

Principles of reconstruction of the anterior cruciate ligament

B.Schulz

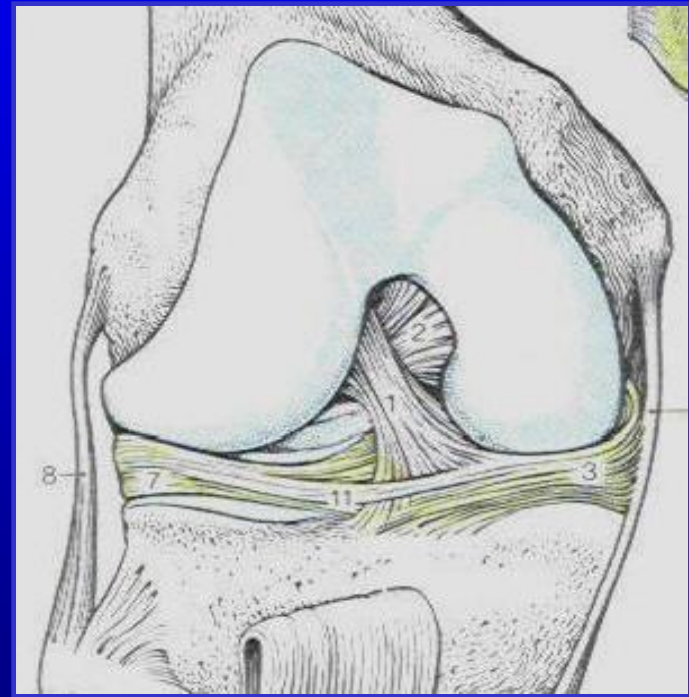
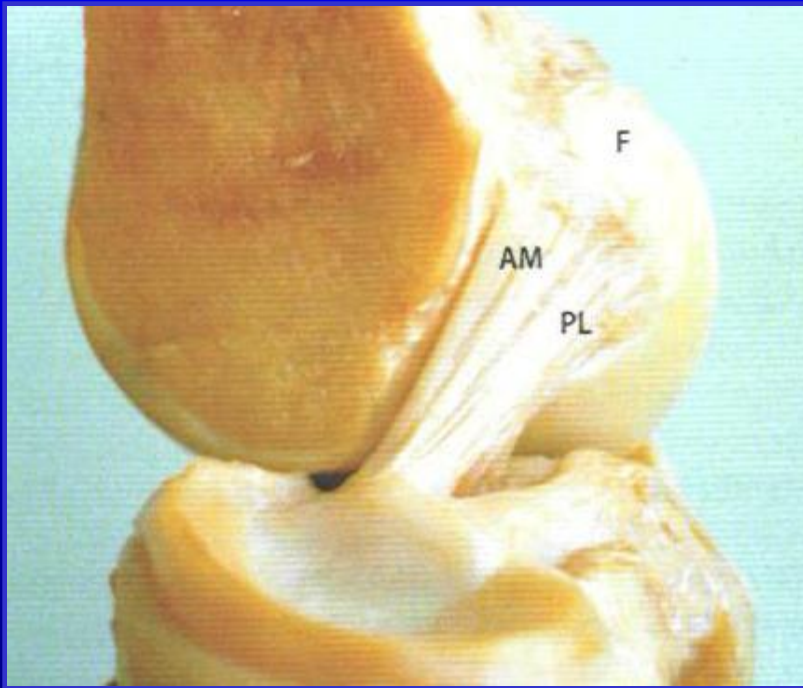
St.Josef-Hospital

Bonn, Germany

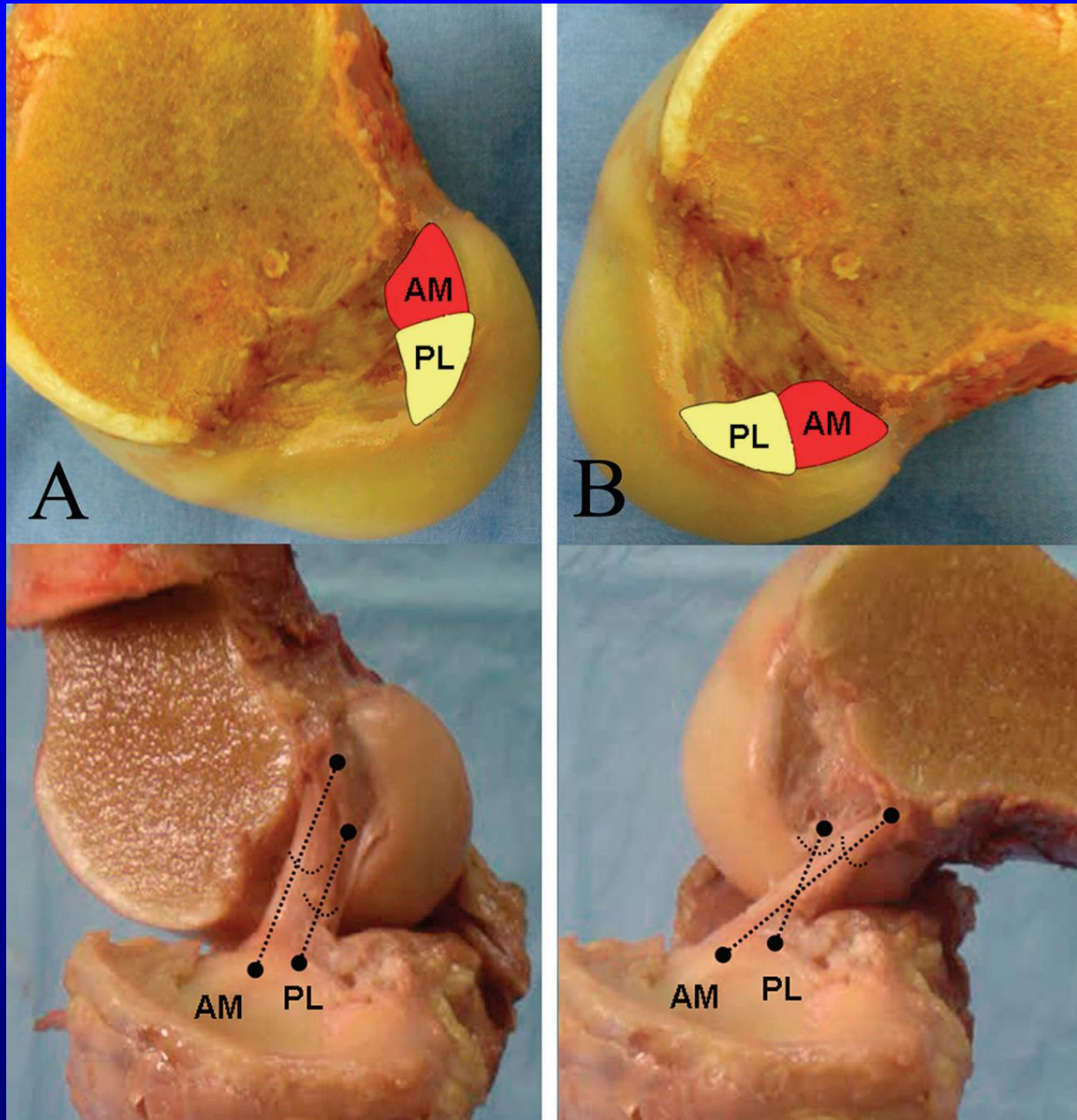
Do Phuoc Hung

University for Medicine and Pharmacy of HCM city

Anatomy

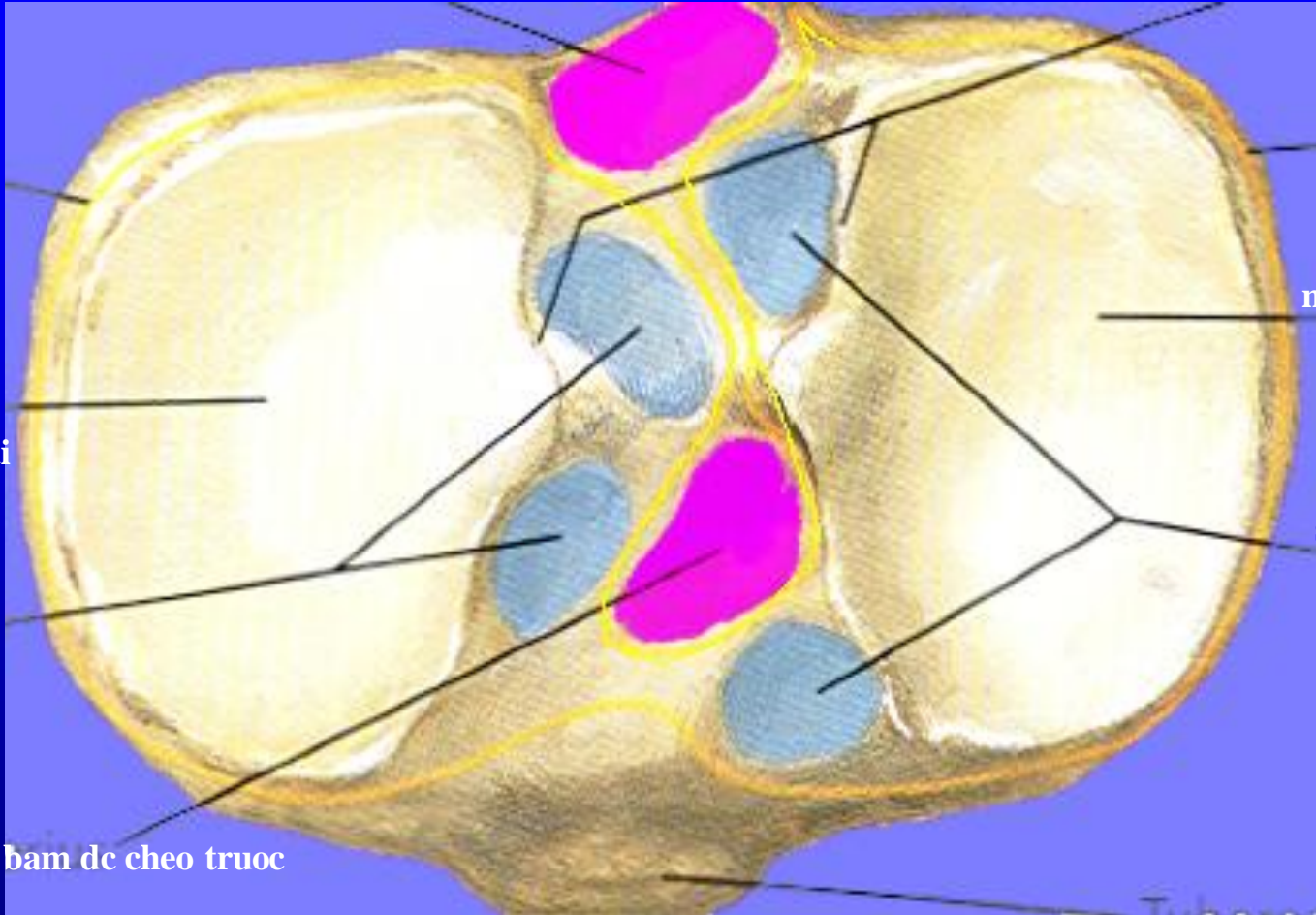


anatomy



Cho bam dc cheo sau

Go lien mam chay



**Mat khop
mam chay trong**

**Mat khop
mam chay ngoai**

**Cho bam sung
sun chem trong**

**Cho bam sung
sun chem ngoai**

Cho bam dc cheo truoc

Loi cu chay

Anatomy

- Tibial insertion point: in front of the posterior cruciate ligament, between the second and third quarter of the ap- diameter of the tibial plateau
- Femoral insertion: at the lateral femoral wall of the notch, as far dorsal as possible

Function

- Stabilisation of the translation of the tibia against the femur in anterior direction
- Stabilisation of rotation of the knee
- Support of the multicentered axis of the knee
- (medio-lateral stabilisation)

ACL-Rupture

- Most common isolated ligament injury of the knee
- about 40.000 ACL- injuries per year are seen in Germany

ACL-Rupture- clinical findings

- Mechanism of injury: sudden change of direction in high speed, often with fixed foot, sudden stop
- Patient hears a „crack“
- Fast development of an effusion (blood)
- Instability, pain

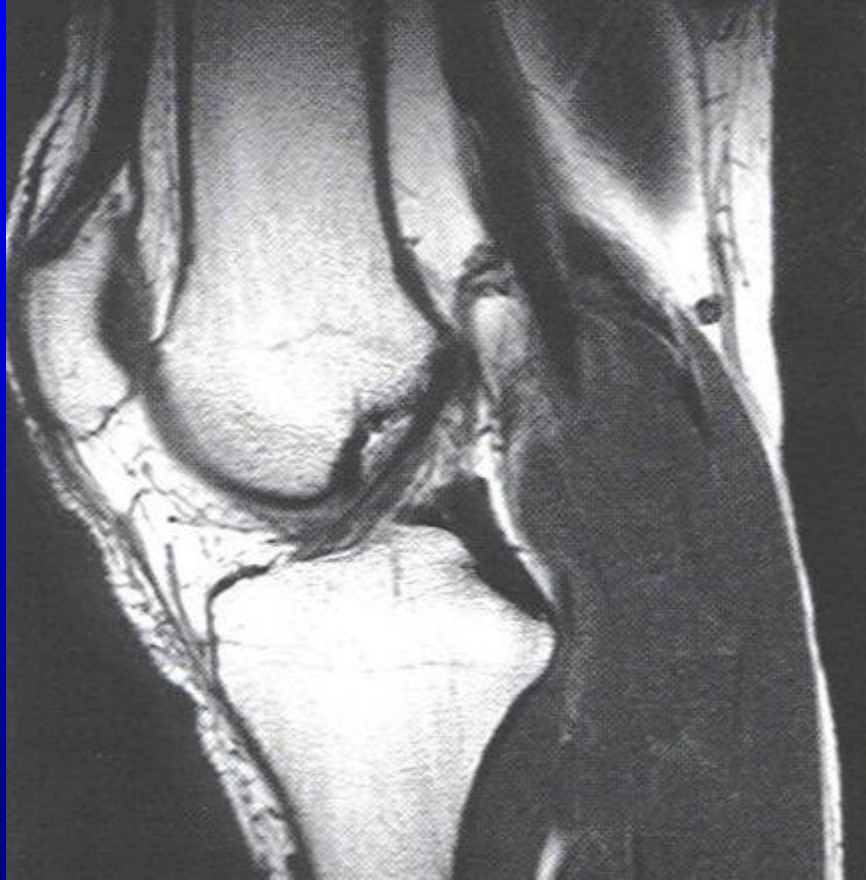
ACL-Rupture- Diagnosis

- Anamnesis
- clinical investigation
 - Lachmann- Test
 - Pivot-shift
 - ~~- anterior drawer in 90° flexion~~
- MRI, X-Ray
- Arthroscopy

