

OSTEOPATHY OF THE KNEE

DYNAMIC
MANUAL
ADHESIOLYSIS

- n Inter-fascial adhesions
- n Subluxation of the fibular head
- n Pathologic plicae, capsular snapping
- n Subluxation of the lateral meniscus

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OUR CONSULTATION, KNEE TYPE

THE STANDARD EXAMINATION confirms the **classical diagnosis**
= Patellar syndrome, patellar tendonitis, iliotibial friction syndrome...
+ eliminate **SURGICAL INJURIES**

SELECT THE MOST PAINFUL/BLOCKED MOVEMENT
to monitor the effectiveness of the treatment during the session

VISION + PALPATION

4 causes of knee pain

ADHESIONS
(Always)

**SUBLUXATION OF
THE FIBULAR HEAD**
(>70%)

**SUBLUXATION OF
THE LATERAL MENISCUS**
(>20%) +- medial

**SNAPPING
PLICAE**
(>20%)

**Interfascial
release**

**Reduction of
subluxations**

Capsular liberation

CONTENTIONS

SELF-MANIPULATION

CONSOLIDATION

CORRECTIONS:
Remote, postural,
dietary dysfunctions

**IF THERE IS DIAGNOSTIC
UNCERTAINTY ?**

**ELECTROSTIMULATION, MANIPULATIONS,
CONTENTIONS TESTS:**
improvement guides the sense
of the manipulation

X-RAYS

| Fibular subluxation
| Other diagnoses

ULTRASOUNDS

| Adhesions
| Plicae
| Snapping
| Meniscal
subluxations

IF FAILED:
An MRI often finds the overlooked
surgical injury

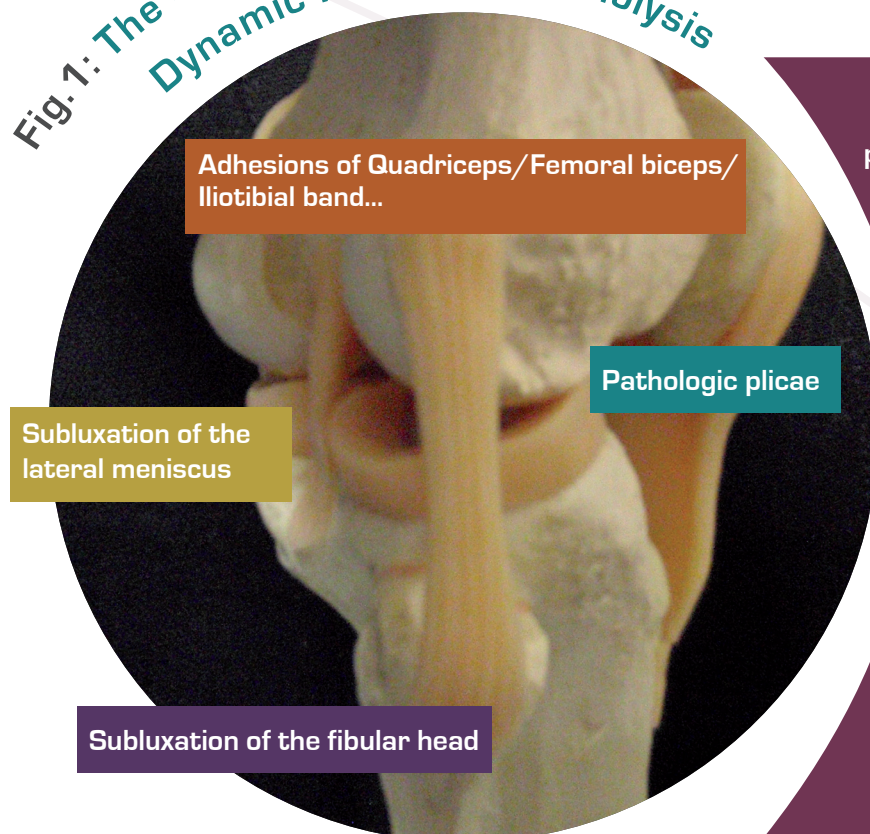
2. INTRODUCTION

Both non-surgical and post-surgical forms of **knee pain** are common complaints, and can be particularly debilitating for manual labourers or those who play sport regularly. Medical treatments for the condition are relatively ineffective, as are the numerous manual therapies that have so far been put forward.

This booklet is based on an open, 26-month study published in 2008 [1,2,3]. Included in the study were 81 military personnel, all of whom played sport regularly, and who had been suffering from anterolateral knee pain for approximately 13 months. Within this group, we identified a **proximal tibiofibular (PTF) origin** in 73% of cases, which was subsequently confirmed by a radiological analysis. After manipulation of the **subluxation of the head of the fibula** (guided by X-ray analysis and not by classical osteopathic examination, which too often gives divergent results), 85% of patients were able to return to sport, of whom 30% within 48 hours wearing a support stocking. We deduced from this that the head of the **fibula acts as the knee's safety valve**, and that for its manipulation to be effective, one should absolutely not follow the diagnosis classically proposed in osteopathy teaching.

In 2010 we successfully treated 5 failed cases from the aforementioned group using Dynamic Manual Adhesiolysis, having **discovered, via dynamic ultrasound, adhesions between the Vastus lateralis, Rectus femoris and Vastus intermedius muscles of the Quadriceps**. Following manual restoration of the movement of these fasciae during the ultrasound test, clinical improvement was immediate. We have since discovered these adhesions in every case we have examined, and treat them prior to each **reduction of the fibula**. When the failure of the treatment persists (in around 20% of cases), **the dynamic ultrasound often reveals subluxation of the lateral meniscus** (manipulated according to classical teaching), or **a pathological plica or femoropatellar capsular snapping** during bending of the knee; these lesions are often associated. These forms of impingement can be accessed via manipulations which we refer to as "**capsular liberation**". If this is ineffective, we generally subsequently discover a surgical lesion which had not initially been identified. Dynamic ultrasound examination (which is easy to learn for any osteopath who knows what he or she is looking for) has led us to select the manipulations which we currently employ, and we are counting on the osteopath community to improve these further.

Fig.1: The 4 lesions approachable to
Dynamic Manual Adhesiolysis



We are proposing a visual and palpatory osteopathic diagnosis of 4 types of lesion approachable to our manipulations (Fig.1), because not all the practitioners have access to X-rays and ultrasound. Those who will get into the dynamic ultrasound will progress faster, and finally do more easily without or discover new applications (spine, pelvis). We wish that our name is no longer associated to new signs and techniques, because the ego is a hurdle in the evolution of our wonderful discipline. I hope that our successors will remember it.

3. MANIPULATABLE KNEE PAIN

3.1. Excluding inflammatory or surgical knee pain

We do not describe the diagnoses, which are sometimes difficult, of serious knee injuries, as there are plentiful descriptions in the medical literature.

In these cases, osteopathy can provide relief, but certainly not a cure!

- | Cruciate ligament rupture (anterior:ACL, posterior:PCL) (Fig.2)
- | Serious meniscal injury (Fig.3)
- | Knee fracture (Fig.4)
- | Gonarthrosis at the prosthesis stage (Fig.5)
- | Infectious or inflammatory knee pain...

Fig.2 : Serious excessive rotation: ACL, PCL

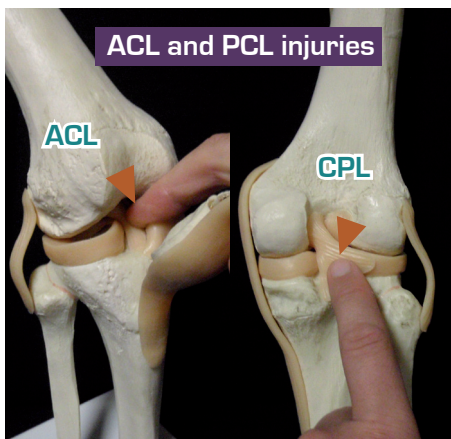


Fig.3 : Meniscal injuries

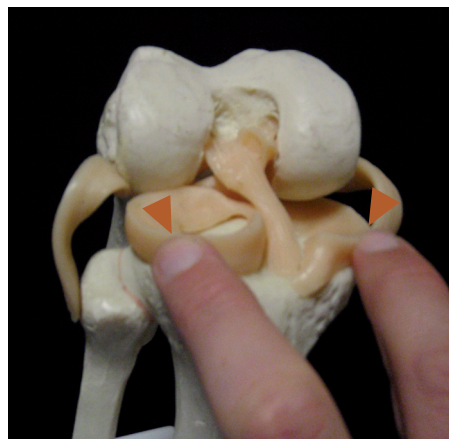


Fig.4 : Anterolateral tibial margin fractures



WARNING!

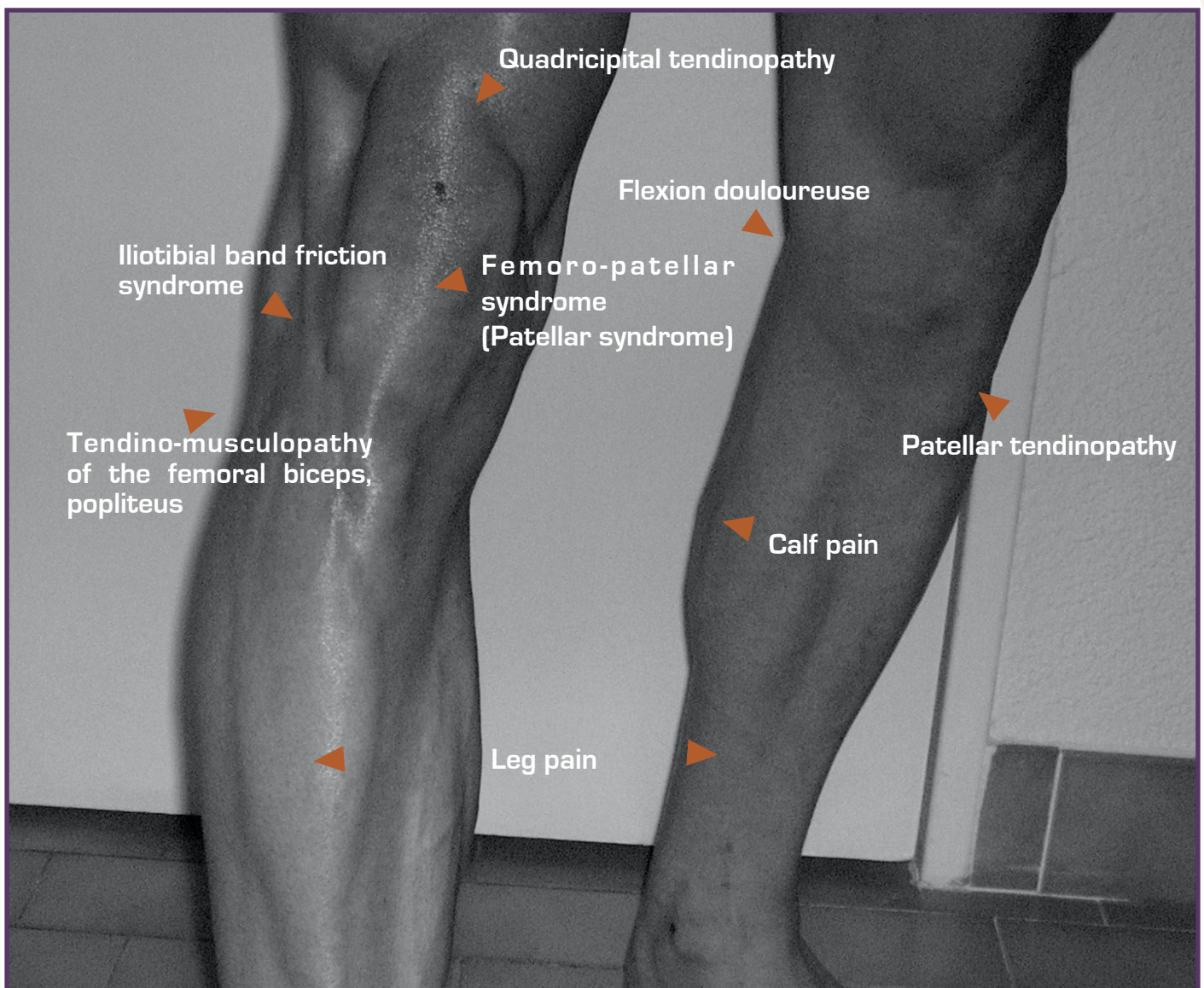
Enthusiasm and overconfidence from your first “miraculous” successes may cause you to call on subluxation of the fibular head and pathologic plicae as a first-line treatment at all times, with the danger of missing the diagnosis of a serious injury of the knee which may be otherwise evident!

3.2. Mechanical knee pain treatable with adhesiolysis

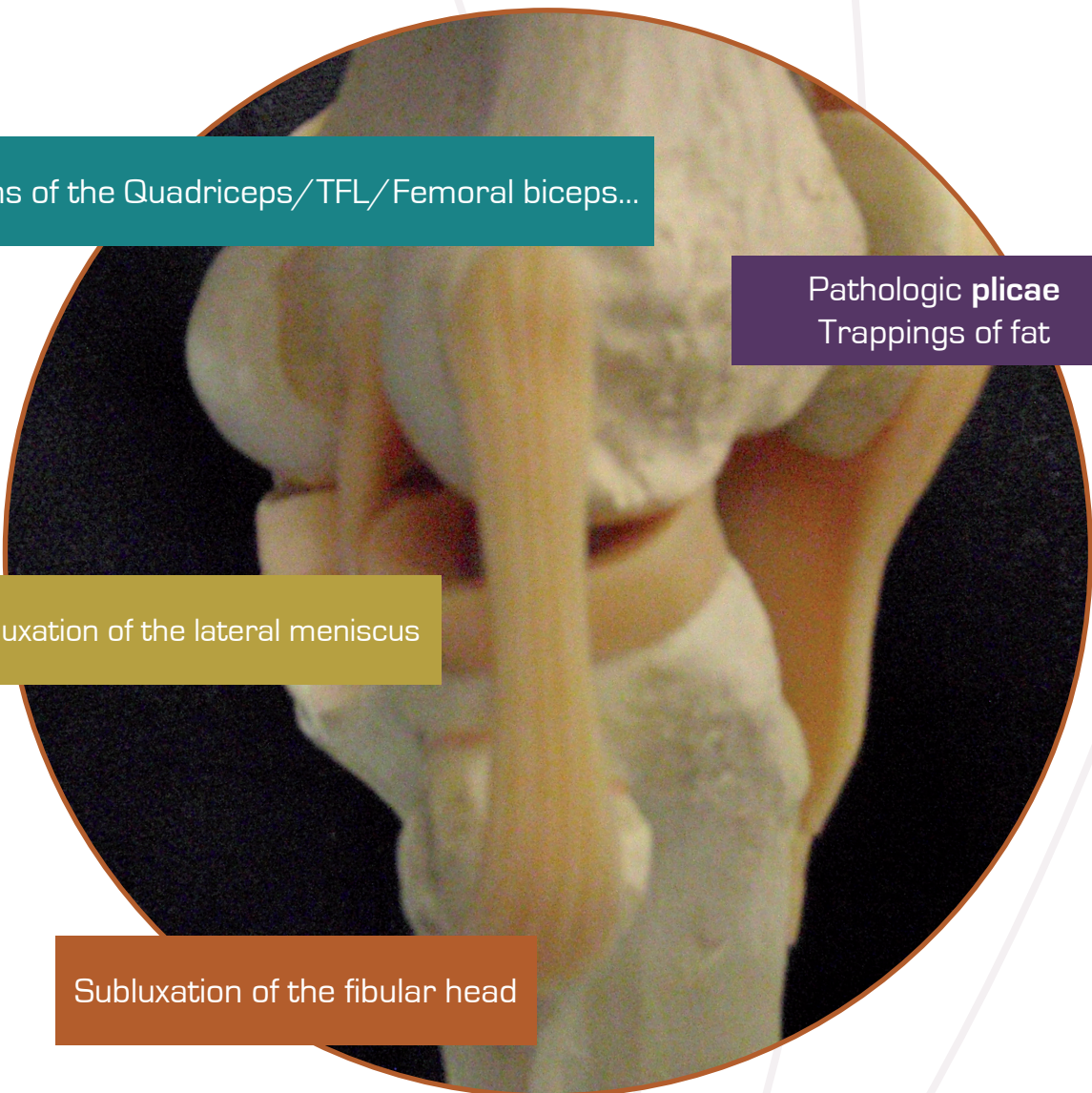
We find that many mechanical knee disorders result from four injuries which are treated with osteopathy. These classical disorders are accessible by Dynamic Manual Adhesiolysis (Fig. 5):

- | Femoro-patellar syndrome (Patellar syndrome);
- | Patellar tendinopathy (Patellar tendonitis);
- | Distal iliotibial band tendinopathy (Iliotibial band friction syndrome);
- | Pes anserinus complex bursitis, Medial femorotibial pain;
- | Tendino-musculopathy of the femoral biceps, popliteus;
- | Leg pain: anterolateral or posteromedial compartment;
- | Limited or painful knee flexion;
- | Poorly defined pain attributable to osteoarthritis...

Fig.5 : Examples of knee pain accessible with Dynamic Manual Adhesiolysis and Capsular Liberation



3.3. The 4 causes of manipulatable knee pain



Adhesions of the Quadriceps/TFL/Femoral biceps...

Pathologic plicae
Trappings of fat

Subluxation of the lateral meniscus

Subluxation of the fibular head

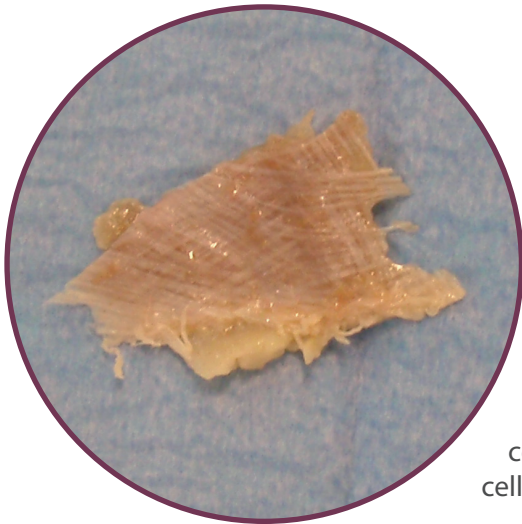
Manual treatment of these 4 causes results in the mechanical healing of > 80% of knee pain without surgery.

The chapters on clinical diagnosis and manual treatment with adhesiolysis and decapsulation are those to be kept in mind. The chapters on self-healing allow you to practice on yourself and, of course, to empower your patients to participate in their treatment. Fewer sessions, but more rewards...

Those chapters on radiography and ultrasounds let you “see” the causes; you will refer to them often, understanding a little more every time. The chapters on anatomy, biomechanics, and physiopathology serve mainly to explain what we are doing to colleagues.

4. ANATOMY.

BIOMECHANICS, PHYSIOPATHOLOGY



General information about the FASCIA

The **FASCIA** (Fig.6-7-8) is the envelope surrounding the muscles, the **APONEUROSIS** extends within them.

Per Ingber D. (4), our body is lined with this **CONNECTIVE TISSUE**, which acts as a cellular skeleton surrounding each organ, down to the cell nuclei. There are voltage variations in the **FASCIAE** which regulate our cell **MULTIPLICATION**, using **ELECTRO-MAGNETISM**.

Fig.6 : Superficial fascia surrounding the knee



Fig.7 : Observe the thickness of the superficial fascia of the lower limbs

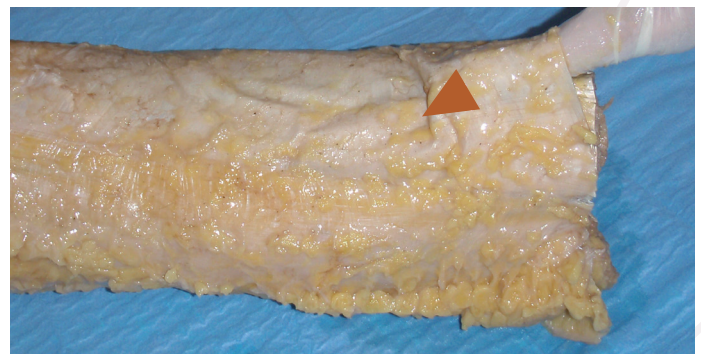
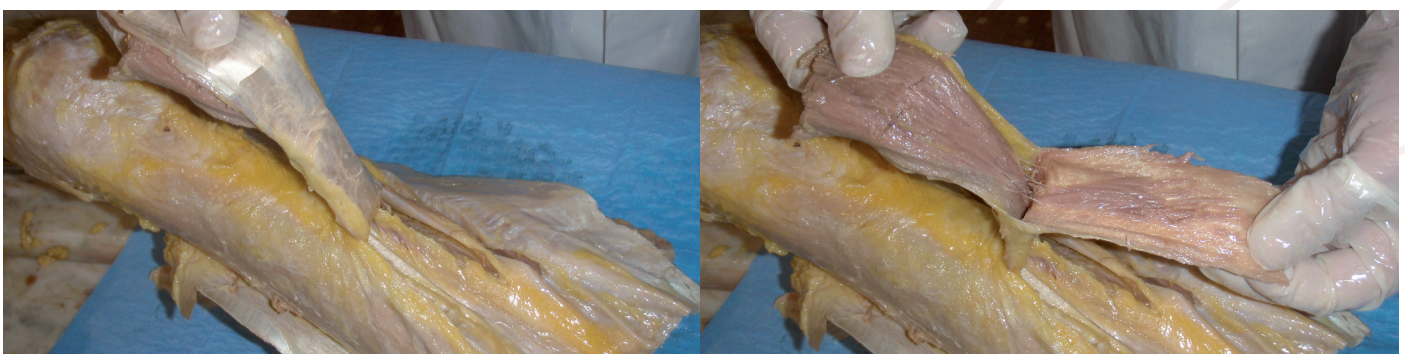
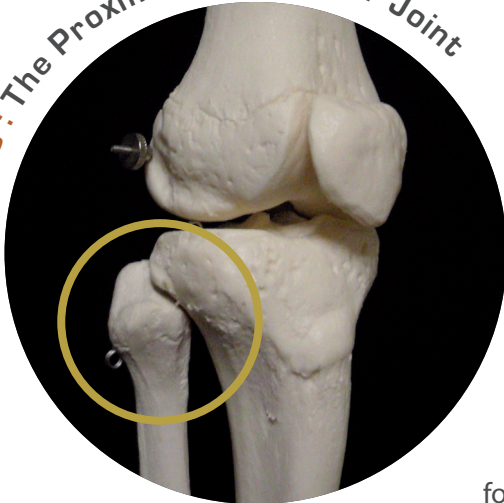


Fig.8 : The Rectus Femoris muscle, seen through the posterior fascia; observe the thickness of this fascia



4.1 PROXIMAL TIBIOFIBULAR JOINT (PTF)(FIG.9)[5,6]

Fig.9 : The Proximal TibioFibular Joint



The styloid process raises itself from behind and beyond the articular surface of the fibular head.

