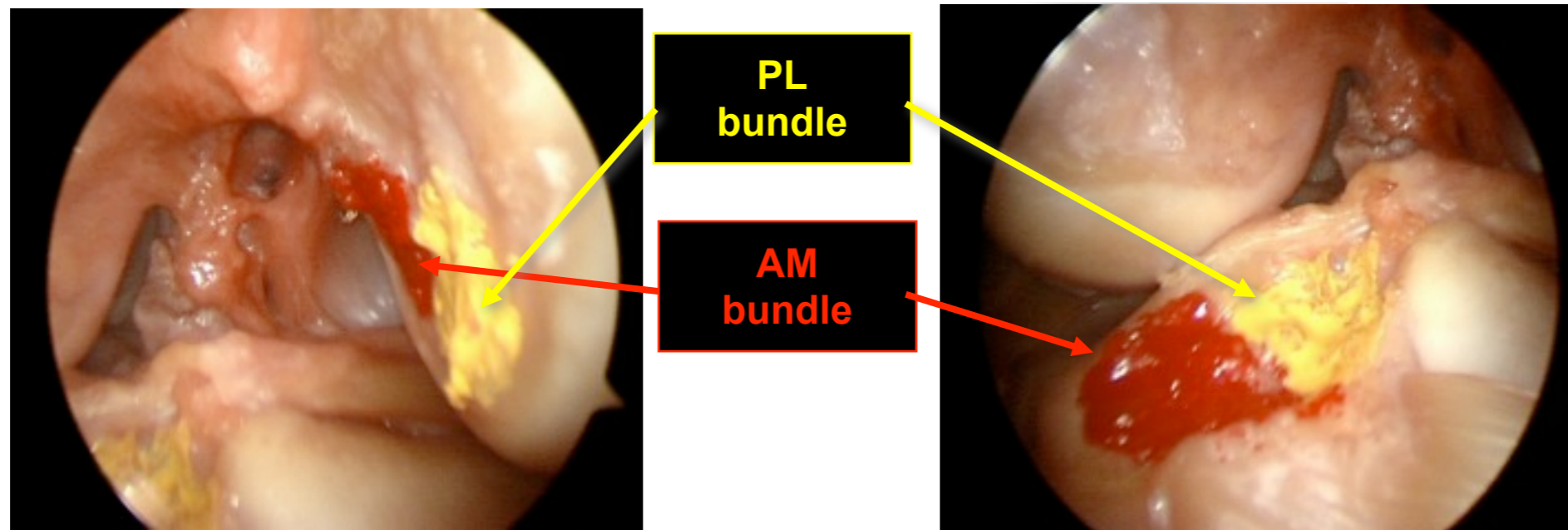
Biomechanik

0363-5465/102/3030-0660\$02.00/0
THE AMERICAN JOURNAL OF SPORTS MEDICINE, Vol. 30, No. 5
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Biomechanical Analysis of an Anatomic Anterior Cruciate Ligament Reconstruction

Masayoshi Yagi, MD, Eric K. Wong, MS, Akihiro Kanamori, MD, Richard E. Debski, PhD, Freddie H. Fu, MD, and Savio L-Y. Woo,* PhD

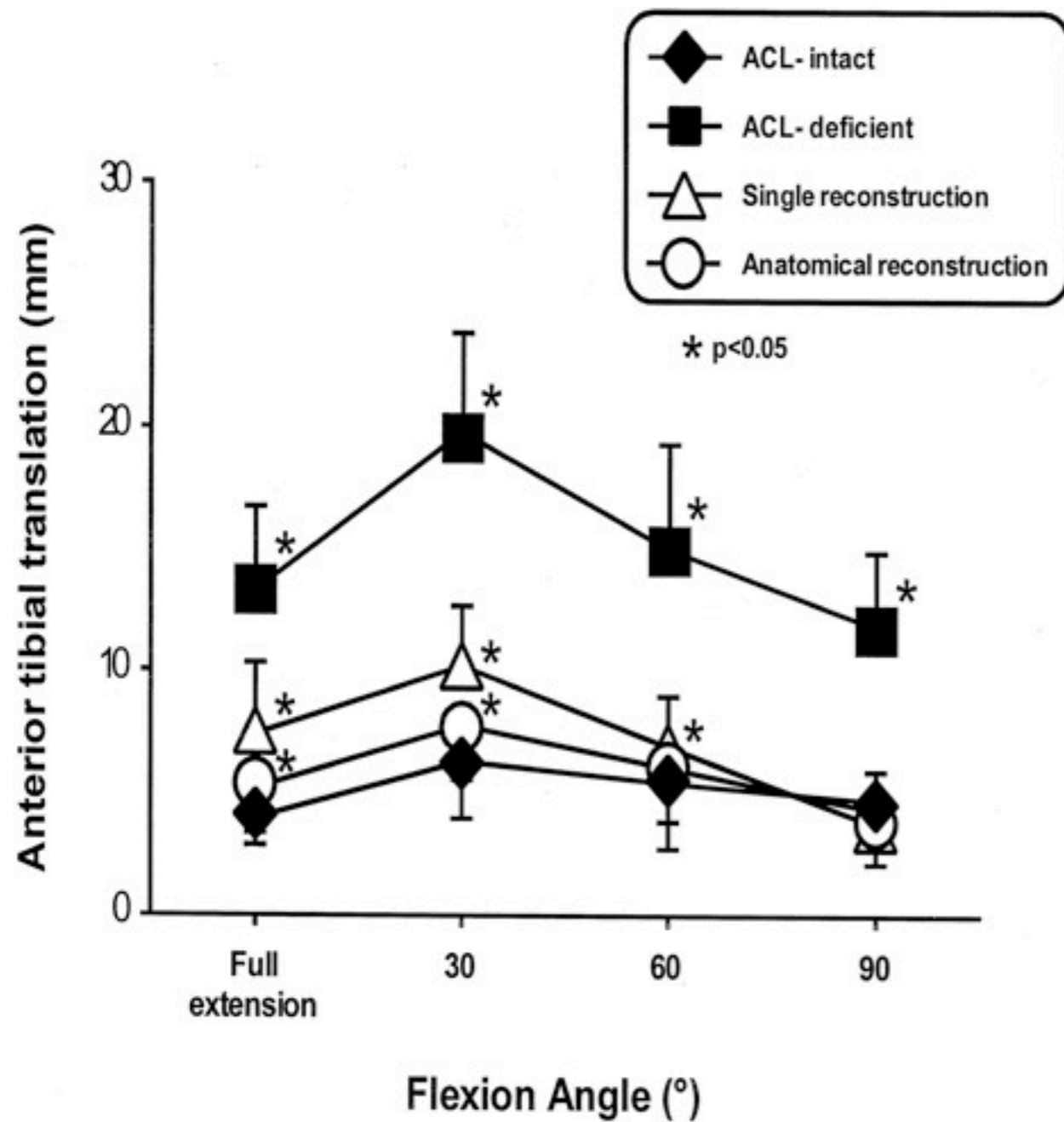
From the Musculoskeletal Research Center, Department of Orthopaedic Surgery, University of Pittsburgh, Pittsburgh, Pennsylvania