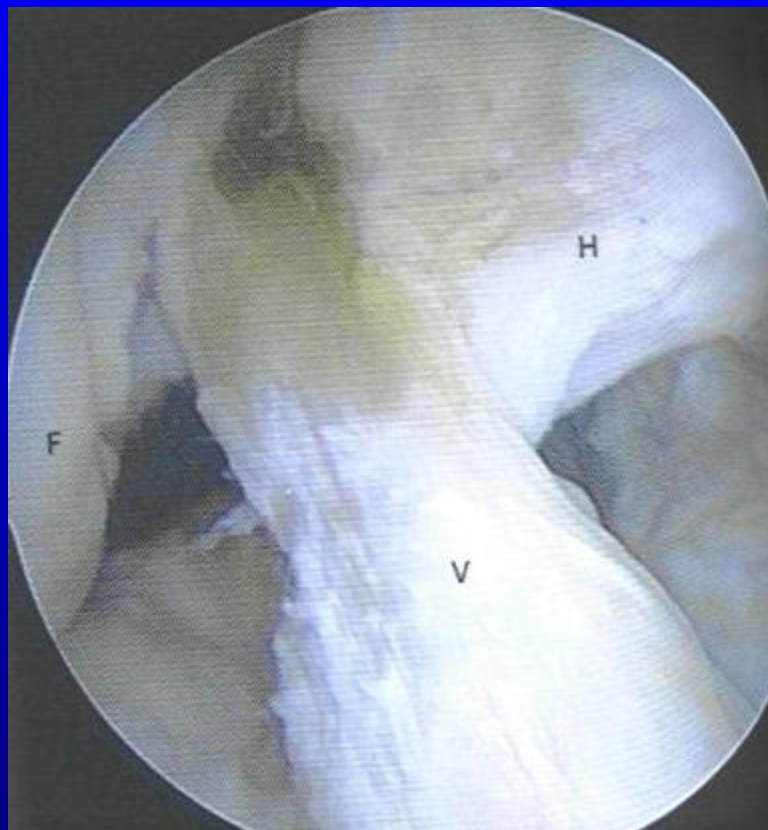
Lachmann-Test



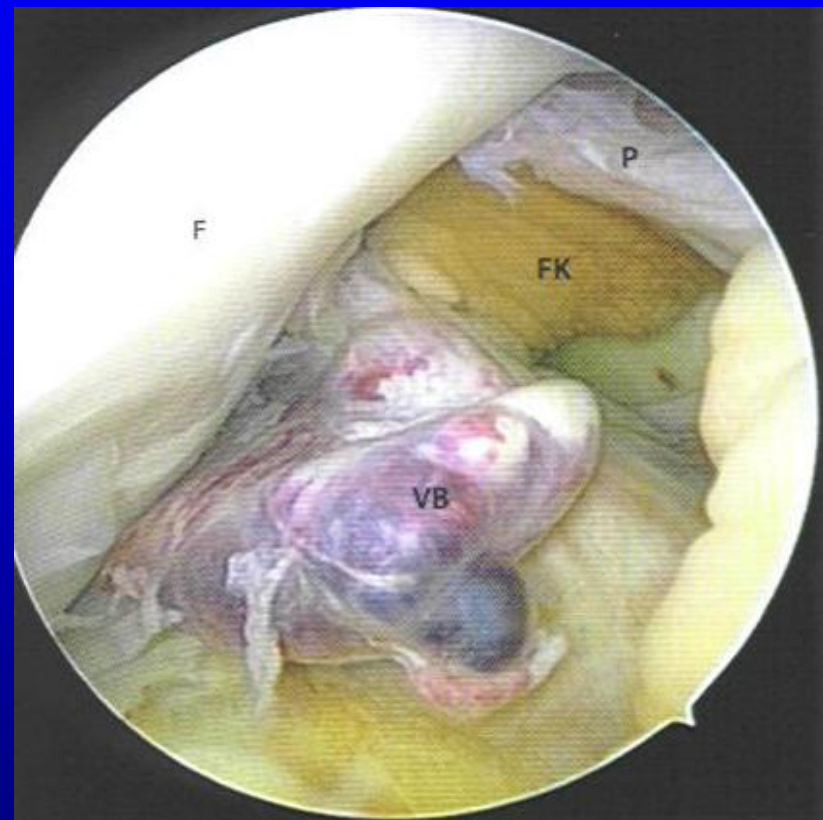
MRI-Diagnosis



Arthroscopy

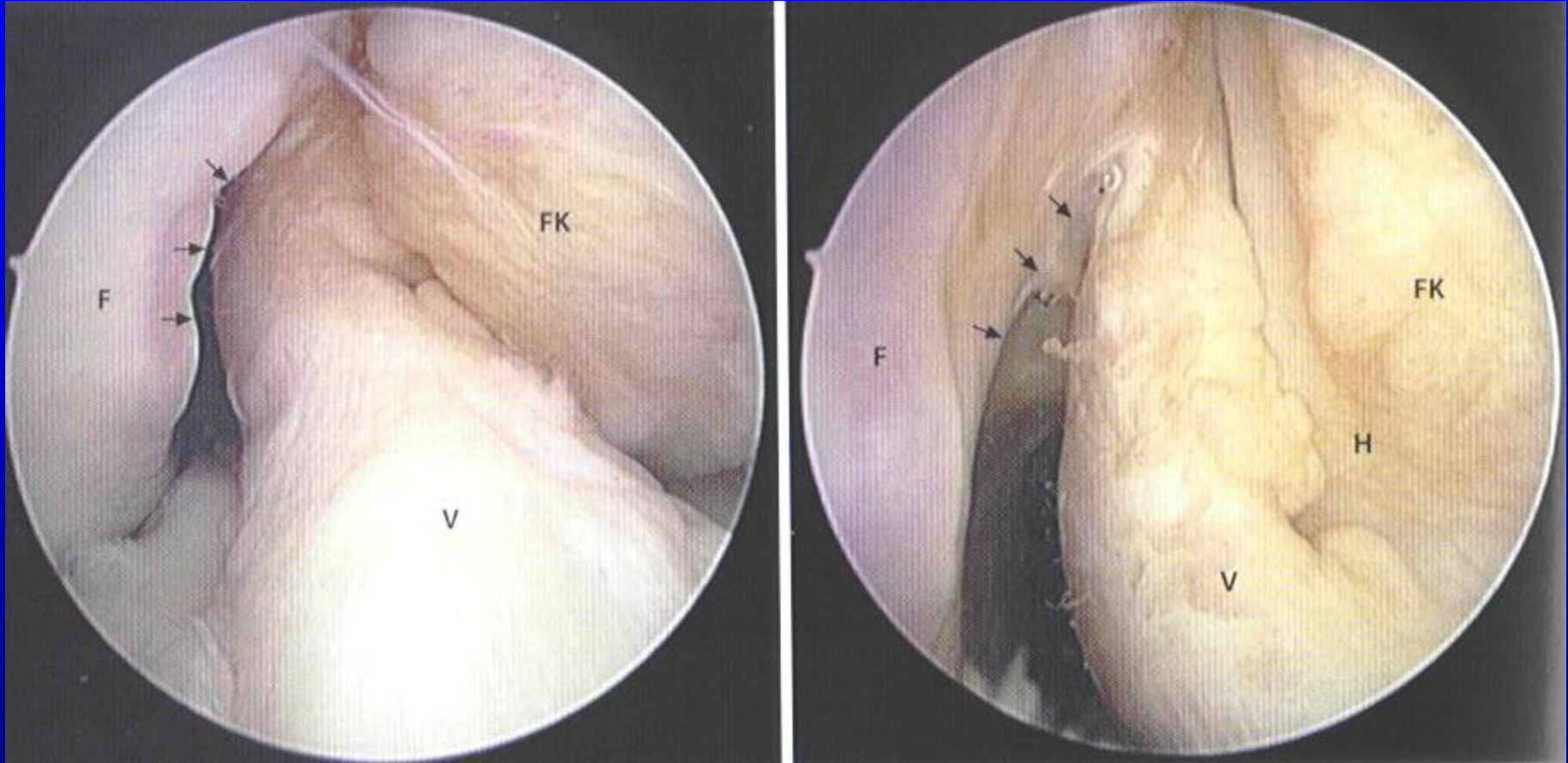


Normal acl



fresh ACL-rupture

Arthroscopy



old acl-rupture: empty-wall-sign

ACL-reconstruction: yes or no

yes

- Regain of the stability of the knee
- avoiding or diminishing of the risk of later occurring damages (meniscal-lesions, cartilage - lesions, Arthritis)

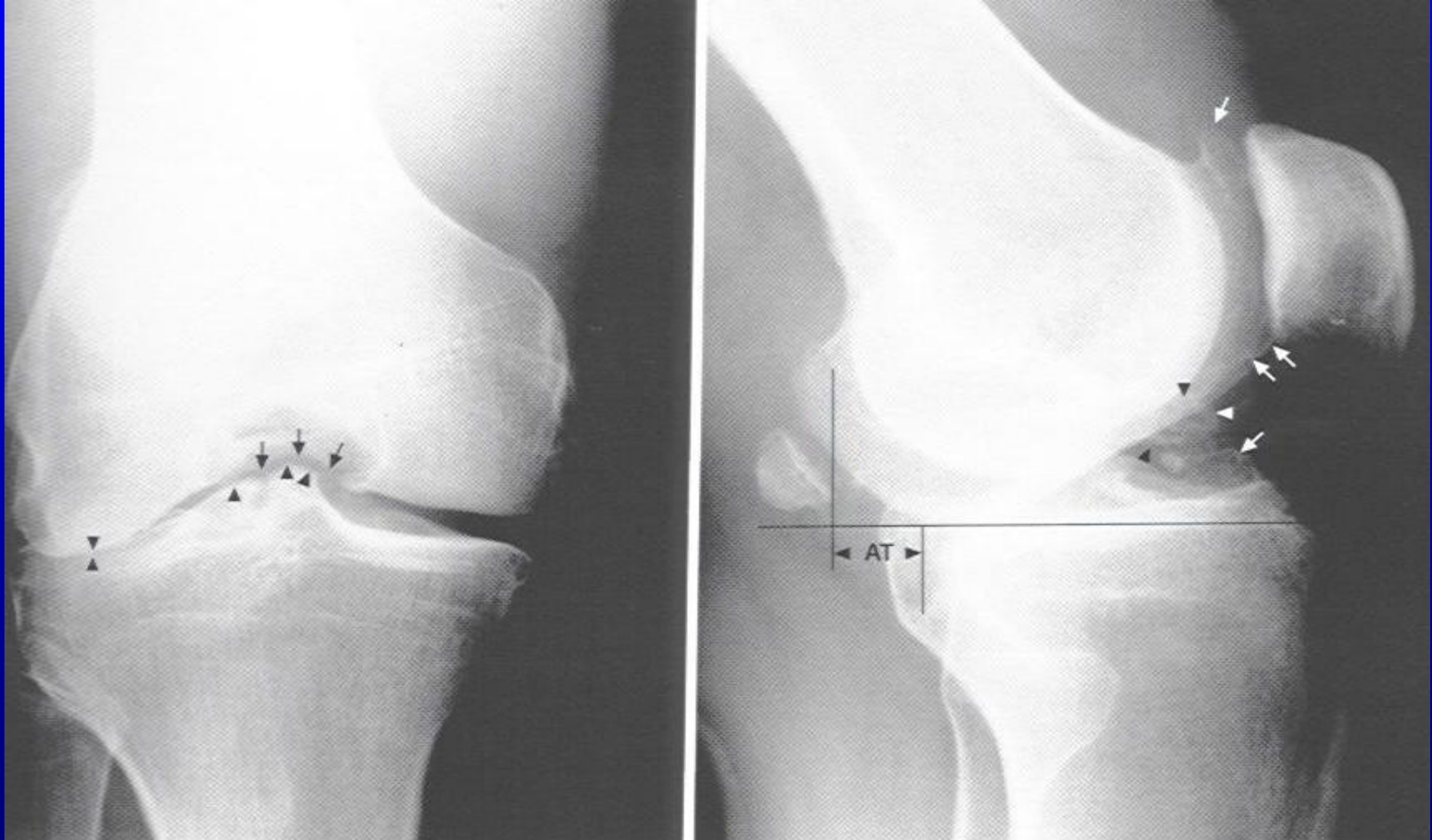
no

- Old patient, inactive patient
- Severe arthritis of the knee
- High risk of surgery

conservative treatment of ACL- rupture

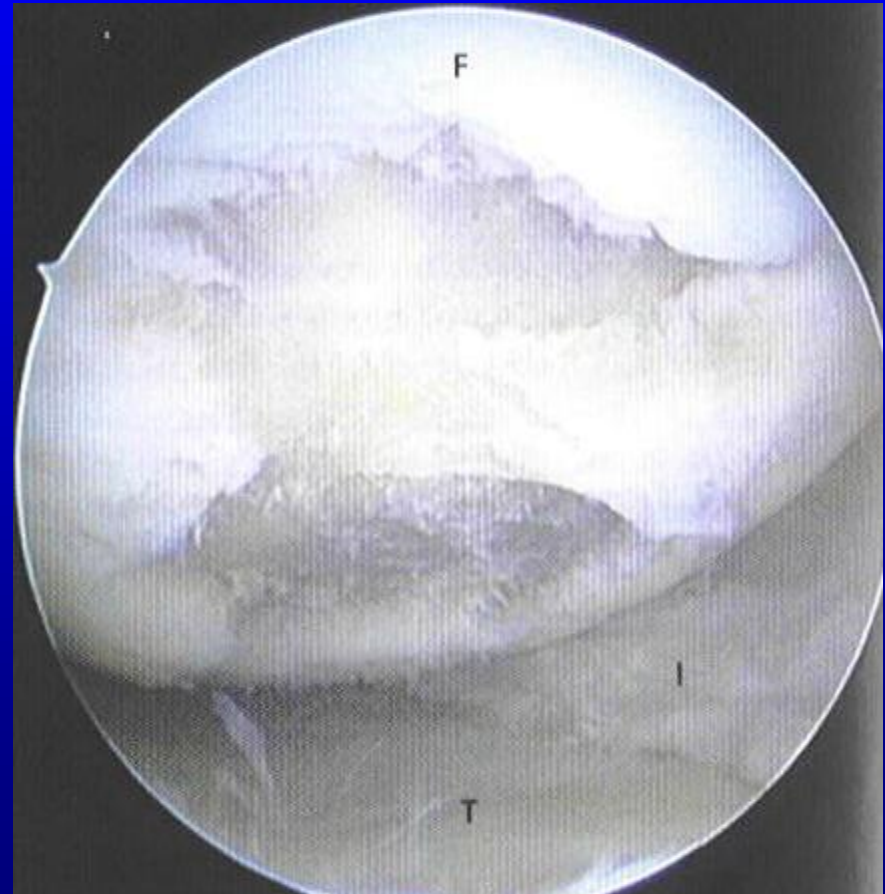
with elderly or inactive patients or if
surgery is not possible

Findings after acl- rupture, conservative treated



38- year old patient, 15 years after ACL-rupture, not treated

Findings after acl- rupture, conservative treated



ACL-reconstruction: technics, which do not work

- Suture of the acl- rupture
- ACL- reconstruction with artificial ligaments (Trevira, Kennedy-LAD, Carbon-ligament etc.)
- Over-the-top- technic
- transplants like dura, tractus iliotibialis, medial menisc etc.

Aspects of acl- reconstruction

- Transplants
- Channel positioning
- Fixation

ACL-reconstruction: qualities of the transplant

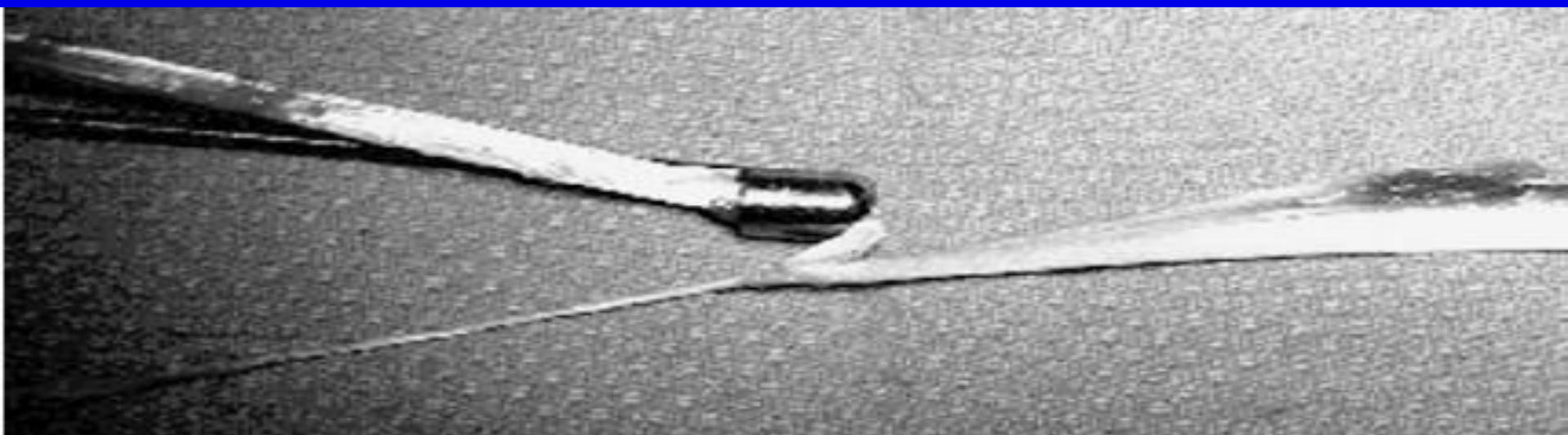
- Tensile strength equal or better than the natural acl (2000-2300 Newton)
- Similar stiffness and elasticity
- Similar morphology
- Low donor-site-morbidity