The PTF is an articular plane communicating one-sixth of the time with the knee joint, through the popliteus bursa.

Its 3 degrees of freedom are of a very small range.

Its articular surfaces are ovular and flat:

- l the tibial articular surface (AS), on the postero-lateral side of the lateral condyle, is slightly convex and faces backwards, down, and away;
- l the fibular AS, on its medial side, is slightly concave and faces up, forward, and inward.

The articulation angle varies between 5 and 80°; 2 variations are described here:

l The horizontal has an angle less than 20°. The fibular head sits behind a prominent lateral tibial bridge.

The AS is circular, flat, around 26 mm². If it were larger, more mobile, and more flexible, it would be more resistant to forces of rotation.

l The oblique has an angle greater than 20°. The AS is an average of 17mm². It is predisposed to instability, as it is relatively immobile with respect to the forces of rotation.

The articular capsule is thicker in front than behind:

l The anterior PTF ligament forms part of the lateral tibial condyle on the anterior edge of the fibular head.

l The posterior PTF ligament unites the posterior edge of the fibular head with the posterior tibial condyle. It is reinforced by the posterolateral structures of the knee: fibular collateral ligament (FCL), arcuate popliteal ligament, fabellofibular ligament, popliteal-fibular ligament, popliteus muscle, and the femoral biceps tendon.

4.1.1 THE 5 LIGAMENT INSERTIONS ON THE FIBULAR HEAD [7,8,9] (FIG.10,11)

Fig.10 : Posterolateral view of the right knee = fibular fibular ligaments

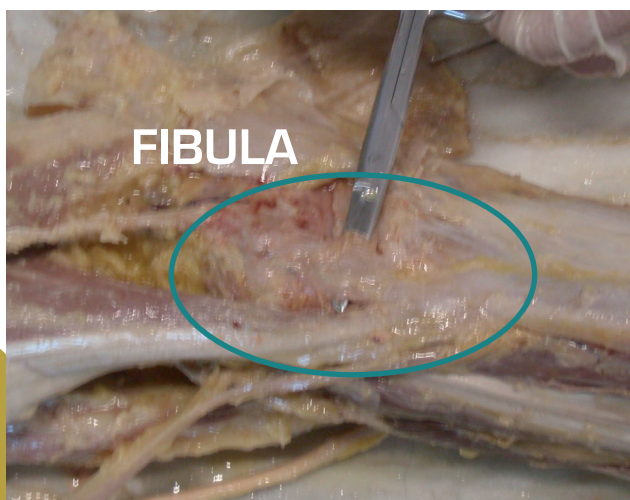
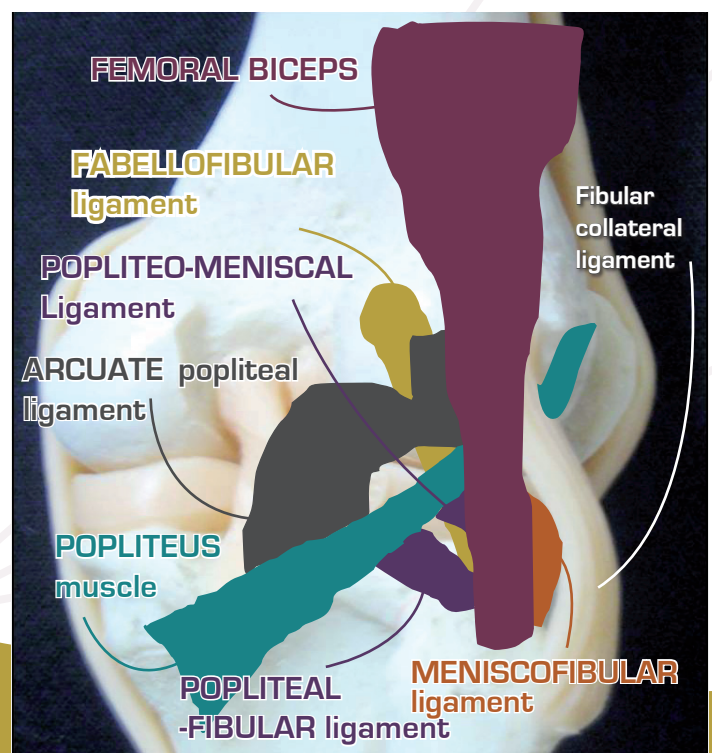


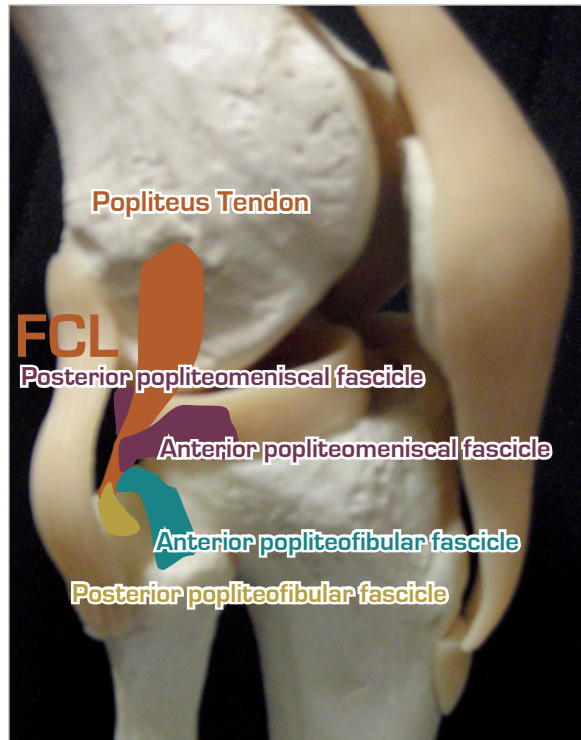
Fig.11 : Posterolateral view of the right knee = schematic drawing of fibular ligaments



1) Fibular Collateral Ligament (FCL) (Fig. 12) :

Extends from the lateral edge of the tendinomuscular intersection of the popliteus at the superior facet of the fibular head apex, just inside the arcuate and fabellofibular ligament insertions. The PF popliteofibular ligament contributes to posterolateral static rotary stability.

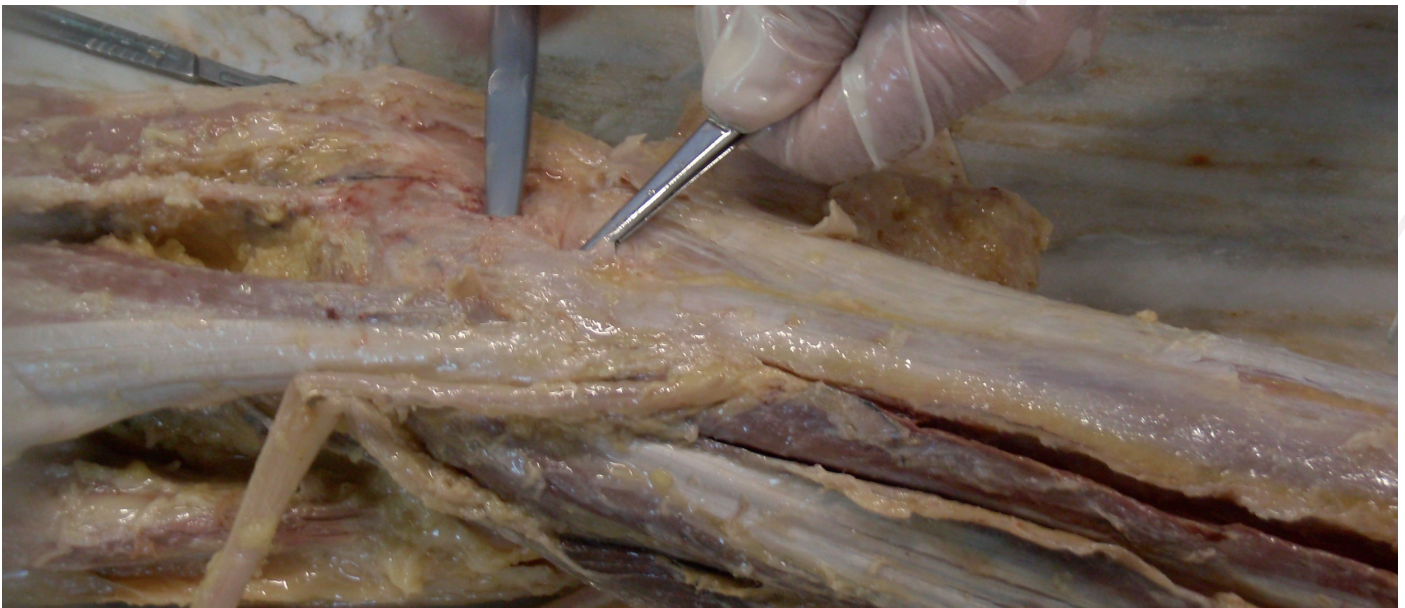
Fig.12 : FCL, PF



2) Popliteofibular Ligament (PF) :

Attaches to the lateral femoral condylar tubercle, runs down and back, terminates at the anterolateral facet of the fibular head, before the styloid apophysis. It is before and outside of the fabellofibular ligament attachments and the arcuate ligament. There is a bursa (18 x 8,4 mm) between the FCL and the femoral biceps. The FCL supports the Proximal Tibiofibular joint and relaxes from 30° of knee flexion, making the joint more vulnerable to injury.

Fig.13 : Fibular Collateral, Popliteo-fibular, and Menisco-fibular Ligaments



3) Fabellofibular Ligament (FF) :

Extends from the fabella (sesamoid bone) to the styloid apophysis, before and outside the PF attachment. The FF and the arcuate ligament fix the popliteal tendon to the articular capsule and the lateral meniscus.

4) Arcuate Ligament :

In a Y-form, it fits on the fibular styloid apophysis, in front of the FF. The lateral fascicle continues upwards, along the lateral capsule of the knee until the lateral femoral condyle. The medial fascicle attaches to the posterior capsule of the knee before the popliteal tendon and intertwines with the fibers of the OBLIQUE POPLITEUS LIGAMENT.

5) Menisofibular Ligament [10] (Fig. 13, 14) :

Coming from the lateral meniscus, it passes in front of the popliteal tendon and attaches to the fibular apex. It positions the lateral meniscus. Per Bozkurt et al., it is thicker in the horizontal PTF than in the oblique, and protects the lateral meniscus and PTF in traumas in varus and lateral rotation.

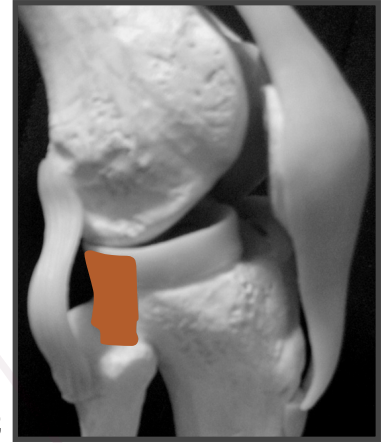


Fig.14a : Diagram of the menisofibular ligament

4.1.2 THE 10 TENDON INSERTIONS ON THE FIBULAR HEAD [7,8,9] (FIG.10,11)

1. Popliteus :

Prevents posterolateral instability of the knee with the FCL and protects the tibiofemoral menisci and cartilage [6].

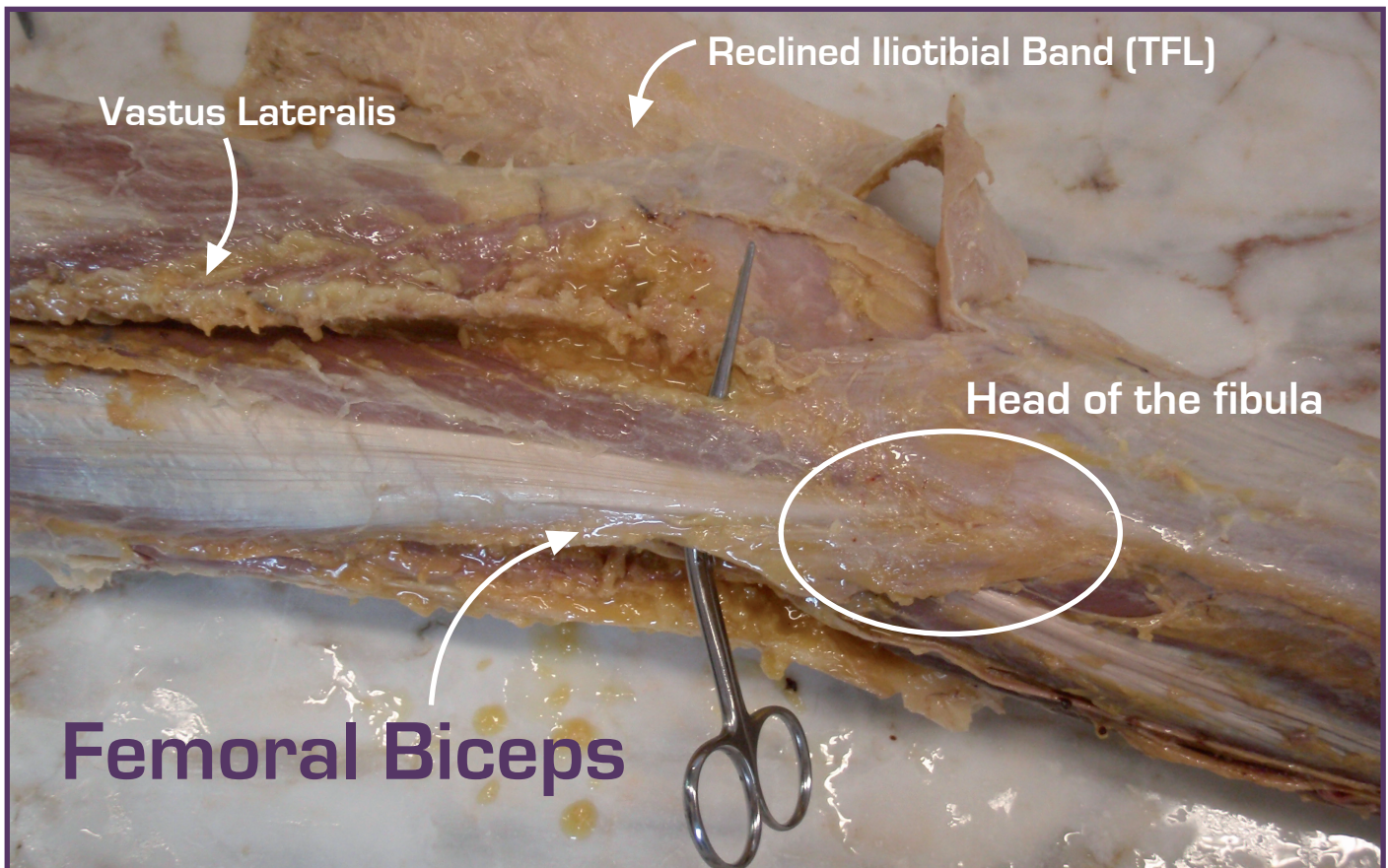
The proximal attachment is on the lateral femoral condyle and there may be 5 distal insertions on:

- l the fibula by the popliteofibular ligament [5] in all cases;
- l the posterior horn of the lateral meniscus via the superior and inferior popliteomeniscal fascicles, which hold the lateral meniscus along when the knee is extended (95% of cases)
- l the posterior capsule of the knee (57%);
- l the arcuate ligament (90%);
- l the oblique popliteal ligament (79%).

2. Femoral Biceps (FB) (Fig .15) :

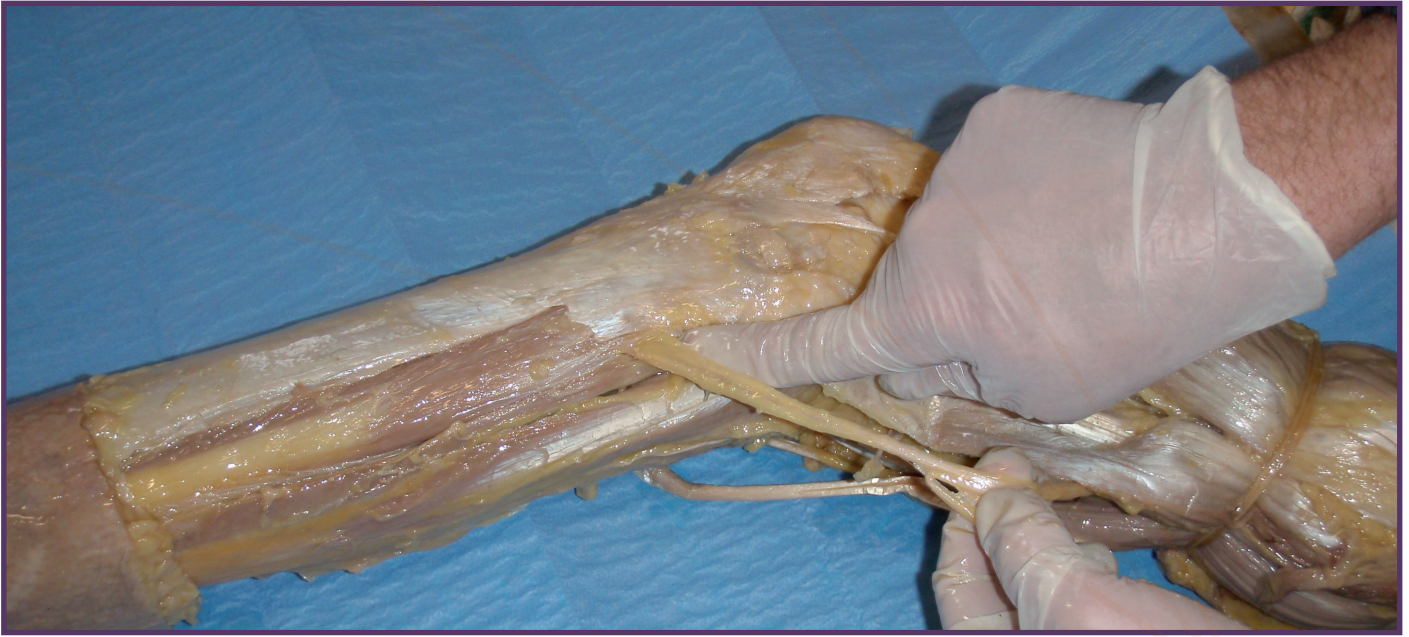
Attaches to the lateral tibial condyle at the apex of the fibular head.

Fig.14b : Femoral Biceps Tendon



3. Peroneus head of the Soleus (Fig. 16) :

Attaches to the posterior sides of the head and the superior quarter of the fibula.



4. Peroneus longus (Fig. 17) :

Its proximal attachment is on the anterolateral side of the fibular head, the upper third of the lateral side of the fibula, and on the lateral tibial condyle.



Fig.18 : Attachments of the peroneal muscles

FEMORAL BICEPS



EXTENSOR DIGITORUM LONGUS

EXTENSOR HALLUCIS LONGUS

FLEXOR HALLUCIS LONGUS

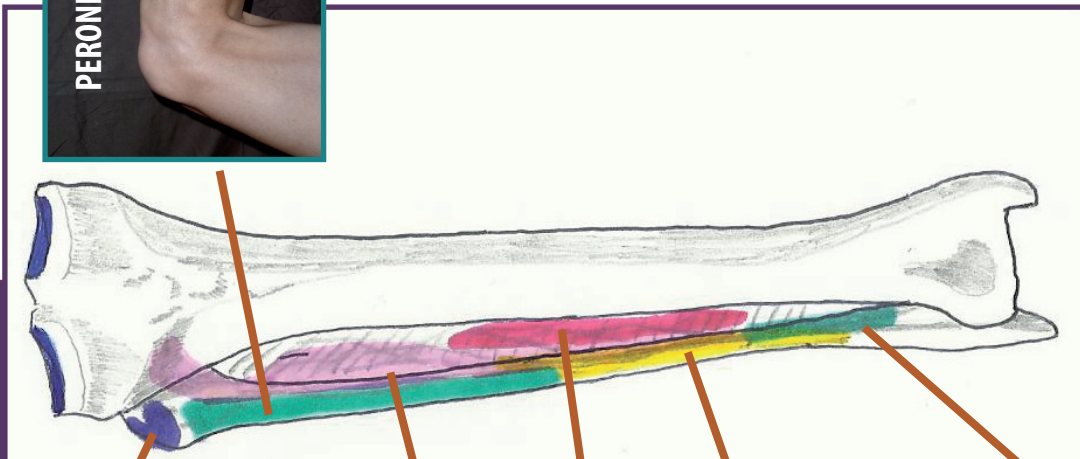
PERONEUS TERTIUS



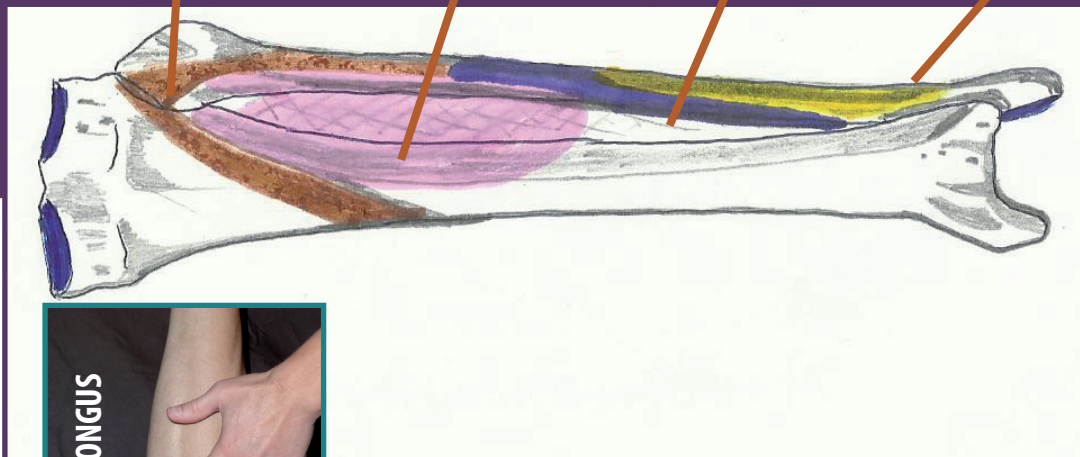
PERONEUS LONGUS



ANTERIOR VIEW



POSTERIOR VIEW



POPLITEUS
via popliteofibular lig.