Femoral

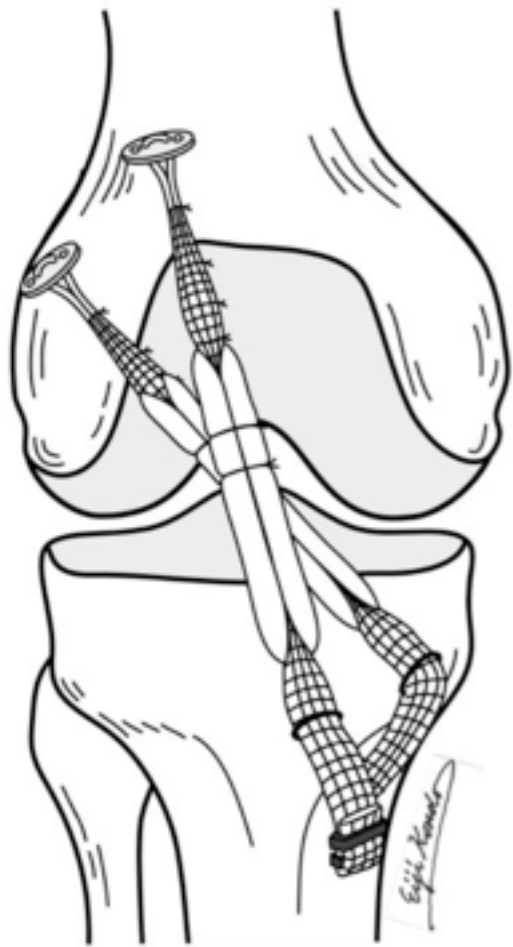
Tibial

Biomechanik

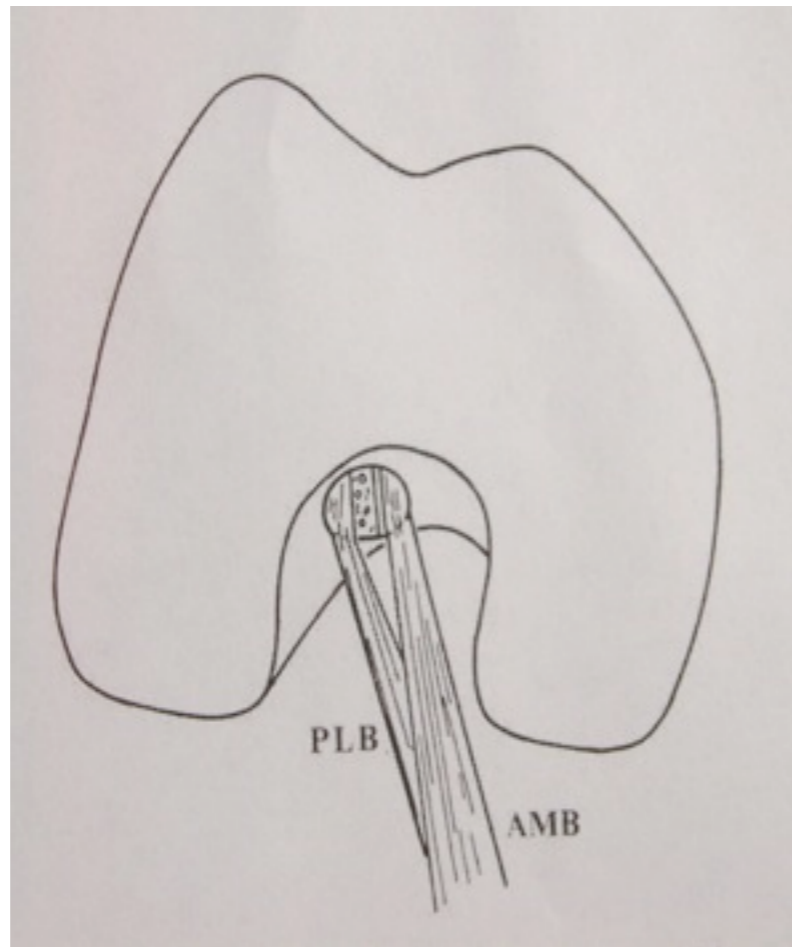


Yagi, Fu, Woo, AJSM 2002

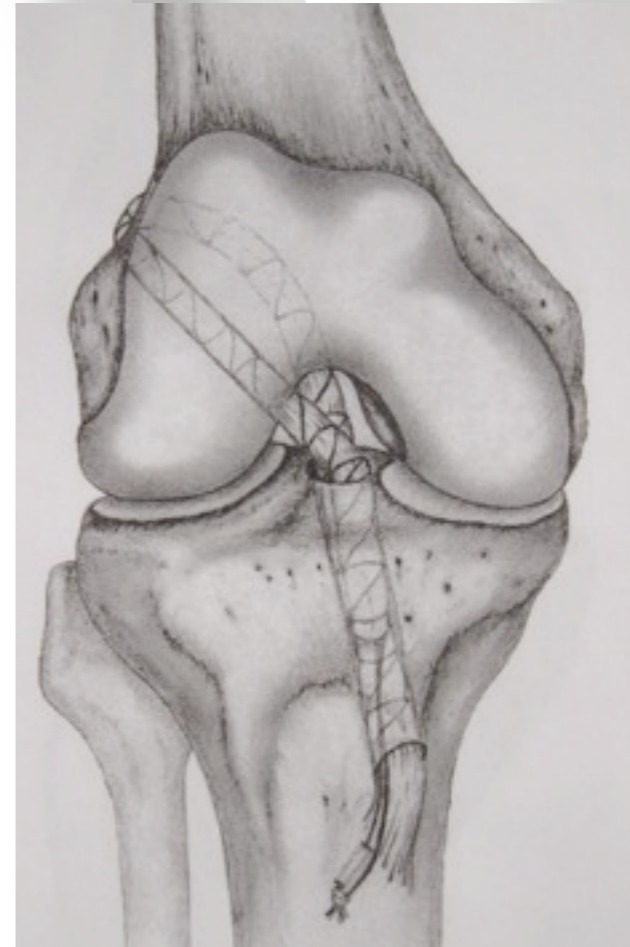
Operative Techniken



Yasuda 2004 Arthroscopy



Takeuchi 2001 Arthroscopy



Marcacci 2003 Arthroscopy



Aglietti 2005

Anatomische Rekonstruktion



Technical Note

Double-Stranded Hamstring Graft for Anterior Cruciate Ligament Reconstruction

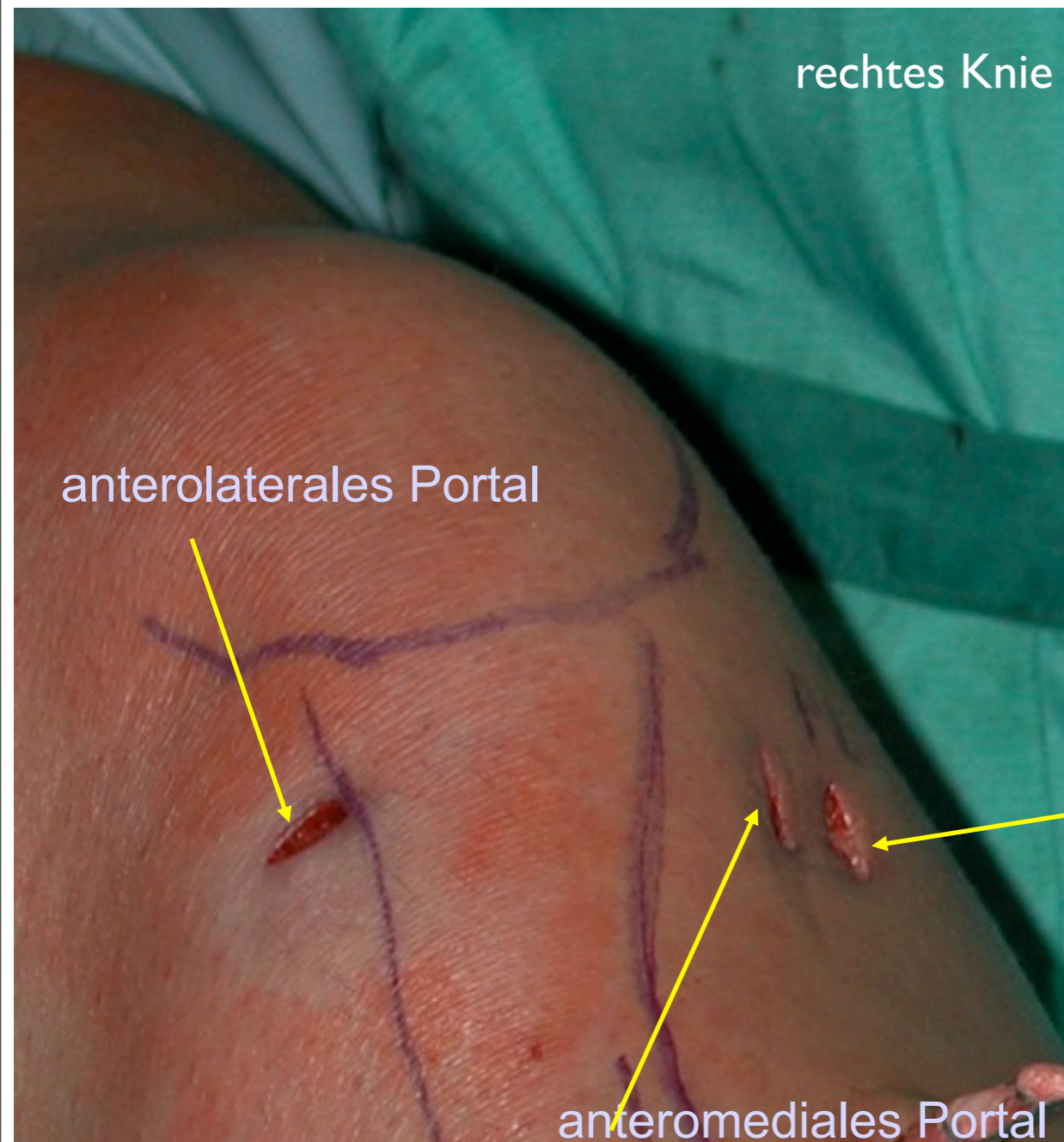
Guy Bellier, M.D., Pascal Christel, M.D., Philippe Colombet, M.D.,
Patrick Djian, M.D., Jean Pierre Franceschi, M.D., and Abdou Sbihi, M.D.