ACL-reconstruction: transplants

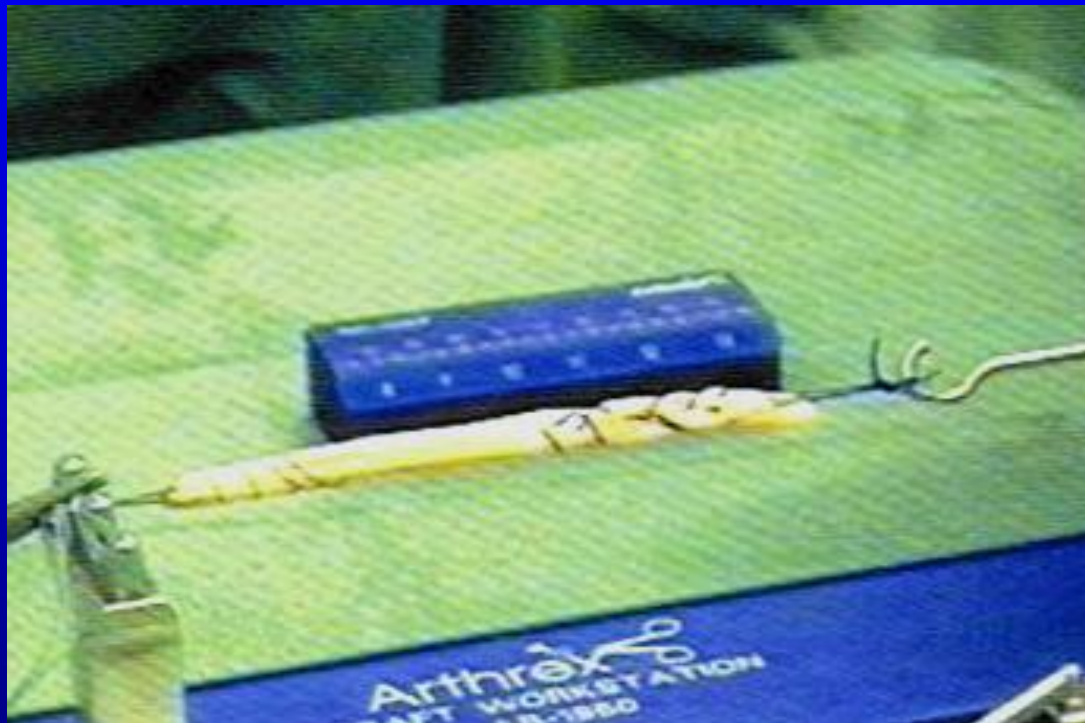
- Quadruple-Hamstrings (semitendinosus and gracilis-tendon, each double)
- Patellartendon (Bone-Tendon-Bone, BTB)
- Quadricepstendon with or without bone plug
- In special cases: achillestendon, donated tendons

ACL-Transplants: Quadruple-Hamstrings

- High tensile strength (4000 Newton)
- In stiffness and other qualities the most similar transplant to the acl
- Low, most times no donor site morbidity
- But:
 - long ingrowth time in the boney channels
 - difficult to harvest



Quadruple-Hamstrings



ACL-Transplants: Patellartendon

- Tensile strength like the acl
- Fast ingrowth into the boney channels
- But:
 - high donor-site-morbidity („The problem knee is the donor-site knee“ R.Steadtman)

Patellartendon



Patellar tendon is for the surgeon-
hamstrings are for the patient!

Johnson 1995

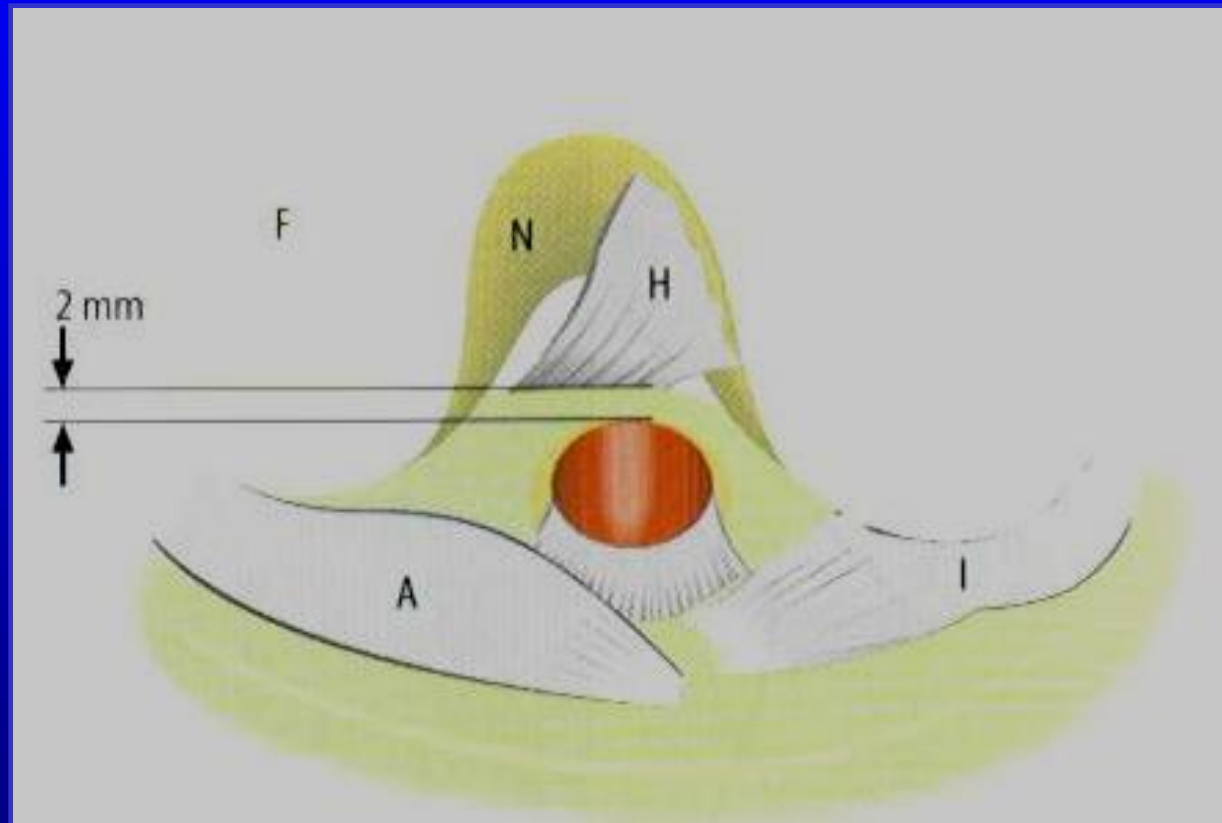
ACL-Transplants: Quadricepstendon

- Tensile strength similar to the acl
- Histomorphology very similar in comparison with acl
- Low long term donor-site-morbidity
- Use in case of second or third rupture
- But: patients need a little longer rehabilitation time

Aspekte der ACL-Plastik

- Transplants
- Channel positioning
- Fixation

Tibial channel



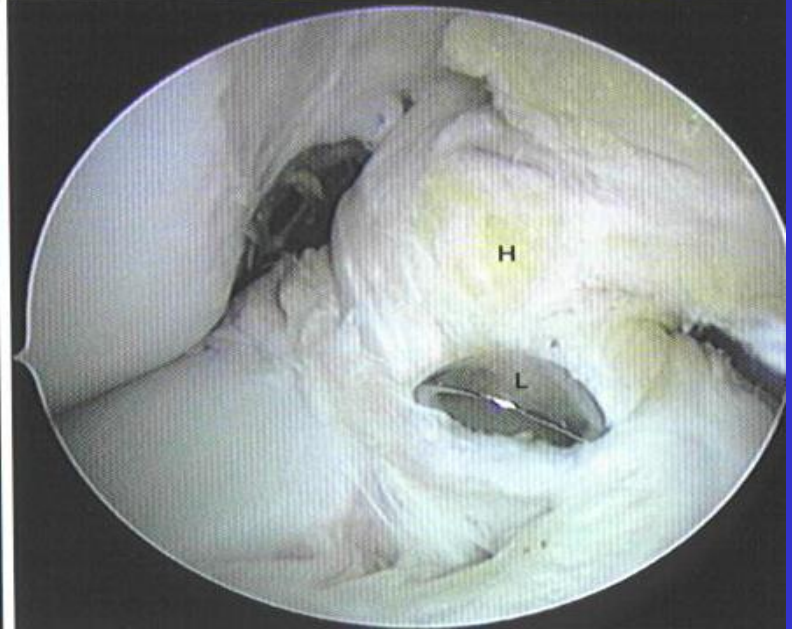
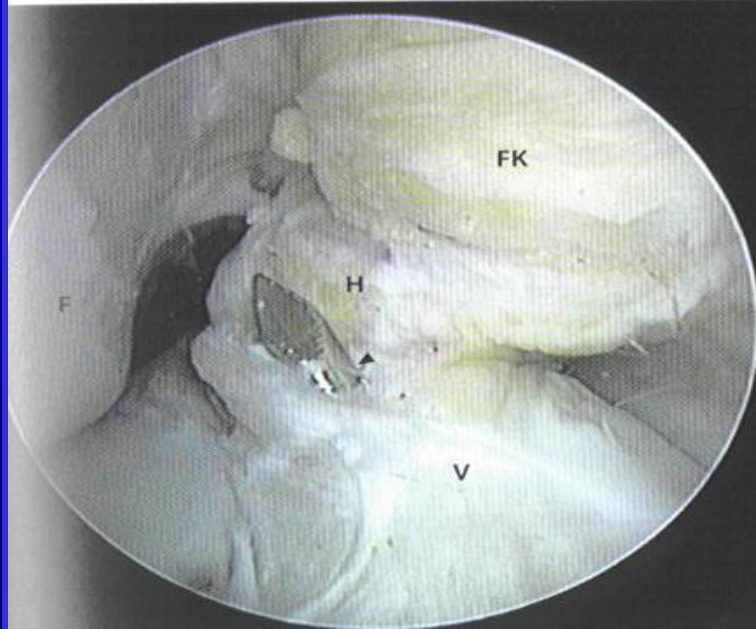
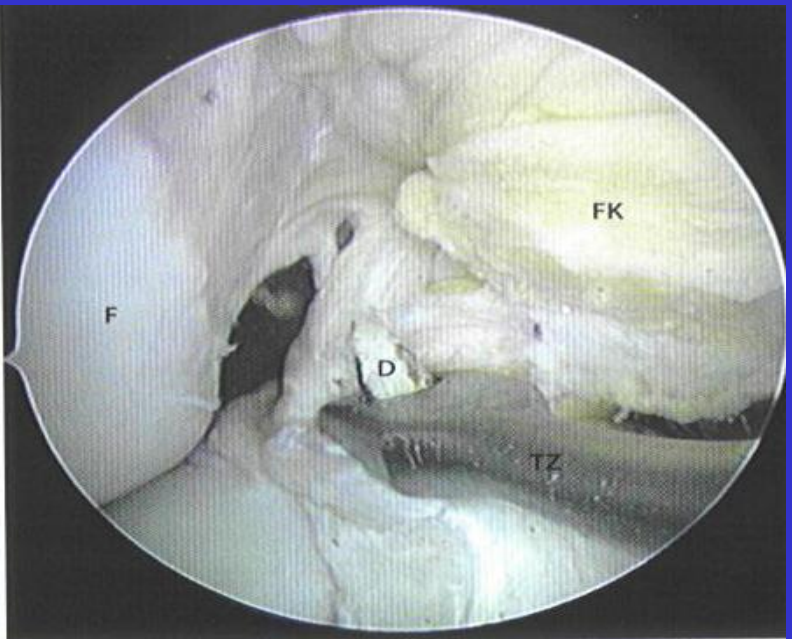
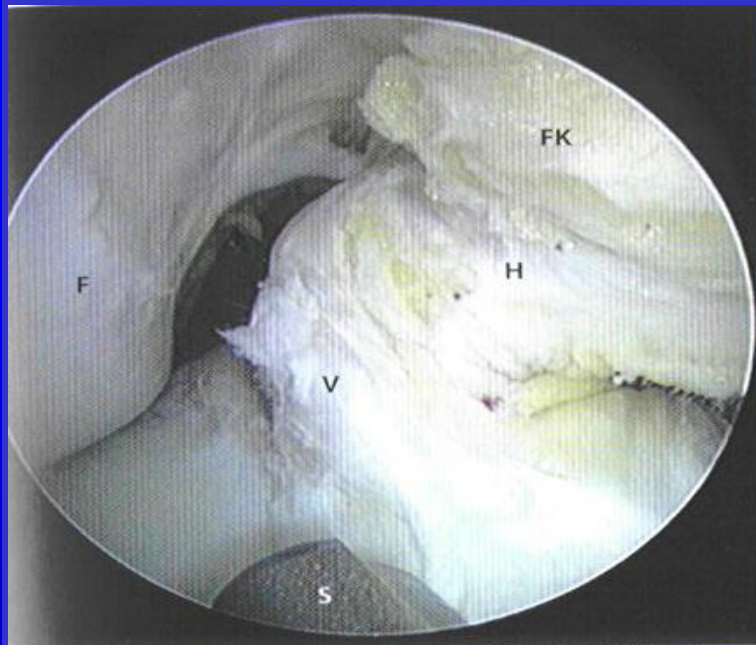
Tibial guide