SOLEUS



POSTERIOR TIBIALIS



FLEXOR HALLUCIS LONGUS



PERONEUS BREVIS



5. Extensor digitorum longus :

Proximal insertion is on the upper 2/3 of the medial side of the fibula and on the lateral tibial condyle.

6. Extensor hallucis longus :

Proximal insertion at the mid-section of the medial side of the fibula.

7. Flexor hallucis longus :

attaches at the lower ¾ of the posterior side of the fibula.

8. Peroneus head of the posterior tibialis :

attaches at the upper 2/3 of the medial side of the fibula.

9. Peroneus brevis :

attaches at the lower 2/3 of the lateral fibula.

10. Peroneus tertius :

attaches at the lower third of the medial fibula.

FEMORAL BICEPS

PERONEUS LONGUS

SOLEUS

EXTENSOR DIGITORUM LONGUS

PERONEUS BREVIS

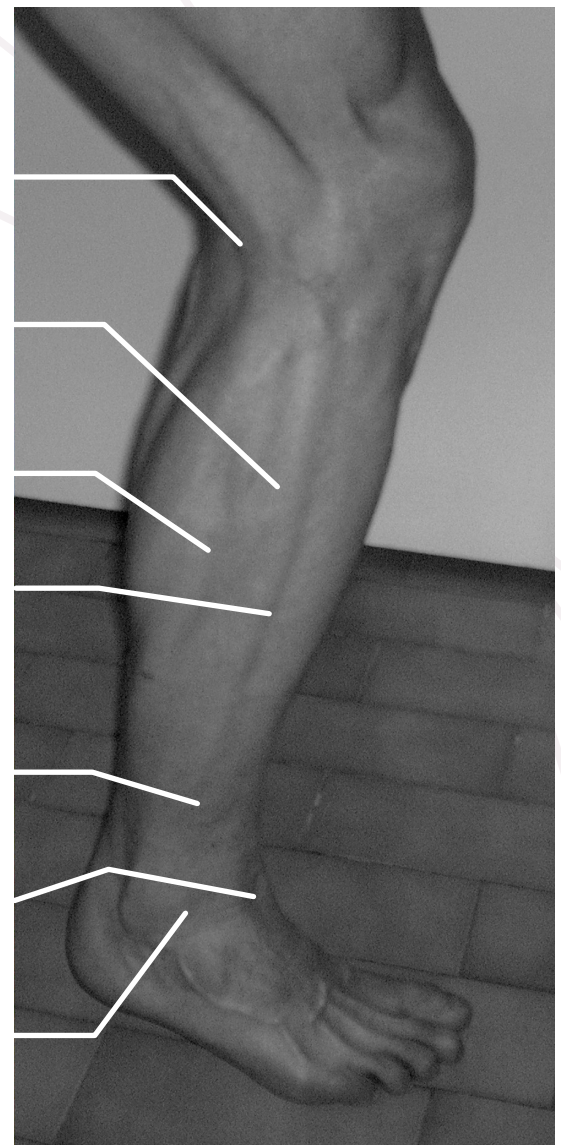
EXTENSOR HALLUCIS LONGUS

PERONEUS TERTIUS

NB : the peroneal nerve

comes from the popliteal fossa and wraps around the fibular gap.

Fig.19 : Palpatory anatomy of the peroneal muscles



4.2. BIOMECHANICS OF THE PERONEAL MUSCLES [14]

According to Professor Bonnel, **all structures of the knee are complementary and interdependent**. Thus, the peripheral formations are just as important as the main joint. There are **29 pairs of rotary stabilization** in the knee, which allow us to understand the risks of desynchronization that we can observe after any injury.

Any abnormality of a single element provokes a dysfunction; it must be treated as a whole, instead of as an isolated problem. The considerable force developed by all these muscular actions explains the rapid speed of joint deterioration when the centering of joint play is no longer assured due to an injury or a deficiency in one of the elements. Asynchronous muscle actions lead to a pathology of mechanical overload, which can affect the patella, the tendons, and, in extreme cases, femorotibial arthrosis with a degenerative state of the menisci.

Any imbalance of the lower limbs results in a **compensatory spinal inflection**.

| The **peroneus longus muscle** is in dynamic continuity with the femoral biceps muscle with the intermediary of the fibular head without limiting the mobility of the lateral tibial condyle. This muscular band constitutes a tension sensor, which governs the balance in the frontal plane of the lower limbs.

| The **popliteus** is one of the 4 essential elements of the posterior dynamic complex (along with the semimembranosus, medial and lateral gastrocnemius). With the vastus medius, it makes up one of the three musculotendonal pairs for the horizontal rotary stabilization of the femoral condyles. Its tendon, of femoral origin, together with the reflected tendon of the semimembranosus, make up one of the four pairs of rotary stabilization between the two fibro-tendonal centers: the posteromedial and the posterolateral.

| The **long head of the femoral biceps** in association with:

- n the direct tendon of the semimembranosus muscles are one of the six muscular pairs for horizontal tibial rotational stabilization;
- n the vertical fibers of the **fascia lata muscle** are one of the four muscular pairs for sagittal rotational stabilization;
- n the direct tendon of the semimembranosus muscles, one of the two pairs ensuring frontal rotational stabilization
- n the medial head of the **gastrocnemius**, one of the seven pairs for long femoro-tibial rotary stabilization;
- n the **short head of the femoral biceps**, along with the vastus medius, makes up one of the three pairs for short femerotibial rotational stabilization.

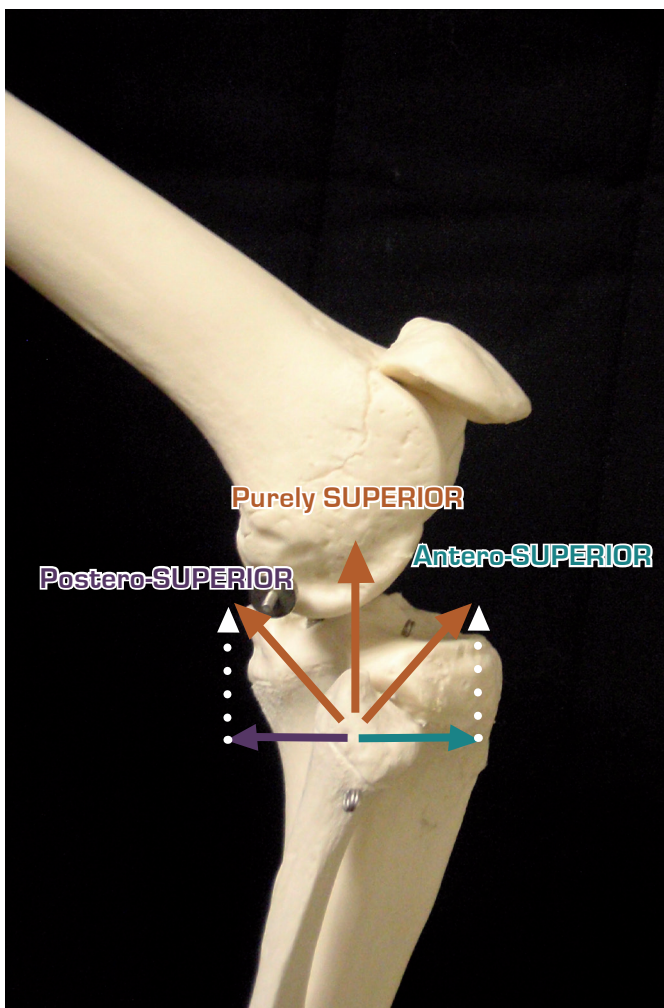
NB : We have not yet researched which chain of muscles (anterior, posterior, direct, crossed, superficial, deep, open, closed...) may be achieved in terms of specific dysfunctions of the knee.

4.2.1 PHYSIOPATHOLOGY OF A FIBULAR HEAD SUBLUXATION

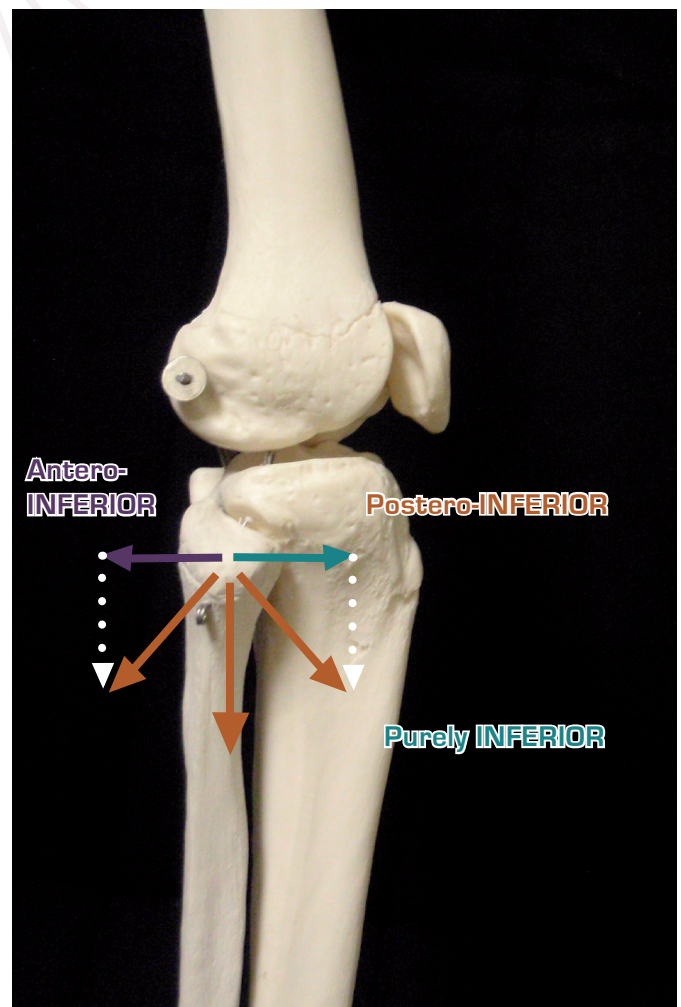
A subluxation of the fibular head (Fig. 20) may provoke injuries to the capsule, the two PTF ligaments, and the five ligaments attaching to the fibular head. Additionally, when the PTF contacts the knee joint, via the popliteal bursa, the PTF suffering can be retained in the knee joint. The three muscles attaching to the fibular head (short and long femoral biceps, popliteus via the PF ligament) take part in the operation of 7 of the 29 musculotendinal pairs for the rotational stabilization of the knee. A **misalignment of the fibula** can thus cause the **muscular actions of the knee to become unsynchronized**. These off-center muscles **contract and then secrete fibrin**, which we can call the "glue" stimulating **adhesion** in the anterolateral muscles of the lower limbs. The most frequent consequence of this is **an misalignment of the patella** laterally and upward, resulting in a mechanical overload of the knee. Frequently, the malposition of the fibula pulls on the popliteofibular ligament, and the popliteomeniscal ligament to cause a **malposition of the lateral meniscus**.

Fig.20 : the 6 main types of fibular head subluxation

SUPERIOR subluxations to
the fibular head



INFERIOR subluxations to
the fibular head



NB: BOZKURT et al., using MRI imaging, found, in 22 out of 32 patients suffering from lateral knee pain, that an effusion of the PTF joint was associated with a partial tear of the anterior or posterior PTF ligaments, the FCL, or the femoral biceps.

4.2.2 TRAUMATIC MECHANISMS:

INJURY MECHANISMS OF FIBULAR HEAD SUBLUXATION

Fig.21 : Traumatic mechanisms of fibular head subluxation

Our research has not assessed injury mechanisms (Fig. 21) causing fibular head subluxations. The following is compiled from our subjective experiences.



1) DIRECT INJURY :

On the posterolateral side of the knee or leg, caused by an **anterior subluxation** of the fibular head; conversely, a direct injury to the anterolateral side of the knee or leg forces the fibula to the medial and posterior planes, provoking a **posterior subluxation** of the fibular head.

2) Violent contraction of the POSTERIOR LEG :

If there is an excessive retraction of the soleus in relation to the elevator muscles of the foot, violent active plantar flexion fosters postero-inferior subluxation and lateral rotation.

3) Violent contraction of the FEMORAL BICEPS (FB) :

The violent contraction of a retracted FB causes a postero-superior subluxation of the fibular head.

4) Excessive rotation of flexed KNEE, inverted foot:

Fosters an anterior subluxation of the fibular head.

5) Excessive rotation of the ANKLE :

Rotation of the distal tibiofibular joint (DFT) results automatically in a rotation of the PTF. Thus, the calcaneal varus leads to a descent and lateral rotation of the fibular head.

When the knee is flexed, the FCL and FB are relaxed. Thus, the inversion of the foot leads to a violent contraction of the anterolateral leg muscles, forcing the fibula forward. This results in an **anterior, inferior, and lateral subluxation** of the fibular head. Conversely, the forced eversion causes a **posterior, superior, and medial rotation subluxation**.

6) When jumping, a hard landing on the heel :

Probably the most frequent cause of **anterosuperior subluxation**.

TO NOTE:

Consequences of a Subluxation of the Fibular head

SUBLUXATION OF THE FIBULAR HEAD



Desynchronisation of the muscular actions of the KNEE
Contractures ⇒ fibrin ⇒ anterolateral adhesions



Mechanical overload of the knee:
Superolateral Misalignment of the PATELLA
Subluxation of the lateral Meniscus
via menisco-fibular and **menisco-popliteo-fibular** ligaments
Medial femorotibial **Arthrosis**
+ degeneration of the **Medial Meniscus**



Remote mechanical disruption:

- | **FOOT and ANKLE (via the peroneus longus...)**
- | **PELVIS (via the femoral biceps ...) ⇒ SPINE**

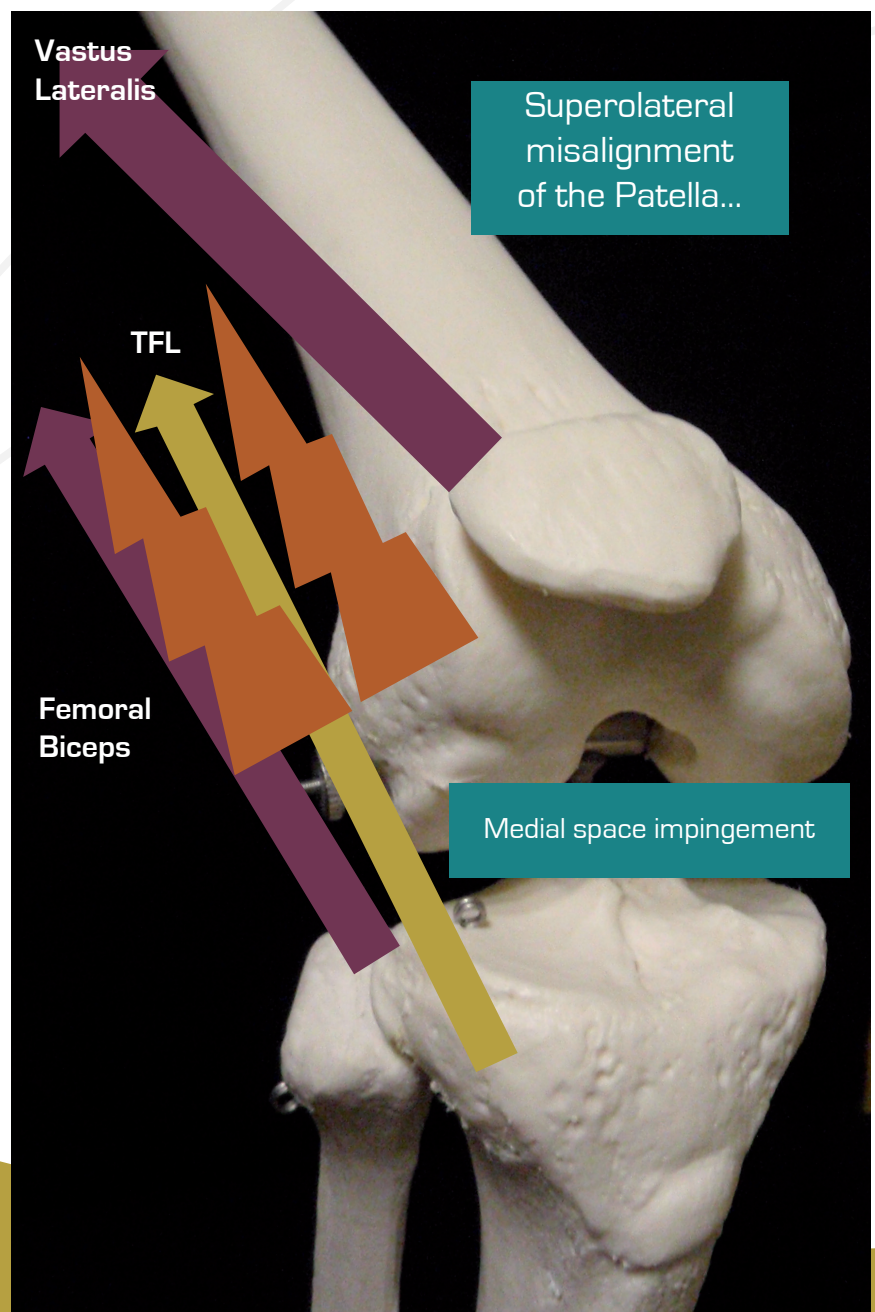
FUNDAMENTAL HYPOTHESES

We think of the fibular head as the knee's safety valve. With its small articular surface (17-26 mm² ≈ 2cm²): (the surface area of the pinky fingernail), it is the first structure to release in the case of a trauma. As the subluxation is not very painful, it remains undetected if its sensitivity is not tested. When the patient is observed at the stage of tendino-musculopathy or strong suffering due to patellar pain, the fibular subluxation remains too often undetected.

4.3. ETIOLOGY OF ADHESIONS OF THE FASCIAE OF THE ANTEROLATERAL THIGH ASPECT

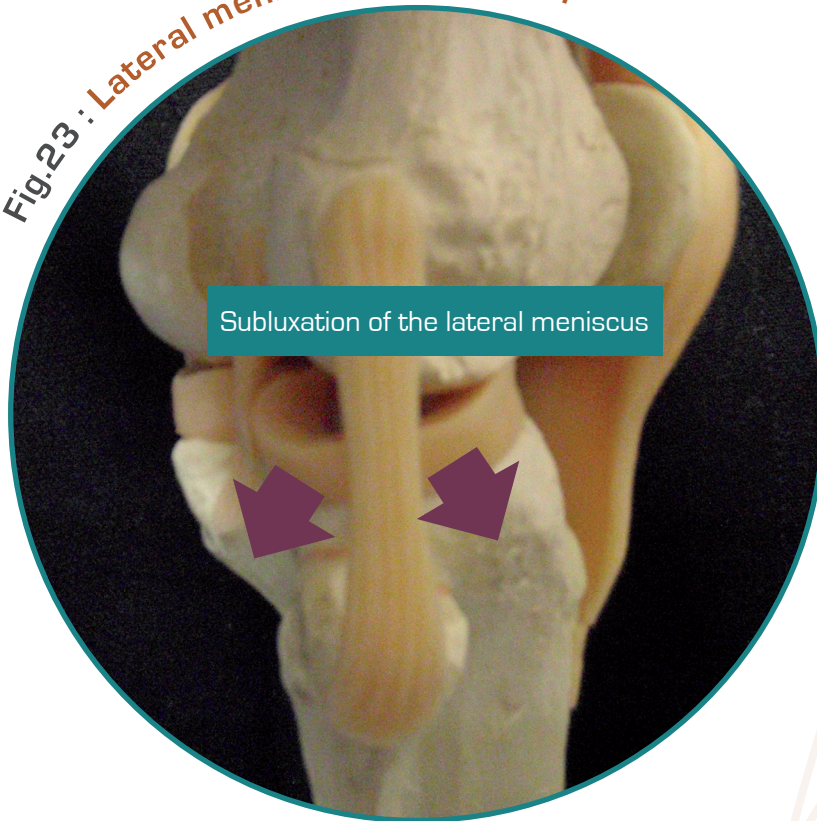
We believe that the majority of anterolateral knee pain is due to muscular dysfunction [15] caused by a change in pennation angle (orientation of the muscular fascicules relative to the aponevrosis) by abnormal tissue gliding. The interfascial cinesiopathy observed in dynamic ultrasound are likely due to adhesions. These adhesions (Fig.22) are caused by micro or macro bleeding following a direct or indirect injury. The blood, in poor metabolic circumstances (which reduce the capacity of self-healing), cannot be completely re-absorbed and become "glue." This starts a vicious cycle of contractures (increase in collagen type I – tendon, skin, bone – and reduction in collagen type III – muscle, vessels-), themselves producers of fibrosis following the secretion of fibrin. Adhesions are painless as long as they do not trap a nerve bundle. Normally, when the muscles contract, the nerves glide along the fasciae wherever there is place, so that they are not compressed. When a nerve bundle is caught in an adhesion, it is compressed and thus becomes painful. An aggravating factor is poor diet [16-21], for example through a hyperacidity of the tissue caused by an interfascial crystallization and the loss of fluid and harmonious gliding of the connective tissue (H⁺ ions increase the negative charge and reduce the water in the vacuoles of the connecting tissue) [14]. In case of doubt, we recommend a change in diet to combat an excess of saturated fatty acids, uric and oxalic acids, and to correct intestinal hyperpermeability, omega 3 deficiency, and oxidative stress (chapter 9.1.2).

