Patellar tendon internal derotation

in painful patella syndrome

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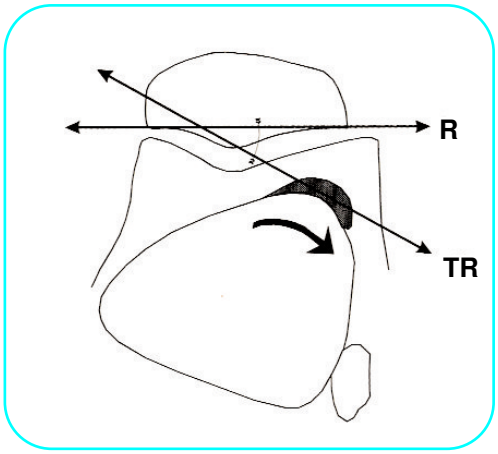
Review of the biomechanical principles

The morphotype of many patients suffering from painful patella syndrome is characterized by an external torsion of the proximal tibial metaphysis. This notion was confirmed by a comparative study of a patient population with this pathology and one without any pain. Using identical measurement techniques, the first group had an average tibial torsion of 30 degrees compared with 15 degrees in the second group.

This external torsion pulls the patellar tendon laterally and posteriorly. Independent of the physiological Q angle, this places the patellar tendon (PT) and the patella (P) in two different planes, forming an open and outward angle P-PT.

When it is under tension, the extensor apparatus has, as all mechanical systems have, a tendency to align itself in one plane. The patella, being mobile, tries to place itself in the same plane as the laterally oriented patellar tendon, but it is prevented by the lateral slope of the trochlea and the medial patellar retinaculum. This results in a dynamic conflict, which also involves the fat pad under the patella.

This external torsion of the extensor apparatus is partially compensated in flexion by the internal tibial rotation, which perhaps explains why these pains appear more often in descent, as emphasized by A. TRILLAT (contraction of quadriceps from extension to flexion). But this compensation is insufficient and the conflict exists also in flexion, which explains the pain after prolonged sitting (cinema sign).



Diagnosis

This painful patella syndrome is frequently troublesome in young athletic patients and is manifested by :

- pain during activity :
  - vertical and medial,
  - lateral, towards the edge of the patella,
  - sometimes curiously postero-lateral (popliteal contraction ?),
  - often aggravated during descent (return from mountain hiking),
- pain after prolonged sitting with the need to “stretch the legs”,
- pain upon rising,
- transient sensations of pseudo-locking,
- crepitus corresponding to cartilagenous lesions.

Clinical examination reveals :

- morphotype of lateral torsion,
- often medial tenderness which has led to many meniscectomies,
- sharp pain during deep palpation of the lateral facette of the patella while subluxating it laterally,
- often a sensation of irregular tracking of the patella during vertical movement in the trochlear groove, evidence of cartilagenous lesions
- absence of other signs.

Radiologically

The distance between the Anterior Tuberosity and the trochlear Groove (ATTG) described by GOUTALLIER quantifies linear translation of the lateral tibial torsion, modified by any anomalies in the frontal plane. Rare cases also exist where the ATTG is unable to identify a significant torsion or the opposite. The ATTG leads to a correction in the frontal plane ; translation, medially or laterally

It is preferable to measure the increased tibial torsion in degrees since it is a circular motion and not a translation. This measurement can be made on the scanner : the torsion of the extensor apparatus is measured by tracing

- the plane of the patellar tendon : a straight line passing through two points equidistant from the crest of the tuberosity,
- the patellar plane : a straight line passing through the medial and lateral margins of the articular surface of the patella.

A straight line passing through the crests of the two trochlear slopes permits the appreciation of the lateral tilting of the patella.

In the majority of cases, a standard radiological exam is sufficient : A/P, lateral and axial at 60 degrees. The practicality and economics of such examinations are clear. The examination using a scanner does not in general add any better information but is reserved for doubtful cases.

The tibial tuberosity is marked using two small lead markers attached with tape to the lateral and medial borders of the patellar tendon insertion

Standing X-Rays

- Strict lateral, condyles superimposed :

The foot the patient is placed on a rectangular board graduated in angles of which one side is held against the table. With the heel as an axis, the foot is turned on the board until perfect superimposition of the two condyles on the monitor screen is obtained.

- A/P of the femur :

Defined by beaming the x-ray perpendicular to the lateral view, achieved by turning both the patient and the board on which his foot lies, through 90 degrees.