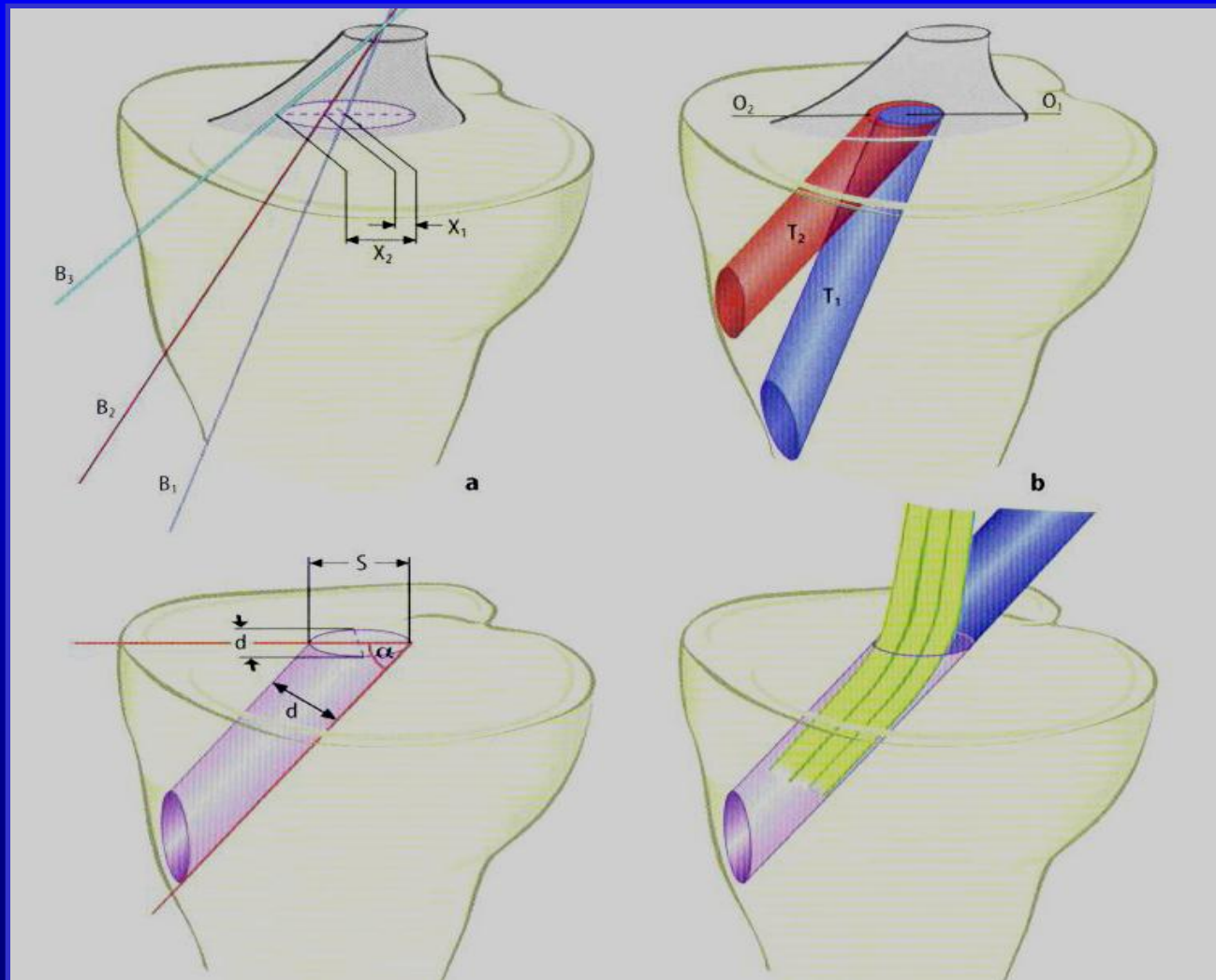
Tip tibial guide





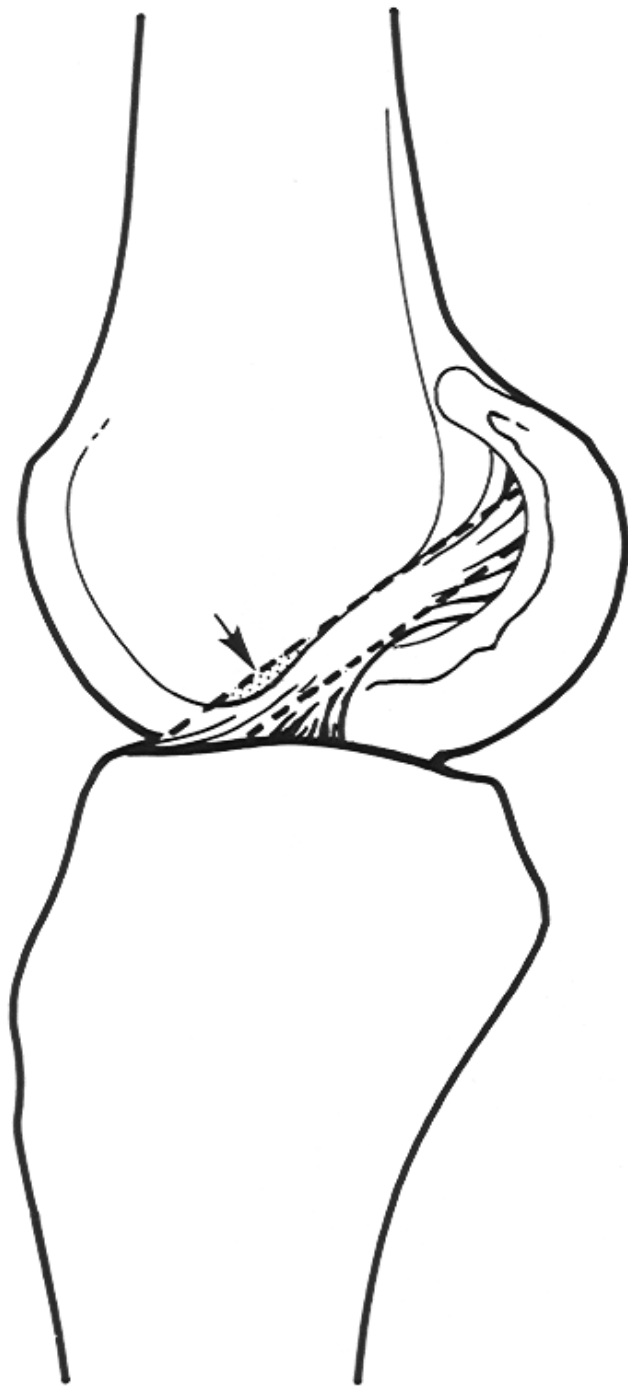


Tibial channel

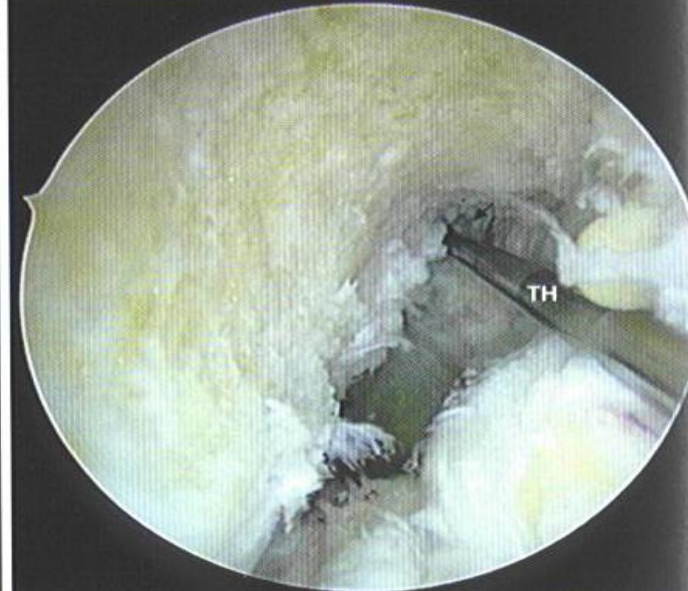
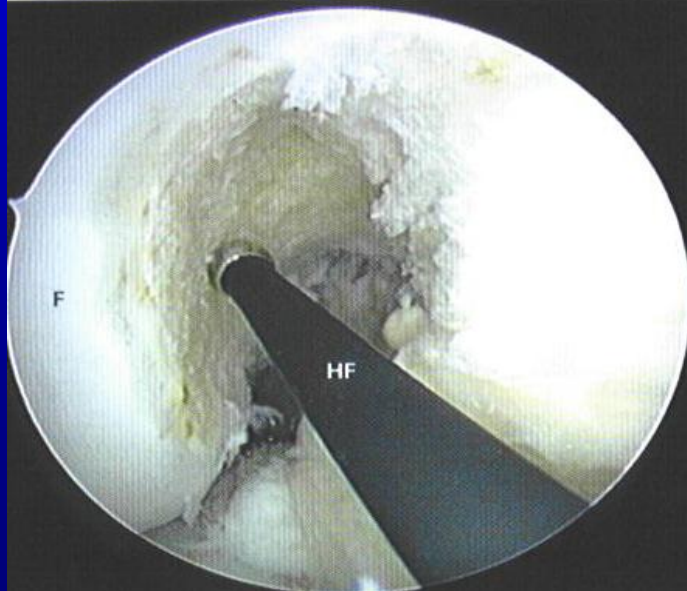
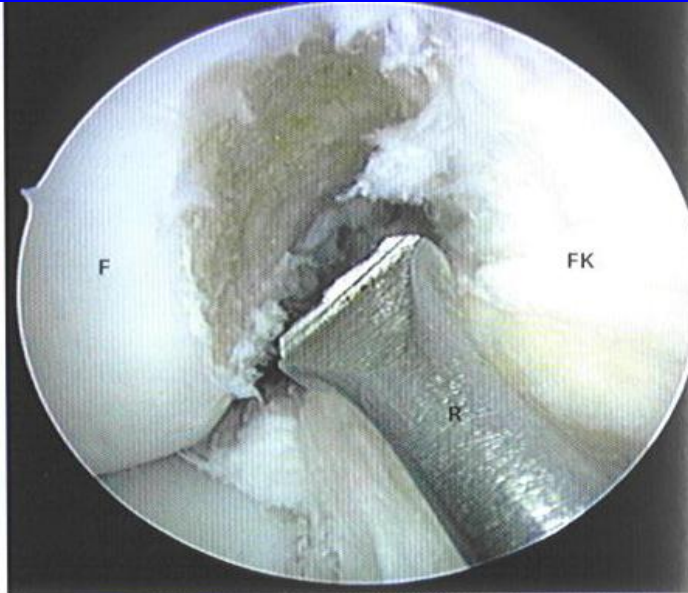
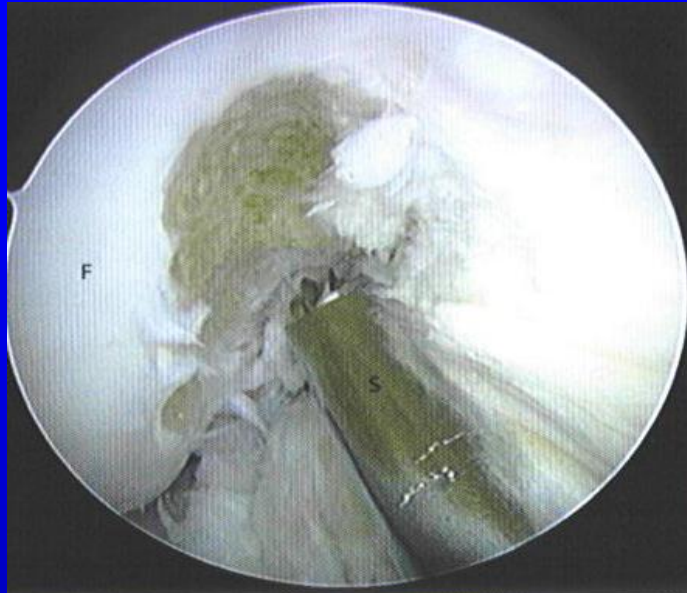


Tibial channel

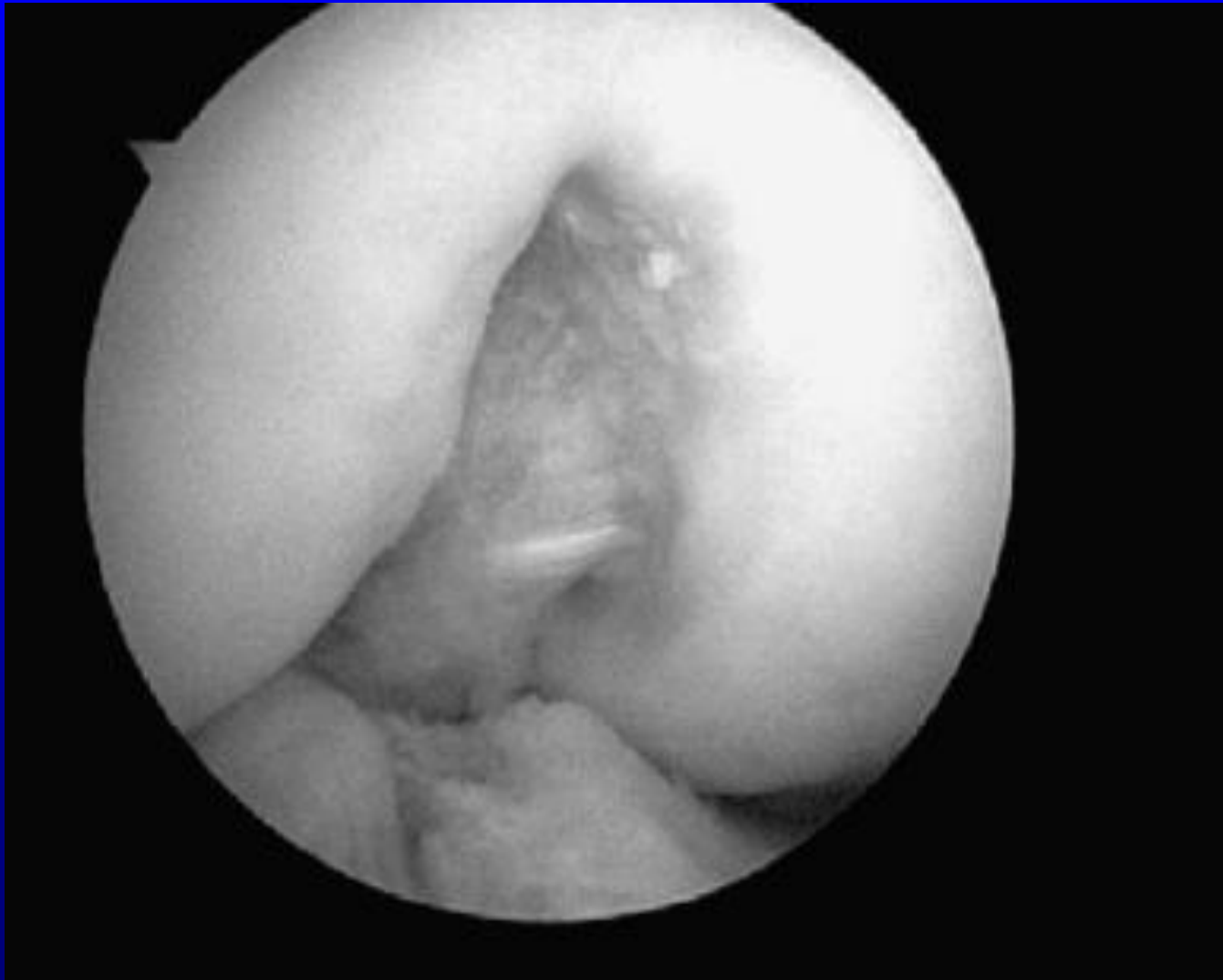
- Position of the guiding wire 6 mm in front of the anterior, tibial circumference of the pcl
- Center of the channel at the border of the 2. to the 3. quarter of the ap- diameter of the tibia
- Be carefull not to harm the medial tibial plateau
- Impingement-test, no contact to the notch roof!
- Diameter not to big (windshield wiper effect, tunnel widening)