Fig.22 : CONTRACTURES and then ADHESIONS between the muscles VASTUS LATERALIS/ Rectus Femoris/ Vastus Intermedius with TFL (Iliotibial band) and Femoral Biceps.



4.4. DYSFUNCTION OF THE LATERAL MENISCUS :

Fig.23 : Lateral meniscus malposition



Dysfunction of the LATERAL MENISCUS :

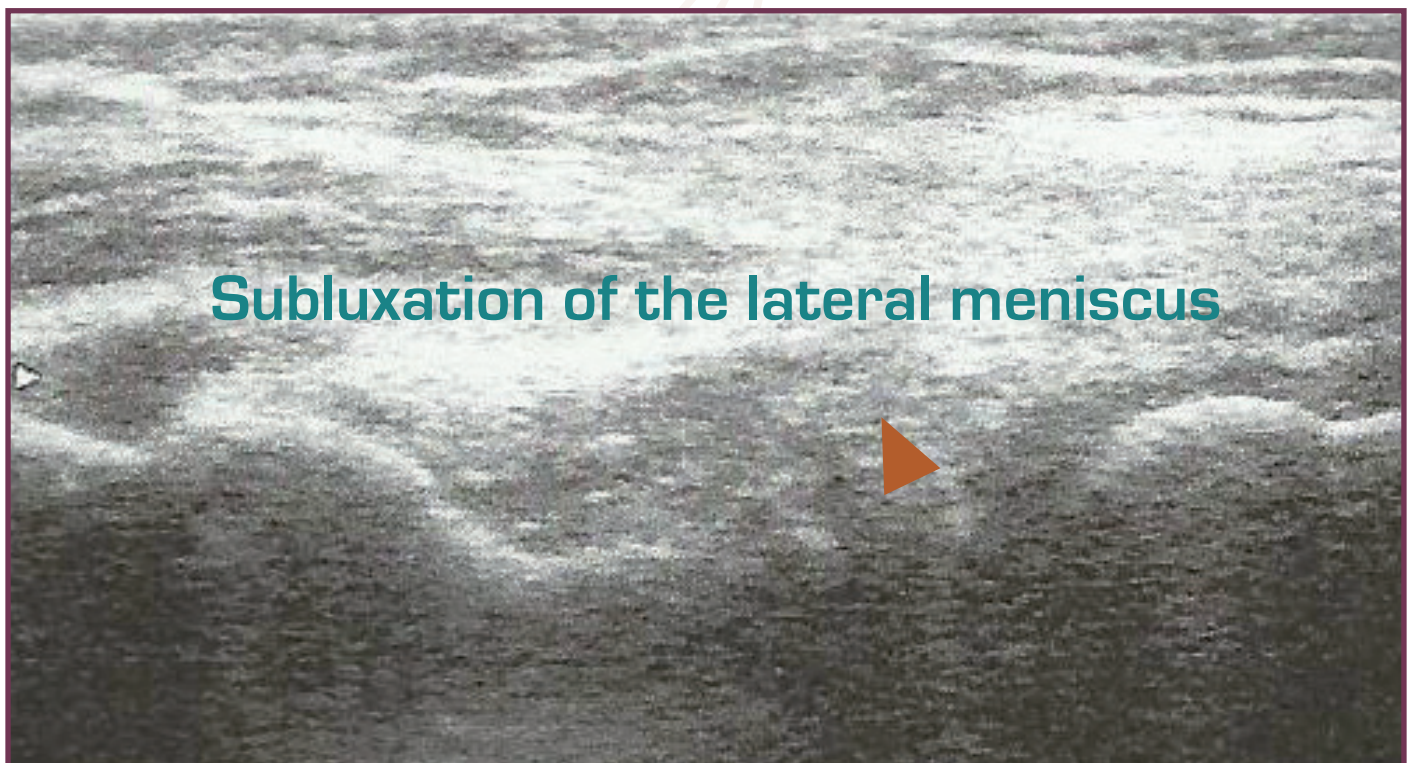
If the fibular head is subluxed, the Lateral Meniscus can become misaligned (Fig. 23, 24), either:

| by direct traction via the MENISCOFIBULAR ligament and/or

| by traction of the MENISCOPOPLITEOFIBULAR ligaments following the misalignment of the POPLITEUS muscle.

All of a sudden the Lateral meniscus no longer plays its protective role against injuries to the lateral tibiofemoral cartilage and against tears of the lateral meniscus (requiring surgical treatment).

Fig.24 : Ultrasound image of a malposition of the lateral meniscus



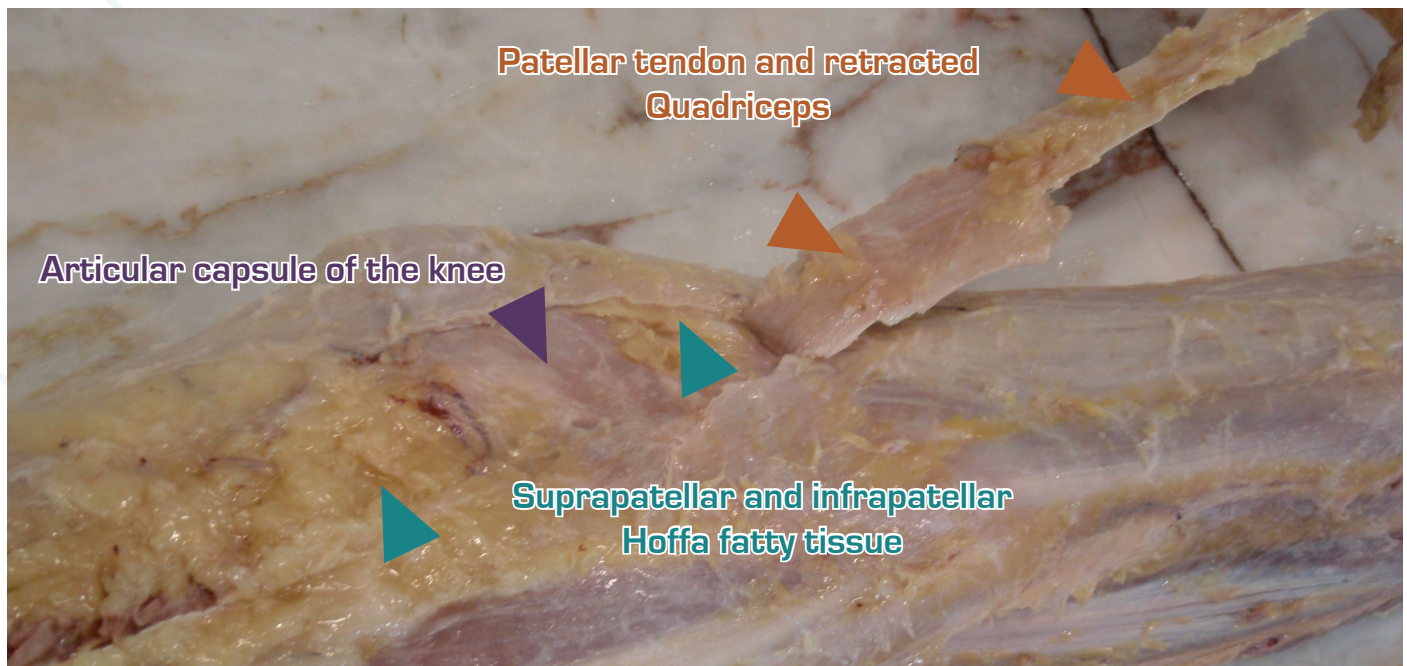
Sagittal section of the lateral tibiofemoral joint space; the lateral meniscus subluxes during knee extension.

4.5. PLICAE ANATOMY

4.5.1 DEFINITION OF A PLICA [24]

The articular capsule (Fig. 25) surrounding the knee is covered with a synovial membrane secreting articular fluid.

Fig.25 : Articular capsule of the knee

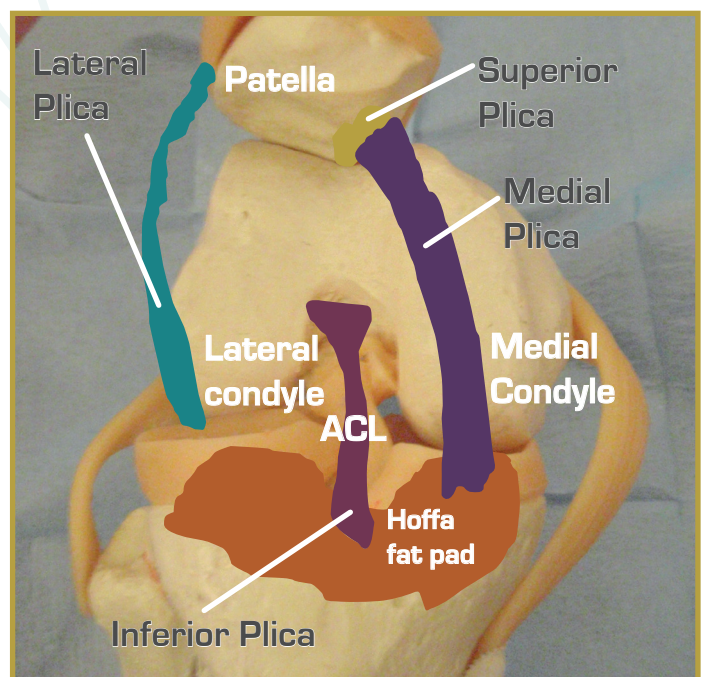


Four types of synovial folds can exist, which are called plicae (Fig. 26, 27) and which are generally asymptomatic. Pathologic plicae are called “plicae syndromes” due to their inflammation. The mediopatellar plica is the most frequent plica syndrome, usually responsible for intermittent knee pain. It is diagnosed by exclusion and if arthroscopy is the gold standard, dynamic ultrasound is very useful. Arthroscopic resection is considered after 6 months of ineffective conservative treatment.

4.5.2 FORMATION OF A PLICA [25]

There are two theories explaining the formation of **plicae during the embryological development of the knee**. In the dominant theory, plicae are the embryological remains of the synovial membranes dividing the knee into 3 compartments (medial, lateral, and suprapatellar). From the sixteenth week of gestation, they resorb themselves to create a cavity. In the other theory, around the seventh week of gestation, the space between the distal femur and the proximal tibial epiphysis is filled with mesenchymal tissue where the cavities develop. At the tenth week, the knee is a simple cavity surrounded by synovial tissue. The formation of plicae is due to **the incomplete resorption of the inter-femoro-tibial mesenchymal tissue**.

Fig.26 : Diagram of the 4 types of plicae



4.5.3 MORPHOLOGICAL CLASSIFICATION IN 4 TYPES

Fig.27 : Location of SUB-PATELLAR pathologic PLICAE

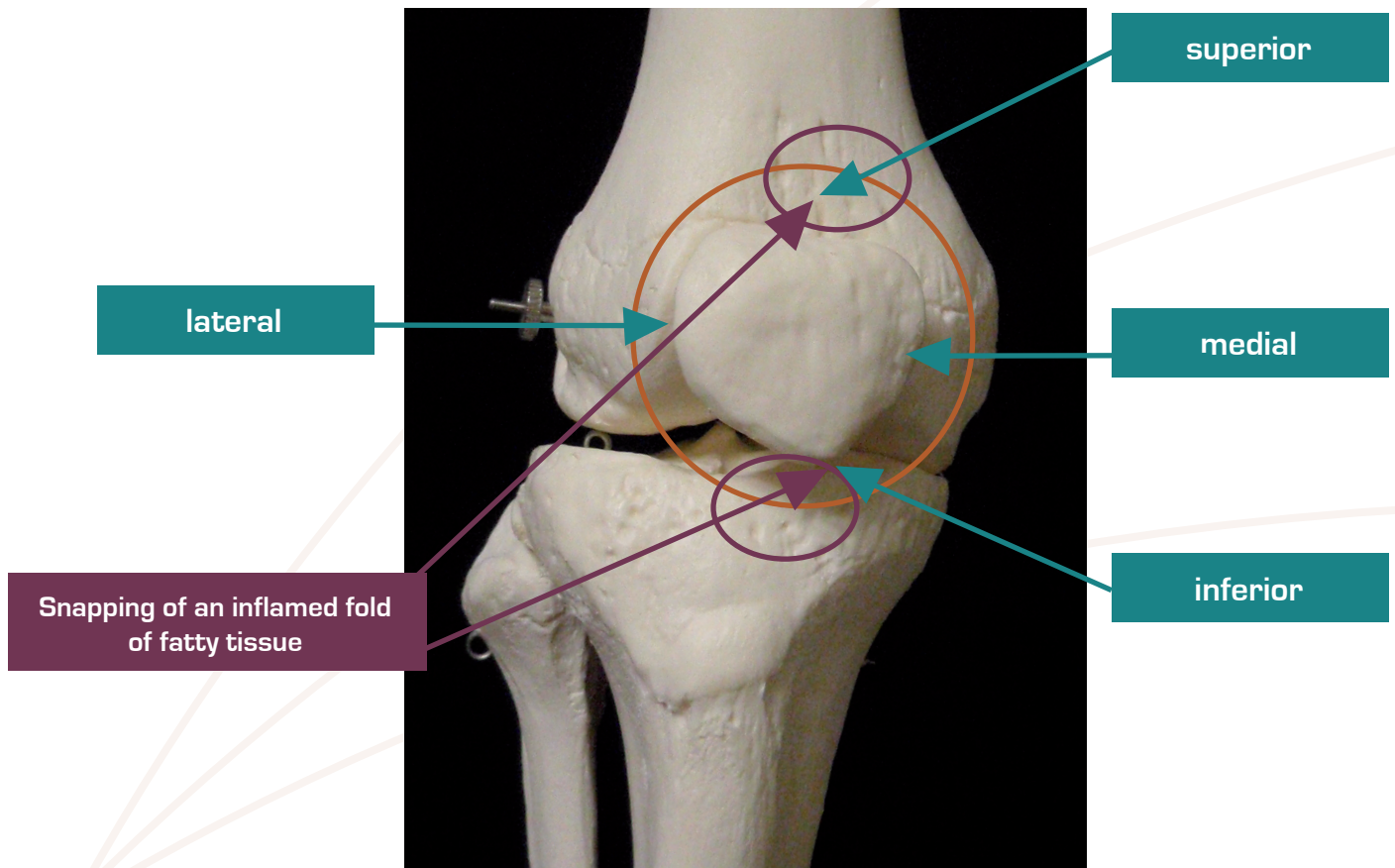


Fig.28 : Superior PLICAE

1) **Suprapatellar plica** (Fig.28) : the most common type, located just above the patella, it partially divides the quadriceps pouch. This plica takes several forms. It comes either from the posterior section of the quadriceps tendon or from the anterior femoral metaphysis and continues towards the medial side of the knee. Sometimes, it hermitically divides the quadriceps pouch causing a suprapatellar bursitis and chondromalacia [26,27].

Depending on its size and shape, it can be trapped between the quadriceps tendon and the femoral trochlea, between 70-100° of knee flexion, and becomes pathologic. Its prevalence varies in function of its cause: 11-87%.

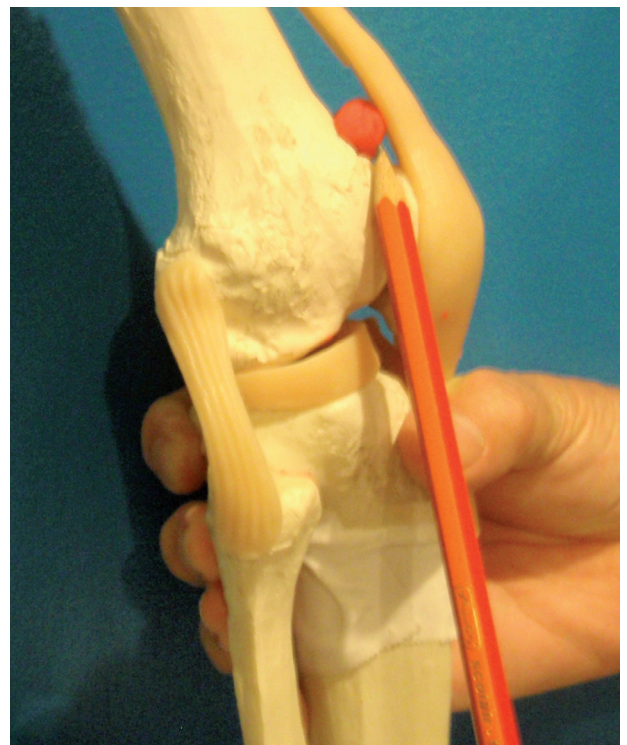


Fig.29 : Inflammatory medial plica



2) La **mediopatellar plica** is the **most common pathologic type** (Fig. 29), as it is thick, painful, and responsible for patellar attachments. It comes from the suprapatellar region, descends towards the medial section of the knee and attaches to the infrapatellar Hoffa fatty tissue. There are 4 types: A (rope-like), B (shelf, not covering the medial femoral condyle), C (shelf, covering the medial femoral condyle), and D (double insertion) [28]. Its prevalence is between 18-60%.

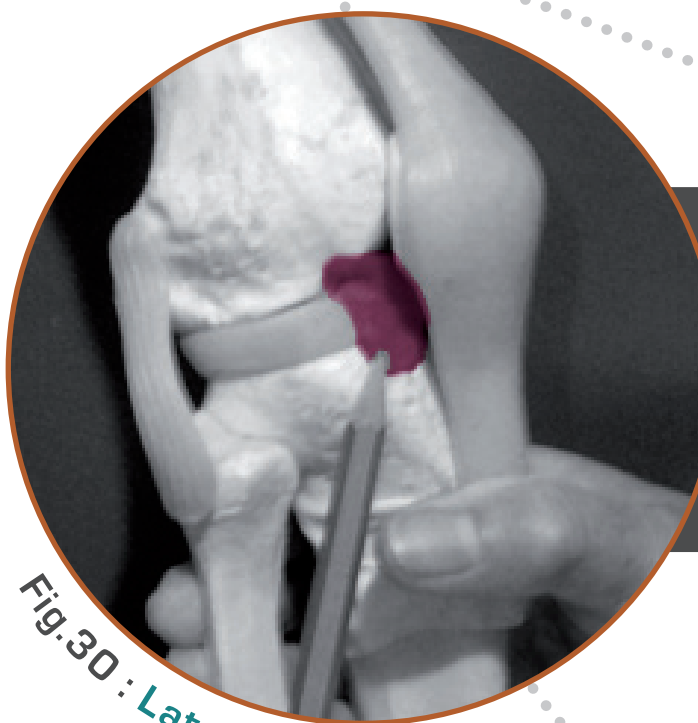
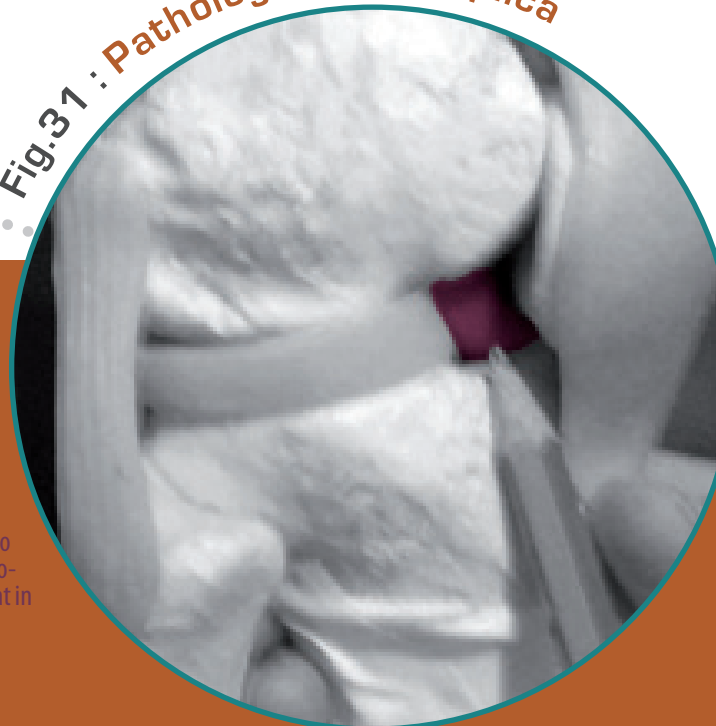


Fig.30 : Lateral Plica

3) The **lateral plica** (Fig. 30) is a taut band of lateral parapatellar synovium at the lateral patellar facet. In some cases, it comes from a synovial fold of the parapatellar fat pad. Its prevalence is between 1 and 2% [29].

Fig.31 : Pathologic inferior plica



4) 65% for the **Infrapatellar plica** (Fig. 31, 32) [30]. The plica becomes pathologic in patients strongly binding their knees, women are affected most often [31].

NB : The Hoffa fat pad or infrapatellar adipose body (IAB) is a cuniform extrasynovial mass located in the infrapatellar region, a real patella-femoro-tibial intersection, and helps understand the conflicts related to plicae [32].

NB : We are surprised at the scope of the inferior pathologic types in those which seem to be a Hoffa disorder with complex snapping in ultrasound: sub- patellaire, Inter capsulo-ligamento-patellar. The Hoffa disorder is expressed with a high signal intensity on the fat in the MRI, while the plicae take shape in a fluid hyperintensity.