Arthroscopy 2004 Oktober

Technik

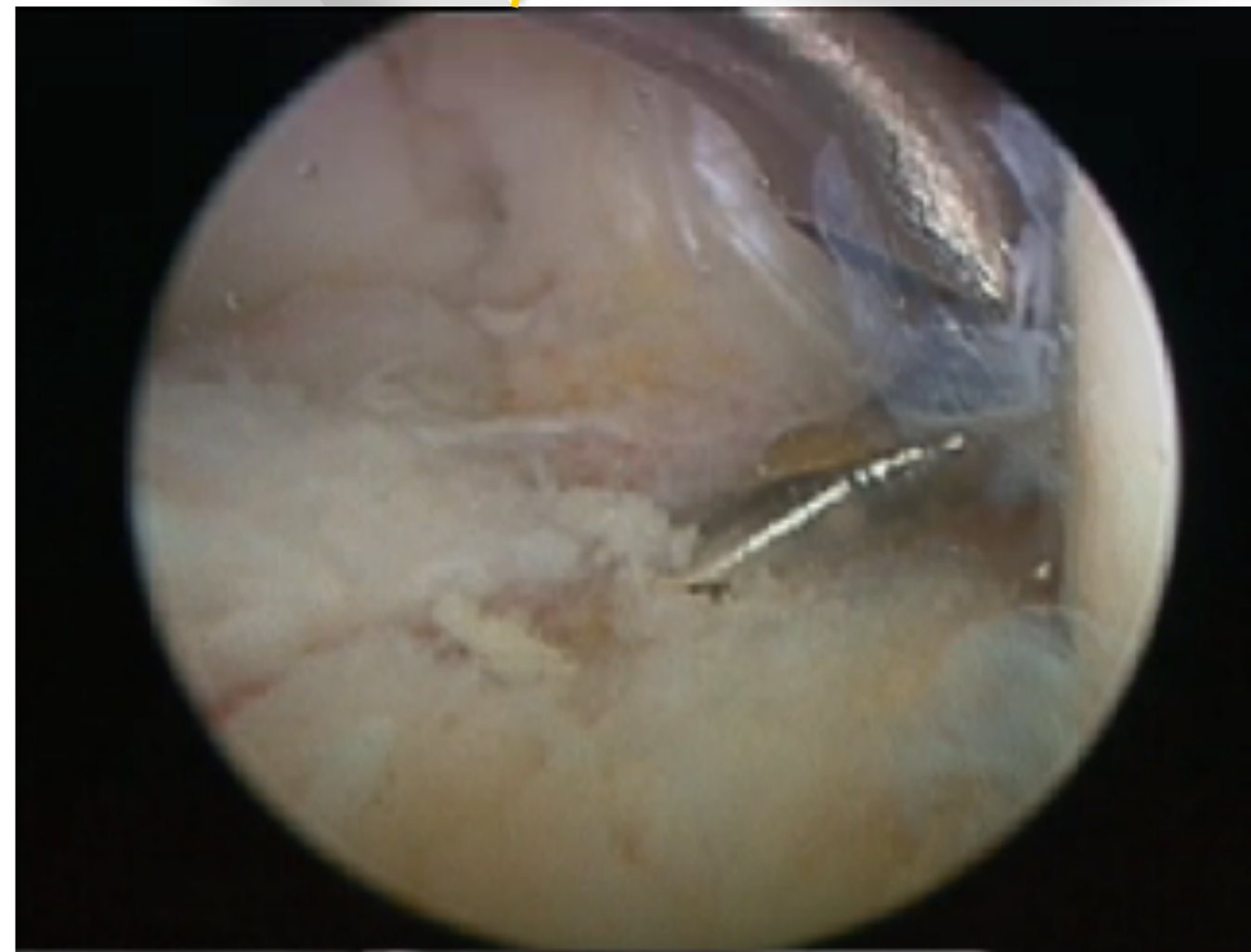
3 Portale Double-bundle ACL



PL tibial



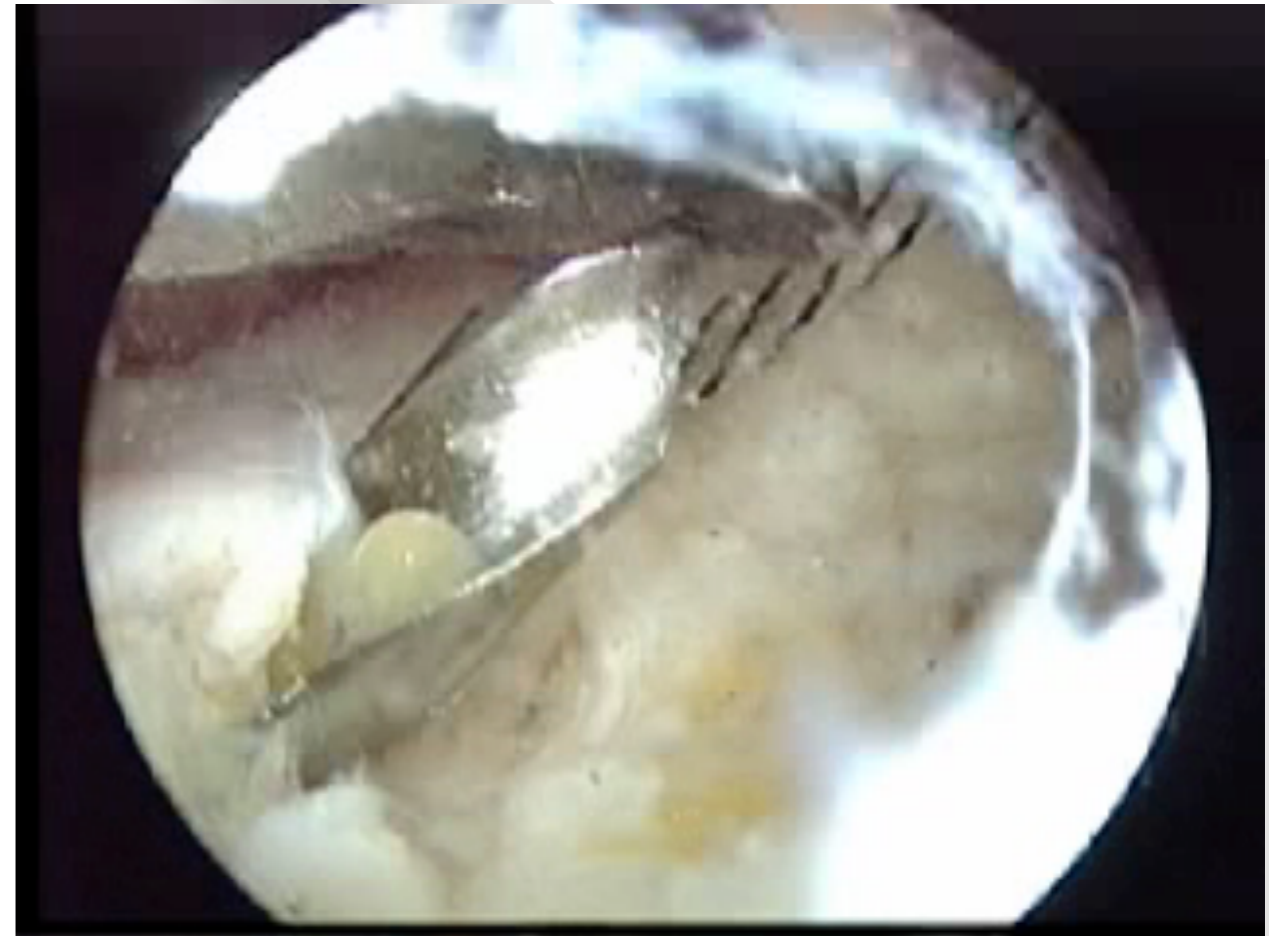
Tibial 45°



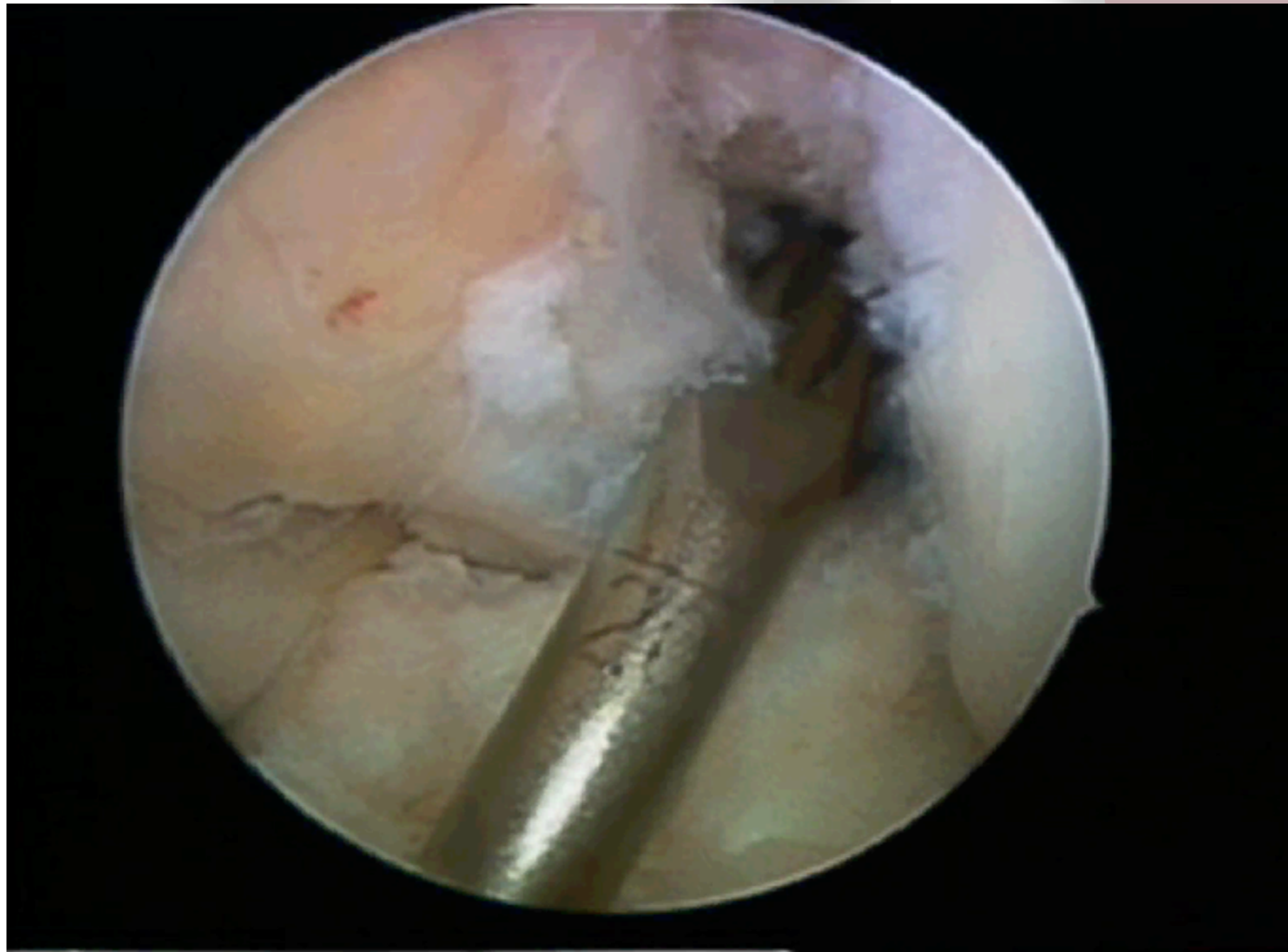
AM tibial



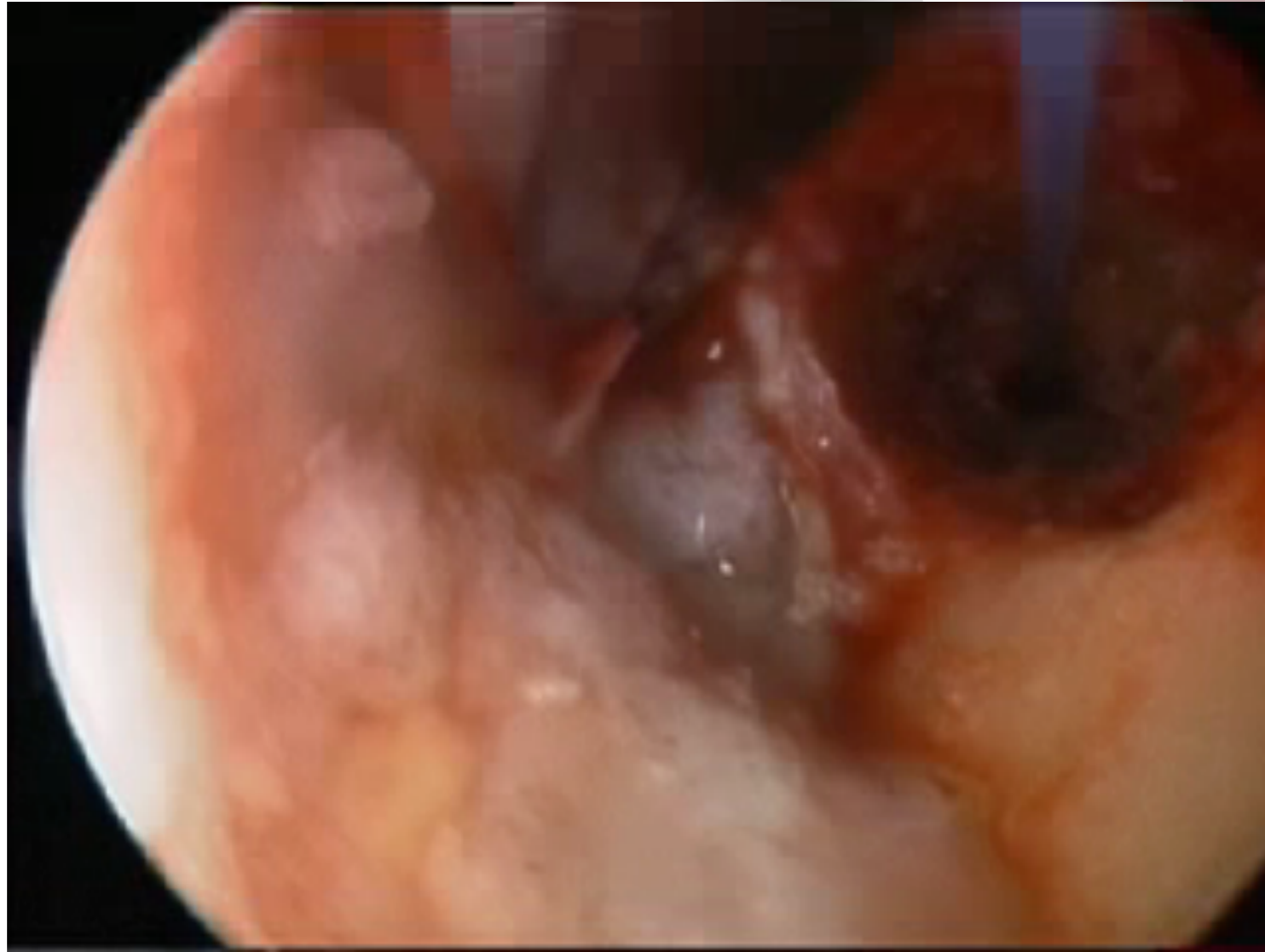
Tibial 60°



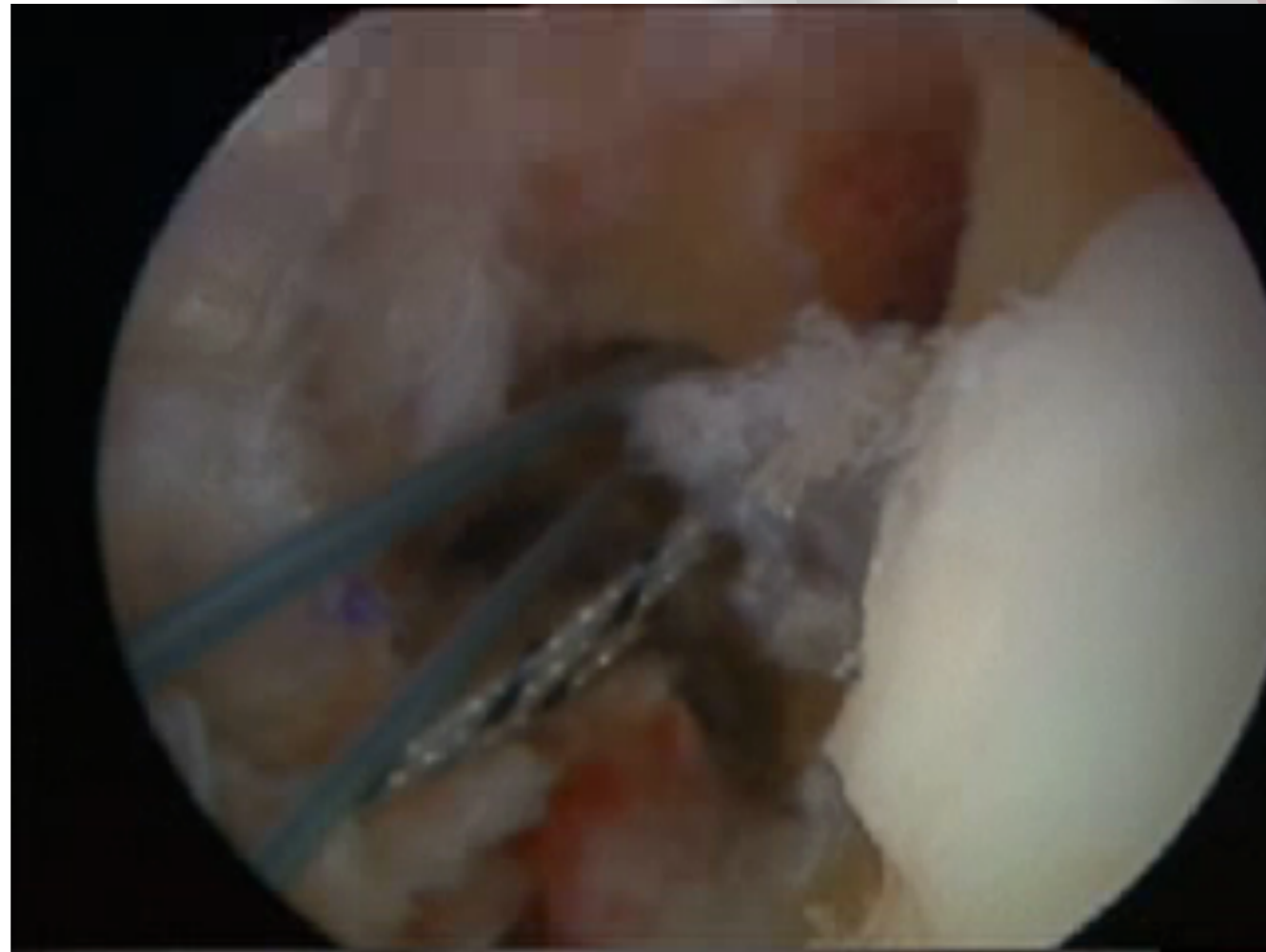
femorale Präparation



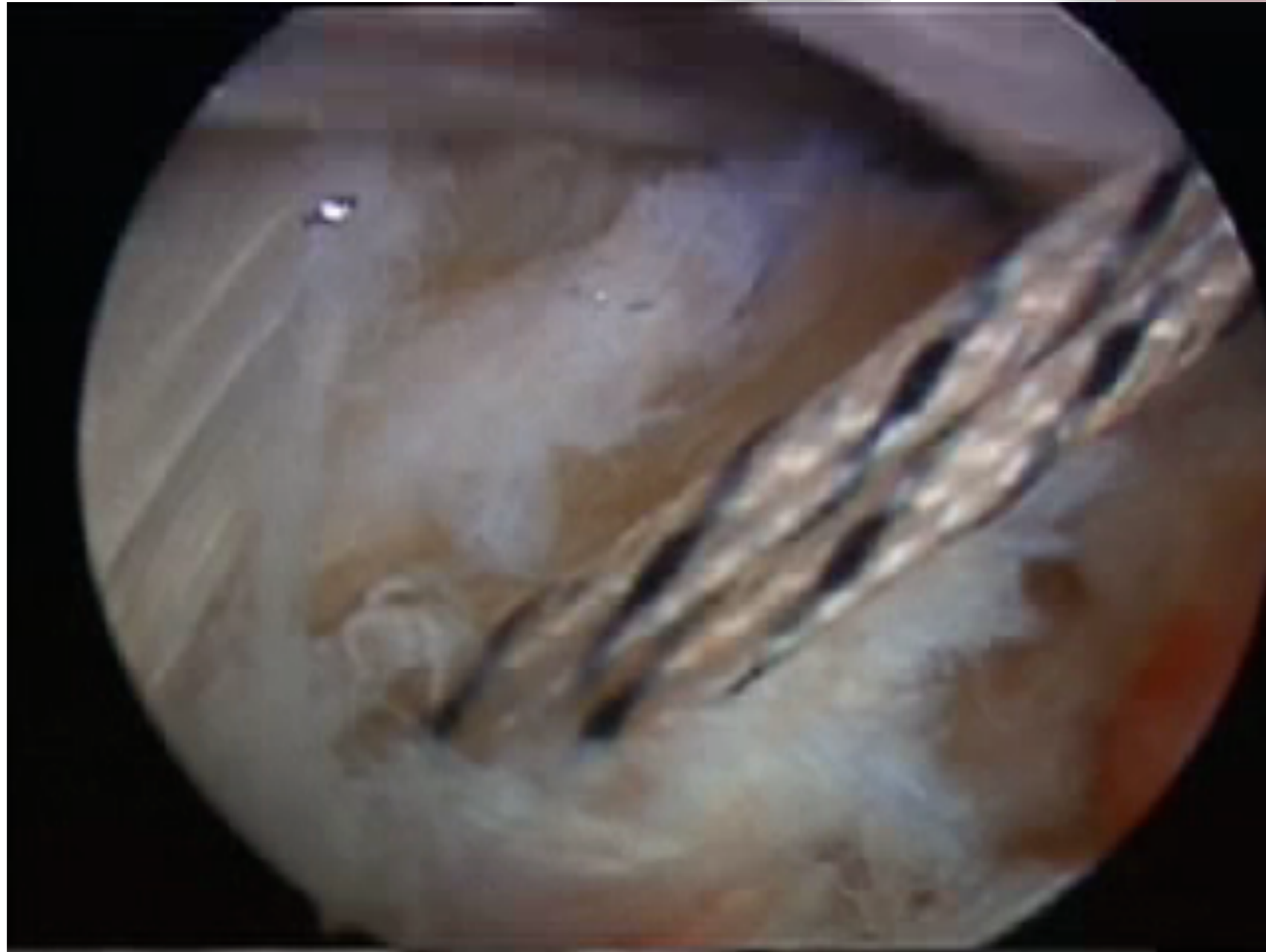
Positionierung der Shuttlefäden



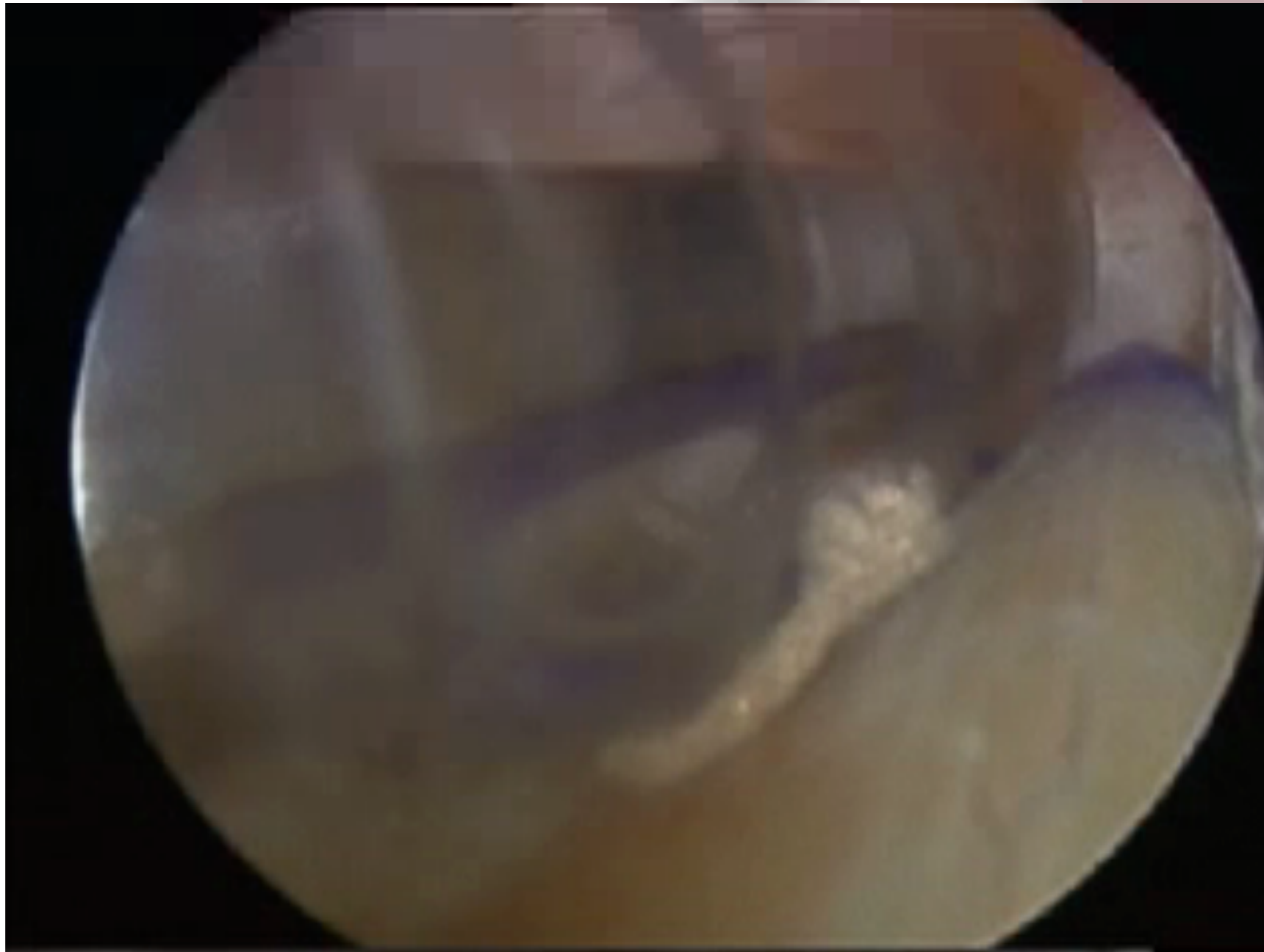
Insertion des AM-Bündels (ST)