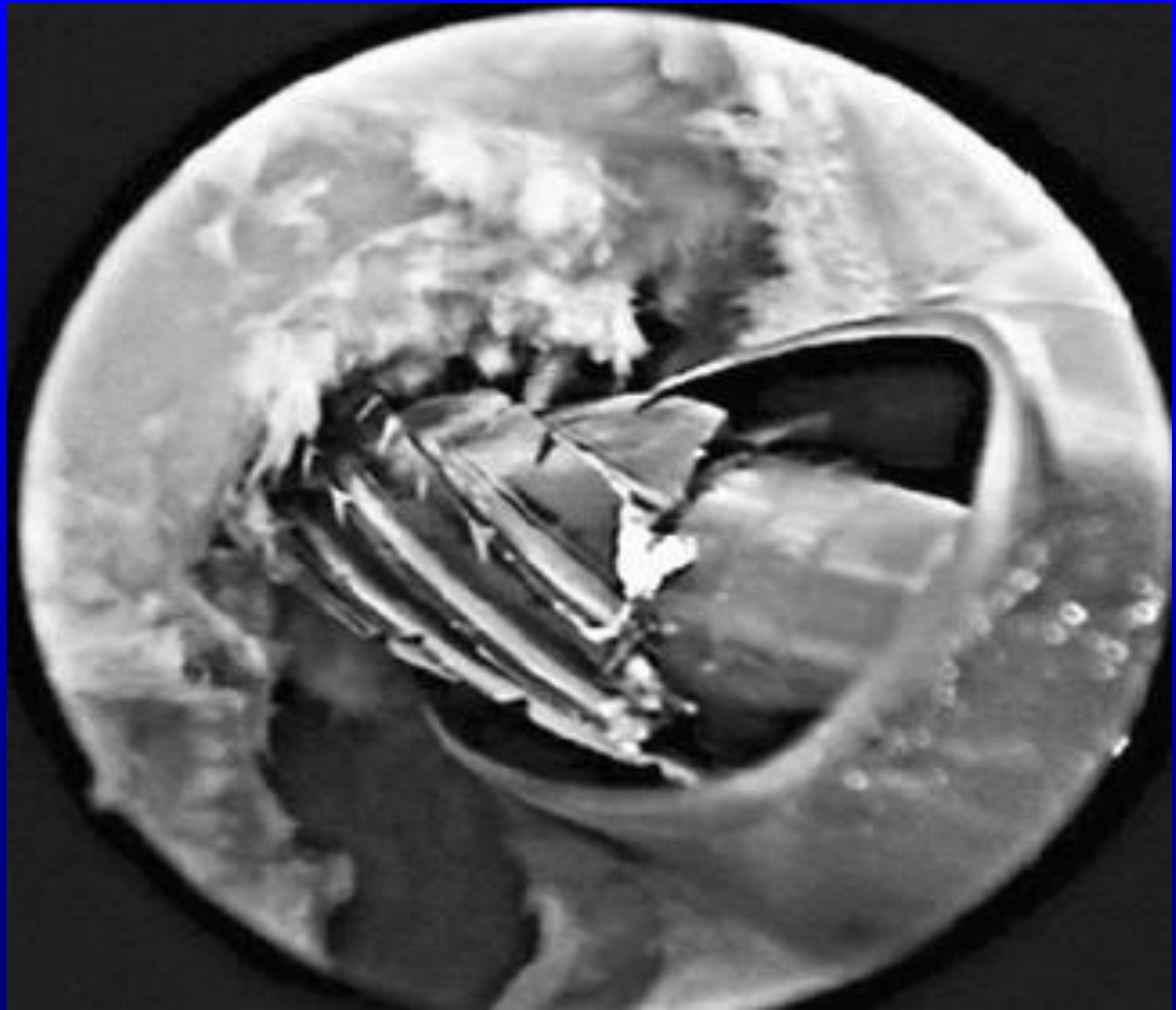
Femoral channel



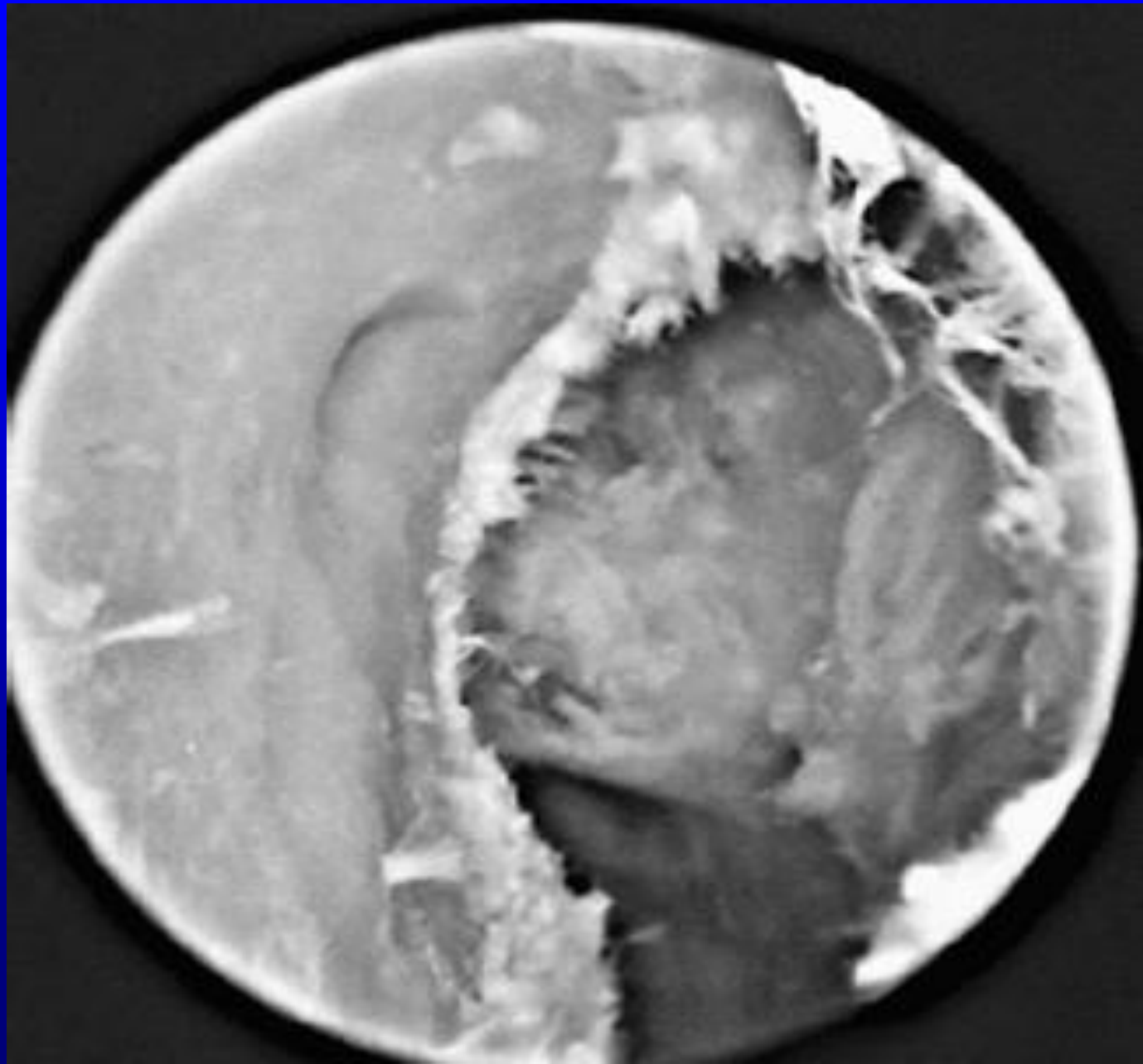
Stenotic Notch

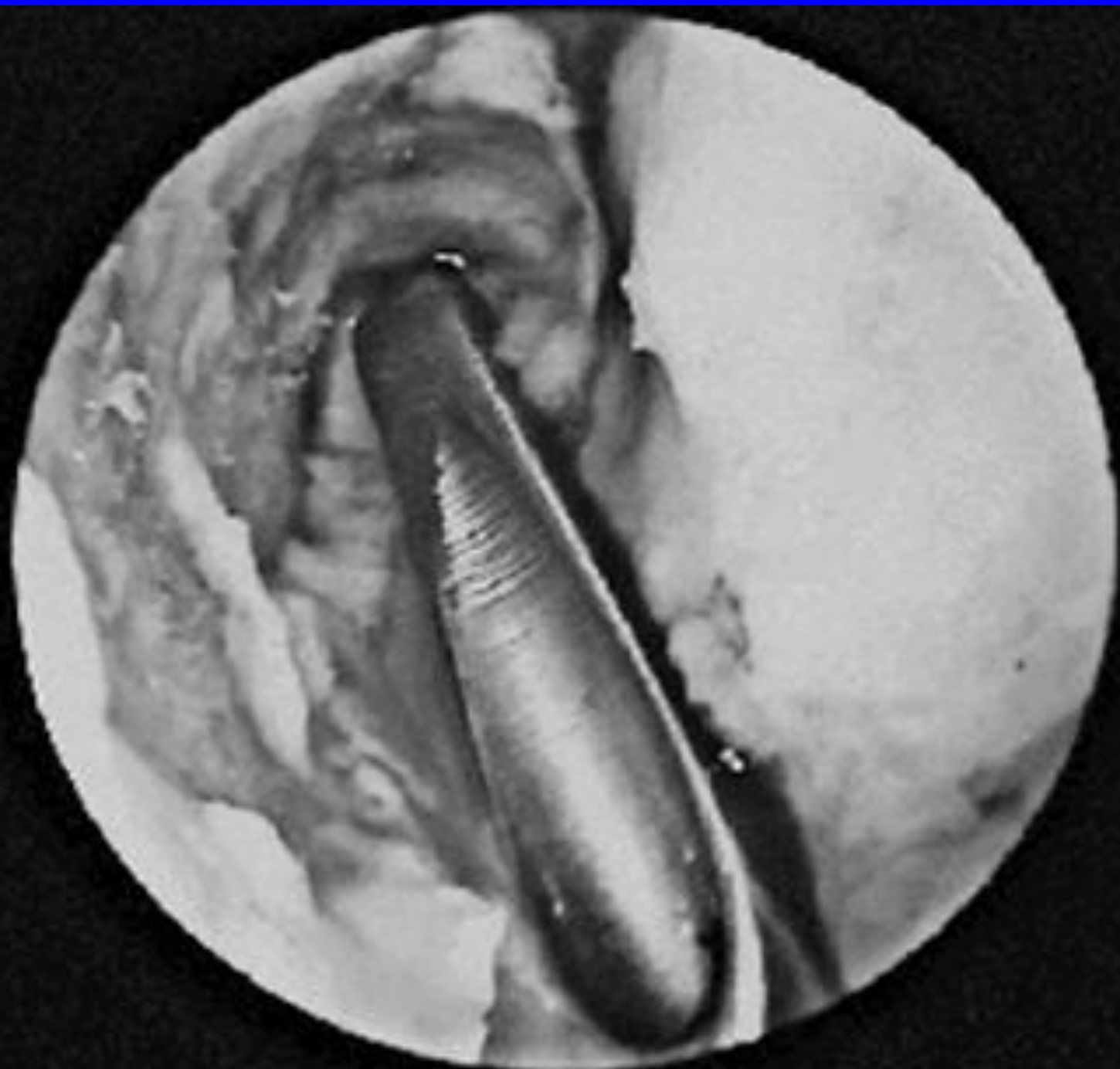


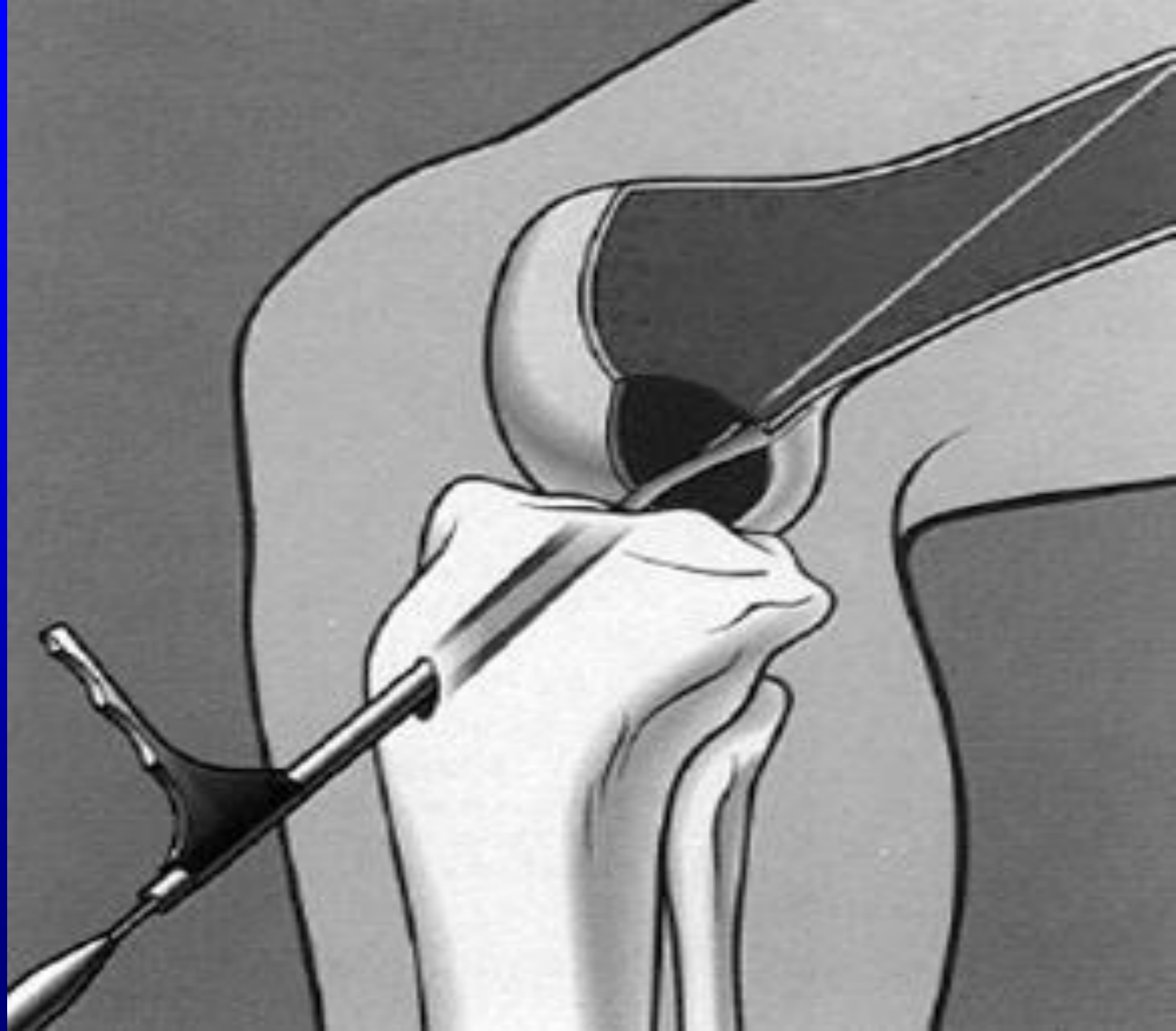
Open up

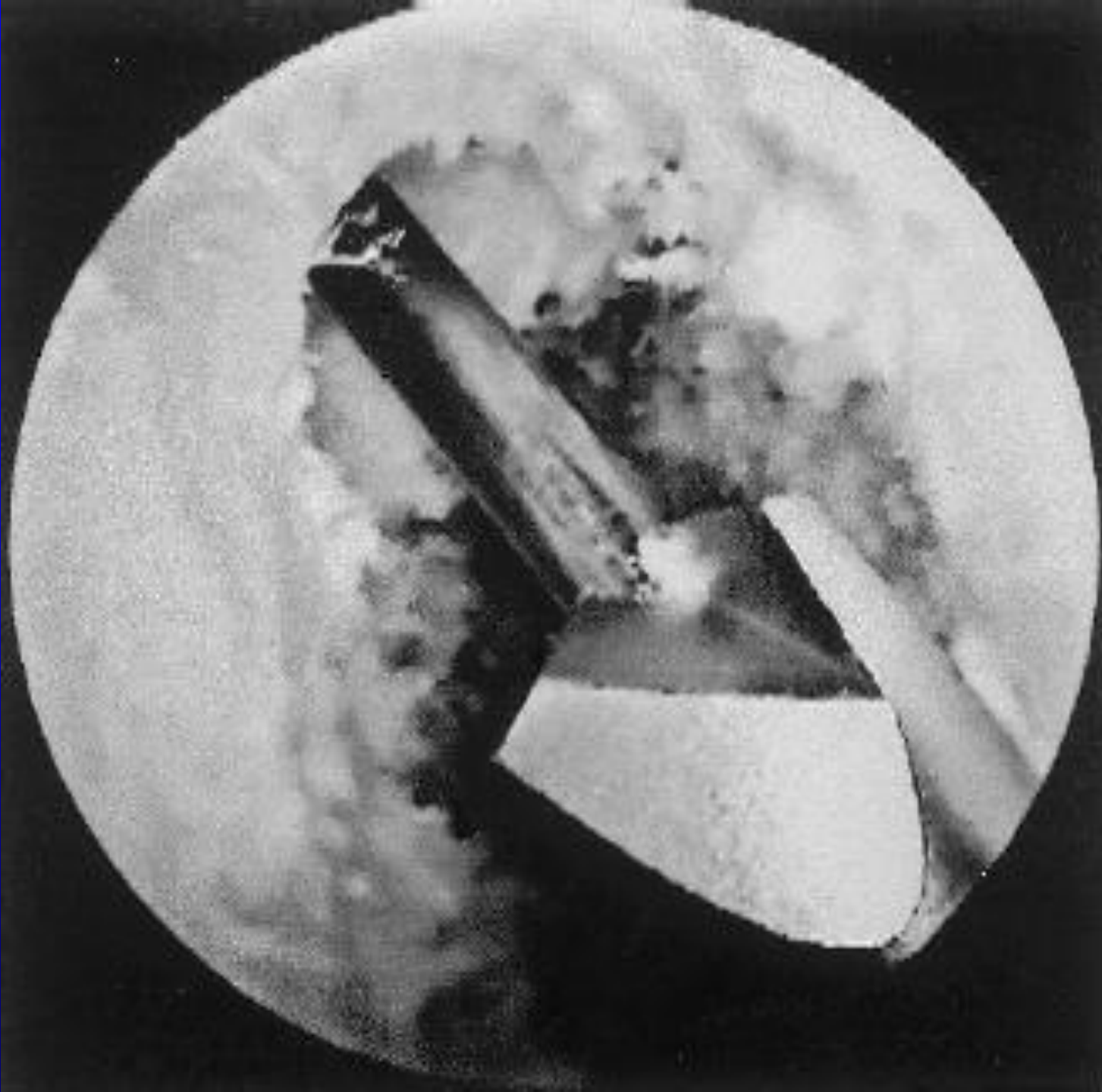


Complete notchplasty





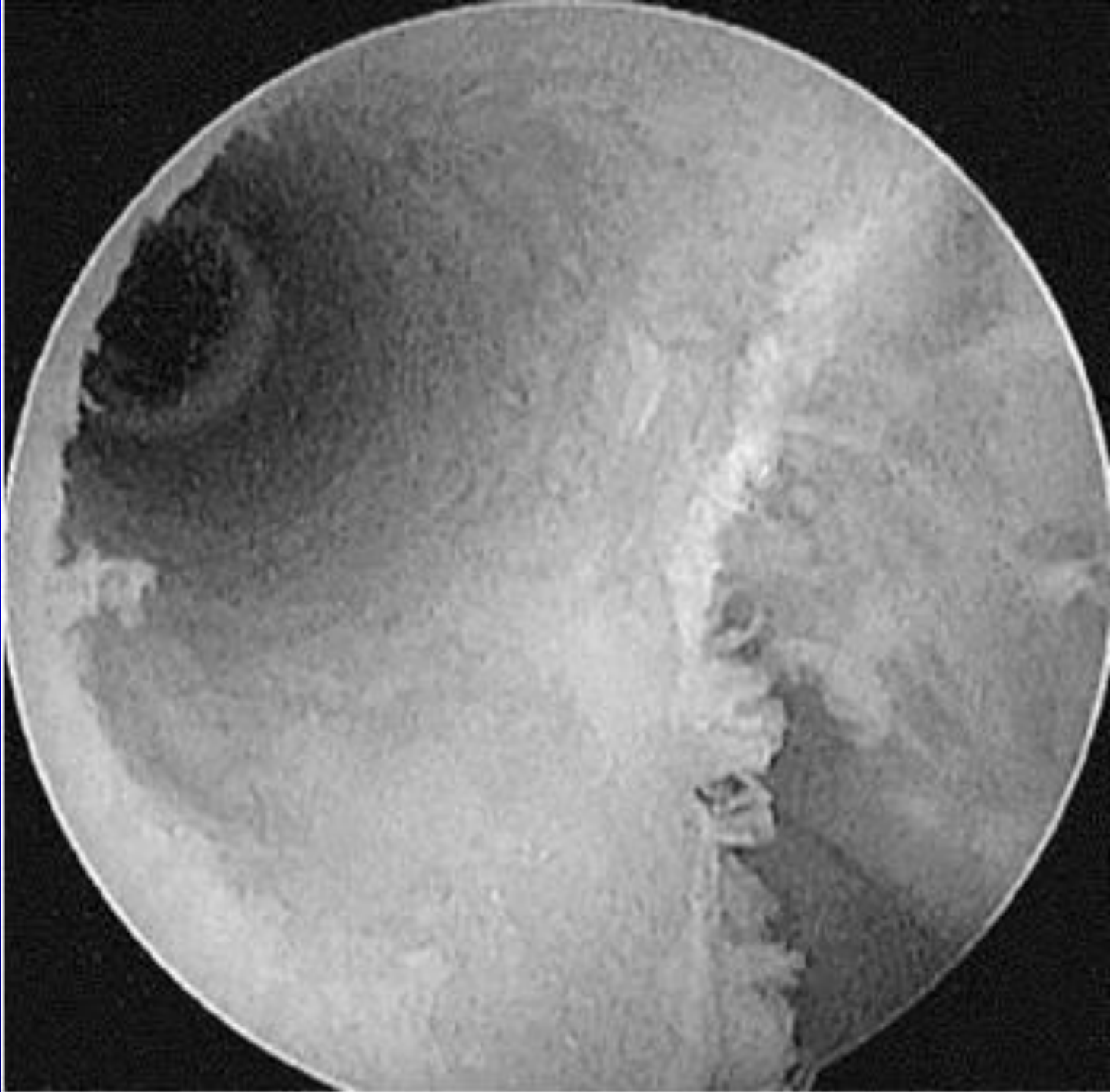




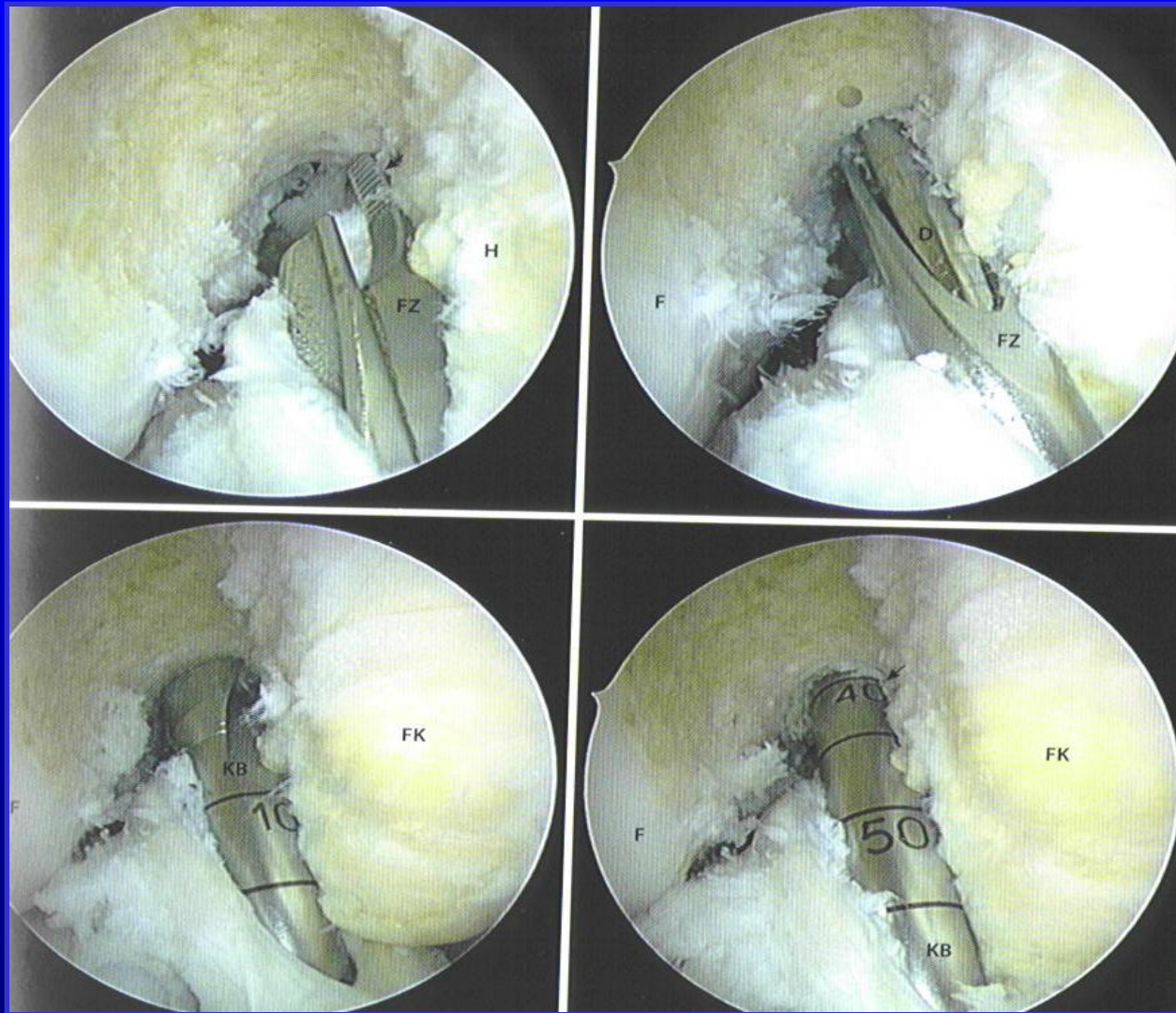
10

15

20



Femoral channel



Femoral channel

- No soft tissue in the notch
- Maybe widening of the notch necessary
- Position 11 or 1 o'clock (left or right knee)
- As far dorsal as possible (Rosenberg-Line in x-ray)