4.5.4 PHYSIOPATHOLOGY OF A PATHOLOGIC PLICA

Normal plicae are fine, supple, flexible, well vascularized, and covered with synovial fluid. Pathologic plicae are hypertrophied, have lost their elasticity, hyalinized, fibrotic, and calcified [33]. They become pathologic after inflammation following acute trauma, repeated microtraumas, a meniscal tear, a loose foreign body, or osteochondritis dessecans. The inflammation can also result in an anatomical change of the knee and the plica themselves (when they irritate the medial femoral condyle) [34]. The condyle abrades during knee flexion. The inflammation may also be due to an edema or a tissue injury and can lead to brittle plicae which damage the femoral condyles and can cause chondromalacia or secondary synovitis [35].

Age may also play a role – though less pathogenic – in the loss of elasticity. Sometimes, plicae can partially tear, at the top or completely. These tears are generally caused by a direct injury or excessive rotation. They can be found in the femoropatellar articulation during arthroscopy [36].

Fig.32 : Pathologic inferior plica



Thickening of the plicae disrupts the function of the Quadriceps, which can pull excessively on its synovial insertions, causing pain as there are many nerve receptors there, especially at the distal insertions on the infrapatellar fatty pad [37].

4.5.5 MECHANISMS OF THE PLICA SYNDROME

Plica, being made of synovium, also undergoes tissue realignment if extended. Anamnesis reports 4 causes for classical onset (Fig. 33).

1) **Acute knee injuries** in the area of the condyles cause pain, edema, or other local signal. The symptoms disappear and the initial injury is often forgotten.

I **A direct injury to the flexed knee** (contusion, knee hitting the dashboard of a car...) can transform asymptomatic plica (usually medial, less often superior – and often inferior or inferomedial, in our experience) and symptomatic plica. A knee damaged during partial flexion causes plica inflammation more easily following a hemorrhage and synovitis..

I **An indirect injury** (excessive rotation...) can cause an interarticular hematoma and/or synovitis following an overlooked meniscal injury.

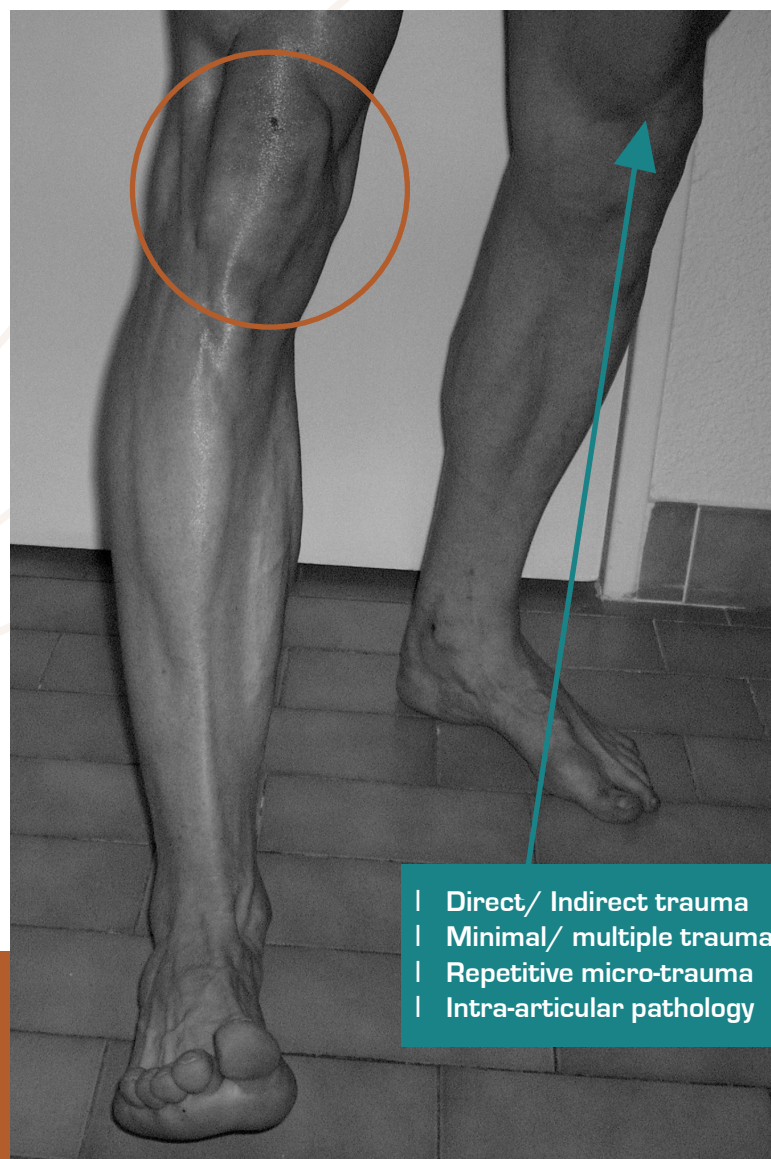
2) **Multiple minimal injuries to the condyle** (combat sports, caving, kneeling...) can cause inflammation and then thickening of the plica, which in turn causes irritation and local erosion of the hyaline condylar cartilage.

3) Repetitive micro-traumas in flexion/extension: as in (trail) running, jumping, swimming (breaststroke), cycling, weightlifting (squats). These repetitive forces form thicker plicae which become pathologic. The two mechanisms creating the conflict are either the friction of the plica against the femoral part, or plica constriction between the patella and the femur (trapping of a conjunctive structure between two bony structures). The articular range between 30 and 45° of flexion is the most limited.

4) Any chronic intra-articular pathology of the knee and soft tissue in the knee area: arthrosis of the knee, patellar chondromalacia, erosion of the cartilage, femoropatellar syndrome, femoropatellar arthrosis, intra-articular loose bodies, Baker's cysts, internal disturbance of the knee, necrosis with sequestra, tendency to lateral patellar subluxation, pre-patellar bursitis, suprapatellar bursitis, excessive rotation of the medial and lateral collateral ligament, etc. ...: restrict the plica, without needing to have femoropatellar contact with the plica to cause pathology.

NB: young adults and children can also be affected.

Fig.33 : 4 causes of Pathologic plica



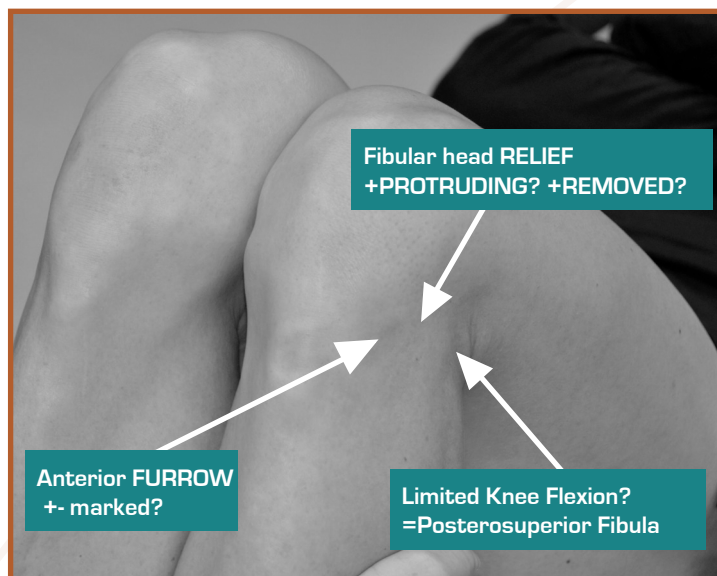
5. DIAGNOSIS

5.1 CLINICAL DIAGNOSIS

5.1.1 SUBLUXATION OF THE FIBULAR HEAD

For a diagnosis of subluxation (Fig. 34), we cannot be satisfied with solely a restriction of mobility. For example, with an anterior dysfunction of the fibula, there must be normal mobility in the anterior direction and limited mobility in the posterior direction. On the other hand, in our experience, it is more frequent to have an anterior subluxation of the fibular head with restricted anterior mobility and normal posterior mobility. If the radiograph does not support the diagnosis of what is believed to be a posterior subluxation, a thrusting movement will not only be ineffective, but could also aggravate the injury or cause dysfunction to the lateral meniscus.

Fig.34 : Clinical diagnosis of a subluxation of the fibular head



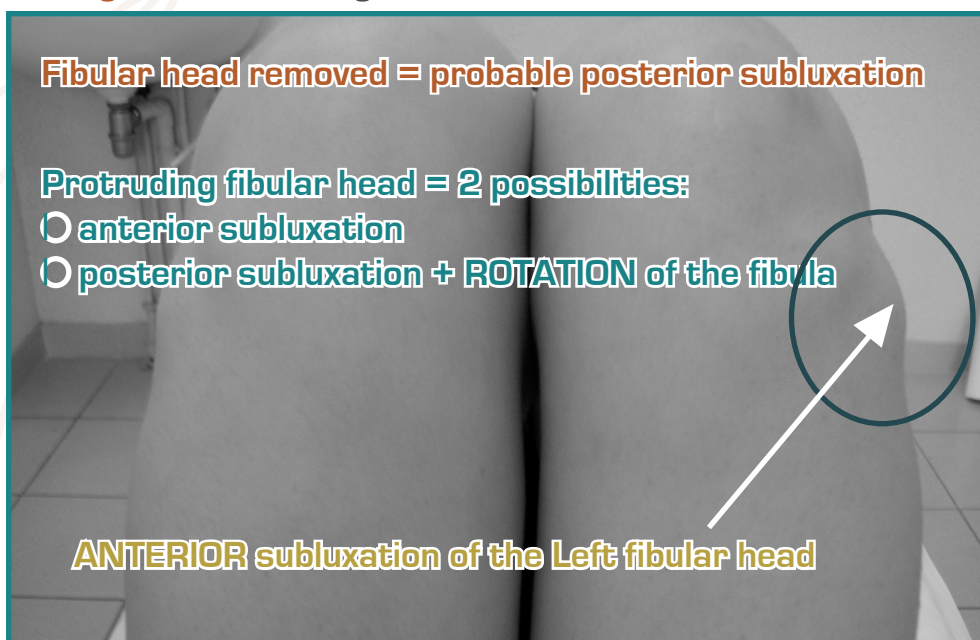
Comparative visual examination of the fibular heads

The patient is supine with bent knees. Look for asymmetry between the two PTFs:

- I an anterior PTF furrow which is more or less pronounced;
- I a fibular head more or less pronounced in relief.

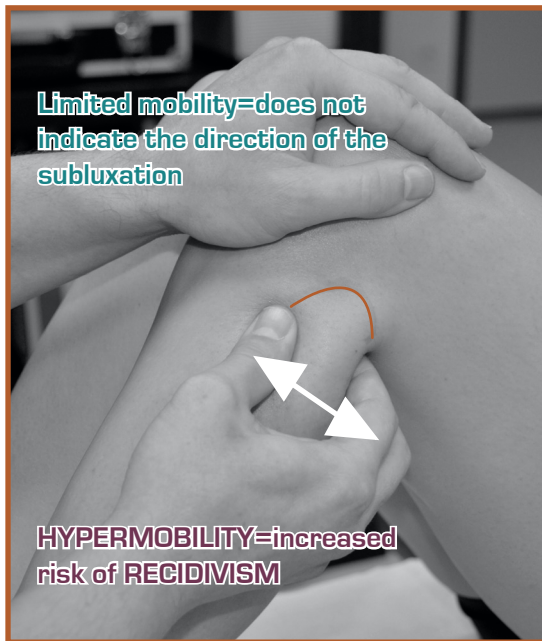
If the relief of the fibular head is less pronounced, then the fibular head is probably posterior. Conversely, if the relief is more pronounced, then the fibular head may be anterior, posterior, or rotating.

Fig.35 : Visual diagnosis of a fibular head subluxation



COMPARATIVE MOBILIZATION (Fig. 36) of a fibular head subluxation

Fig.36 : Restriction of mobility?



Find the muscle contractures of the anterolateral compartment of the leg, posterior leg, and femoral biceps.

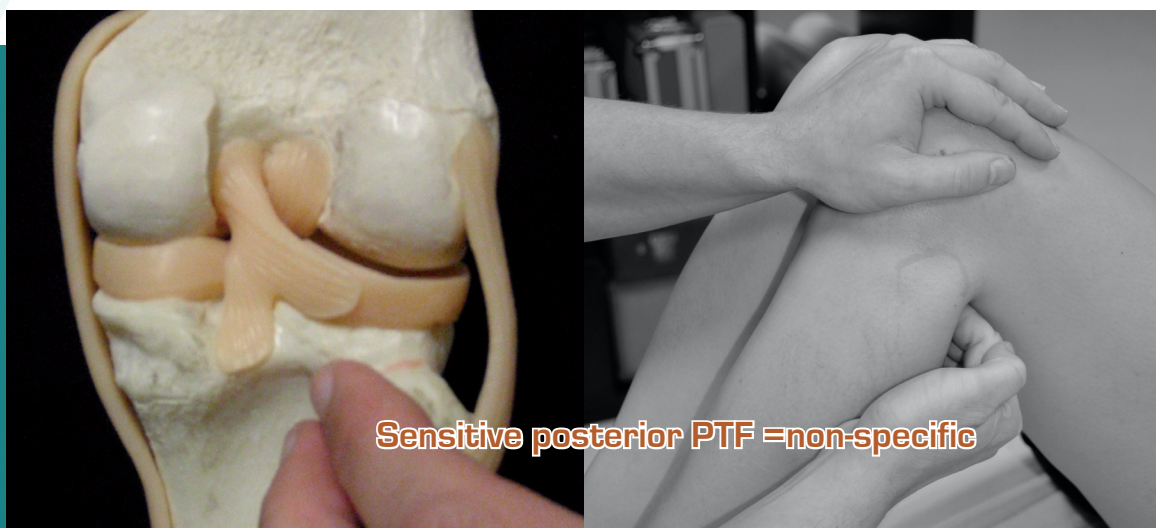
The diagnosis of anterior and posterior subluxation is very difficult, as, in these two cases, there is pain on the anterior side(Fig.37) and/or the posterior side(Fig.38) of the PTF as well as hyper and/or hypo-mobility of this joint. If there is a malposition under external rotation: the anterior side of the fibular head seems enlarged and its external ridge is more posterior. The opposite applies to internal rotation.

Fig.37 : Sensitivity of the anterior PTF?



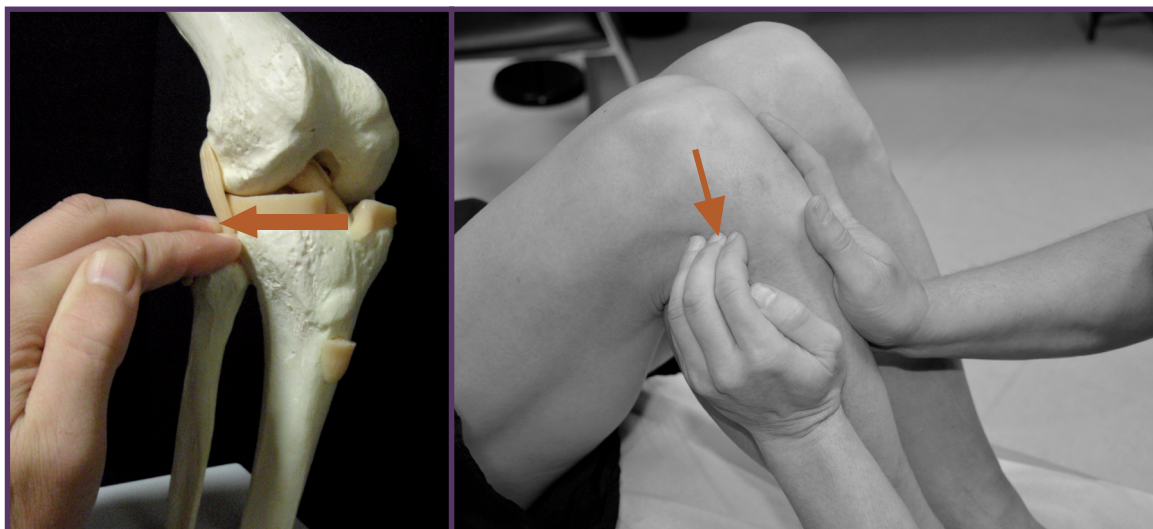
NB: The PTF could be irritated, but certain patients who are used to stronger physical pain may not experience any sensitivity, even with a subluxation!

Fig.38 : Sensibility of the posterior PTF?



Subluxation INFÉRIEURE:

Fig.39 : Sensitivity of the superior PTF?



Tenderness in the superior section (Fig. 39) of the fibular head, with regard to the FB insertion, which disappears when climbing the fibular head. It can be moved backwards or forwards to test for the direction providing the most relief (Fig. 40) and to guide the manipulation.

NB: Do not confuse with a subluxation of the lateral meniscus: in this case, the pain will increase when the fibula is raised!

Fig.40 : Test for decreased sensitivity of the superior PTF?



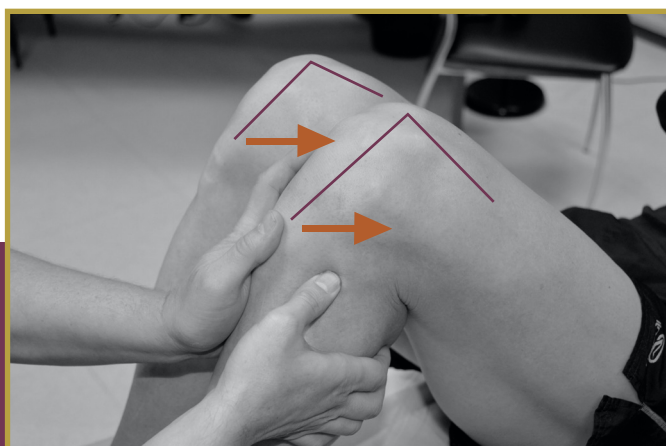
Limited knee flexion (Fig. 41)

= probable POSTERIOR and SUPERIOR Subluxation (which “blocks” upon flexion): an almost pathognomonic signal.

NB: Unless if there are post-surgical retractions or adhesions of the anterior plane of the knee

After manipulation, flexion of the right knee immediately becomes symmetrical. If painful, the pain should be reduced, but may continue for a few days longer.

Fig.41 : Limitation of knee flexion?



5.1.2 COMPARATIVE (SUFFICIENT) CLINICAL EXAMINATION OF THE ADHESIONS

Palpatory diagnosis

The mobilization of several fasciae in the lower third of the thigh (Fig. 42), (especially the m. vastus lateralis, TFL, Femoral biceps) is painful (Fig. 43), which allows for a comparison between the healthy and the affected side.

Fig.42 : Muscles of the lower 1/3 of the anterolateral aspect of the thigh.



Fig.43 : Palpatory diagnosis of thigh adhesions.



5.1.3 COMPARATIVE CLINICAL EXAMINATION OF AN ABNORMAL POSITIONING OF THE LATERAL MENISCUS

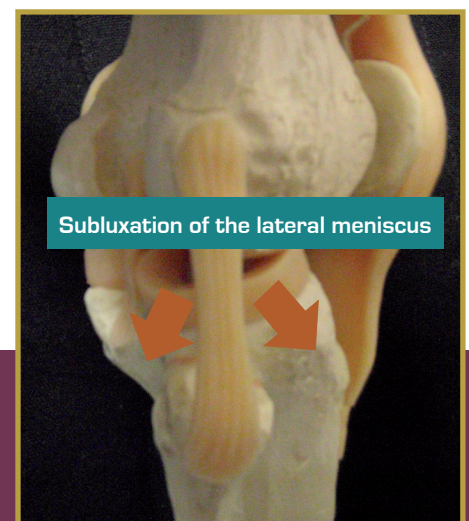
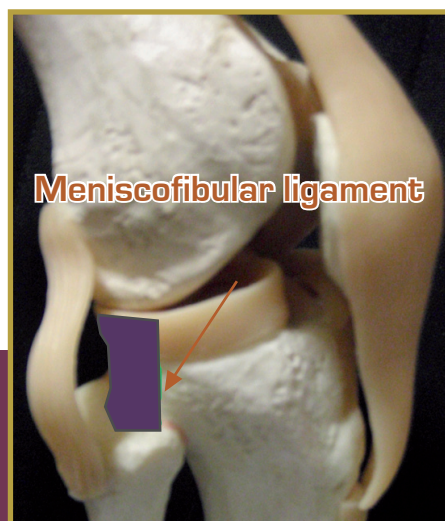
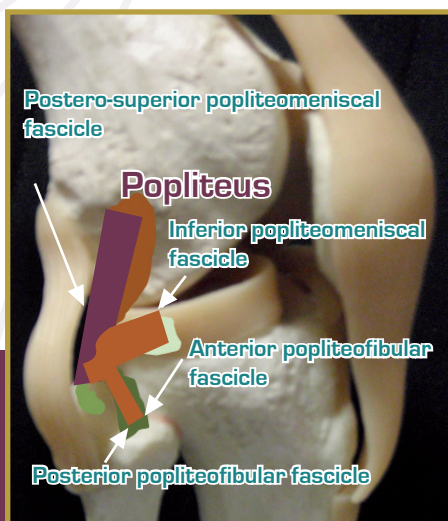
Malposition of the posterior horn of the lateral meniscus:

Palpation of the posterior-superior section of the fibular head is sensitive (Fig. 44). This pain is in regard to the menisofibular or popliteo-menisco-fibular ligaments (Fig. 45) : behind the insertion of the FB tendon.

Fig.44: Subluxation of the posterior horn of the lateral meniscus



Fig.45 : Palpatory diagnosis of thigh adhesions.



5.1.4 COMPARATIVE CLINICAL EXAMINATION OF A PATHOLOGIC PLICA

Remember that any injury or disorder causing chronic irritation of a synovial fold may lead to its thickening and may become pathologic. Take, for example, the **pathologic anteromedial plica**, as it is the most widely studied in the literature. It causes **anteromedial knee pain** which is intermittent or aggravated by activity.