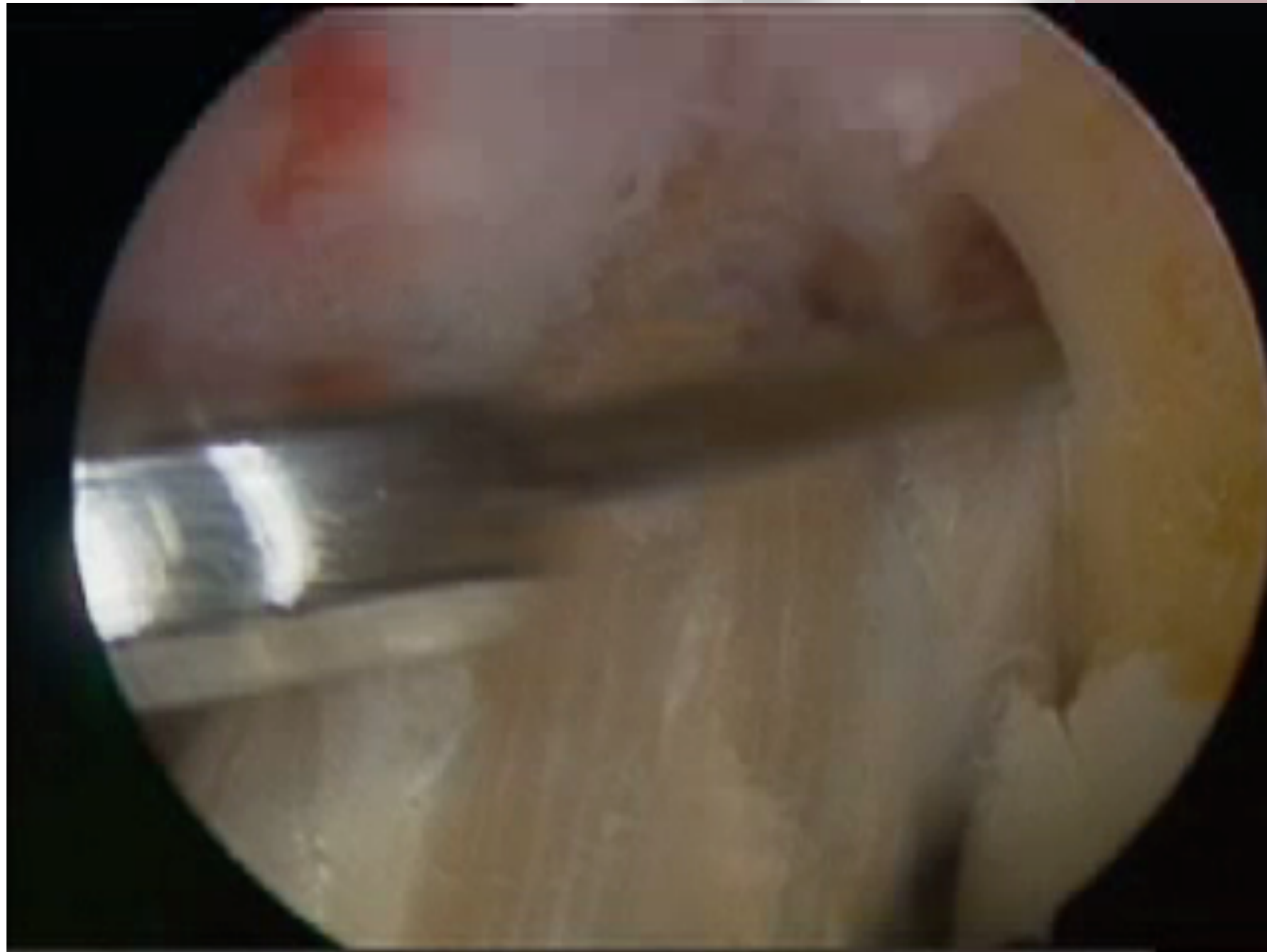
Insertion des PL-Bündels (Gracilis)



Femorale Fixation (AM) mit Bioschraube (7 mm)

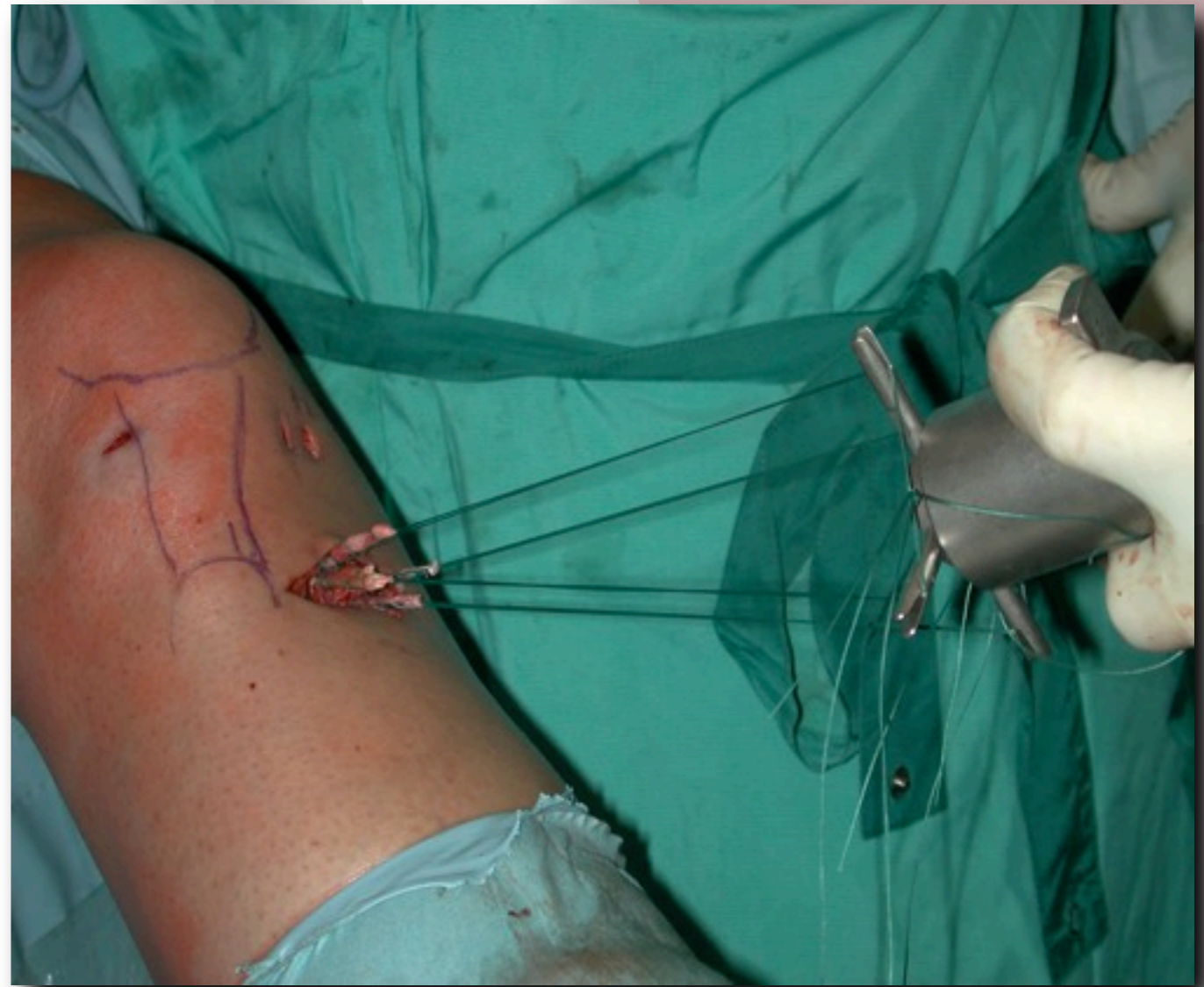
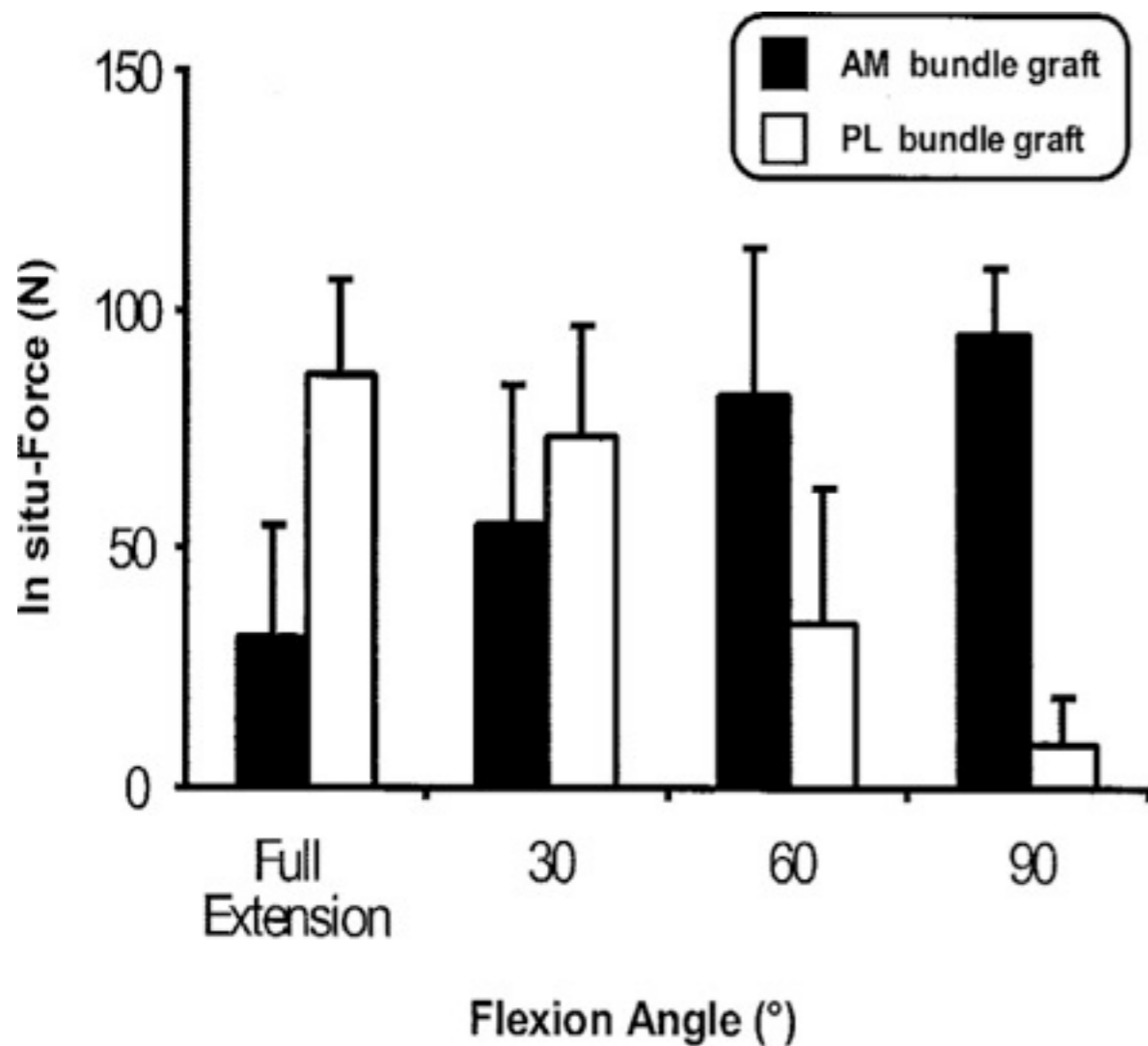


Femorale Fixation (PL) mit Bioschraube (7 mm)



Biomechanical Analysis of an Anatomic Anterior Cruciate Ligament Reconstruction

Masayoshi Yagi, MD, Eric K. Wong, MS, Akihiro Kanamori, MD, Richard E. Debski, PhD, Freddie H. Fu, MD, and Savio L-Y. Woo,* PhD



*Am J Sports
Med 2002*

Transplantat-Fixation

Autor	AM	PL
Yasuda et al., 2004	10 Grad	10 Grad
Yagi et al., 2004	60 Grad	15 Grad
Shino et al., 2004	20 Grad	20 Grad
Christel et al., 2004	60 - 90 Grad	15 Grad
Aglietti et al., 2004	45 Grad	10 Grad
Woo, ISAKOS, 2005	30-60 Grad	30 Grad
Amis ISAKOS, 2005	30-45 Grad	10-15 Grad
Fu 2008	60 Grad	10 Grad