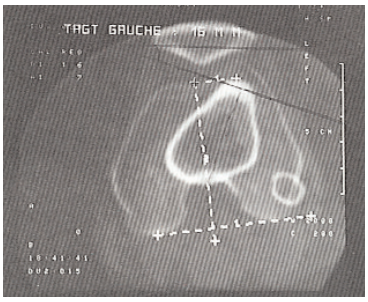
- The lateral x-ray allows appreciation of the trochlea according to the criteria of DEJOURS et Al and the height of the patella.
- The A/P x-ray demonstrates objectively that, when the femur is facing straight ahead, as evidenced by visualization of the axial margins of the two condyles, the tibial metaphysis is in external torsion. The insertion of the patellar tendon, verified by the two markers, is very much lateralized. The axis of the foot, on the board, is oriented externally and its angle gives an approximation of the global tibial torsion. The angle read on the foot is often an underestimation of the torsion of the proximal metaphysis, since some internal torsion of the lower part of tibial compensates (reading an angle of 25 degrees as an example corresponds most often to an upper tibial torsion of 35 degrees). This approximate measurement is only a confirmation of the morphotype. A discordant result should raise suspicion that other factors may be involved.

Axial views of the patella with muscles relaxed

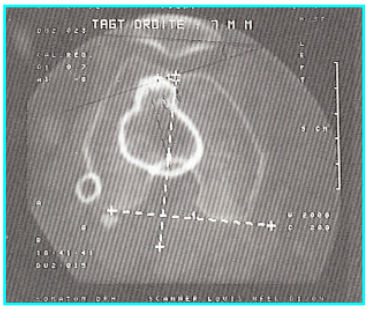
These allow visualization of :
- a patella that is usually well centered,
- lateral tilting and subchondral sclerosis of the lateral facet,
- especially the P-PT angle.

The plane of the patella is defined by a line across the outer margins of the medial and lateral facets and the plane of the tendon by a line connecting the two markers. The angle between these two planes must be diminished in order to reduce the constraints producing rotation of the patellar.

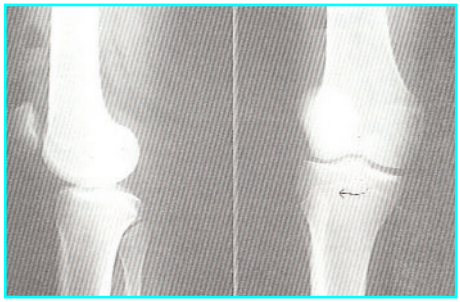
Scanner



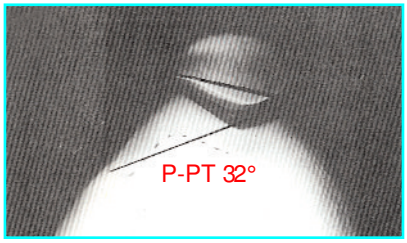
P-T Angle ATTG 16 mm



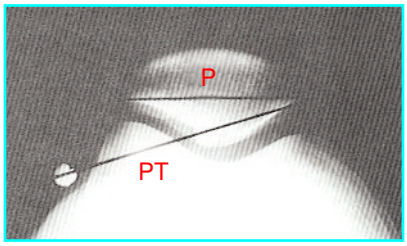
Osteotomy of the tibial tuberosity with medial translation Emslie type. Pain syndrome not improved. The remaining P-PT angle must be corrected by a derotation of the ant. tuberosity (+ lateral translation).



A - Lateral x-ray.
B - Turning the foot 90°, produces a theoretical A/P of the femur. In this position, it is clear that the tibia is in lateral torsion. The axis of the foot is in 25° of external rotation.



The projection of the tibial tuberosity is well seen : this allows plotting of the patellar tendon plane.



The medial and lateral margins of the patellar tendon are identified by two markers, which again allow tracing of the patellar tendon plane.

Surgical technique

Principles

The principle is to make the two planes grossly parallel, the plane of the patella and the plane of the patellar tendon, by correcting the P-PT angle.

Either of two techniques may be used :

- derotating osteotomy of the tibial tuberosity, which has been described previously,
- derotation reconstruction of the patellar tendon, which is a variation of the GOLDTHWAIT technique, revised by PEYROU and modified by us.

Indications

The indications for each of these techniques are now clarified.

- Derotation osteotomy, mechanically more efficient in its effect as a “lateral MAQUET" :

- if there exists significant pre-arthritic cartilagenous lesions,
- if the patient is a competitive athlete (runners ...),
- if the derotation is associated with other repairs, including those for patella-alta, patella-baja, genu-valgum and genu-varum.

- Patellar tendon reconstruction in other cases :

- isolated derotation,
- patients who do not put significant demands on their knees,
- women for whom the resulting “bump” after a bony graft is esthetically unacceptable,
- adolescents.