SYMPTOMS (Fig.46)

Mediopatellar plicae are found above the medial femoral condyle. When the knee is bent, the femoral condyle is no longer protected by the patella and becomes more vulnerable to injury in flexion/extension of the knee. Plicae become pathologic when they come in between the patella and the medial section of the femoral trochlea irritating it. The inflammation of plicae and their thickening can result in the wearing away of hyaline cartilage underlying the condyle.

Fig.46 : Palpation of a pathologic medial plica



1) PALPATION

The knee pain is anterior or anteromedial, episodic and accompanied by snapping and pseudo-blockages of the knee; aggravated by activity, climbing stairs, prolonged sitting or standing... There is a painful hypertrophic membrane palpable in 15% of cases.

Sometimes, they are associated with snapping (protusions of the patella) or pseudo-blocking of the knee [38], rarely associated with a swelling of the knee [39]. If the plica is torn, the knee may be blocked and its flexion limited. The inferomedial edge of the patella is tense and sensitive. Sometimes, the thickened band of the plica can be felt (like a sensitive cord rolling under the finger parallel to the patella) and the pain can be reproduced.

2) DYNAMIC TEST

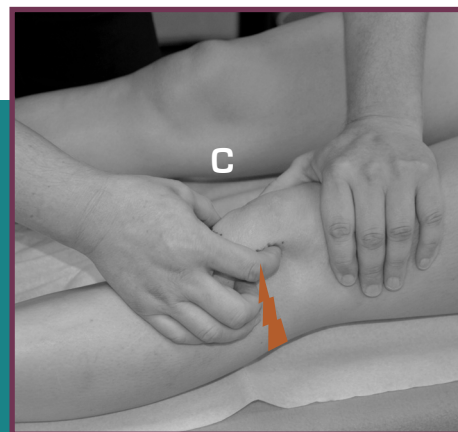
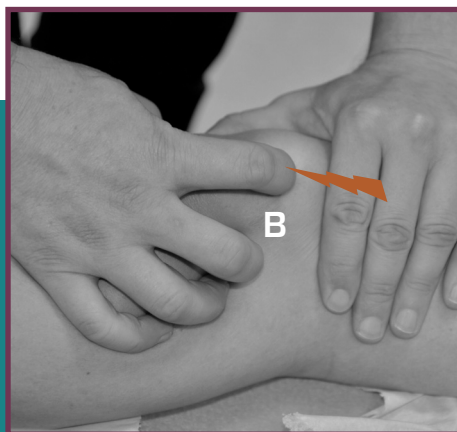
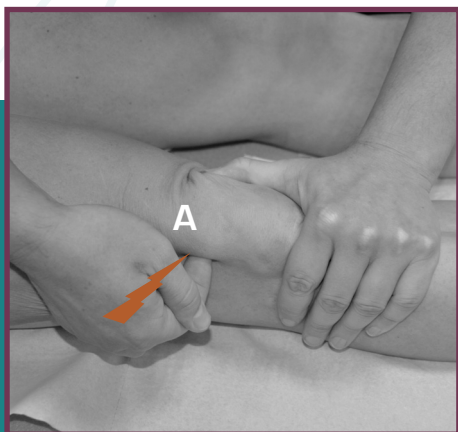
A test of the mediopatellar plica (Fig. 47) has a sensitivity of 90% and specificity of 89% in 172 knees [40]: when the knee is forced into 90° flexion, during which strong pressure is applied to the inferomedial section of the femoropatellar joint: this test has a positive result when the pain occurs at extension and is reduced at 90° of flexion.

Realistically, we are satisfied with performing the palpatory test described below:

3) Palpation then CAPSULAR LIBERATION = best DIAGNOSTIC TEST

In our experience, pathologic plicae almost always cause tenderness of the inferior facet of the patella (Fig. 47). If you do not have access to an ultrasound specialist used to this type of examination, just perform a “capsular liberation” of this painful zone. A temporary improvement in the patient will confirm the diagnosis.

Fig.47 : Palpatory diagnosis of a superolateral (a), inferior (b), and lateral (c) plica.

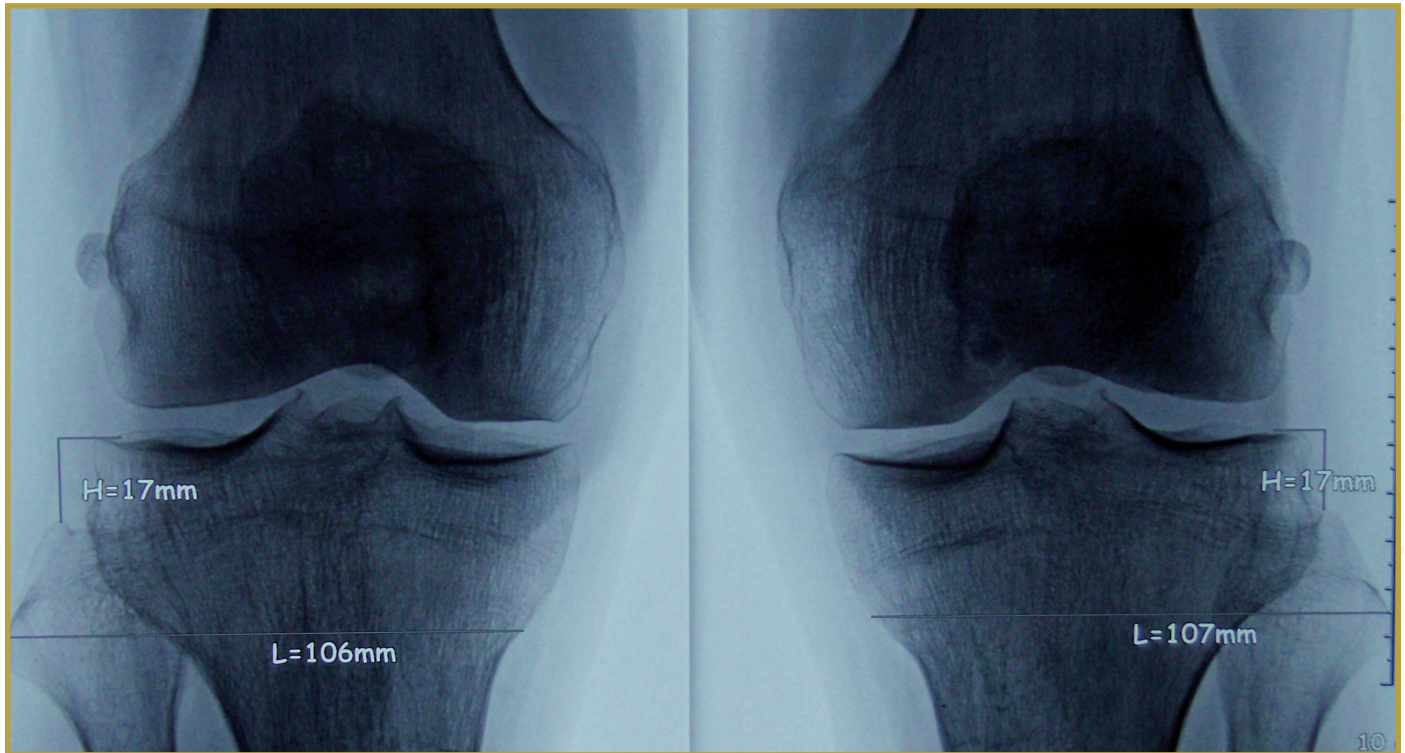


5.2 RADIOLOGICAL DIAGNOSIS

5.2.1 COMPARATIVE RADIOLOGICAL IMAGES: Subluxation of the Fibular Head

Fig.48 : Frontal radiograph of the 2 knees

Fibular Heads = symmetrical and in place



1. Comparative image of the standing knee, frontal (Fig. 48):

When standing, the lower limbs are slightly rotated inwards, the second section in the sagittal plane. Once the angle has been set, the images are taken successively and in simple transition, without changing the height.

Fig.49 : Comparison of fibular head height

**SUPERIOR + medial
Subluxation of the Left
Fibular head**



Realignment manipulation of a superior fibula generally realigns the incorrect rotation automatically

- a. We can compare **the height of the fibular heads** by comparing the distance between the tibial plateaus and the parallel passing over the apex of the styloid processes (Fig. 49, 50).
- b. A **lateral or medial subluxation** can be assessed by a comparison between the distances from the outer edge of the tibial diaphysis to the internal edge of the fibular diaphysis.

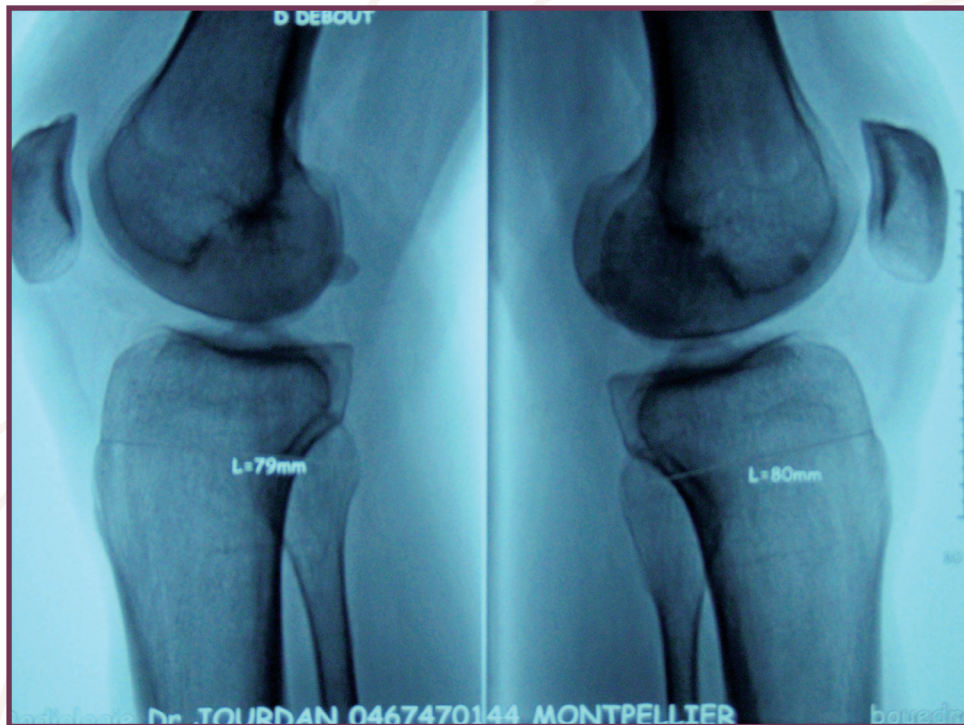
Fig.50 : INFERIOR Subluxation of the Left Fibular head



c. The fibular pass seems narrower in medial rotation and larger in lateral **rotation**

Fig.51 : radiograph of the 2 knees in profile

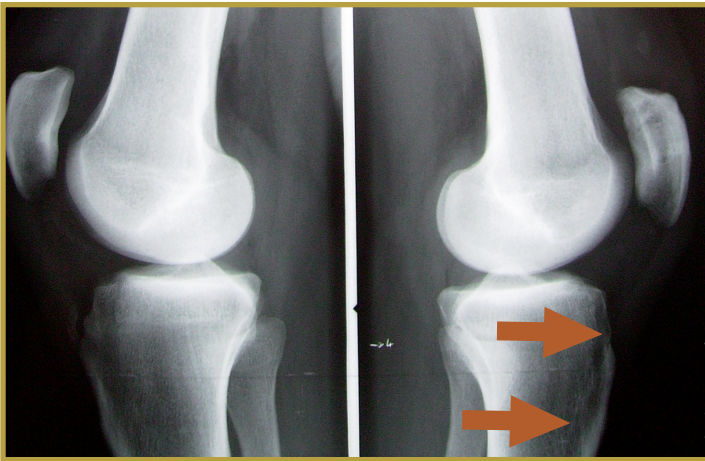
Fibular Heads = symmetrical and in place



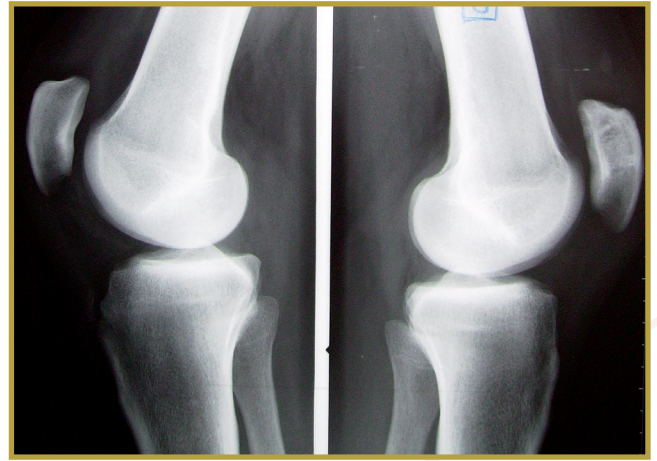
2. Comparative image of the knees in profile, at 20° of flexion (Fig. 51, 52) :

A sagittal subluxation is assessed by the measurement from the most posterior section of the fibular head until the anterior part of the tibial metaphysis, parallel to the plane of the tibial plateaus.

Fig.52 : ANTERIOR Subluxation of the Left fibular head



BEFORE



**After
MANIPULATION**

Fibular malposition is well known to osteopaths. However, there are only two variants described, anterior-inferior-lateral and posterior-superior-medial, probably as they correspond to the movements of the PTF. We find that a subluxation can result from a combination of the 8 directions possible for fibular displacement. Thus, classically-described anterior-inferior and posterior-superior malpositions are only seen in one out of six knee cases.

Finally, for manipulations, there are only 4 types of fibular head subluxation to know:

ANTERO-SUPERIOR ++++

POSTERO-SUPERIOR +++

ANTERO-INFERIOR +

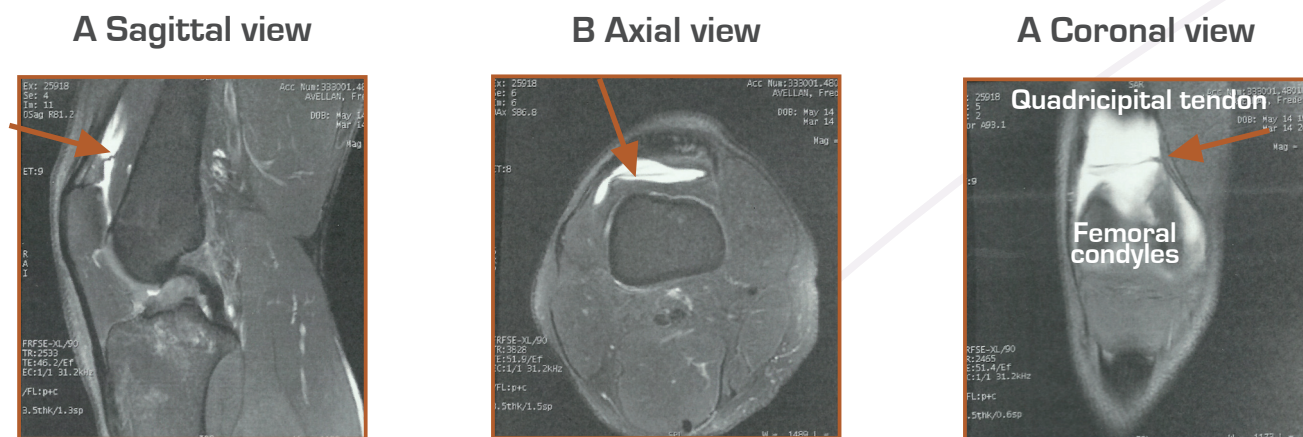
POSTERO-INFERIOR +

5.2.2 Radiology of a calcified plica

Radiographs allow us to exclude other pathologies, as the plica are invisible [41], unless there is calcification [42]. They allow us to exclude: arthritis, osteochondrosis dissecans, osteophytosis, fractures, and to look for any bone pathology which can irritate the plicae.

| The **MRI** has a sensitivity (95%) and specificity (72%) according to the plica position no the medial facet [43]. On an axial MRI, a medial pathologic plica can be seen as a thick band of weak intensity, irregular, with a cartilaginous surface of the medial patellar facet. The sagittal images show the orientation of the thickened, hypertrophied, and fibrotic plica towards the Hoffa fat pad, in front of the anterior-medial corner of the medial meniscus. The superior plicae are clearly visible (Fig. 53 a, b, c).

Fig.53 : SUPERIOR PLICA

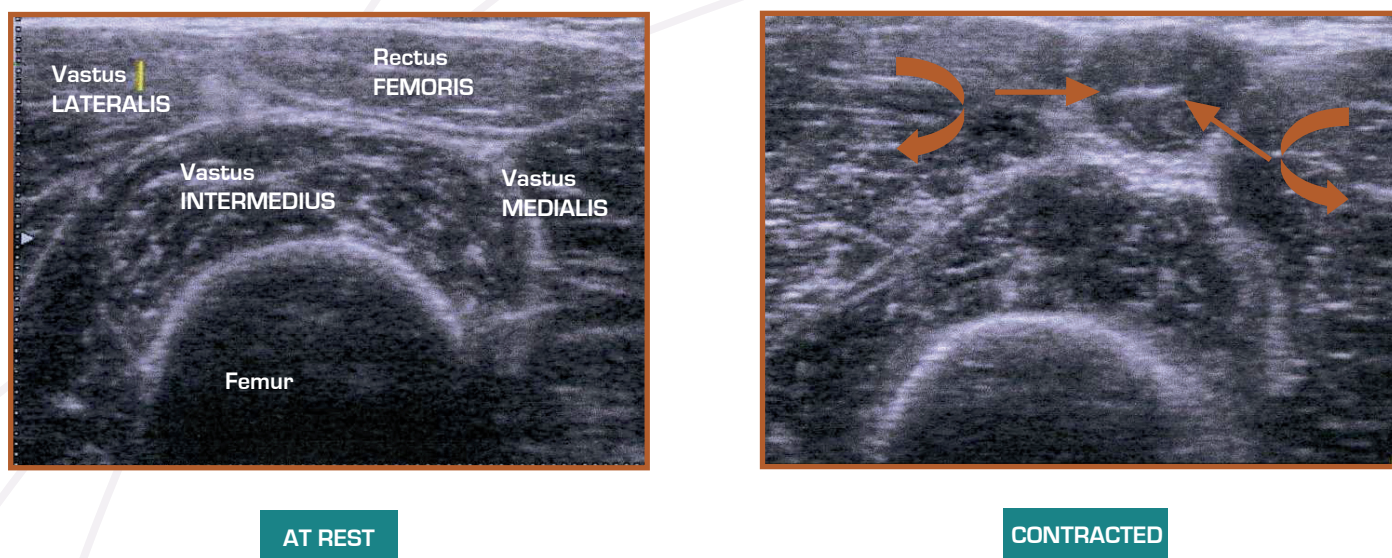


| **Arthroscopy** of the knee remains the gold standard for visualization and treatment [44].

5.3 ULTRASONOGRAPHIC DIAGNOSIS

5.3.1 DYNAMIC ULTRASOND: ADHESIONS

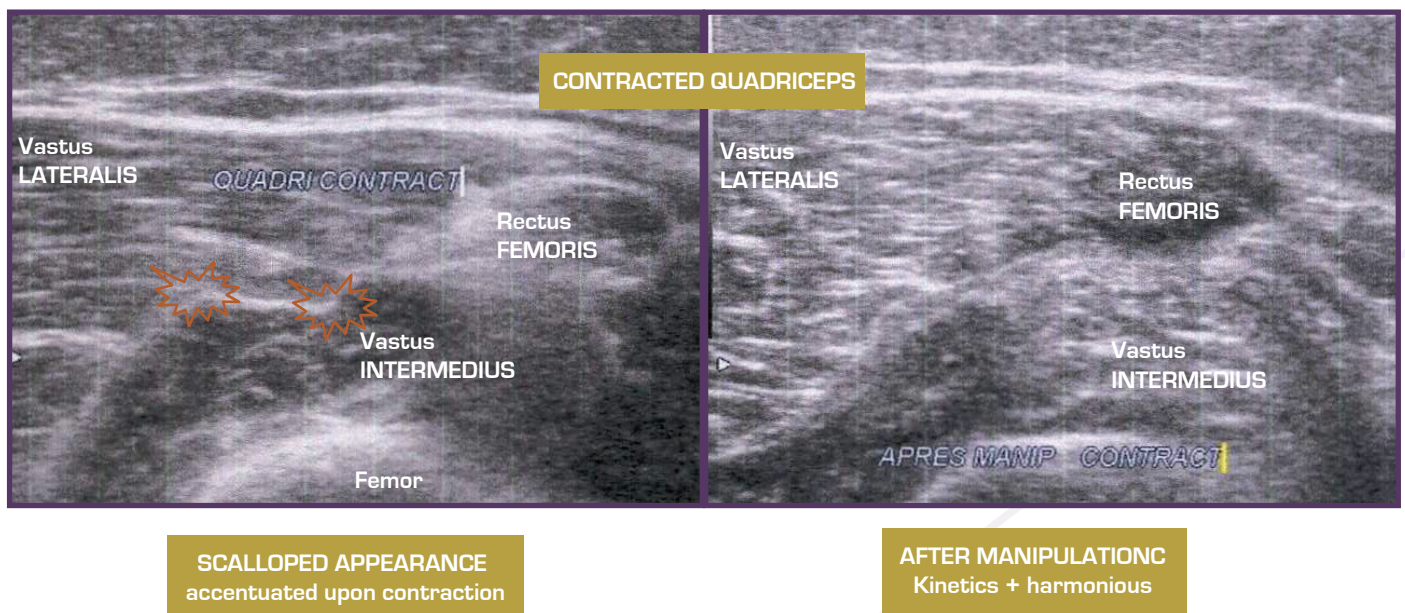
Fig.54 : Axial view of the kinetics of the NORMAL QUADRICEPS



Looking at the kinetics of the Quadriceps in axial view (Fig. 54), around 7 cm above the patella. In a healthy knee, we can clearly see the superficial layer of the Rectus Femoris surrounding the Vastus Lateralis and Medialis. When contracted, the Rectus Femoris becomes rounded and the two Vasti slide under the Rectus Femoris and over the Vastus Intermedius.