Tibiale Fixation mit zwei bioresorbierbaren Interferenzschrauben



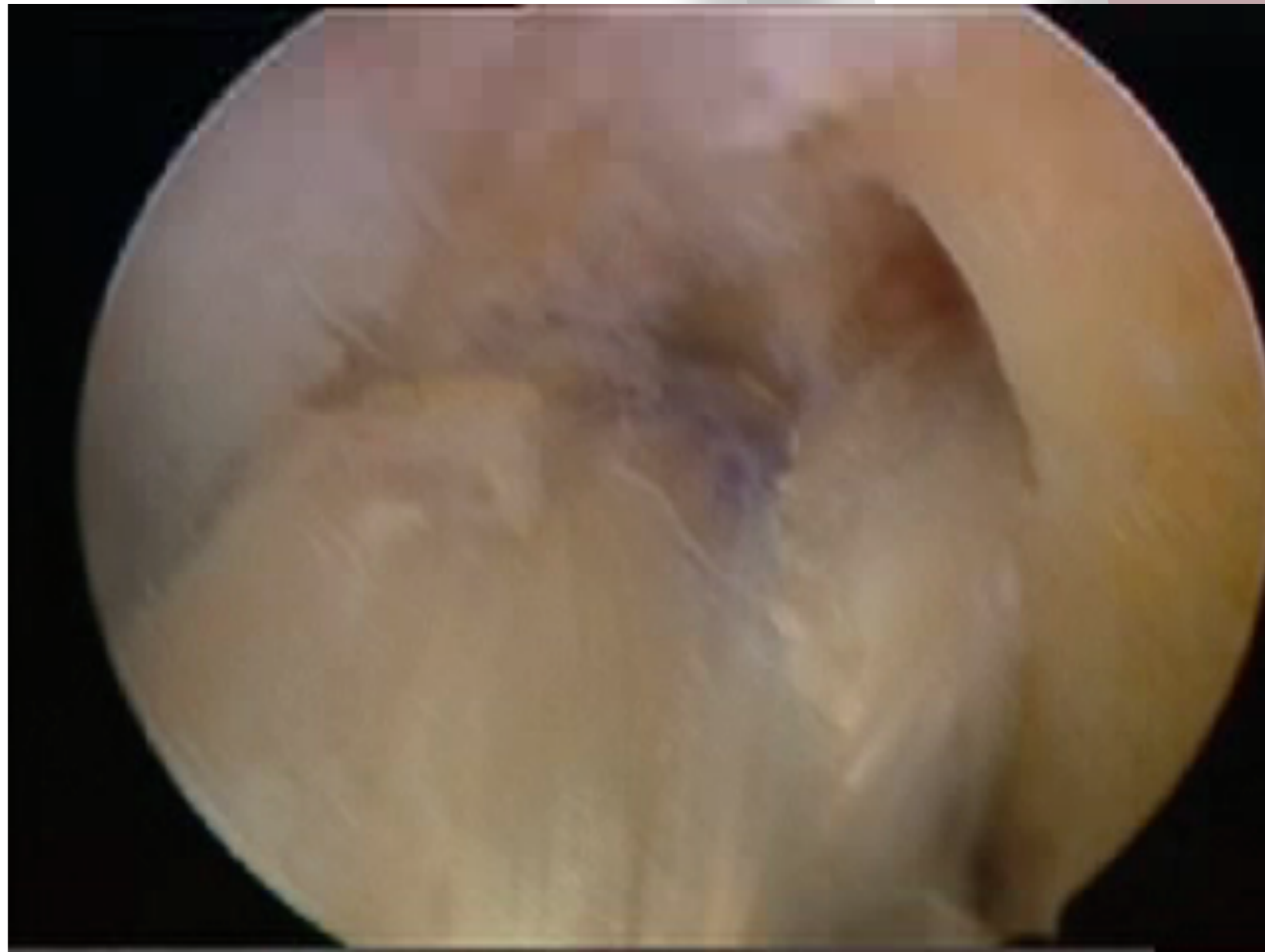
AM-Bündel

in 45-60° Flexion

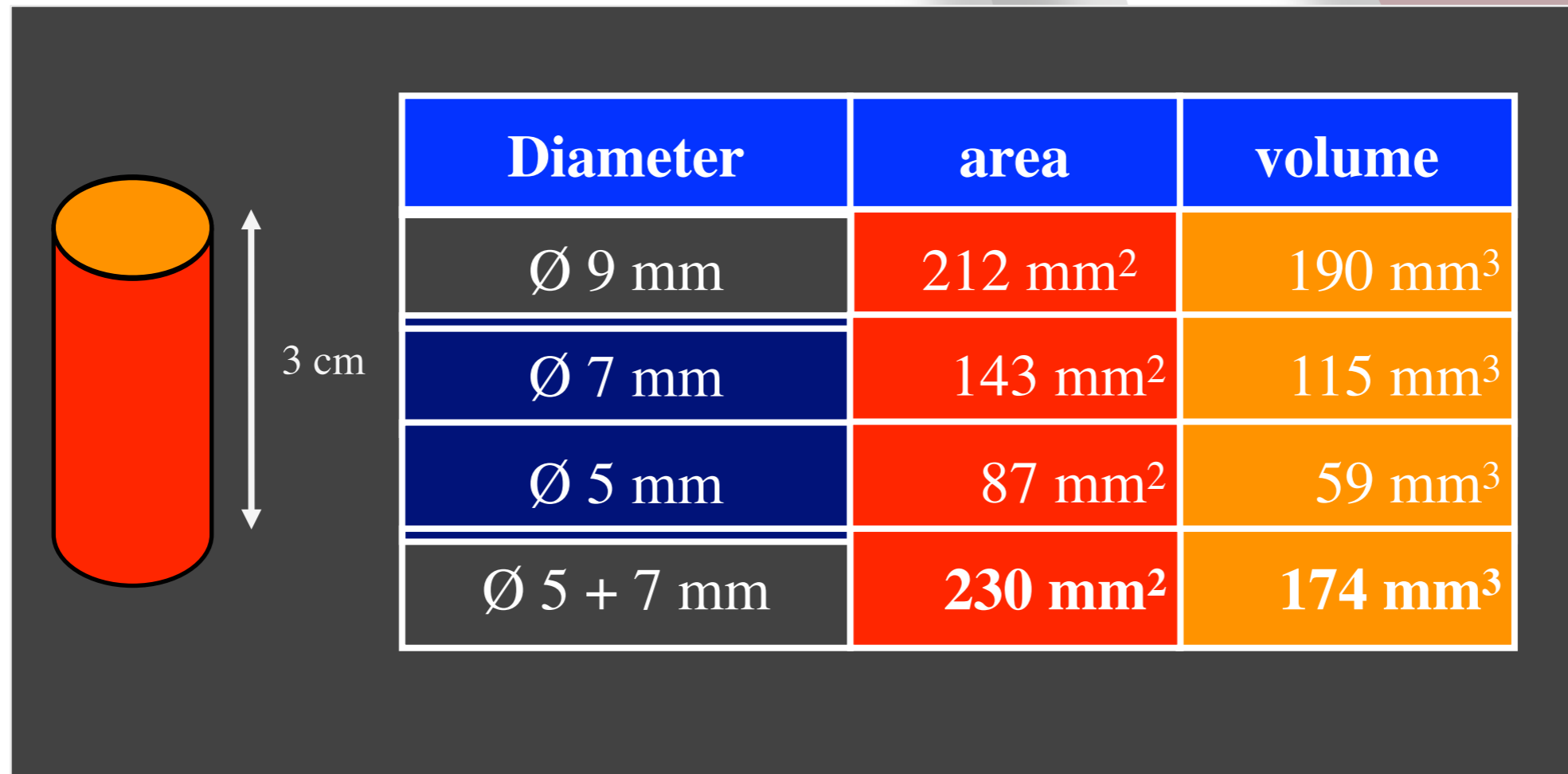
PL-Bündel

in 0-10° Flexion

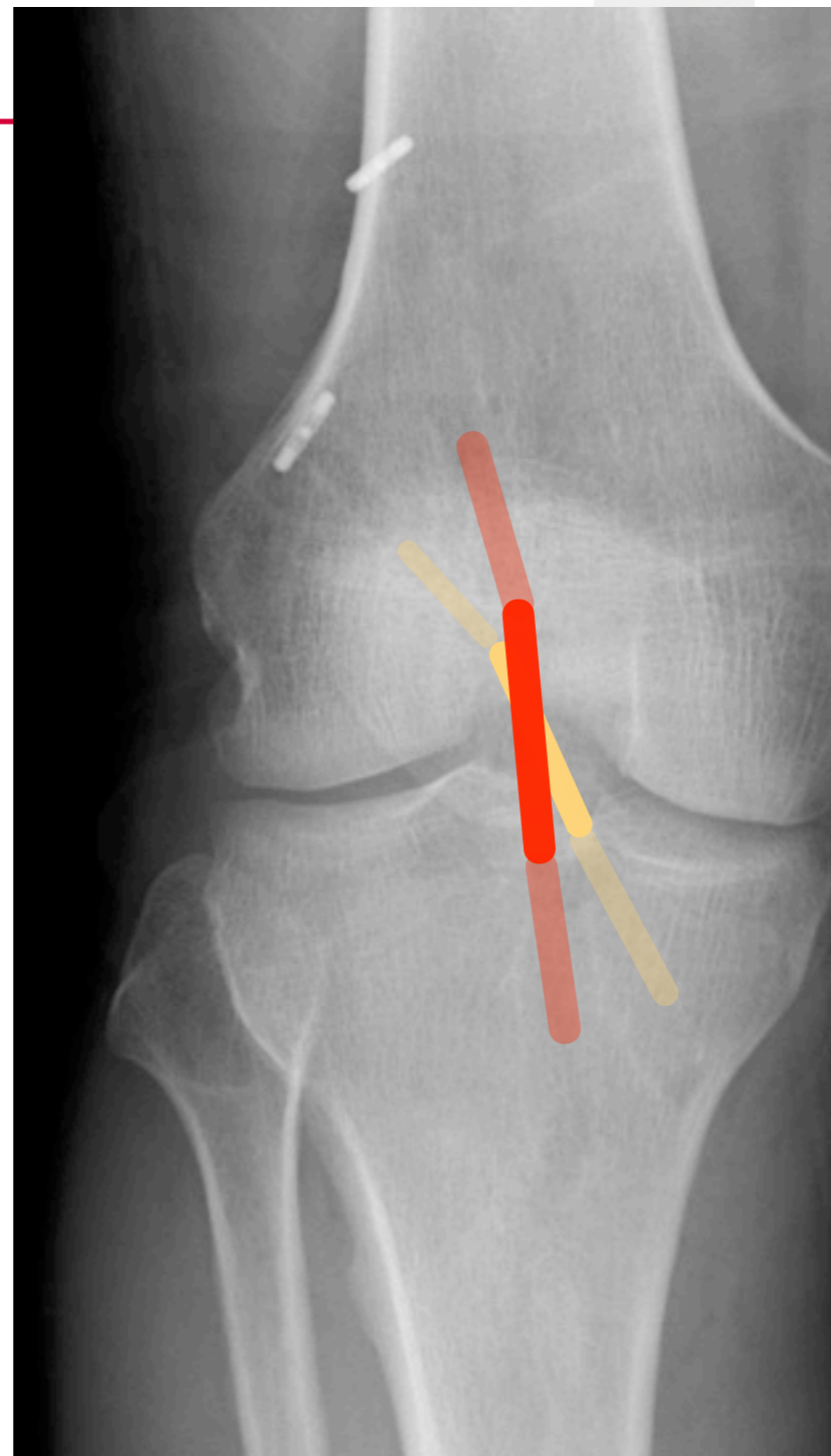
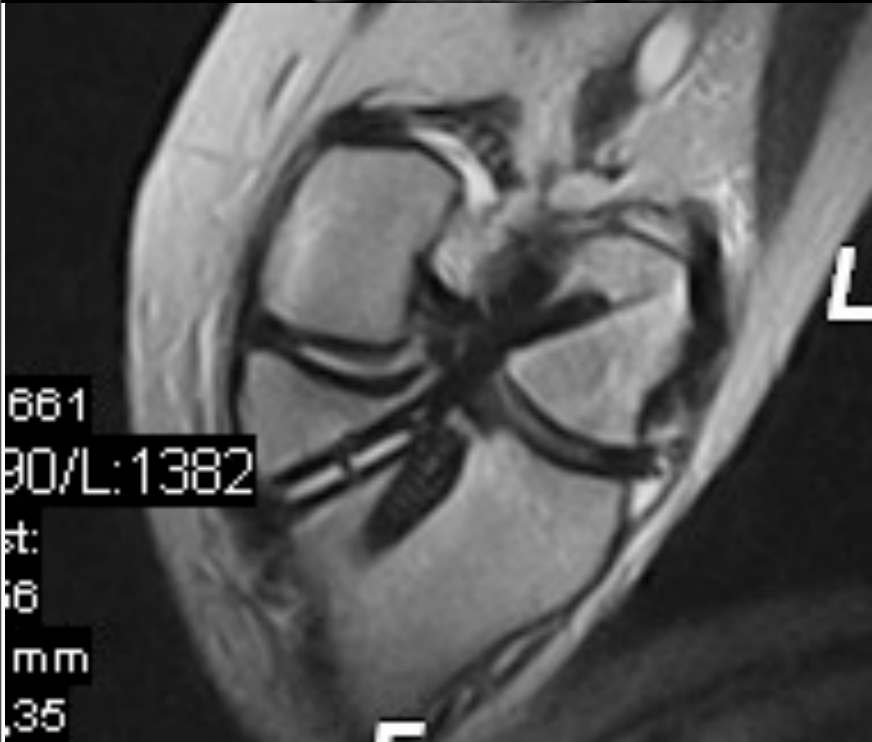
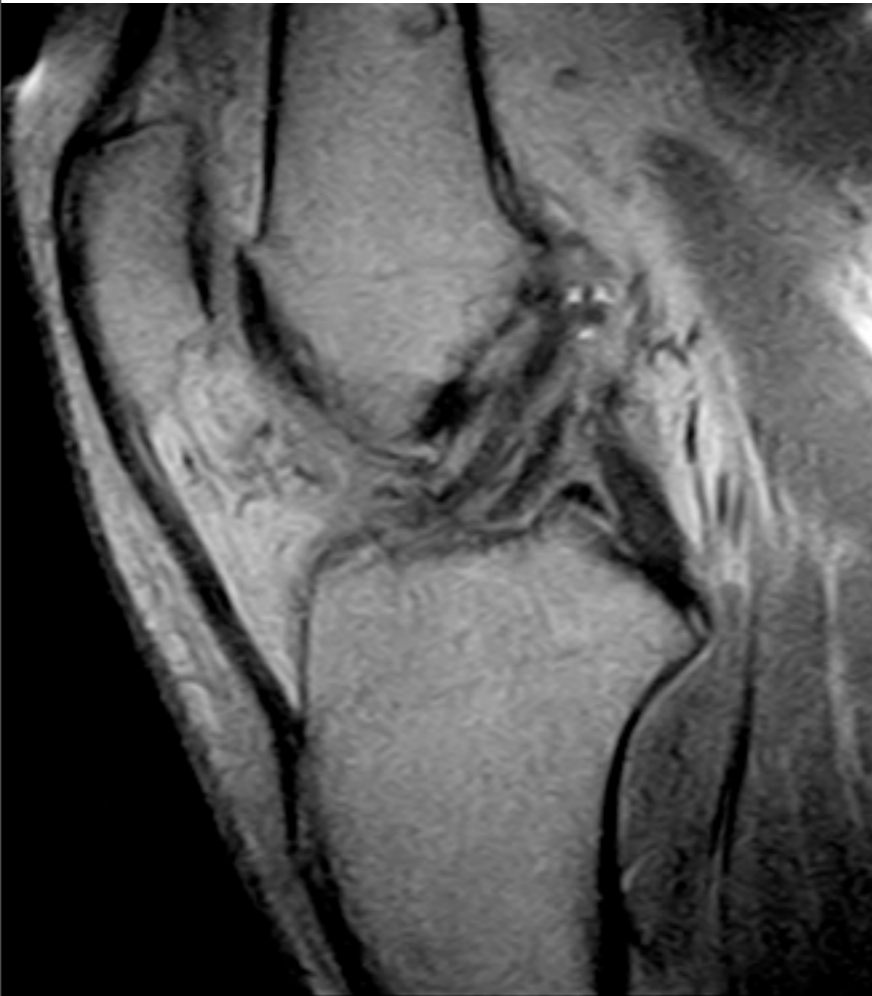
Notch-Impingement-Test



verbesserte Einheilung ? geringerer Knochenverlust ?