Ligament and fixation

The ligament is made of polyester, **LARS PTR 30**, consisting of three separate portions :

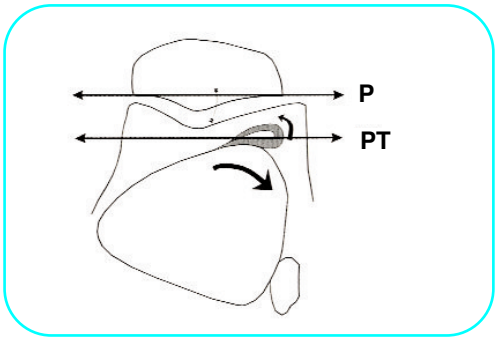
- a superior or proximal portion, flattened, whose end contains a small titanium barrette which aids in the primary fixation of the ligament,
- a middle portion corresponding to the patella tendon of small diameter, made of free fibers which are rapidly invaded by fibroblasts,
- a distal or inferior portion, cylindrical, intended for tibial fixation.

The ligament consists of 30 longitudinal fibers, not braided and therefore less sensitive to plastic deformation. The resistance of the ligament is in the order of 1 500 N. The elasticity is in the order of 9 %.

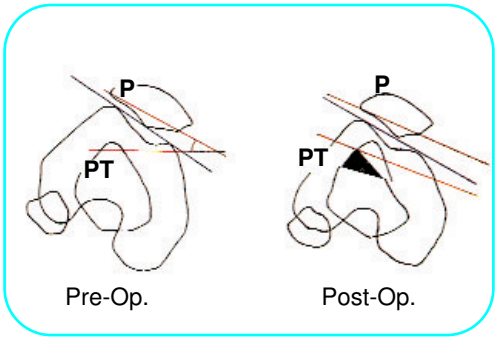
The specific treatment of the fibers assures excellent tissue tolerance and no foreign body reaction has yet been encountered.

The porous structure of the ligament ends allows the fixation at the attachment sites to be rapid and solid.

Fixation is achieved by titanium screw LARS 5.2 x 30 or 6 x 30 in the tibial tunnel.



Derotation of the patellar tendon compensates for the external tibial torsion. The planes P and PT become parallel once again. The patellar tendon continues to be more lateral than the patella : the Q angle is respected.



Correction of the angle P-PT by derotating without medial translation of the anterior tibial tuberosity, using a wedge shaped graft.

Operative technique

- Lateral para-patellar incision from the insertion of the patellar tendon to mid-patella.
- Complete release of the lateral retinaculum including the lower fibers of the vastus lateralis and avoiding the synovium. Careful hemostasis particularly the inferior-lateral geniculate vessels.
- Release by scalpel, from the bone and from outside in, of the patellar tendon to the midline. It is interesting to observe that the tendon "unravels" by itself. (1)

Preparation of a lateral pre-patellar tunnel for about 3 cm, between two transverse incisions of the surrounding aponeurosis. (2)

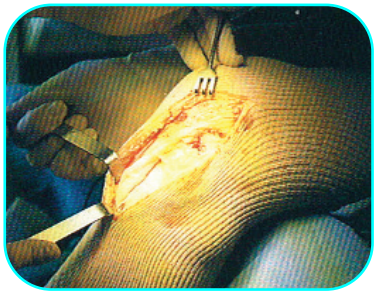
- Reinforcement of the patella tendon

The challenge is to ensure a reconstruction in the right place and sufficiently solid to allow an early return to activity. A reinforcing ligament is used : **LARS PTR 30**.
The ligament is passed from above below through a fibrous tunnel. The titanium barrette, which is at the proximal end in the flat part of the ligament, fixes it at the entrance of the tunnel. In case of a thin skin, the barrette can be removed and replaced by absorbable sutures. This fixation is completed by a few sutures and the proximal end is tucked in. (3 - 4) The open fibers of the ligament correspond to the patellar tendon. The latter is wrapped around the reinforcing ligament and is held in place using continuous absorbable sutures. (5)

- Reinsertion.

A 5 mm drill bit is used to make the bony tunnel, a few millimeters below the most distal fibers of the patellar tendon, adjacent to the tibial crest. (6)
The posterior cortex is not broached.
The cylindrical end of the reinforcing ligament is cut appropriately to allow the introduction of 3 - 4 cm into the tunnel using a fine forceps. A blunt k-wire is introduced into the tunnel, adjacent to the ligament. This serves as a guide for the collarless cannulated interference fit screw (5.2 x 30) which is left flush and gives excellent fixation. (7)

Closure is accomplished in two layers over a drain.