Fig.55 : Axial view of a kinetic problem of the QUADRICEPS

Femoropatellar syndrome: **ADHESION** of the Vastus Lateralis-Vastus Intermedius

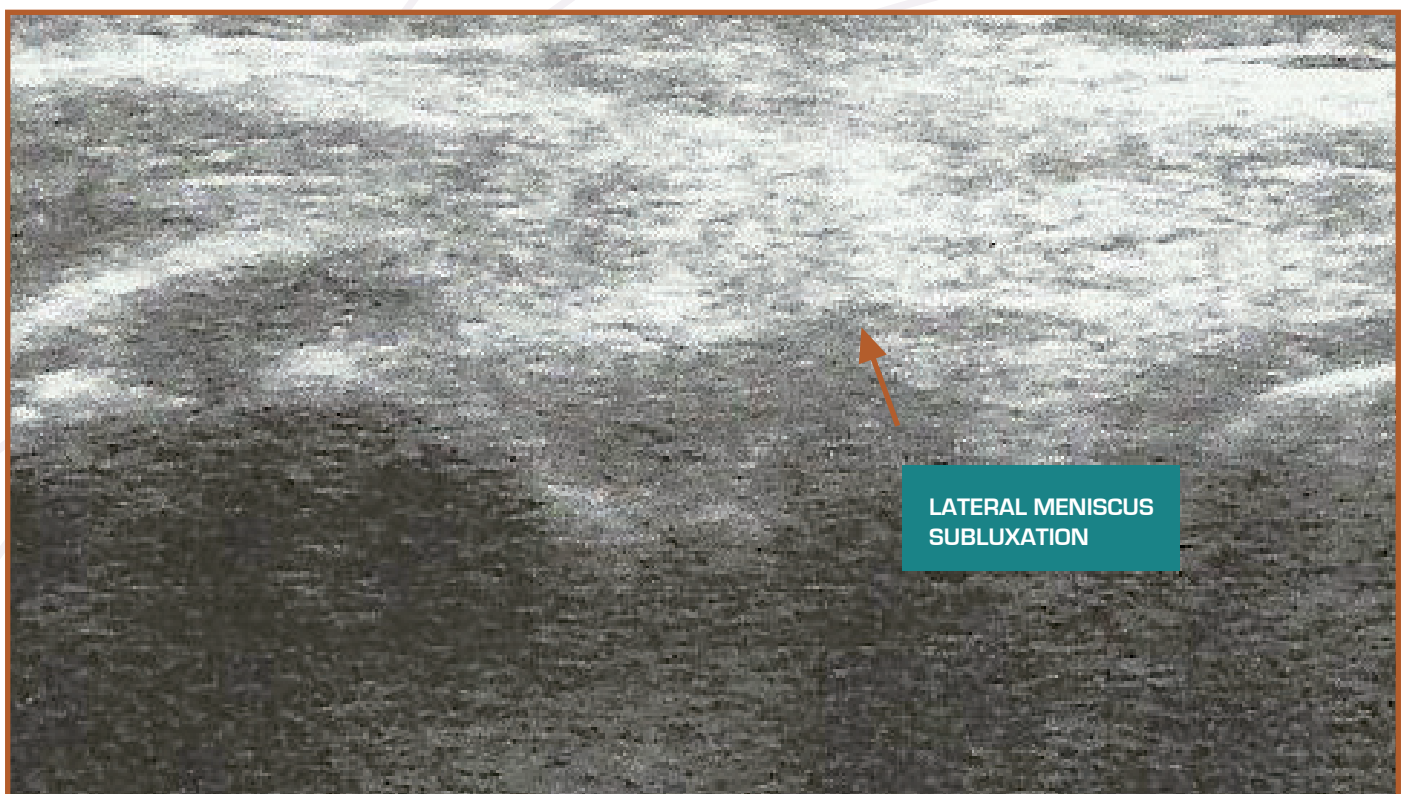


In patella syndrome, dynamic ultrasound often finds a “scalloped” appearance or a “sawtooth” look to the fasciae (Fig. 55) between the vastus lateralis and the vastus intermedius. If the kinetics of the other fasciae are also disturbed, they are also difficult to observe.

Results: Manual adhesiolysis is immediately effective on the kinetics of fasciae which become harmonious

5.3.2 DYNAMIC ULTRASOUND: SUBLUXATION OF THE LATERAL MENISCUS

Fig.57 : Sagittal view of the lateral femorotibial joint space;
the lateral meniscus subluxe when the knee is extended

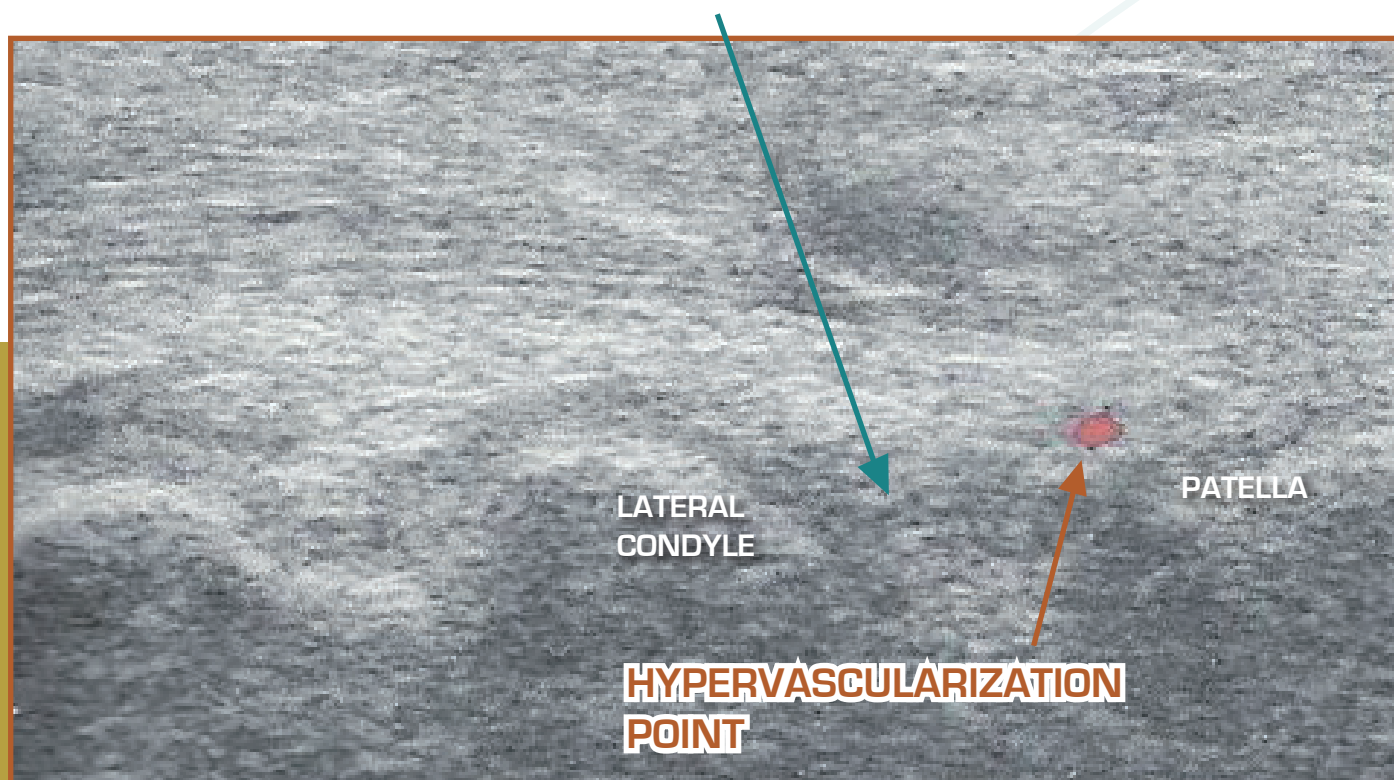


5.3.3 Dynamic ultrasound: trapped plica

Classical dynamic ultrasound [45] is very effective at detecting a medial pathologic plica (sensitivity of 90% and specificity of 83%). All plicae can become pathologic and can be detected using dynamic ultrasound [46], when they become thicker, inflamed, and are trapped between the patella and the femoral condyle (Fig. 58, 59, 60, 61, 62). However, not having had a MRI for all of our patients, we are not able to identify with certainty a PATHOLOGIC PLICA (which resembles a “tent” in the joint) of a CAPSULAR FOLD which is INVAGINATED and is thus much easier to manipulate. While awaiting confirmation, we are likely confounding the terms: pathological plica and synovial trapping – this is the current limit of our terminology.

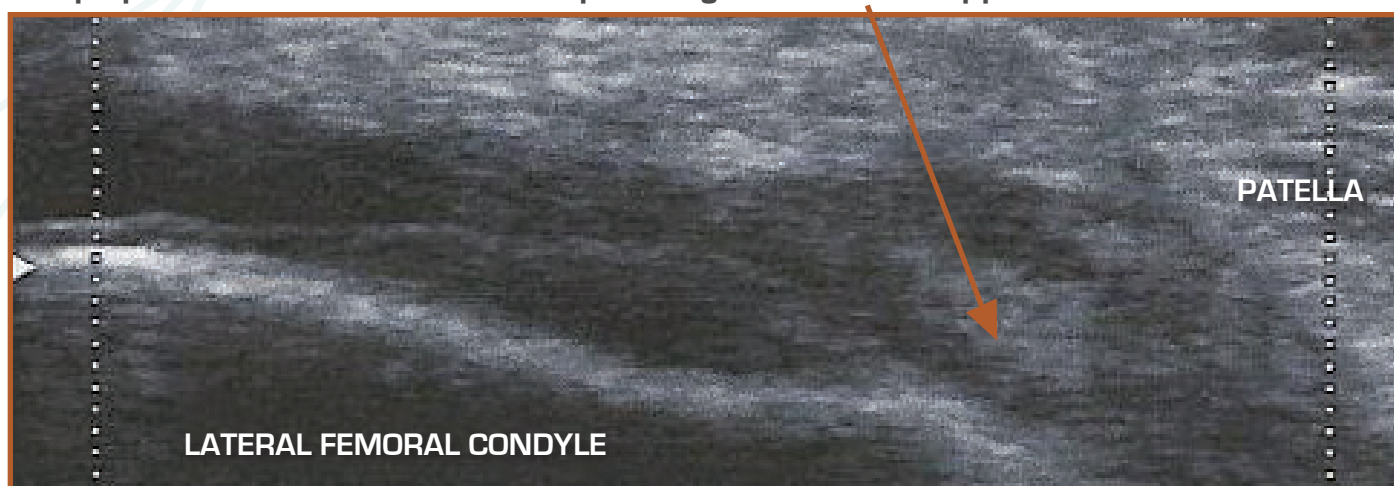
In any case, for inflamed capsules trapped between the quadricipital tendon and the condyles (especially the lateral condyle), the ultrasound suspicion of a superior pathologic plica is easily confirmed by MRI. The advancement of our findings sometimes shows a discontinuity (liberation) of the lateral aspect of the superior plica in the sub-quadricipital recessus.

Fig.58 : Sagittal view in knee flexion. Snapping of lateral subpatellar synovial and fatty fold in regard to the painful lateral femoropatellar area at palpation :



LATERAL PATHOLOGIC PLICA= TRAPPING + THICKENING + HYPERVASCULAR

Fig.62 : Sagittal lateral femoropatellar view of in regard to the painful area at palpation: SUPERIOR-LATERAL pathologic PLICA or Trapped SYNOVIAL FOLD?



Ultrasound monitoring: after manipulation (Fig. 63, 64, 65, 67) = capsular liberation (Fig. 66)

Classical dynamic ultrasound [45] is very effective at detecting a medial pathologic plica (sensitivity of 90% and specificity of 83%). All plicae can become pathologic and can be detected using dynamic ultrasound [46], when they become thicker, inflamed, and are trapped between the patella and the femoral condyle (Fig. 58, 59, 60, 61, 62).

Fig.63: Sagittal view of a synovial fold before manipulation, which remains during flexion.

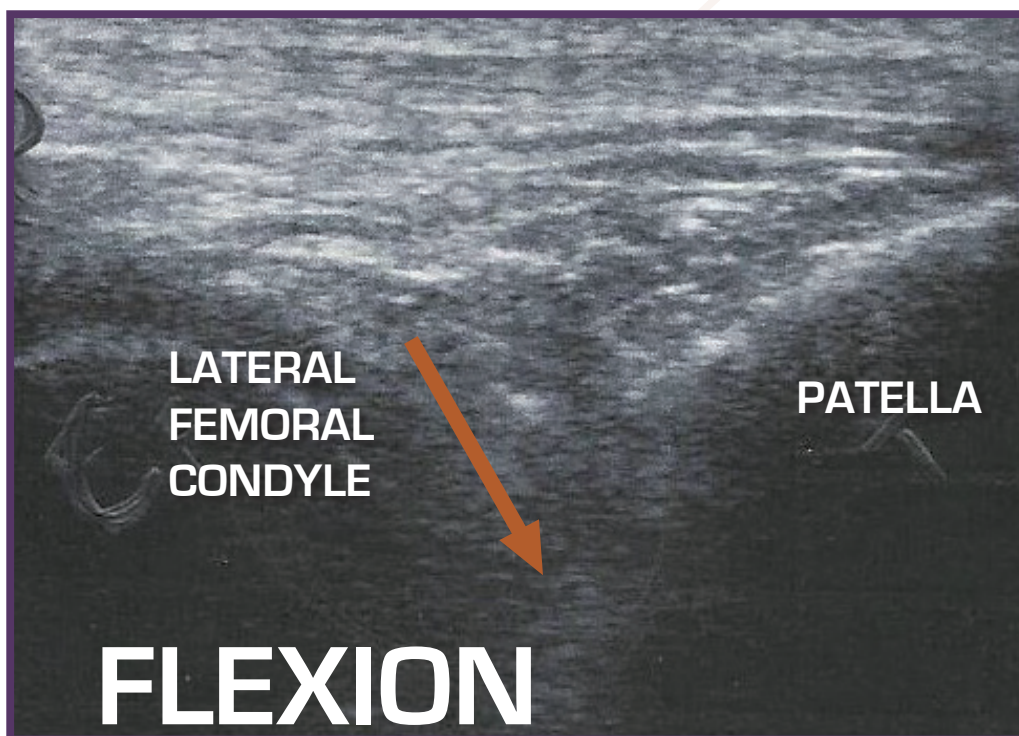


Fig.64 : Sagittal view after liberation: the plica is shallower in flexion and painless.

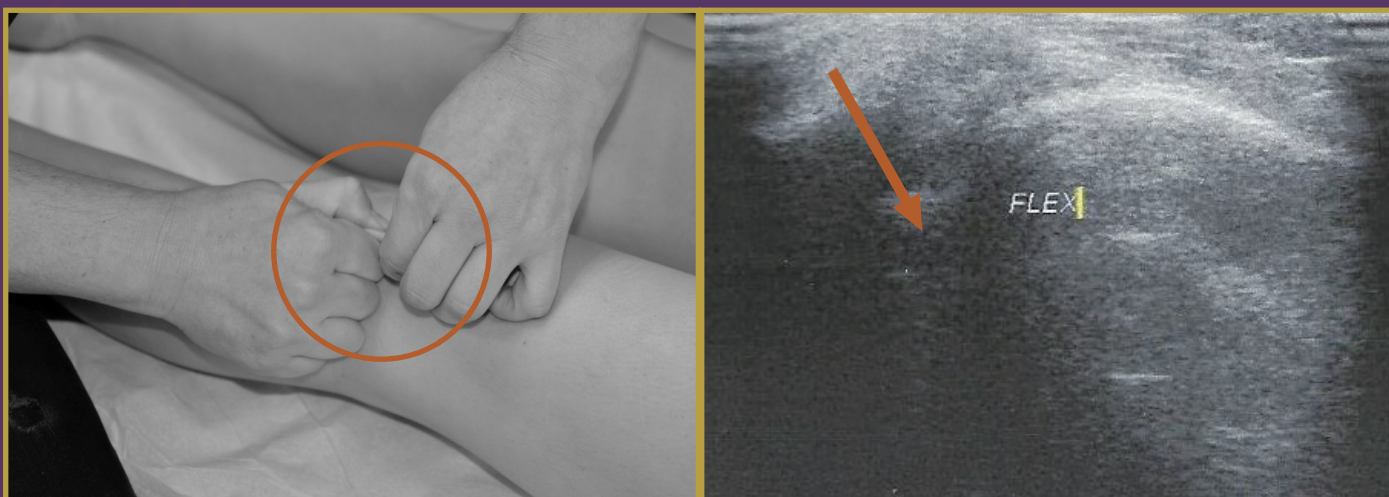


Fig.65 : Sagittal view of a superior-lateral pathologic plica, which remains during flexion

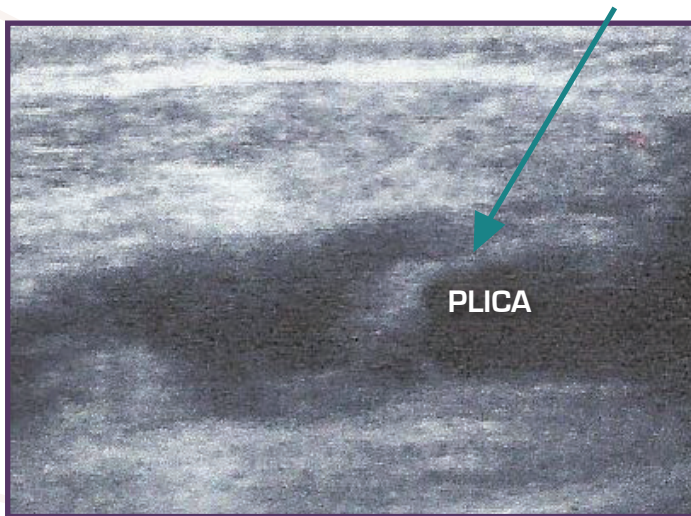
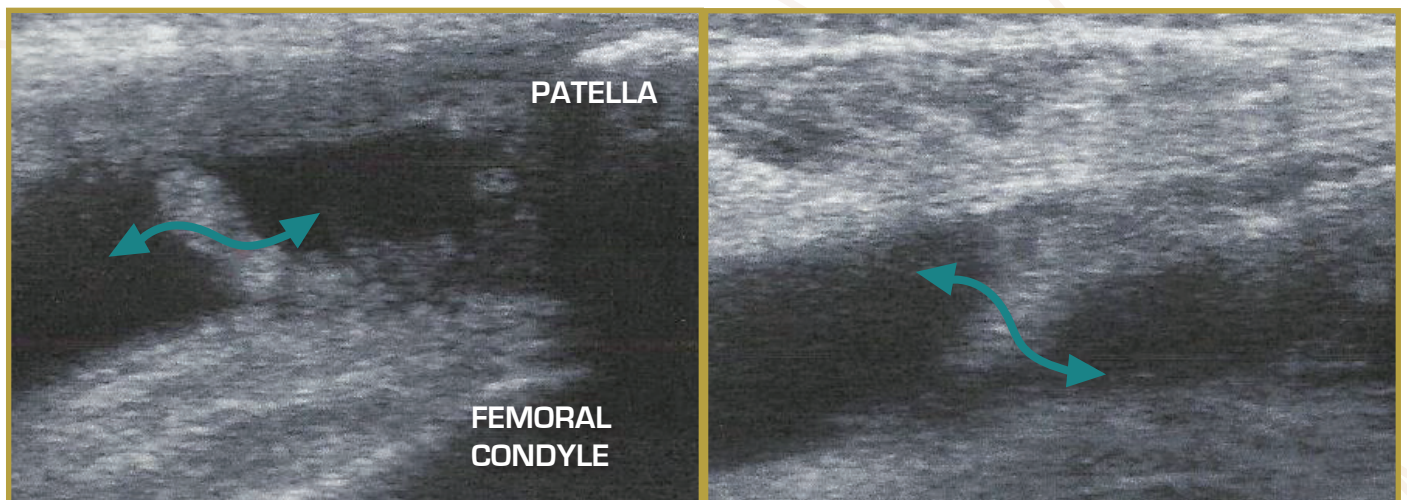


Fig.66 : Capsular liberation



Fig.67 : Sagittal view after LIBERATION: the plica “floats” and is medially deflected



6. OSTEOPATHIC TREATMENT

6.1 PREPARATION OF THE LOWER LIMB FOR MANIPULATION

This allows for the lysis of the adhesions and release of the contractures, which may cause persistence of subluxation of the fibular head. Otherwise a rapid «rebound effect» will again sublux the fibular head.

6.1.1 PHYSICAL MEDICINE

If **the subluxation is only a few days old**, that means that the muscles are only slightly contracted and the articular capsule is only slightly fibrotic, then the manipulation can be carried out with light preparation, combining, in function of the clinical presentation:

- | Mobilization of the pelvis, knee, ankle, and foot;
- | Adhesiolysis of the fibular muscles (FB, elevator muscles of the foot, soleus), of the TFL and Quadriceps (see adhesiolysis chapter);

However, if **the subluxation happened several weeks ago**, there would ideally be 5 long preparatory sessions (in 1 week) combining:

- | **Relaxing and antalgic electro-stimulation (Fig. 68) of the elevator muscles of the foot and soleus.**
- | **Capillarization physiotherapy** of the proximal and distal Tibio-fibular ligaments.
- | Warm baths of the lower limb: “the glued sections become unglued much easier with heat and humidity”, D. Wolff.

NB: : Impatient, I carry out manipulations from the first session, at the detriment of the patient’s comfort, as adhesiolysis is rather painful. They don’t mind you doing it because they will improve. For your first adhesiolysis sessions, I could advise for you to “anesthetize” the patient. This allows you to break the adhesions and release the contractures, for example, so that the reduction of a fibular head subluxation continues. If not, “the spring effect” will quickly misalign the fibula again.