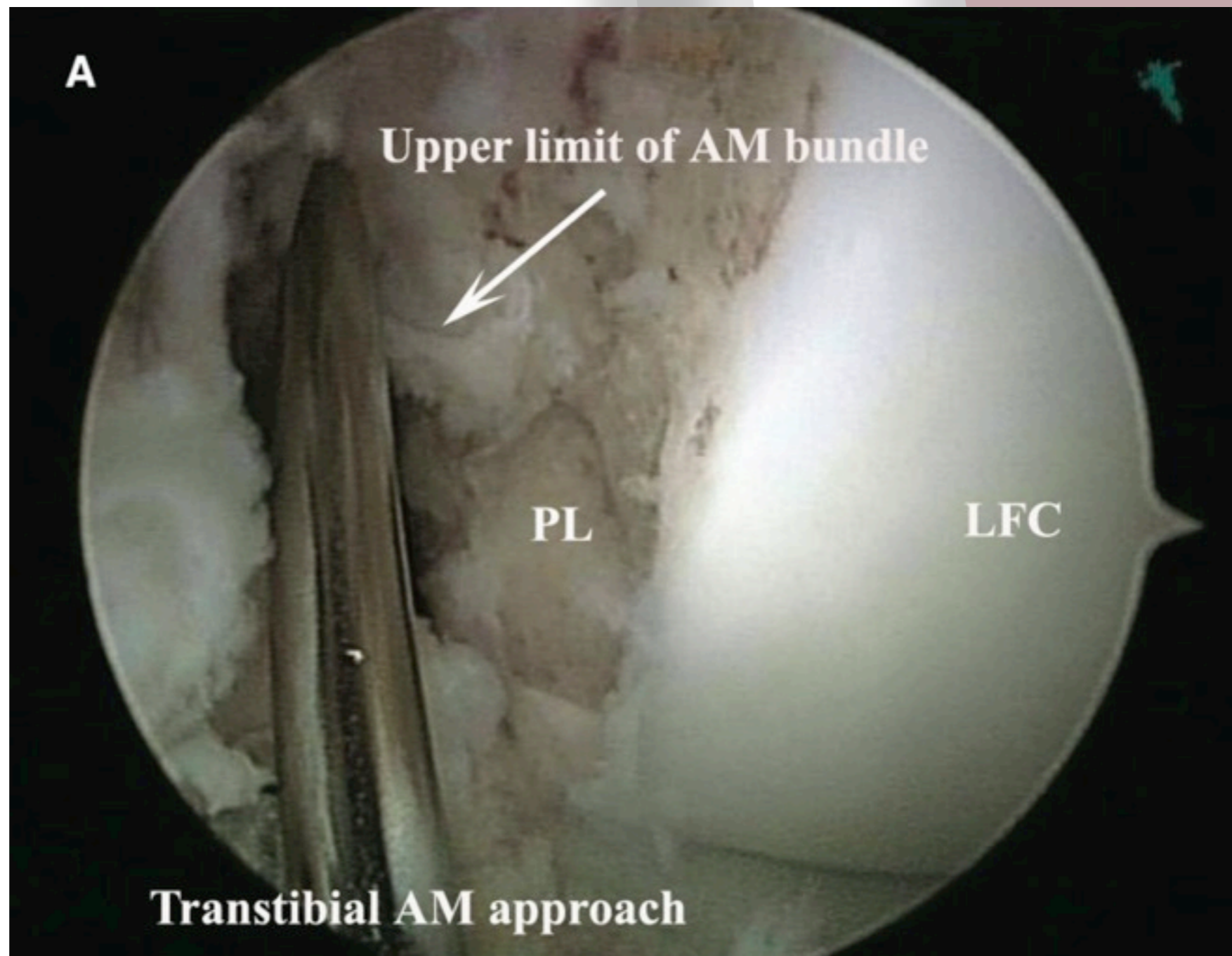


Transplantatlage

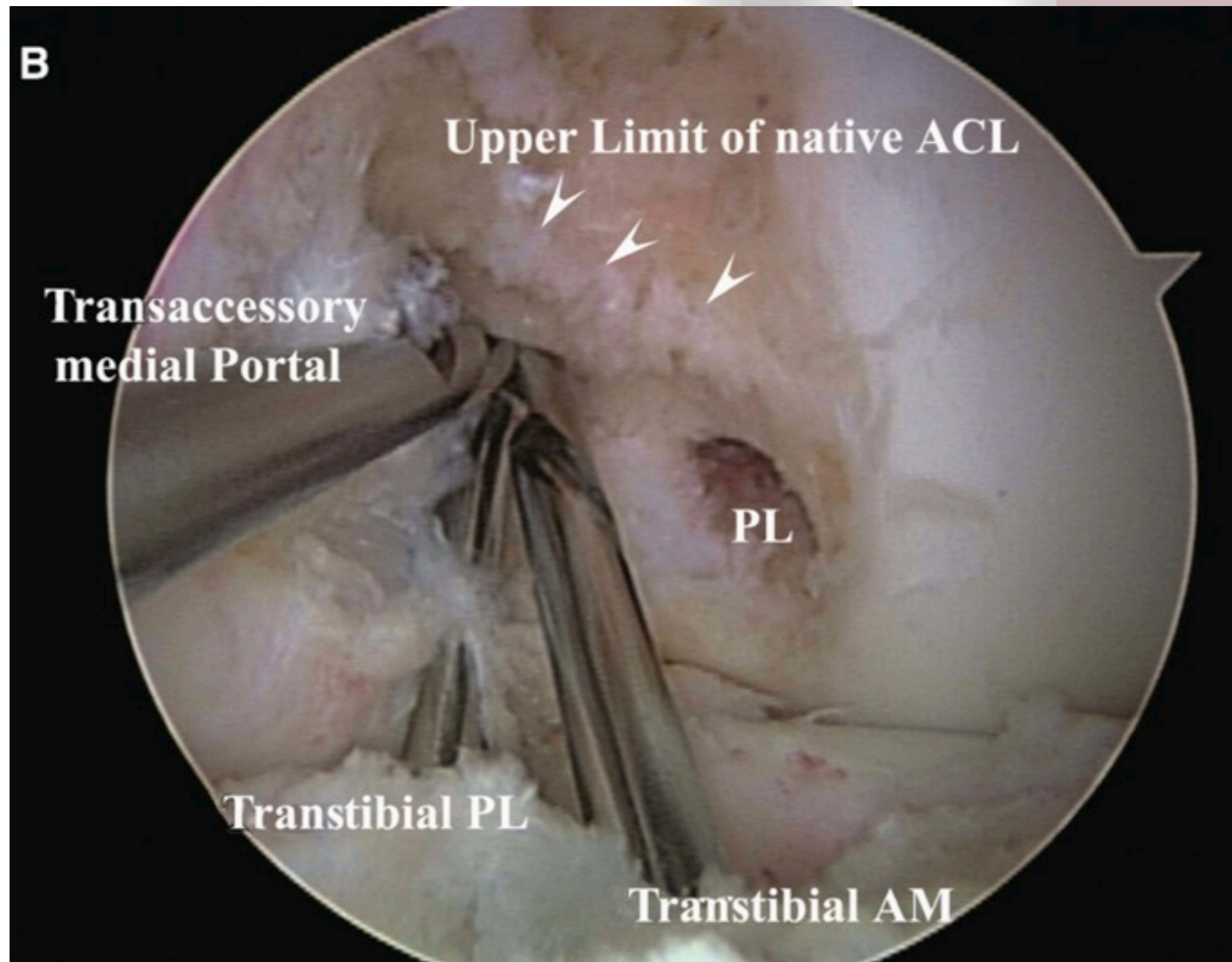


transtibiale Technik

50 %



unterschiedliche Zugänge



DB vs. SB

Primary Anatomic Double-Bundle Anterior Cruciate Ligament Reconstruction

A Preliminary 2-Year Prospective Study

Freddie H. Fu,* MD, Wei Shen, MD, PhD, James S. Starman, MD, Nnamdi Okeke, MD, and James J. Irrgang, PhD, PT
 From the Department of Orthopedic Surgery, University of Pittsburgh, Pittsburgh, Pennsylvania

Laxity Findings

Test	Result	No. of Patients Affected
Lachman test ^a	< -1 to -3 mm	2
	-1 to 2 mm	62
	3 to 5 mm	30
	6 to 10 mm	2
Pivot-shift test ^a	Equal	90
	+Glide	6
30-lb KT-2000 ^b	Average	1.0 ± 2.3 mm ^c
	Normal	51
	Nearly normal	32
	Abnormal	4

AJSM 2008

Knee Surg Sports Traumatol Arthrosc (2004) 12: 189–197

KNEE

DOI 10.1007/s00167-003-0438-8

Tim Rose
 Thomas Engel
 Joachim Bernhard
 Pierre Hepp
 Christoph Josten
 Helmut Lill

Differences in the rehabilitation period following two methods of anterior cruciate ligament replacement: semitendinosus/gracilis tendon vs. ligamentum patellae

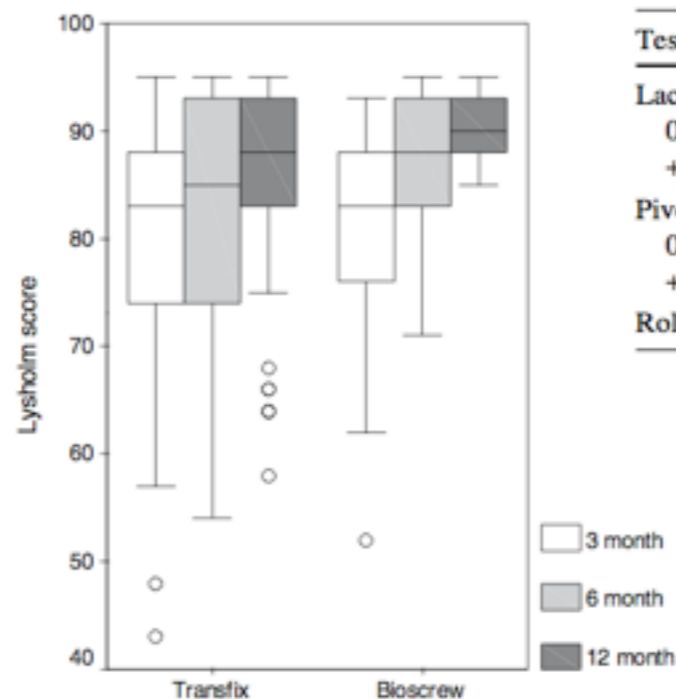
Knee Surg Sports Traumatol Arthrosc (2006)

KNEE

DOI 10.1007/s00167-006-0034-9

Tim Rose
 Pierre Hepp
 Julia Venus
 Christoph Stockmar
 Christoph Josten
 Helmut Lill

Prospective randomized clinical comparison of femoral transfixation versus bioscrew fixation in hamstring tendon ACL reconstruction—a preliminary report



Test	SG	LP	P
Lachmann			0.49
0 (0–2 mm)	47	44	
+1 (3–5 mm)	3	6	
Pivot-shift			–
0	44	44	
+1 (trace)	6	6	
Rolimeter (mm)	1.9±1.6	1.3±1.3	0.30

klinisch kein Unterschied

Winner of the 2007 Systematic Review Competition

Outcome of Single-Bundle Versus Double-Bundle Reconstruction of the Anterior Cruciate Ligament

A Meta-Analysis

Richard B. Meredick,* MD, Kennan J. Vance,* DO, David Appleby,[†] MPH,
and James H. Lubowitz,^{‡*} MD

*From *Taos Orthopaedic Institute Research Foundation, Taos, New Mexico,
and [†]Smith & Nephew, Andover, Massachusetts*

aber: signifikant bessere
Werte bei KT 1000 (0,5 mm)

Single vs double

- kein Unterschied in Stabilität

Streich NA 2008 KSSTA

nur ST-Sehne
für AM + PL

- KT-1000 und Pivot besser

Kondo E 2008 AJSM

ST + G-Sehne
für AM + PL

- KT-1000, Pivot und IKDC besser

Siebold R 2008 Arthroscopy

- kein Unterschied, db mit reduz. ROM

Asagumo H 2007 Arthroscopy

Fixation in 30°

Was bringt die Doppelbündeltechnik ?