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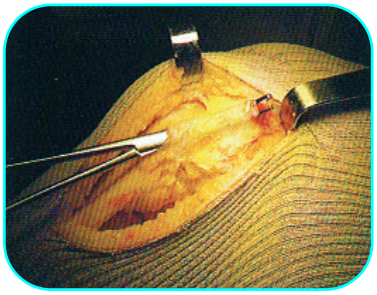

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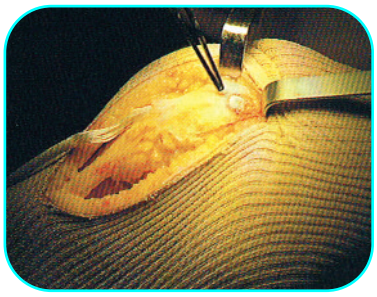

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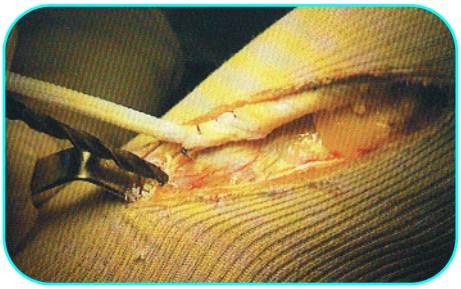

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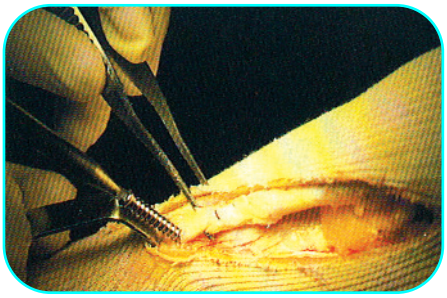

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Post operative care

- Immediate mobilization.
- Weight bearing with crutches after removal of drain.
- Isometric quadriceps exercises.
- Dynamic extension against resistance is contraindicated.
- A removal splint can be used for early ambulation and discarded as soon as full extension of the knee is attained.

Full range of motion is achieved by the 3rd or 4th week.
The average time of return to activities of daily living is 5 weeks. Progressive return to sports is authorized at the end of 2 months.

The screw is problem free and usually does not require removal.

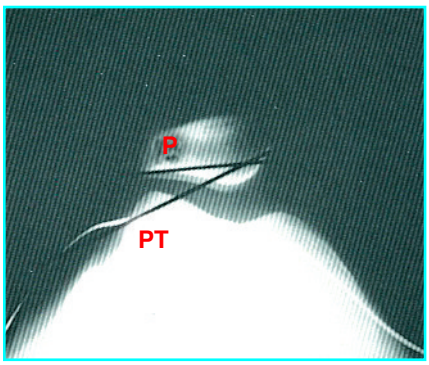
Conclusion

Reconstruction of the patellar tendon with a reinforcing ligament has the advantage of immediate solidity, is a dependable and simple solution for painful patellar syndromes.

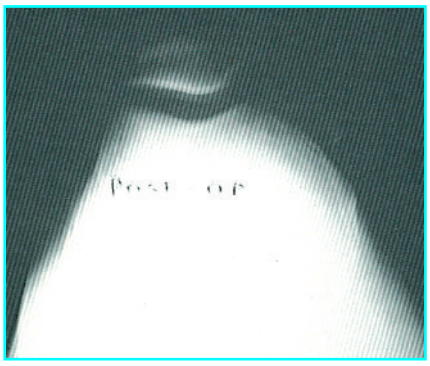
These syndromes are debilitating if they persist. The complaints of these patients should no longer be considered unjustified, as it is often the case when the pathology and its treatment are unclear, resulting in "physiotherapeutic obstinacy" to treat a mechanical problem.

The derotation osteotomy of the tibial tuberosity and the reconstruction of the patellar tendon each have their respective indications and give good to excellent results in over 90 % of cases.

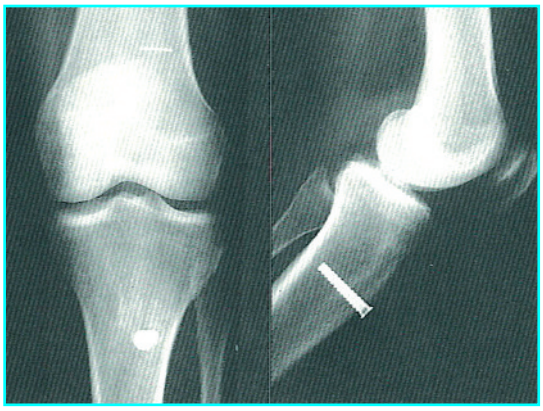
No exacerbations have been seen, nor have other internal derangements been noted to occur following this procedure in contradistinction to findings after other techniques.



Pre operative P-PT angle with lateral tilting of the patella.



Post operatively, the lateral tilt has disappeared.



A/P and lateral post operative x-rays. The titanium barrette locks the reinforcing ligament at the upper end of the fibrous tunnel.

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