- avoiding impingement at the lateral side of the notch
- Diameter not to big (windshield wiper effect, tunnel widening)

Tibial and femoral channel



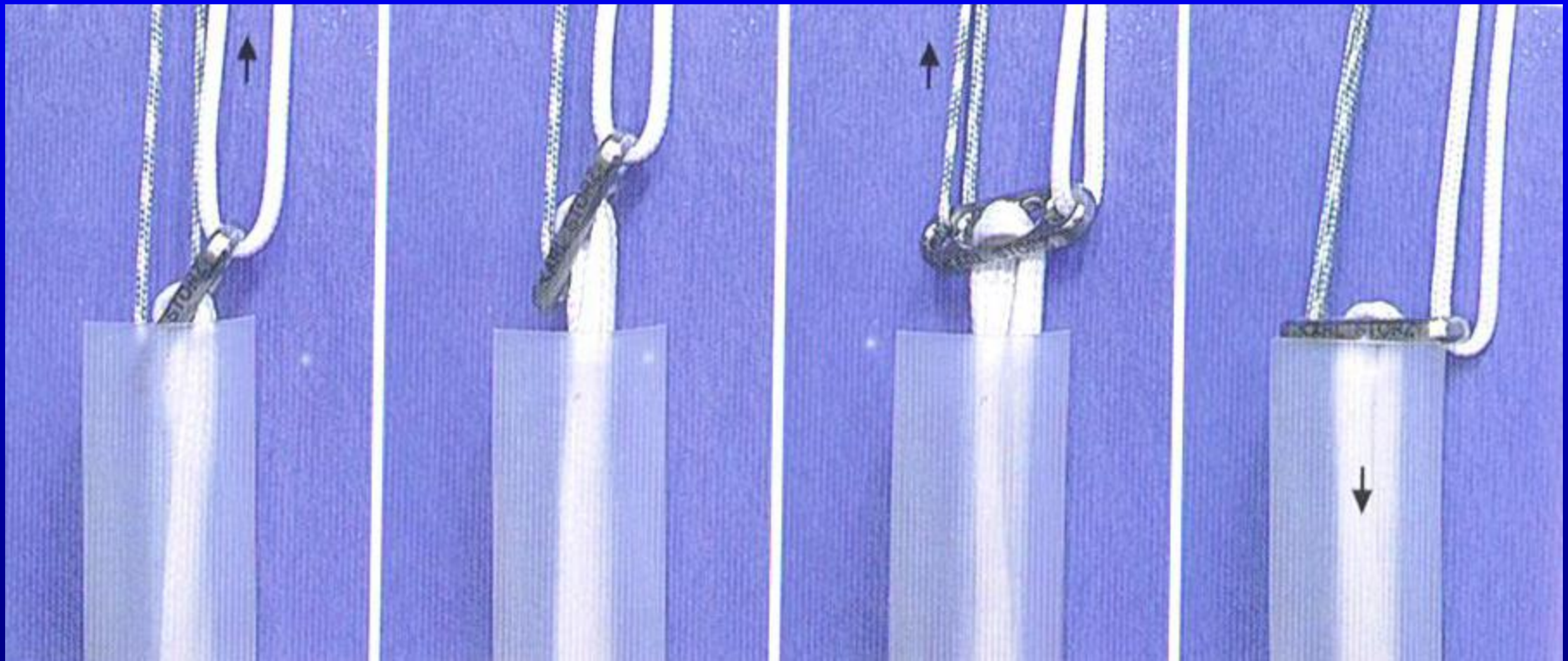
Aspects of acl- reconstruction

- Transplants
- Channel positioning
- Fixation

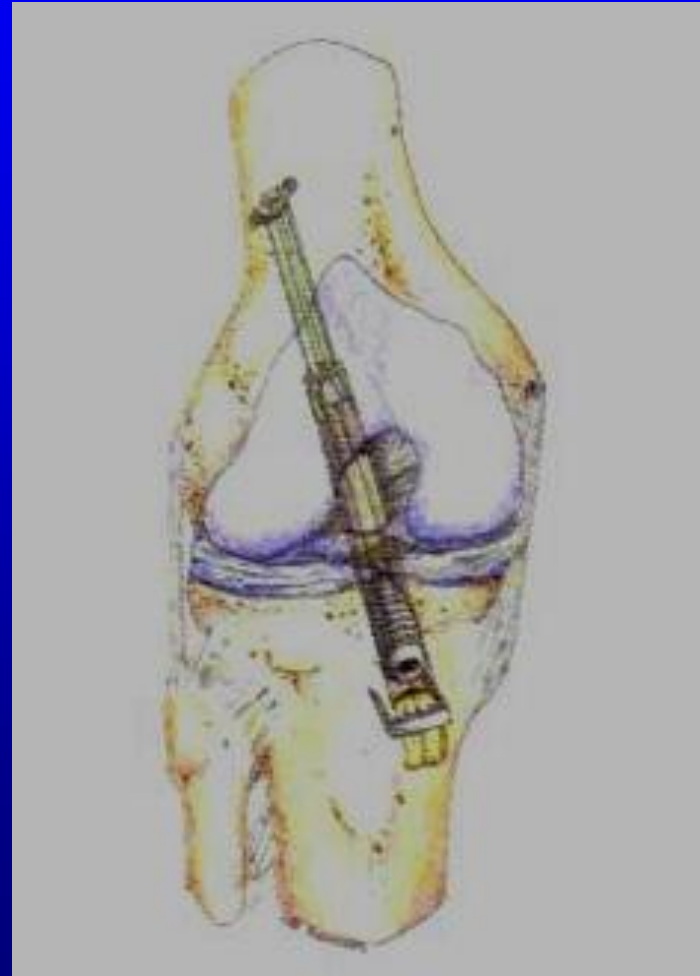
Fixation of the transplant

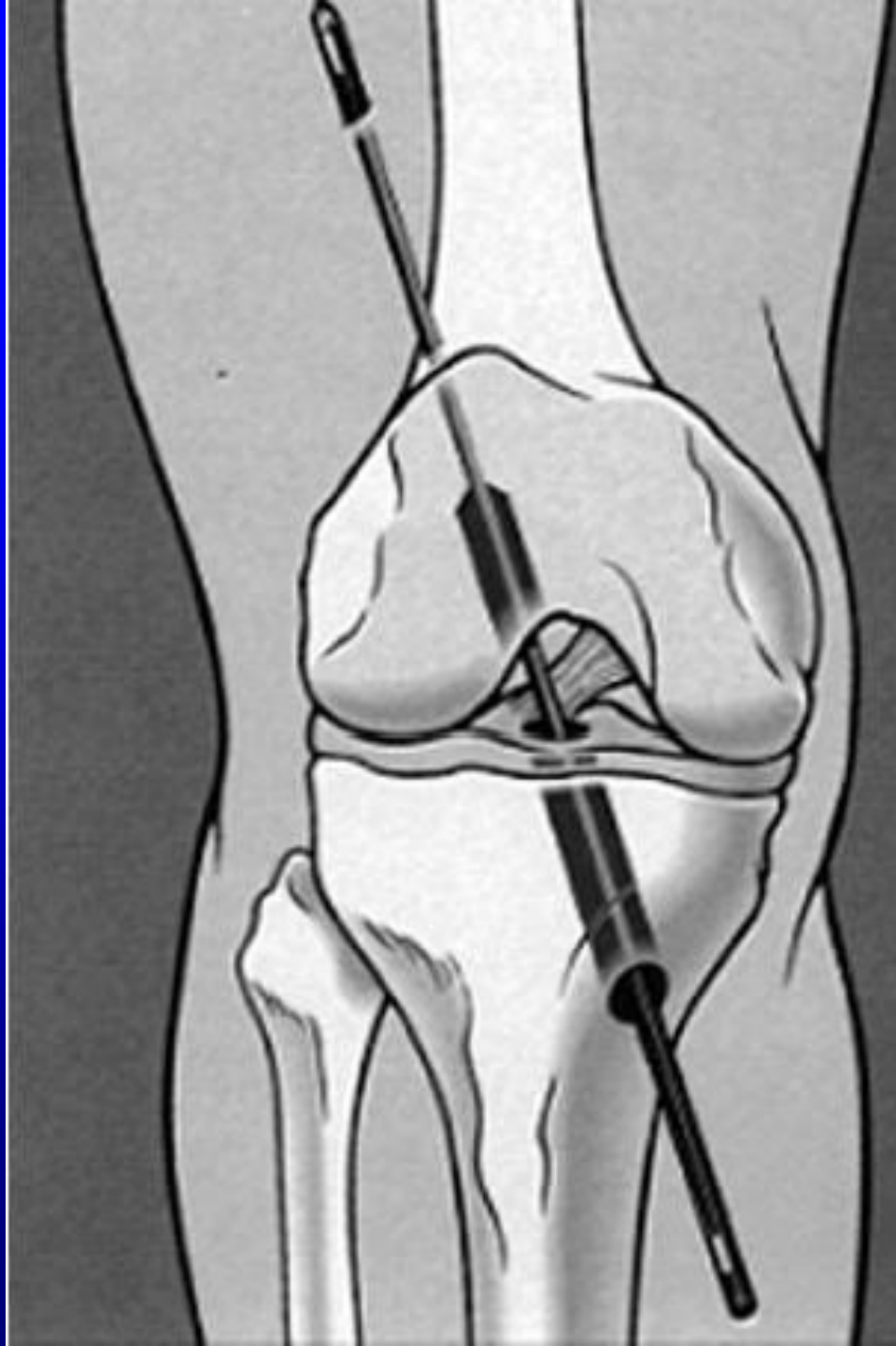
- save, high pull out
- Near the transplant (bungee-effect)
- Near the joint (windshield wiper effect, tunnel widening)
- Think of rerupture- revisions have to be possible!
- Minimal invasive: no further skin incisions