Pro

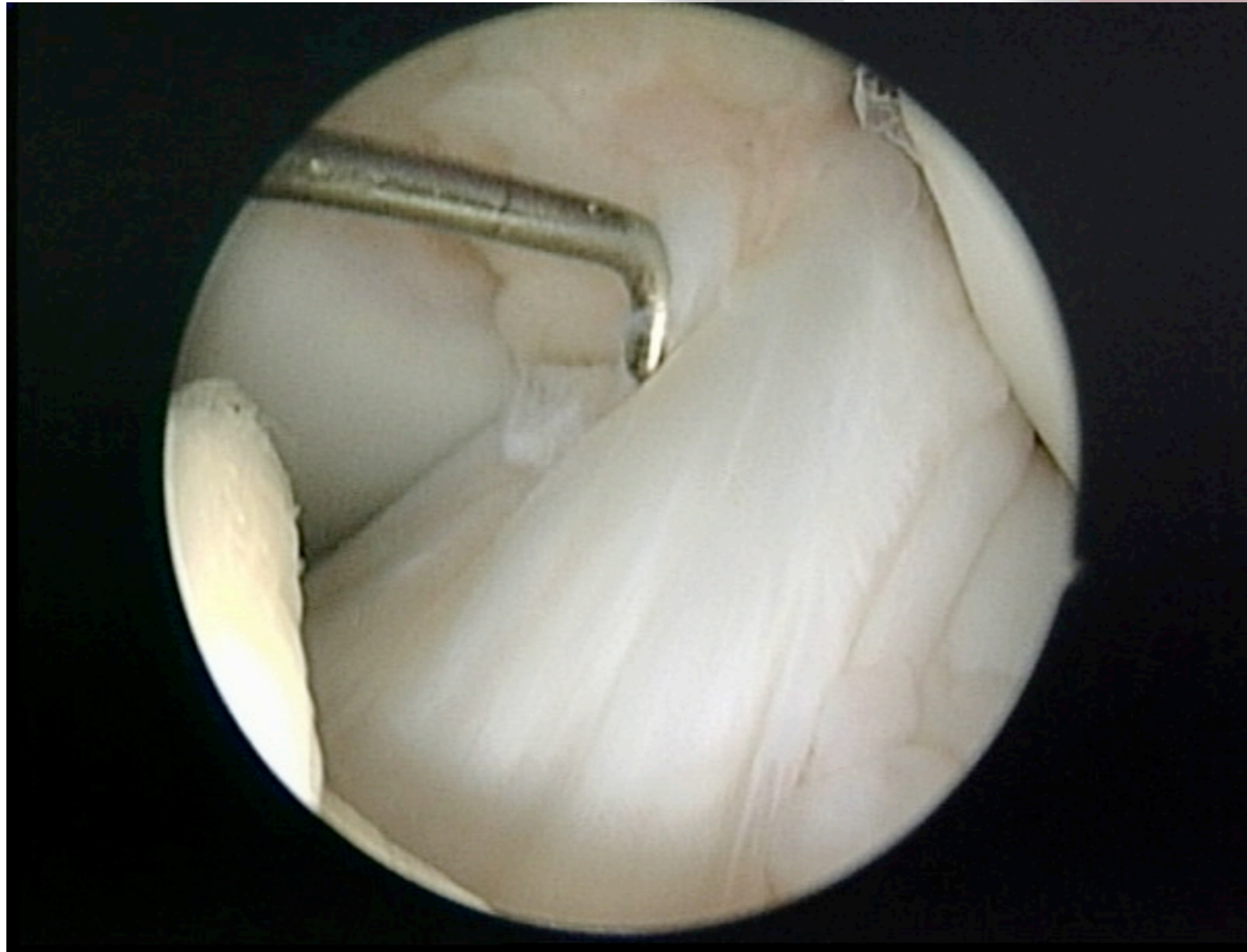
Anatomie orientierend

Biomechanisch Vorteile

klinische Vorteile?