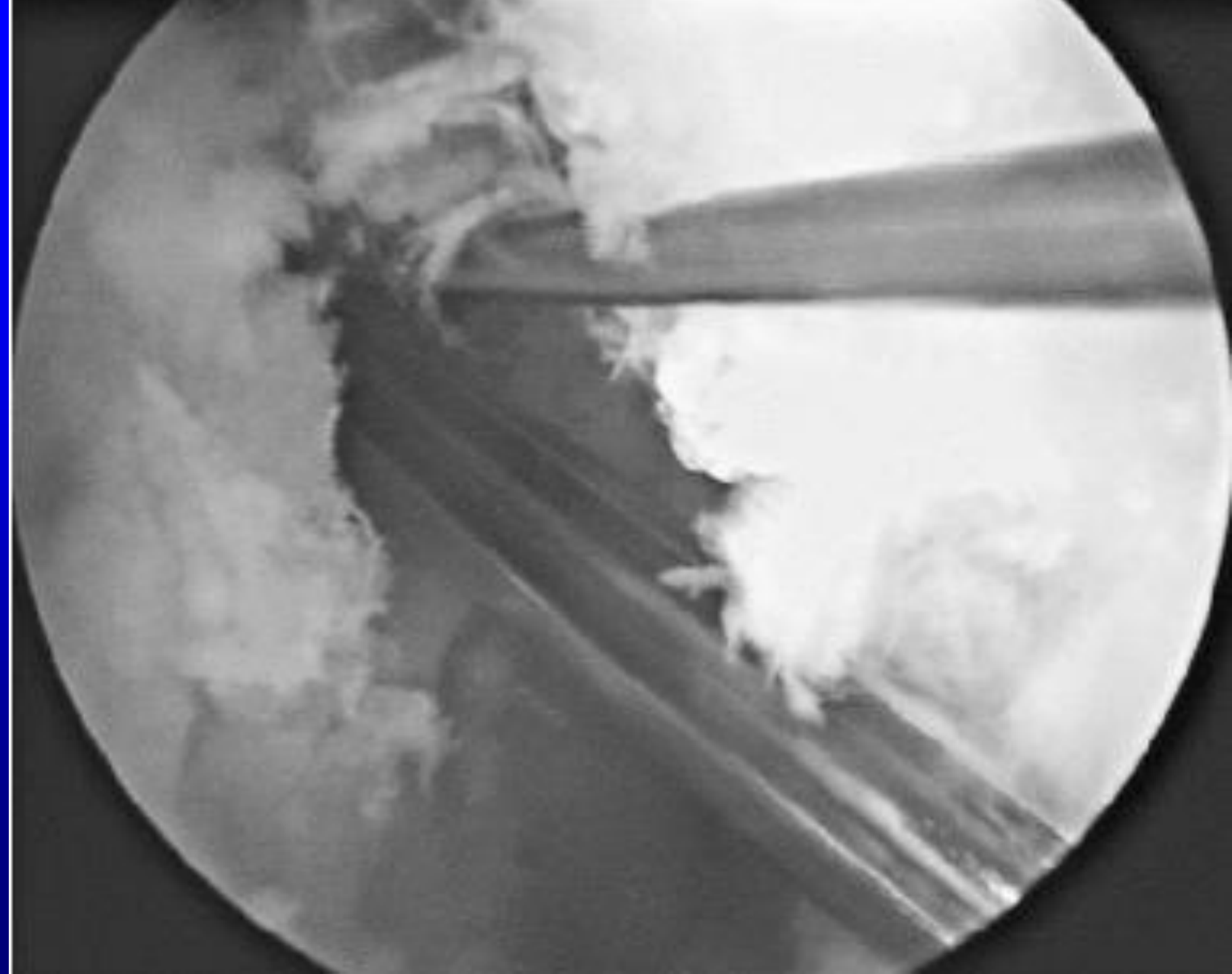
Endobutton, technic

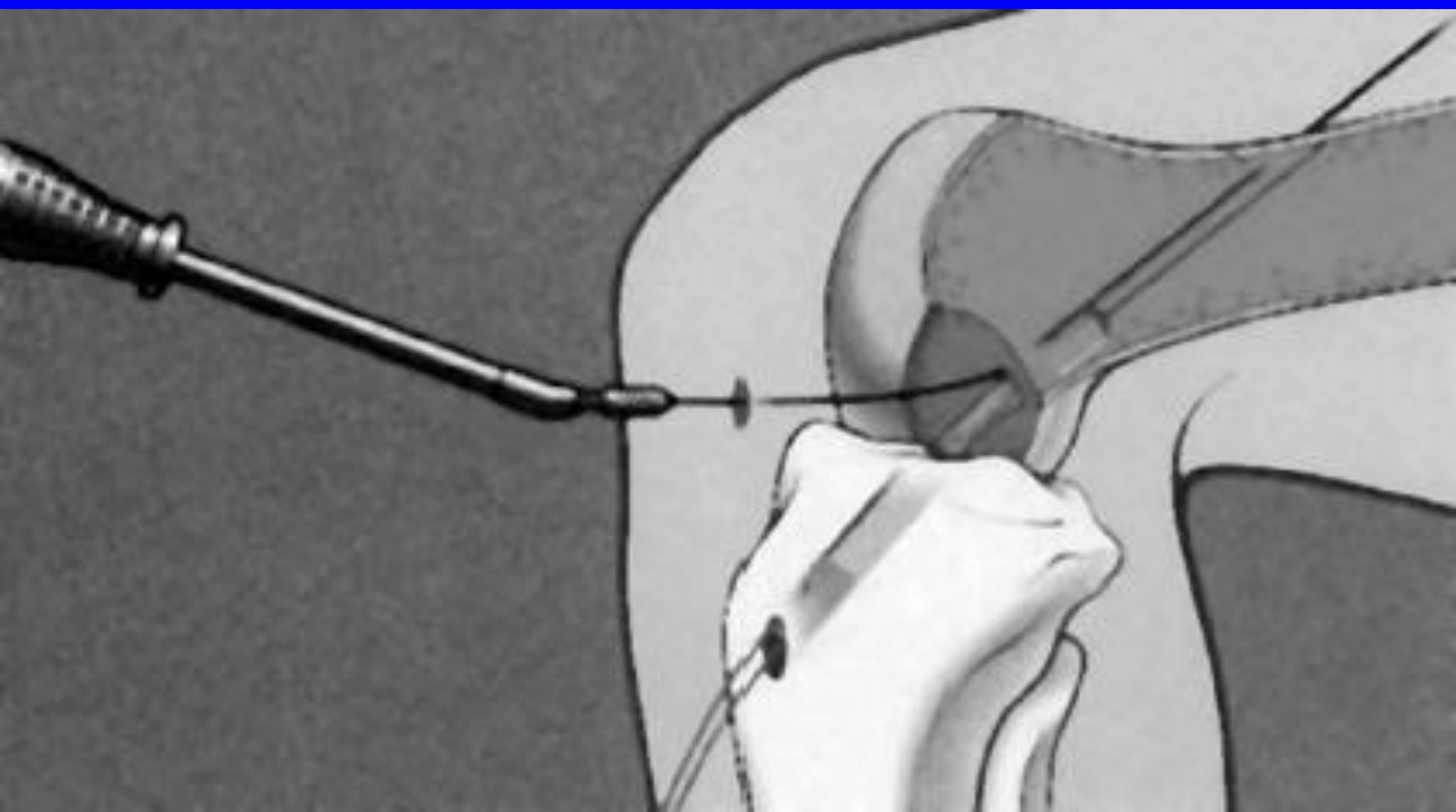


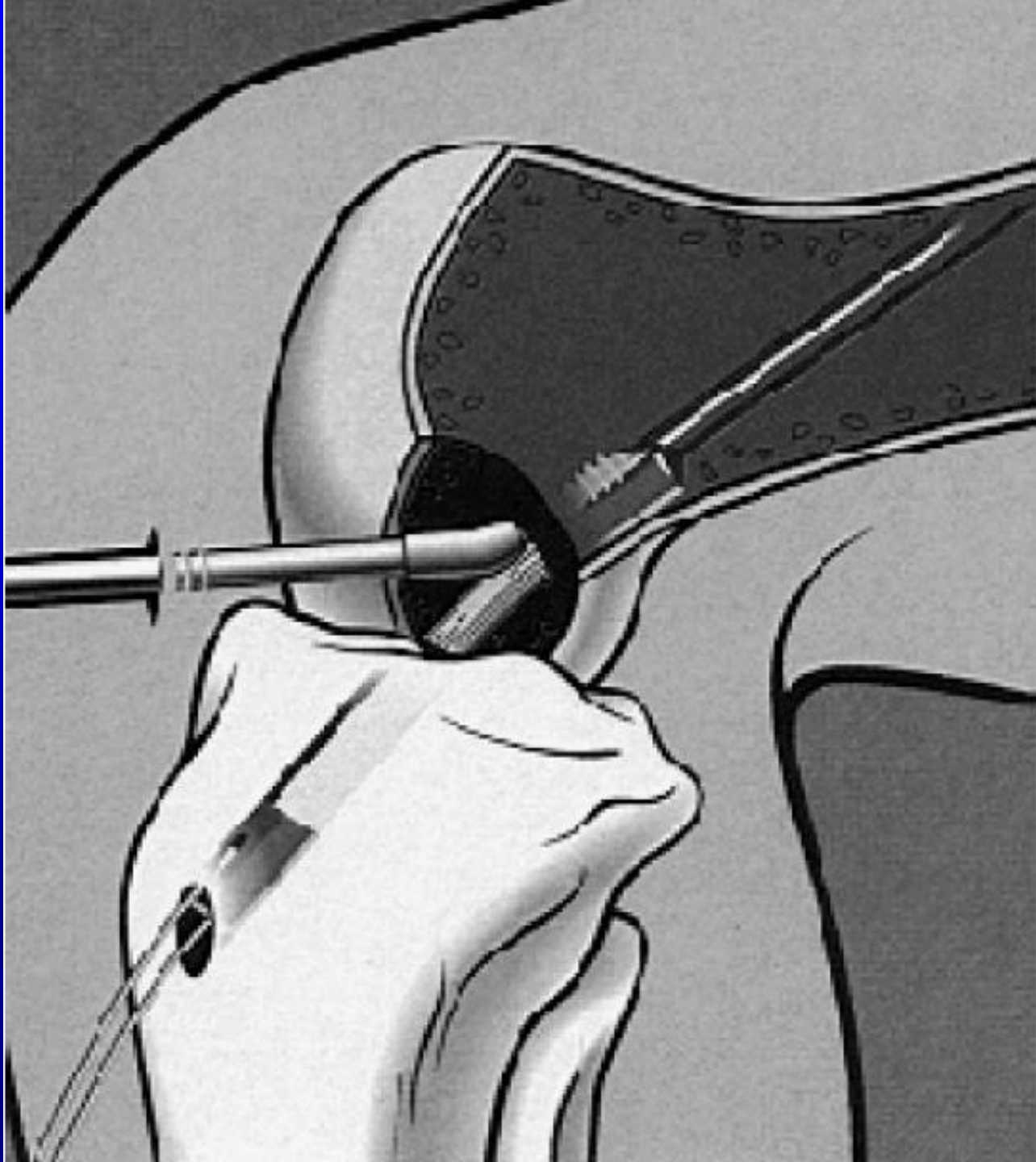
Endobutton















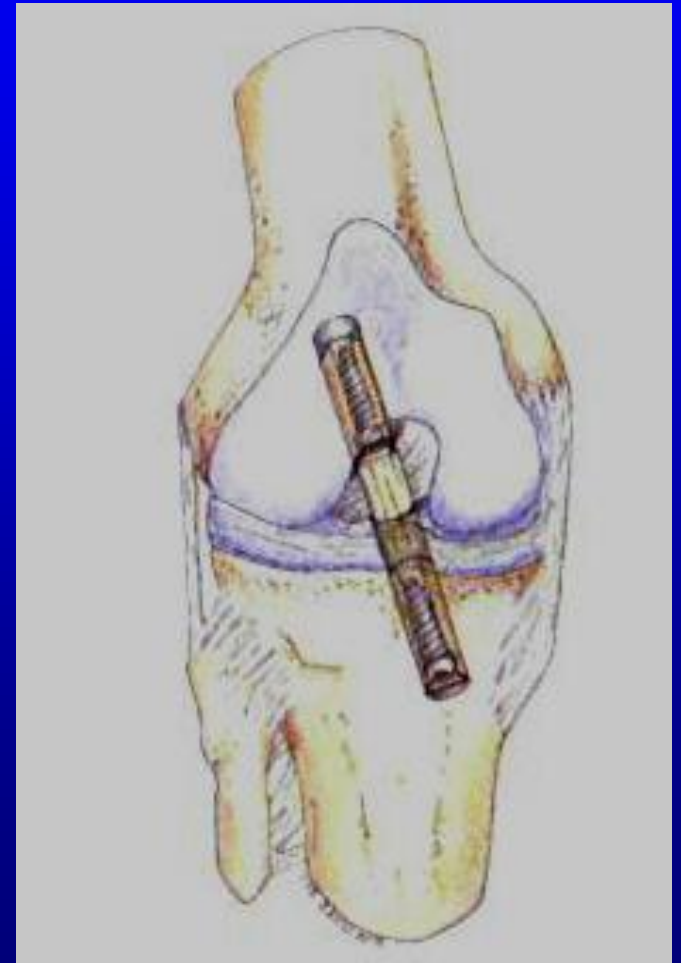
Endobutton, Suture Disc

- Possible for acl and pcl
- Hamstrings, Quadricepstendon
- High pull out-force
- Far of the joint and transplant:
 - Bungee-effect
 - windshield wiper effect
 - what about the mersilene- suture?
- Belong specialists it is not anymore a favored technic!

Interference screws

- For patellartendon, quadricepstendon and hamstrings, tibial and femoral
- Resorbable (Polylactid) or out of metall
- Fixation near the joint and transplant
- Closes the channels
- Lower pull out force: slow rehabilitation!
- Metallscrews: difficult to get out again in revision, big boney defects
- Polylactidscrews: sometimes big holes because of resorbtion

Interferencescrews



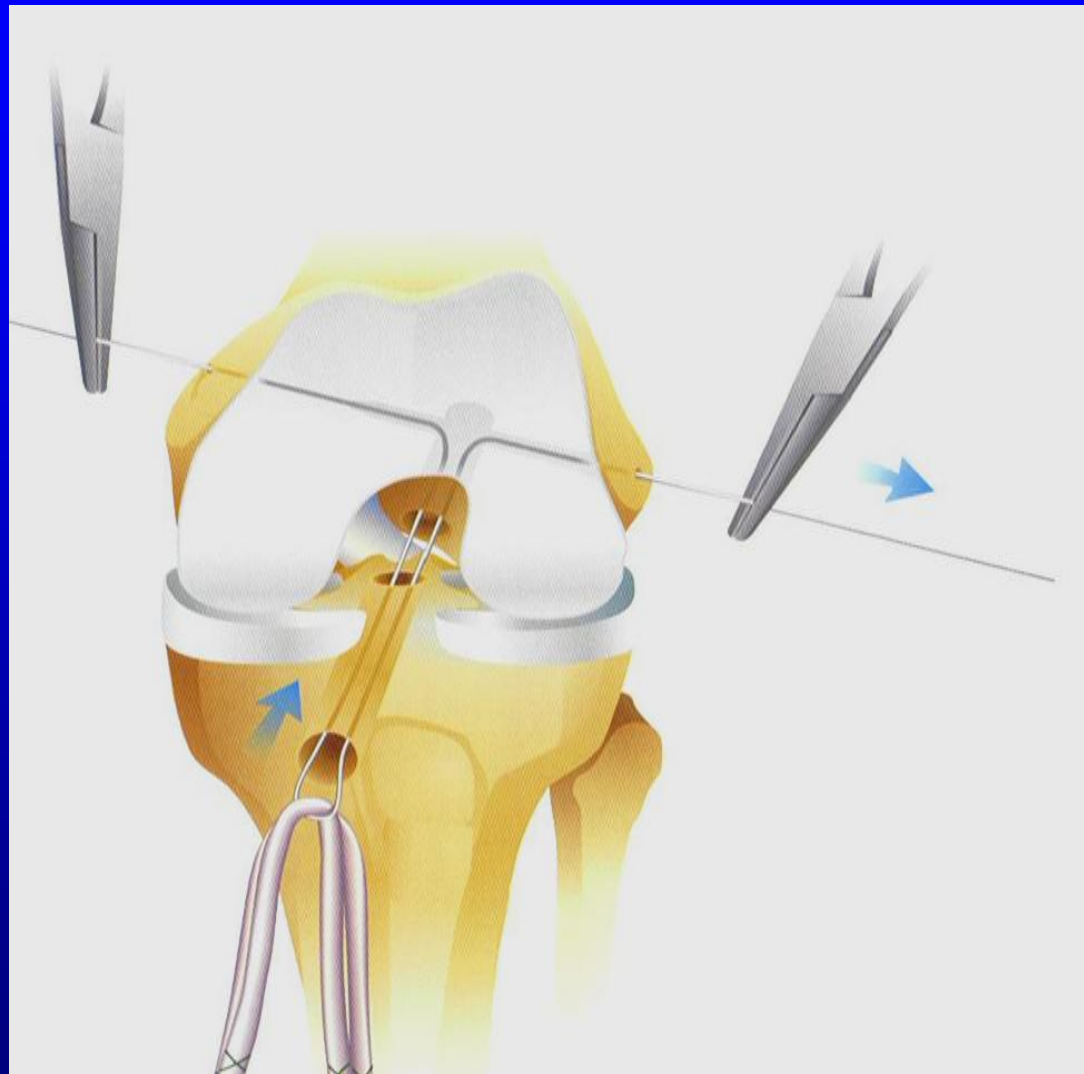
Crosspin- Technic (Transfix, Rigidfix)