mehr Verständnis für Pathologie

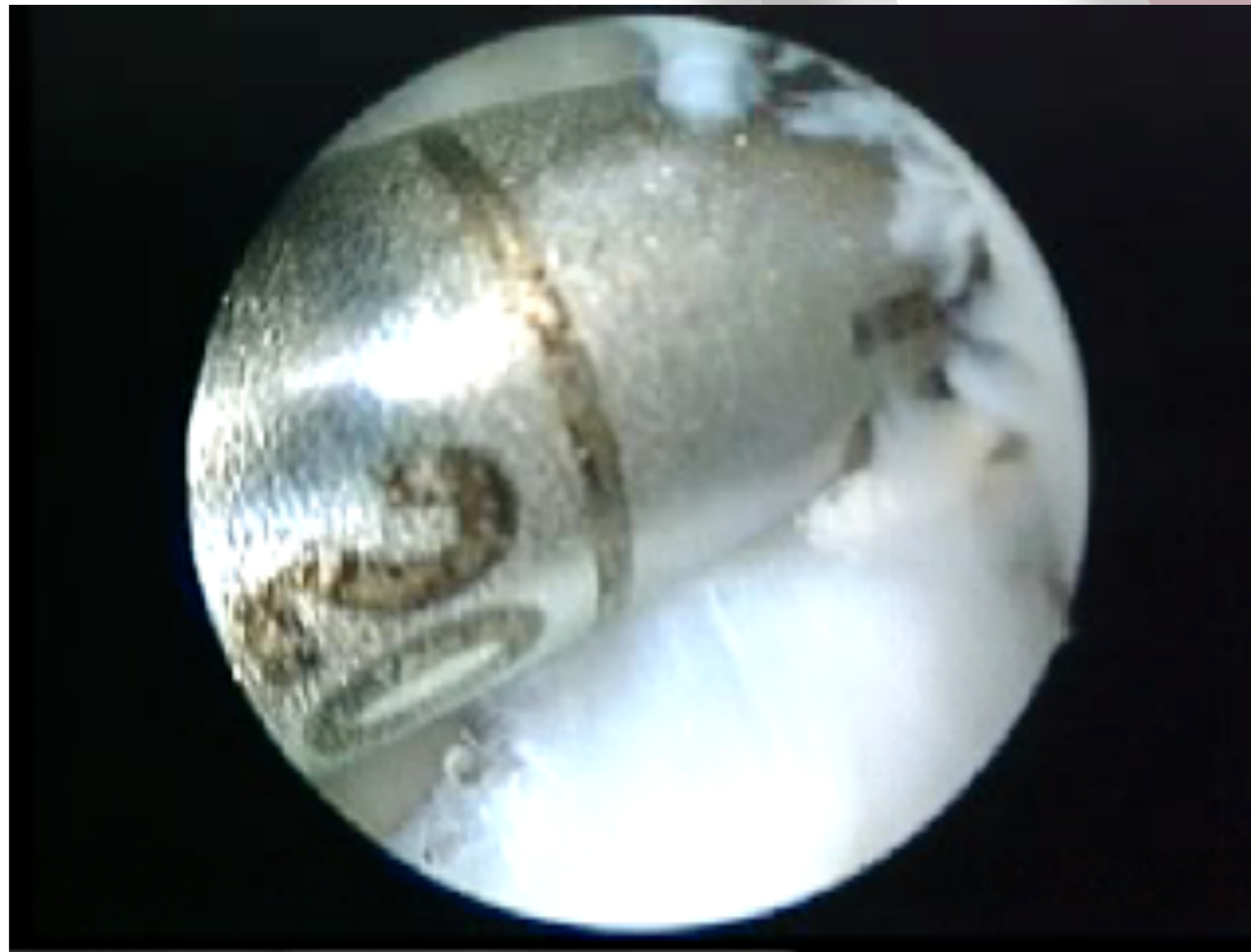
Intaktes AM-Bündel



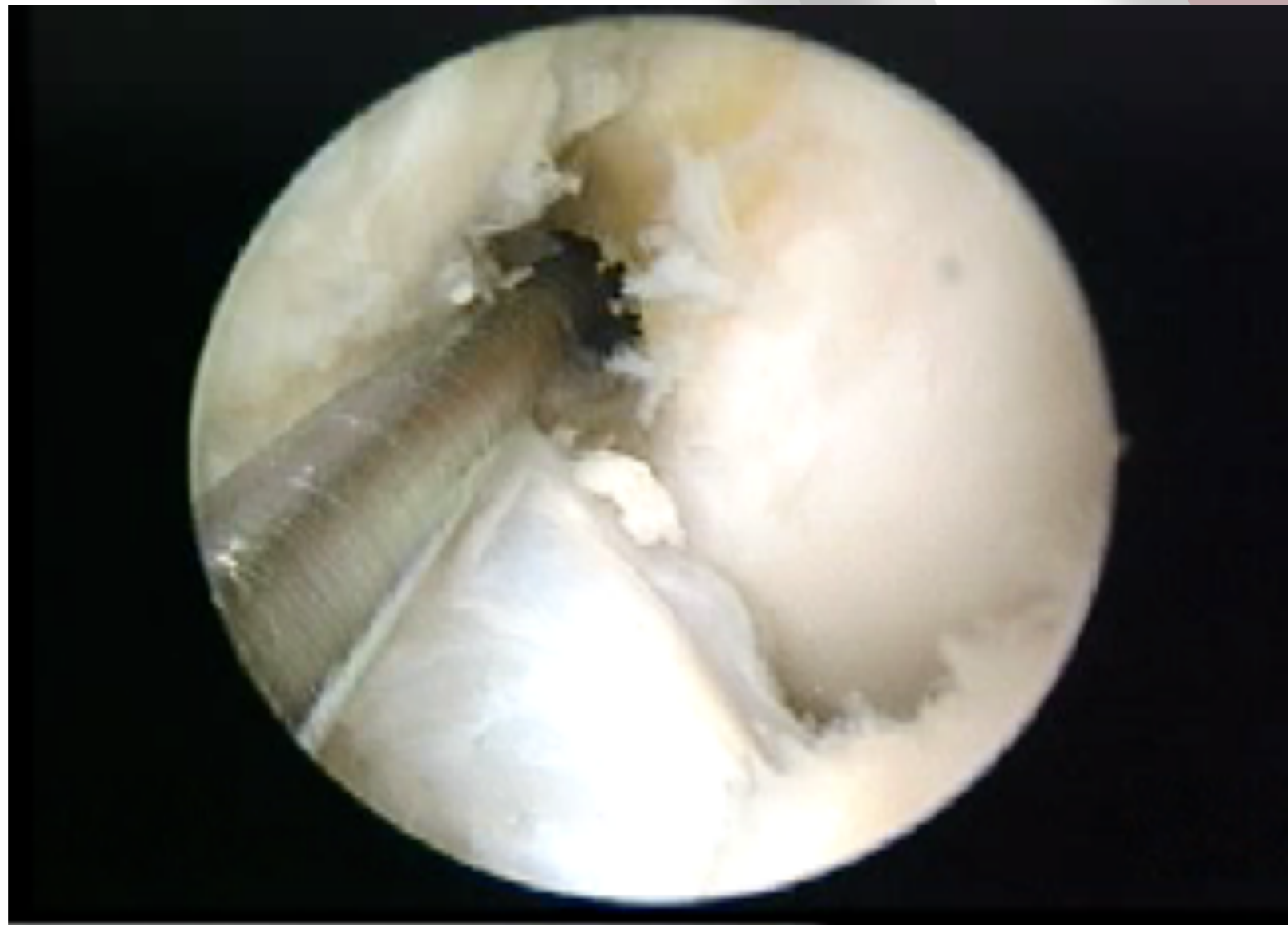
Insuffizientes PL-Bündel



Femoraler Tunnel für PL-Bündel



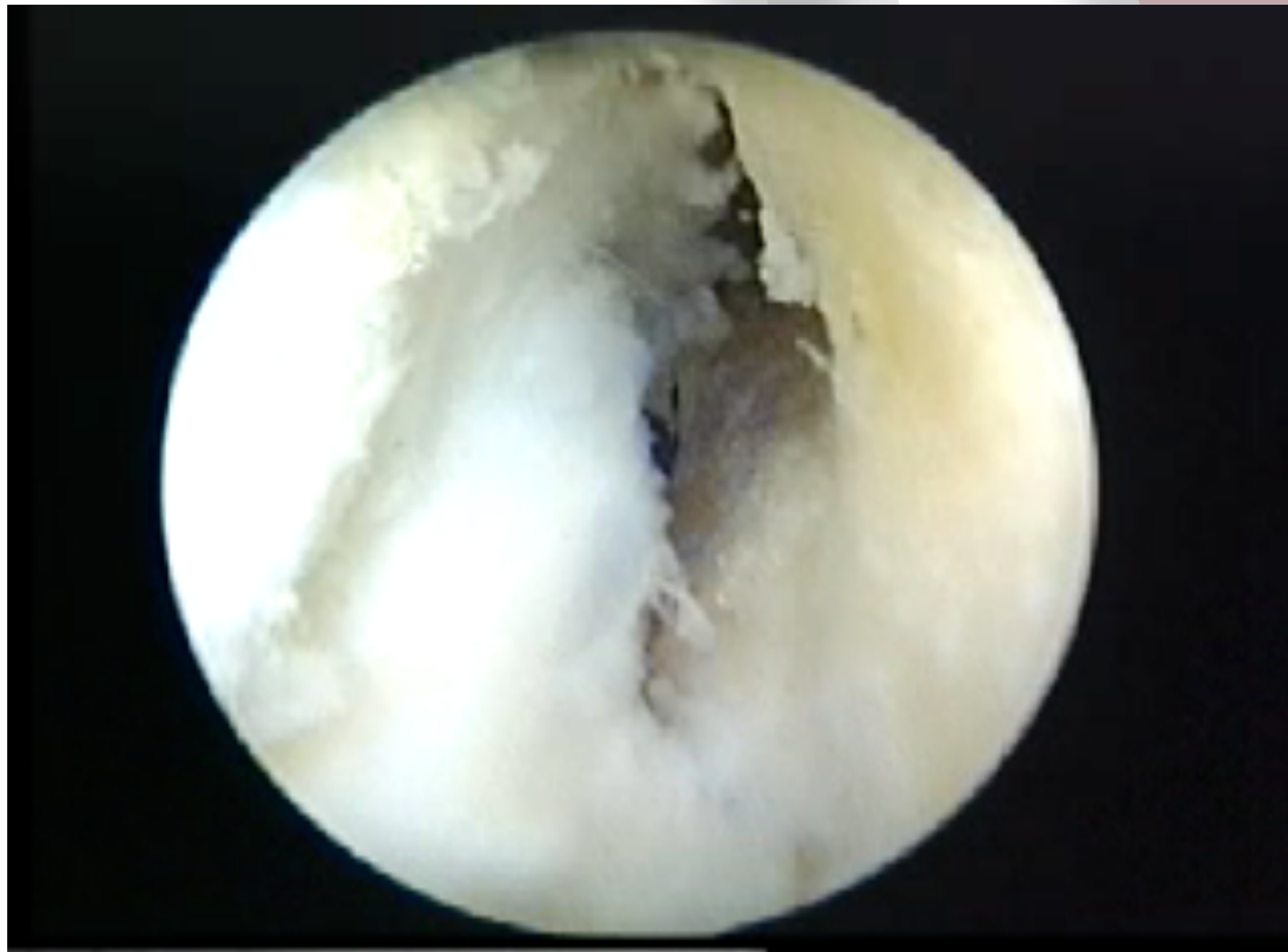
Shuttle Suture



Shuttle-Faden hinter AM-Bündel



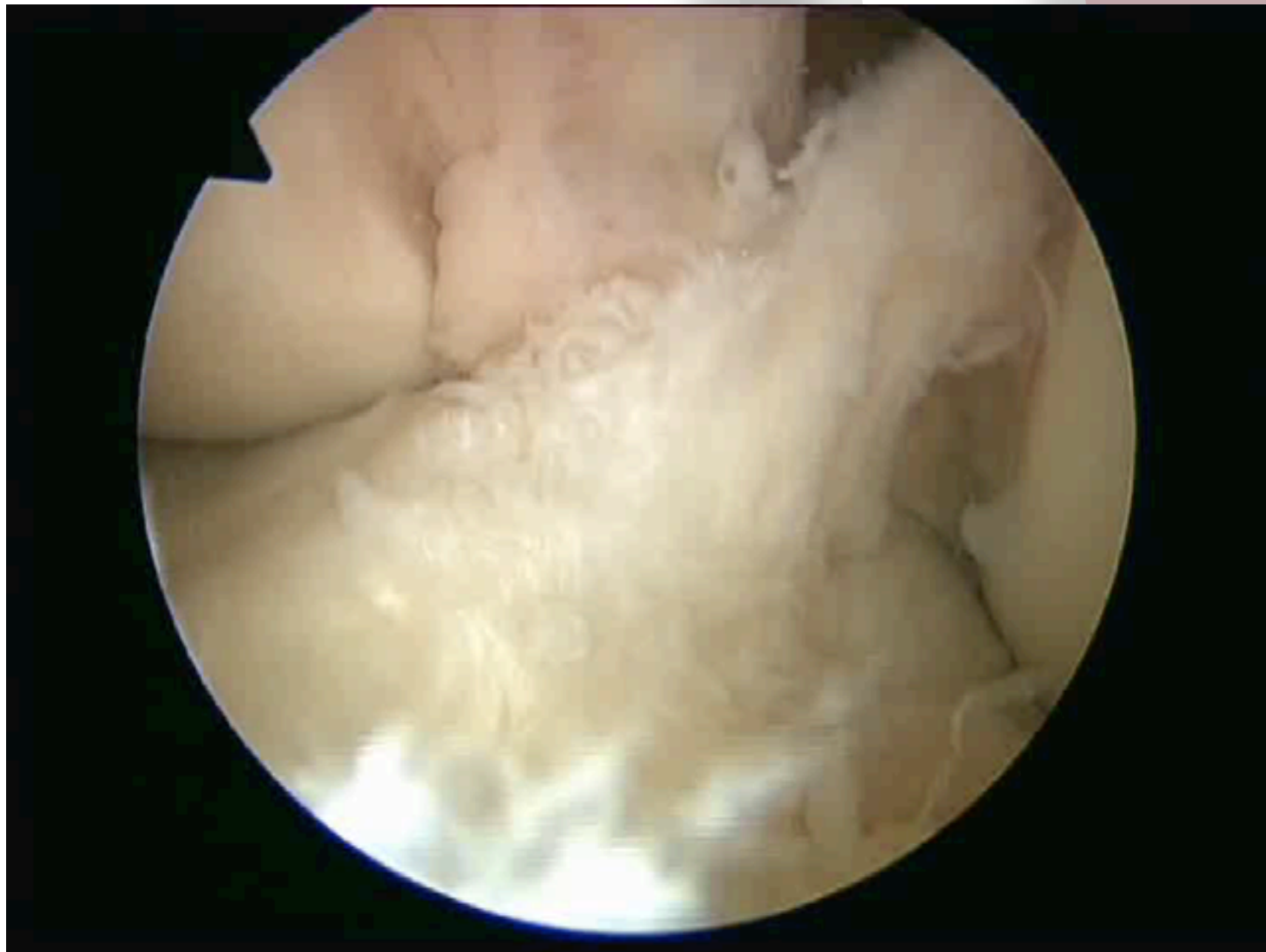
Einziehen des Transplantats



Ergebnis



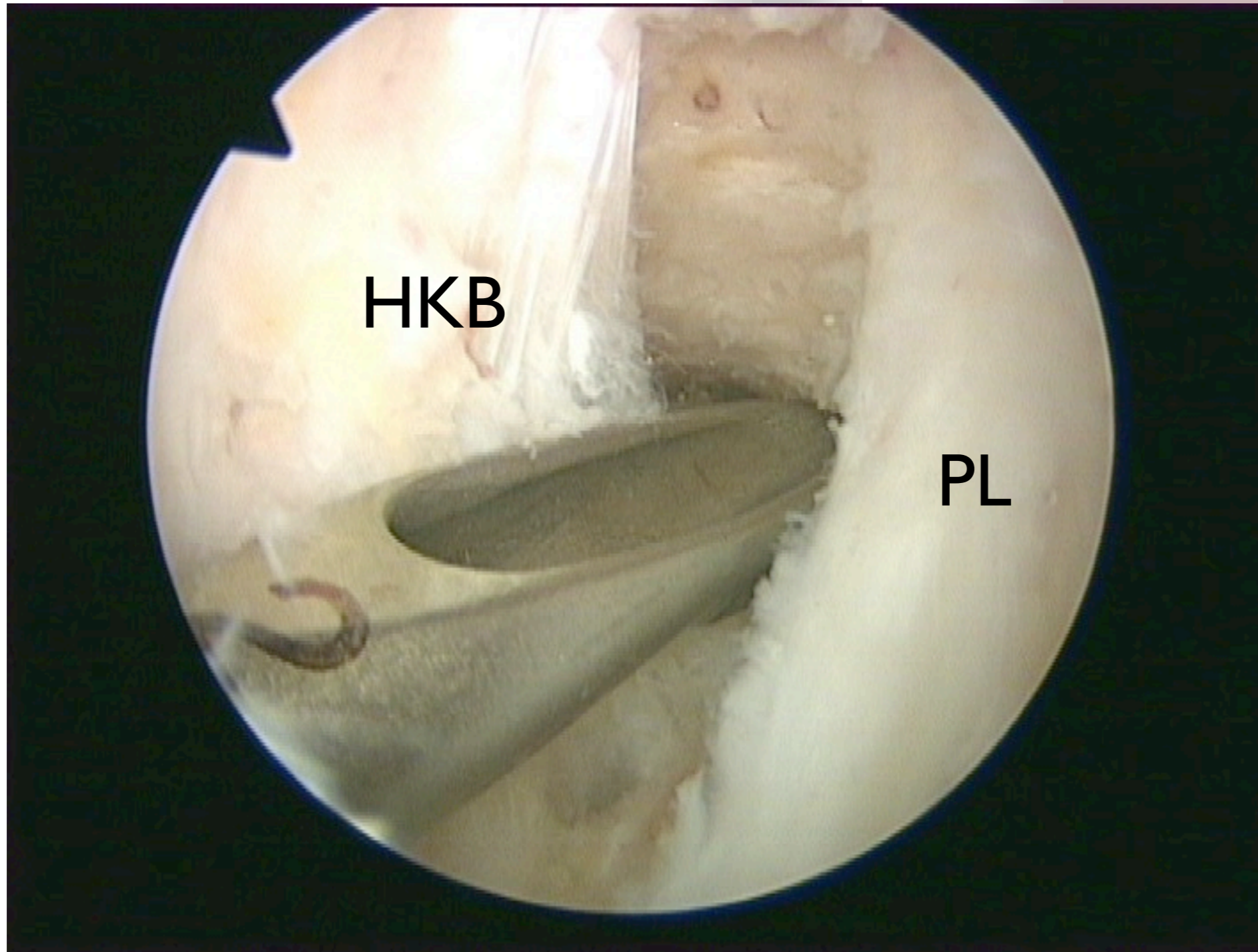
intaktes PL-Bündel



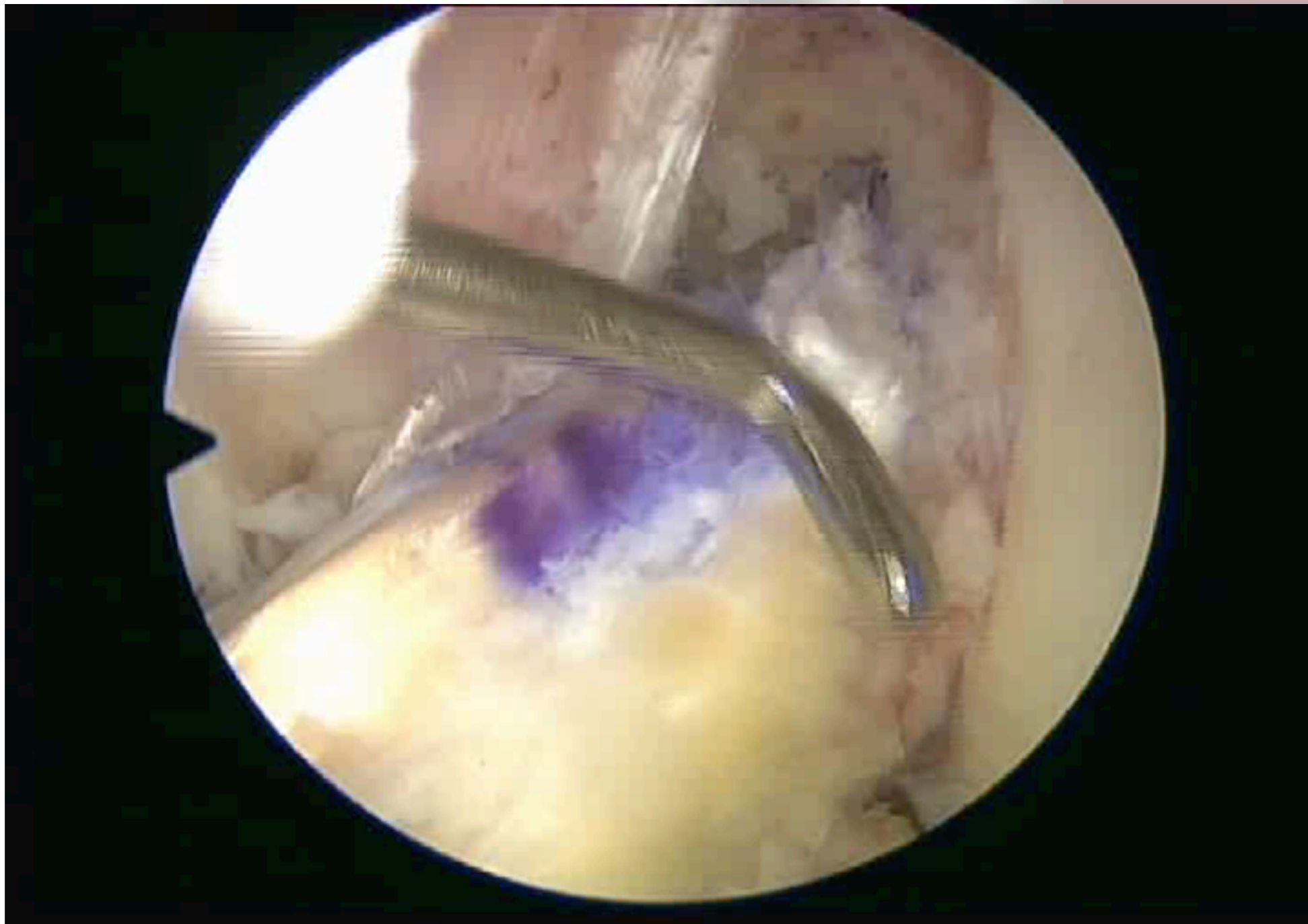
Tibiale Platzierung



Femorale Platzierung

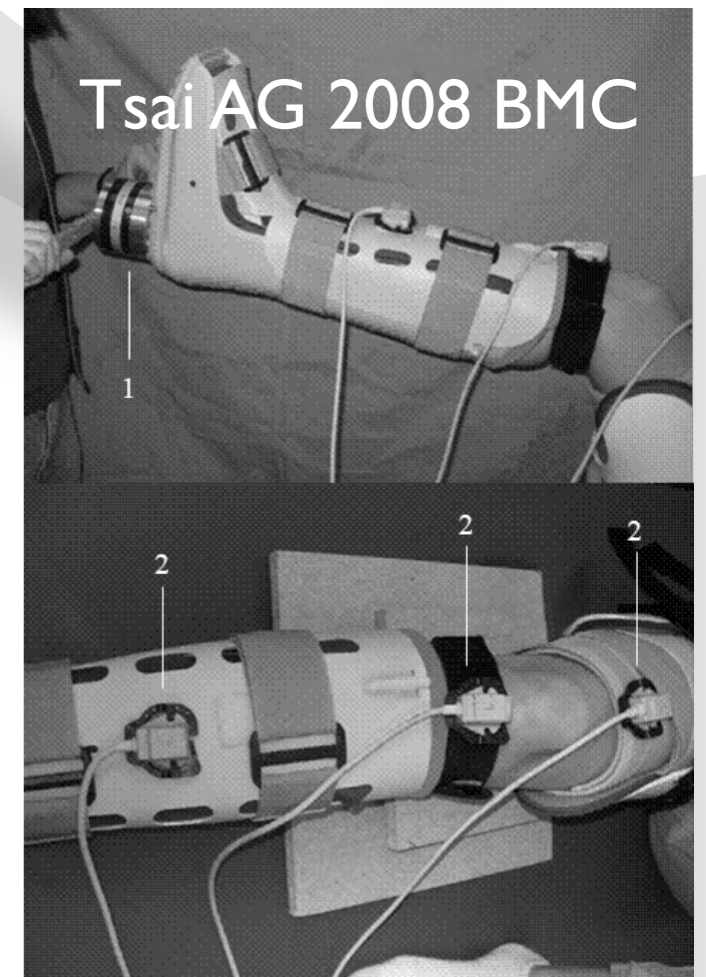


Resultat



Ausblick

- klinische Langzeitergebnisse
- bei ausgewählten Indikationen
- Entwicklung der Technik
- kritisch für Outcome
- weitere Messmethoden



vielen Dank