- for hamstrings and quadricepstendon
- Highest pull out force of all modern technics
- Fixation near the transplantation
- In combination with if-screw or bone-plug also closing the channel
- Out of metall or resorbable
- In case of revision easy to get out

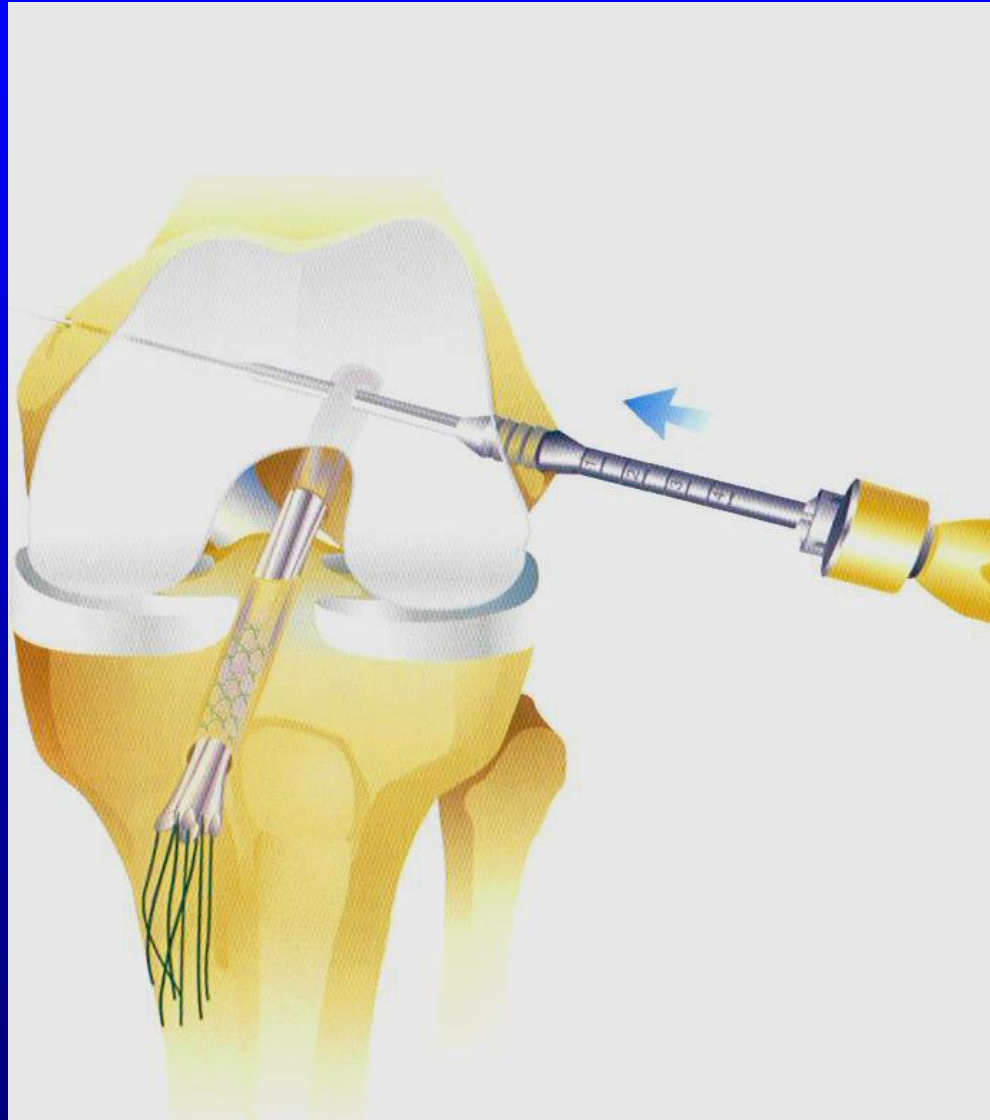
Transfix- Technic



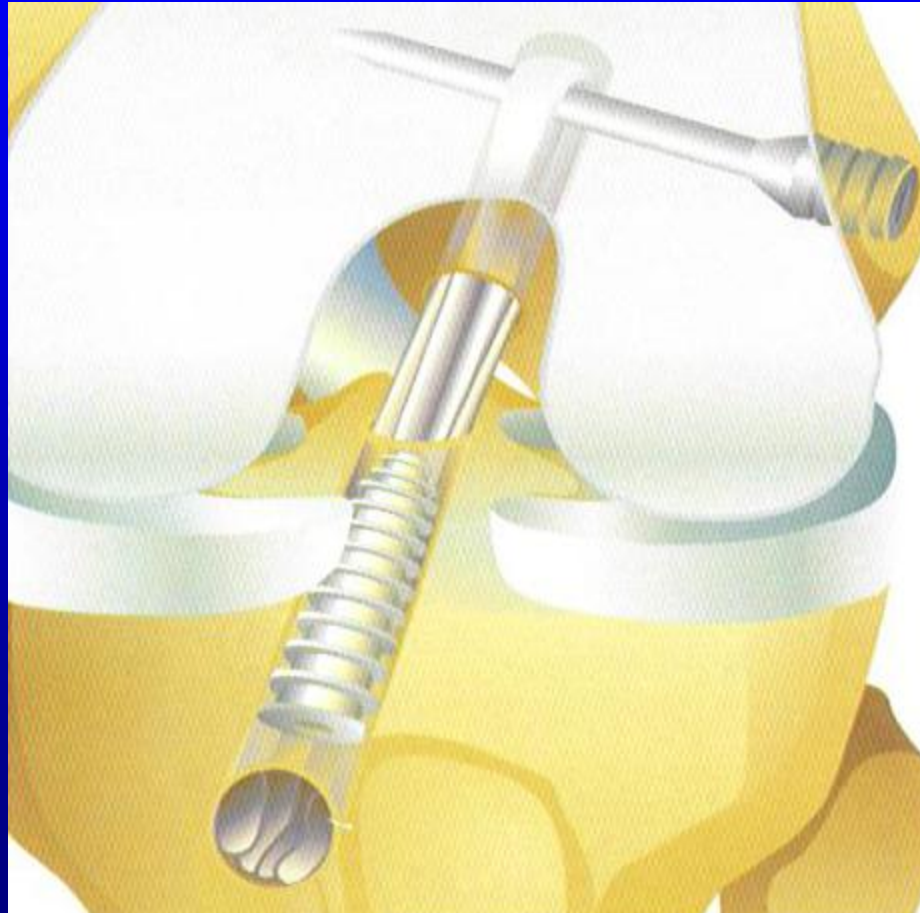
Transfix-Technic



Transfix-Technic

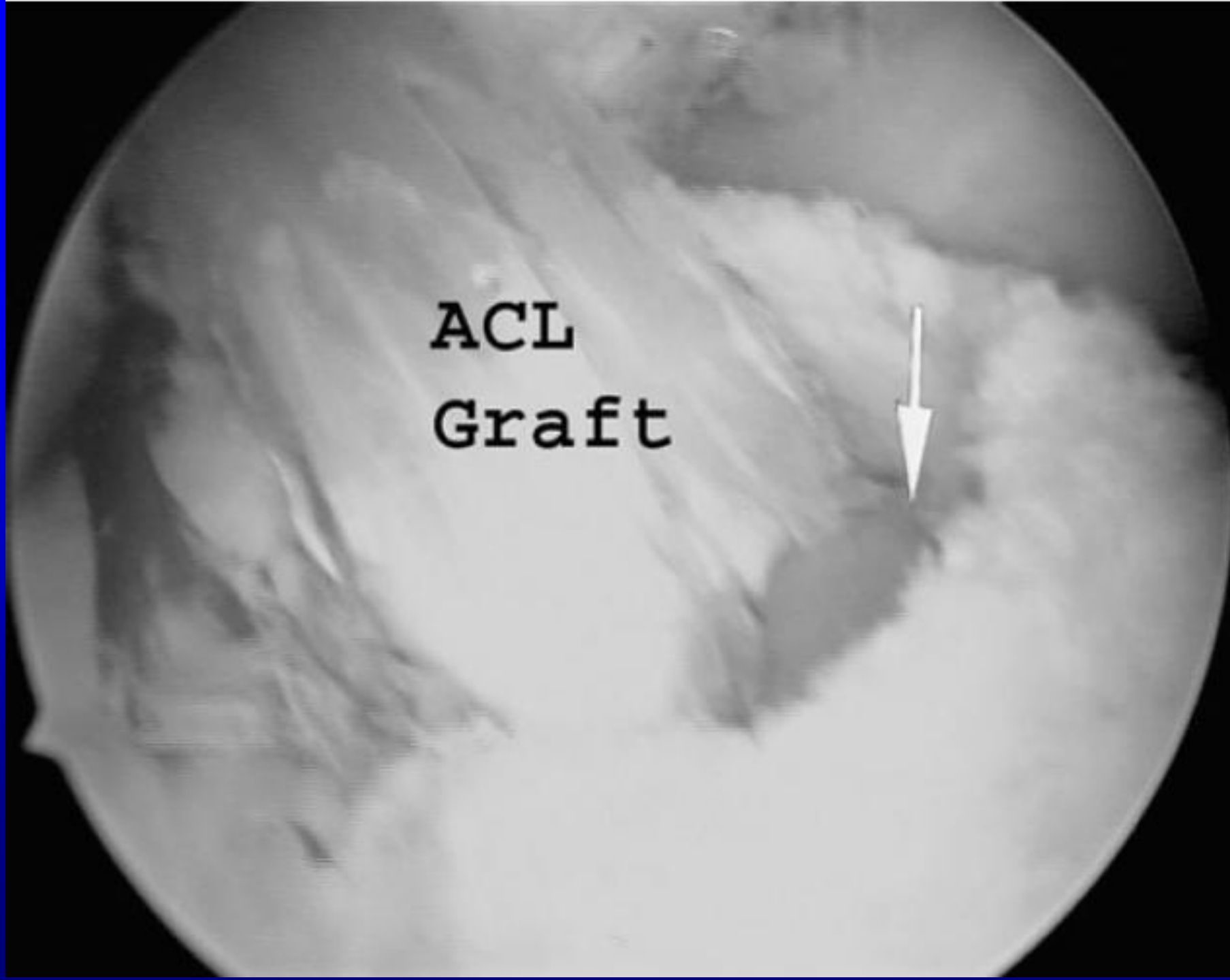


Transfix- Technic





ACL
Graft





Pressfit-Technics

- Pressfit-technics for patellartendon (Boszotta, Hertel),
- Pässlers pressfit-technic for hamstrings
- Pressfit- technic (Stäubli) for quadriceps tendon
- Pressfit- technick (Pässler) for quadriceps tendon

Pressfit- technics

- Main principal:
Implantfree fixation of the transplant: good possibilities of revision, high contact-zone channel wall- transplant

new technics: only short follow up
until now good results

But: carefull rehab!

Rehabilitation after acl-reconstruction

- Very important
- Weight bearing and training methods vary depending on method of fixation and transplant
- „right“ training is important (closed systems, kneeflexors, coordination-training)
- sports after acl- reconstruction?

Rehab- plan

- Partial weight bearing 10-15 kg for 3 weeks after surgery
- Knee brace
- Extension/flexion 0/0/90° for 3 weeks
- Regaining of full extension is important
- Isometric training right after surgery

Rehab-plan

- Training of knee flexors is more important than extensors (knee curler machine causes problems)
- Training in water (physiotherapy, aqua-jogging etc.) after second week
- Full weight bearing after 3th week, if full extension is possible

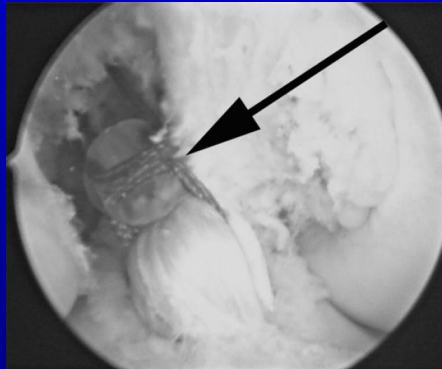
Rehab-plan

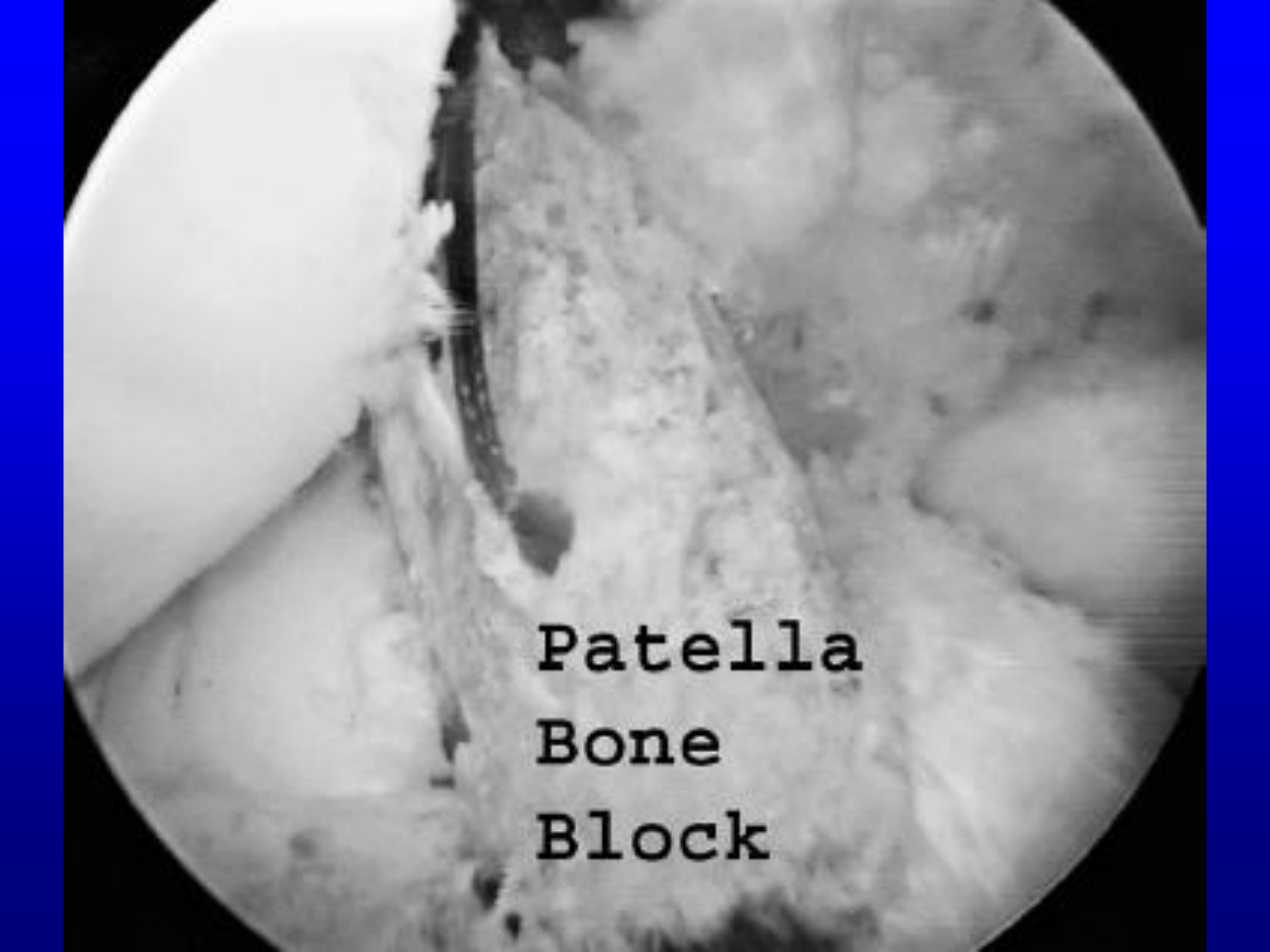
- Back to work: light work between 3th and 6th week, strenuous work after 8 to 12 weeks
- Back to sports: swimming after second week, cycling after 4th week
- Contact sports like football: 4-6th month, only with full range of motion and full strength!

Experience is what you get
when you don't get what
you want!

Thank you for
your attention!





A black and white photograph of a patella bone block. The bone is shown in a cross-section, revealing its internal structure. The surface of the bone is smooth and light-colored, while the interior shows a porous, trabecular structure. A dark, vertical line runs through the center of the bone, possibly representing a blood vessel or a surgical incision. The bone is held in place by a blue background.

Patella
Bone
Block