Fig.68 : Electrostimulation of the elevator muscles of the foot



6.1.2 NUTRITION

We believe that poor nutrition paves the way for adhesions. For example, hyperacidic tissue [uric and oxalic (Fig. 69)] leads to crystallization between the fasciae, thus progressively reducing their ability to slide. The examination, and laboratory tests if necessary, make it possible to propose an adapted diet to the patient (Fig. 70) until they are healed. Experience shows us that those who follow this diet heal the fastest, and that the majority stick to this type of nutrition later.

Fig.69: FOODS TO AVOID

- **URIC ACID:** meat, cold cuts, dairy
- **OXALIC ACID:** coffee, black tea, refined sugar
- **SWEETS:** cake, bread, energy bars, energy drinks, soda
- **ACIDIC SATURATED FAT:** cooked fat, milk, yogurt, cheese
- **INTESTINAL PERMEABILITY:** dairy, gluten, cooked fat, refined sugar, soda



Fig.70: ENCOURAGED FOODS

- **ALKALINE:** fresh fruits and vegetables, dried fruits (never industrial fruit juice, not even if it's organic!)
- **VITAMIN D:** fish, crustaceans
- **OMEGA 3:** almonds, walnuts, raw hazelnuts; avocados, olives; fish, organic egg whites



6.2 ADHESIOLYSIS OF THE LOWER LIMBS

Dynamic Manual Adhesiolysis (Fig. 71) must break, in priority, the adhesions of the anterolateral thigh muscles: quadriceps, ilio-tibial band and the Femoral Biceps.

It is important to also perform a quick Adhesiolysis of the leg.

Fig.71 : Adhesiolysis between the Vastus lateralis and the Iliotibial band.

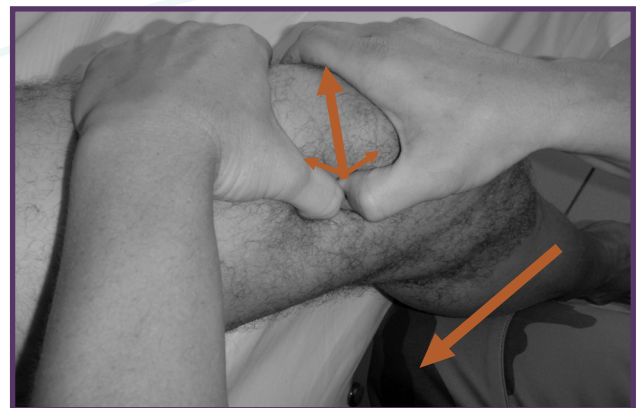


Fig.72 : Hematomas caused by Adhesiolysis

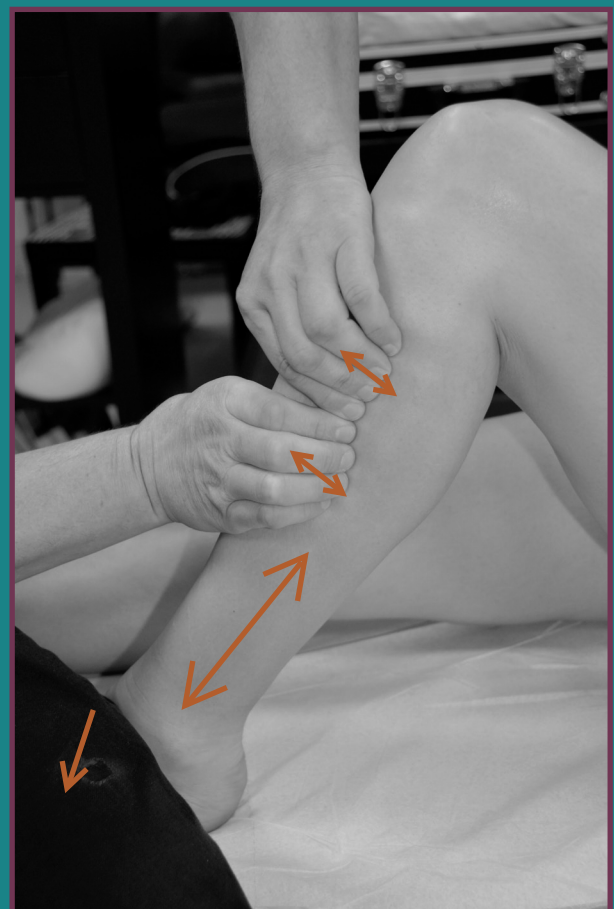
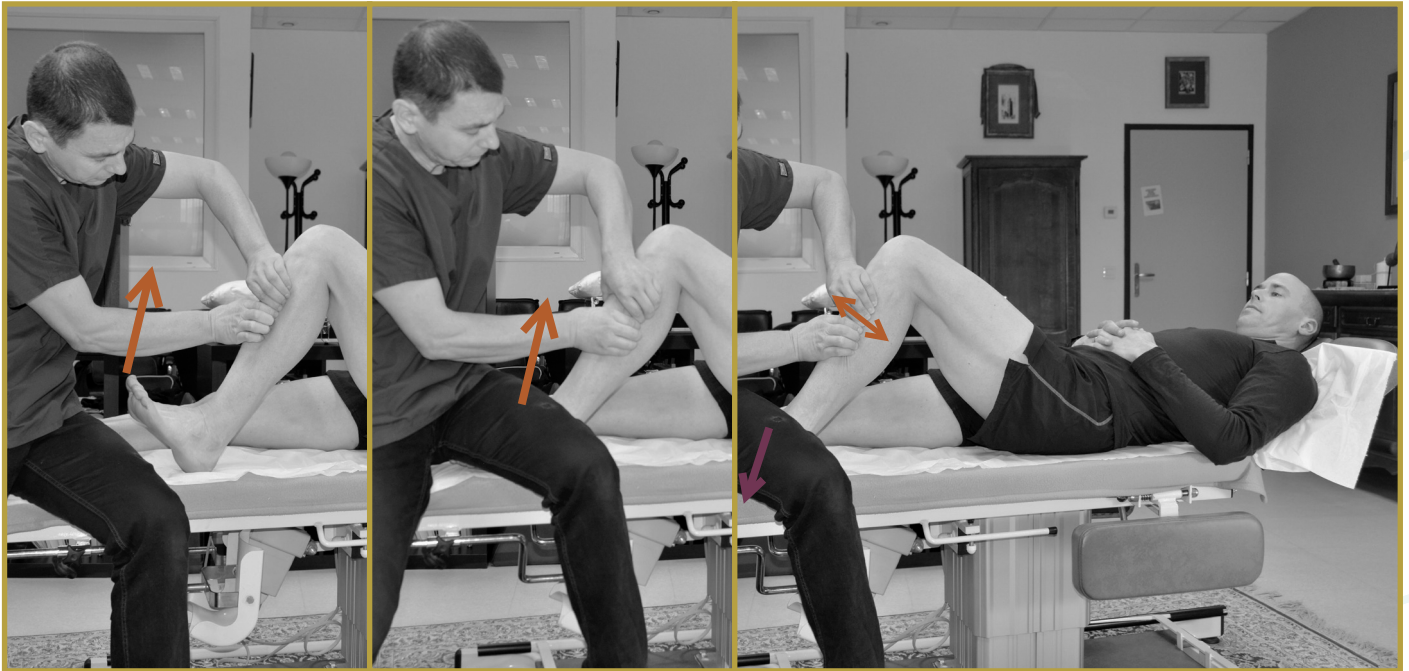
This can be interpreted in different ways. For example, the patient holds the leg, in a way which lets them grasp the leg well and insert their fingers, here between the vastus lateralis and the iliotibial band. When the patient flexes the knee, the practitioner mobilizes the m. vastus lateralis on the deep muscular layer.

The only secondary effect is the possibility of a superficial hematoma (Fig. 72), especially in women during the first session. The manipulation is much less painful through the pants, sparing the cutaneous receptors that do not interest us.



It is more practical to begin Lower limb Dynamic Adhesiolysis with the least sensitive muscles[to extensors, peroneus] (Fig. 73) and to finish with the most contracted and sensitive muscles: calf (Fig.74), Quadriceps, Iliotibial band (Fig. 75) and Femoral Biceps(Fig. 76).

Fig.73 : ADHESIOLYSIS of the Antero-lateral Area of the leg



- 1) 1) The patient lifts their toes. Sit on the foot for resistance. Place the fingers between the muscles of the antero-lateral area: toe retractors, anterior tibialis, peroneus, and Soleus.
- 2) Upon releasing their foot: deeply mobilize each fascia.

Fig.74 : CALF ADHESIOLYSIS

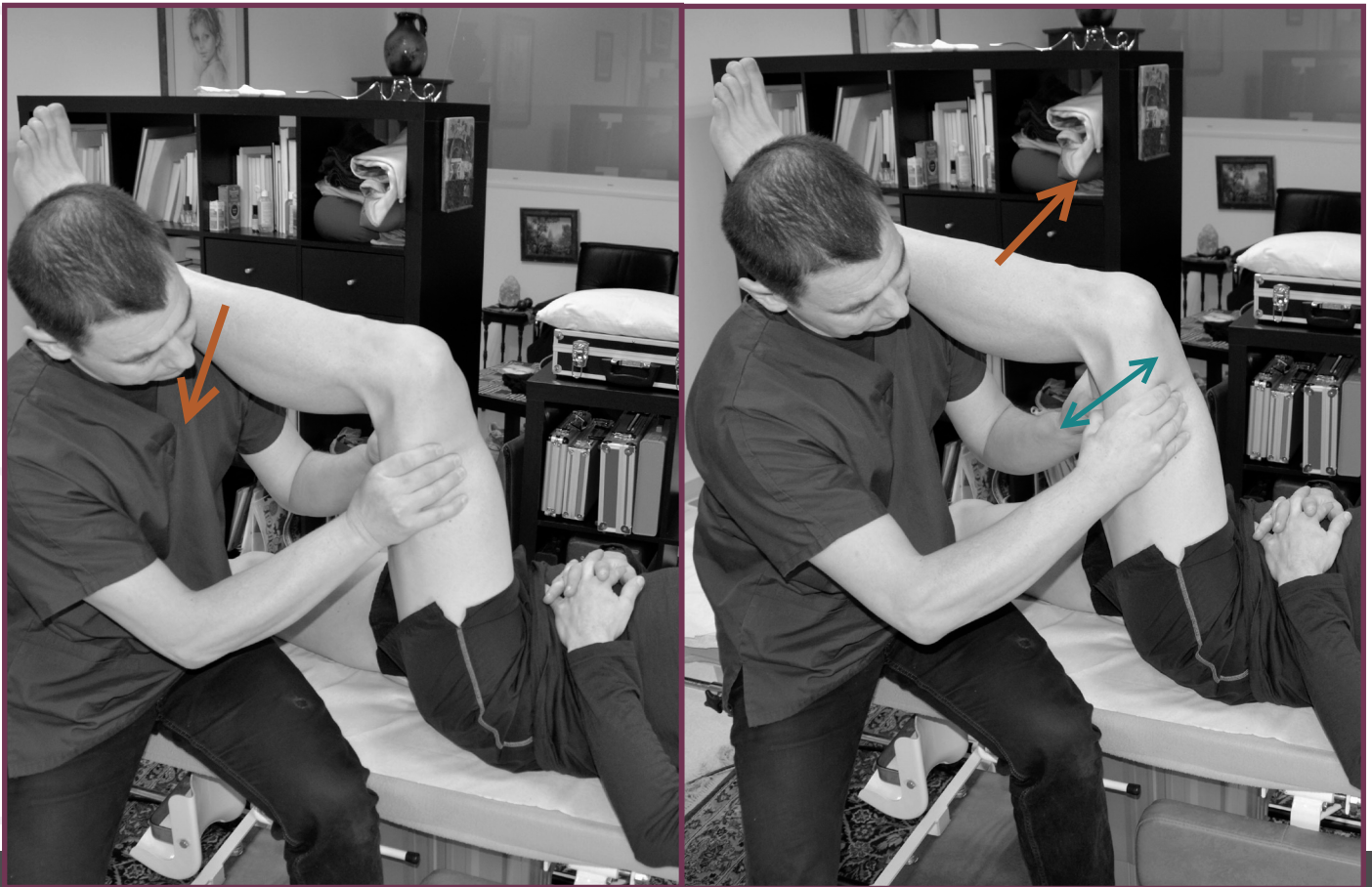


- 1) The patient performs a plantar flexion “as if pressing the gas pedal”, which allows the practitioner to insert their fingers between the calf muscles: soleus, gastrocnemius, tibialis posterior, toe and hallucis flexors.
- 2) Upon releasing the calf, we can deeply mobilize each fascia against each other.

NB: Frequently, patients see their cramps decrease due to an improvement in lower limb circulation.



Fig.75 : ADHESIOLYSIS of the POPLITEAL FOSSA and HAMSTRING



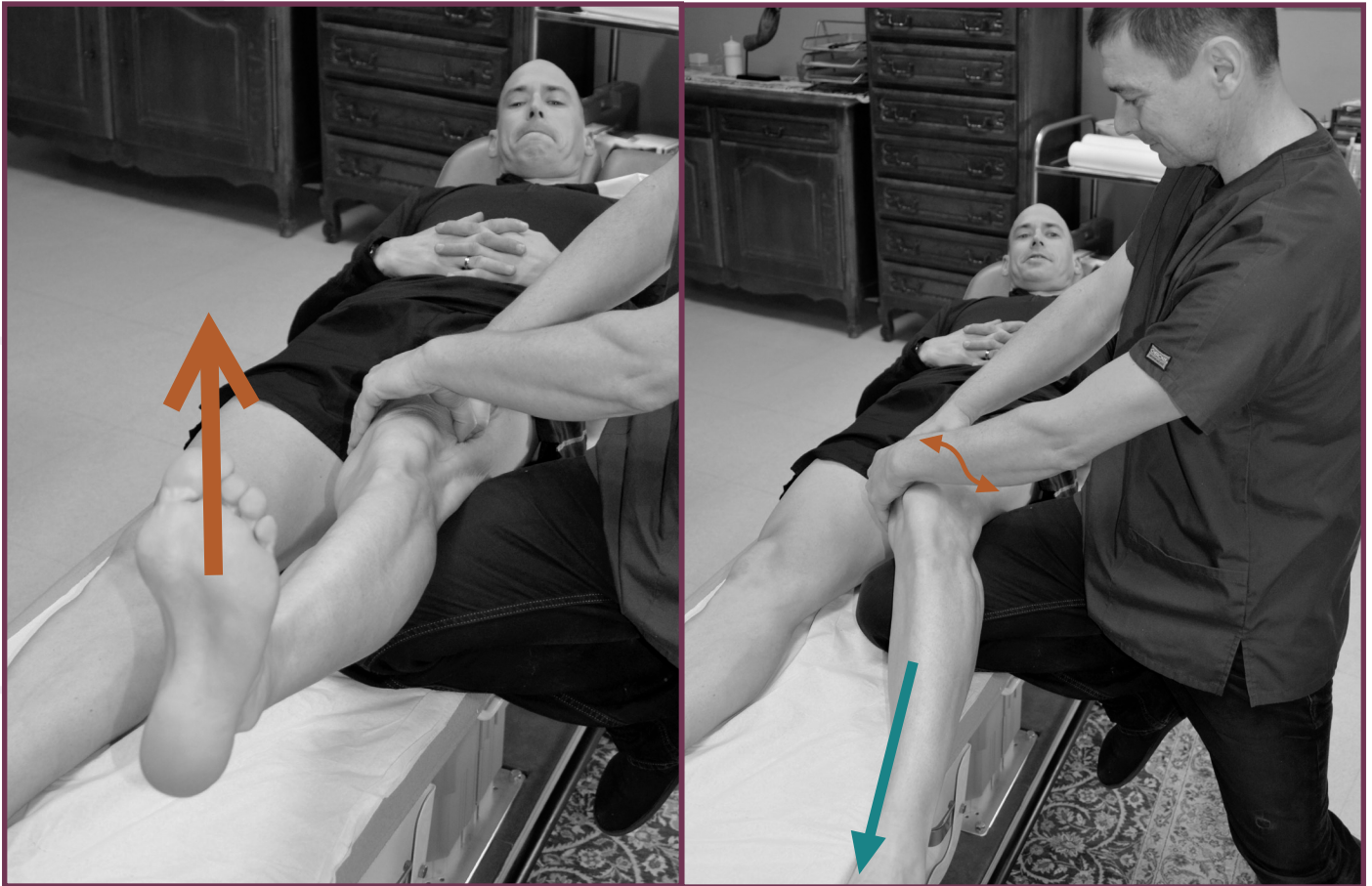
1) The patient lowers their leg 1/second on the practitioner's shoulder, who inserts their fingers between the muscles of the posterior thigh, popliteus, ligaments...

2) When the patient releases their leg: the thumbs mobilize all the musculotendinous fasciae and ligaments.



Fig.76 : ADHESIOLYSIS of the ANTEROLATERAL aspect of the thigh

1) The patient lifts their leg in order to make the anterolateral thigh muscles palpable. The practitioner can then insert their fingers between the different muscular layers.



2) When the patient lowers their leg: one mobilizes the Superficial Fasciae: Rectus femoris, Vastus Lateralis+++, TFL, Femoral Biceps – all while separating them from the deep layer: Vastus Intermedius.



6.3 REDUCTION OF THE FIBULAR HEAD

For manipulation, it is enough to know the direction of the subluxation in the vertical and sagittal planes.

ANTERO-SUPERIOR SUBLUXATION (THE MOST COMMON): “BEAR CLAW” TECHNIQUE (FIG. 77, 78)

Fig.77 : Superior subluxation

In the first place, it is reduced to open up or lift off the fibular head. The patient is seated at the edge of the table to reduce tension. The practitioner performs a “whiplash” motion up and down with the palm of the hand on their thenar eminence, interposed on the styloid process.



Fig.78 : Anterior subluxation

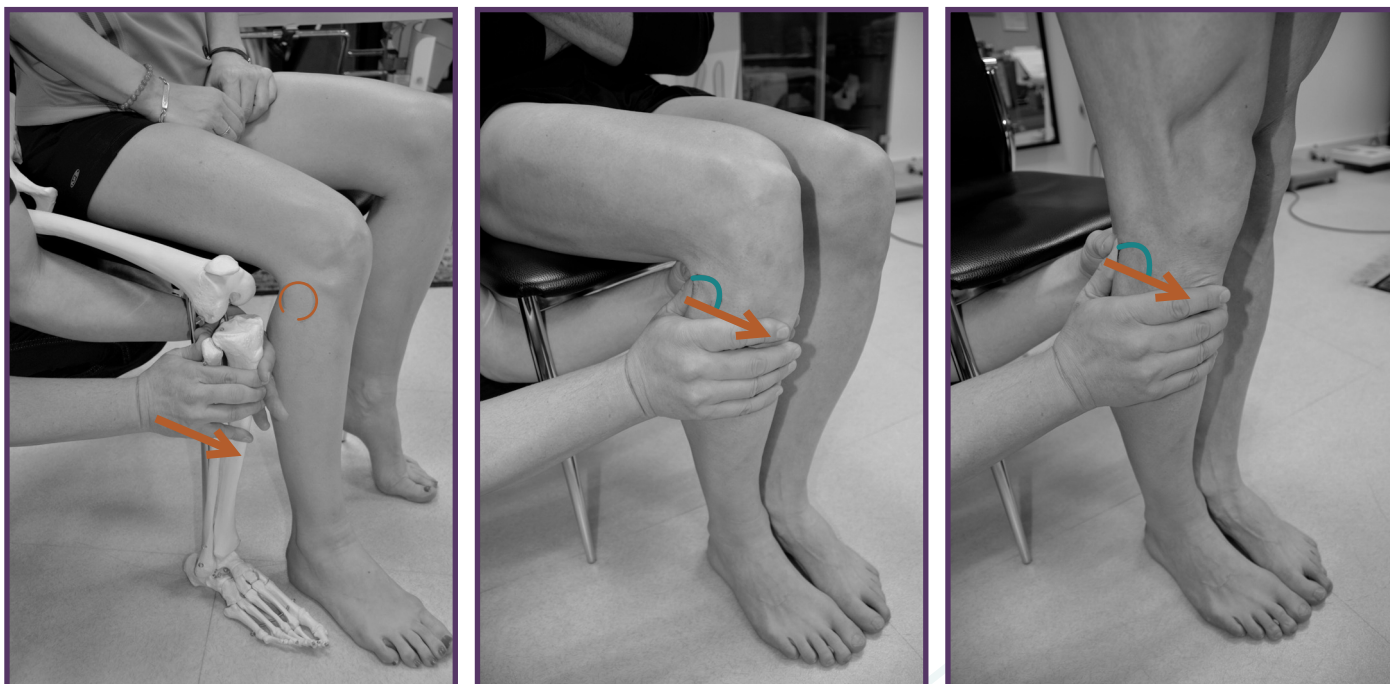
The patient is seated at the edge of the table with the practitioner's knee behind their heel. The practitioner changes the orientation of the “whiplash” in regard to the rotation of the fibular head.



6.3.1 REDUCTION OF THE POSTERO-SUPERIOR FIBULAR HEAD (FIG. 79)

Fig.79 : Chair technique – crossed thumbs :

Keep the fibular head forward and down while the patient stands up. Repeat when they sit back down.



Among the different reduction methods, my favorite is the extremely effective operation of “chair technique – crossed thumbs”, as it can be easily reproduced by the patient in case of recidivism.

The patient is seated on a chair. The practitioner clasps the leg with two hands, the thumbs on top of each other, pressing on the posterior aspect of the fibula. At the same time, the patient stands up until full extension of the knee and the practitioner keeps forward pressure until a projection is felt.

6.3.2 NORMALIZATION OF THE INFERIOR FIBULAR HEAD (FIG. 80, 81)

Inferior subluxation is rare (<10%).

The manipulation can be performed by pressing on the fibular head and possibly on the fibular malleolus at the ankle. The components are stacked, then a quick pressure of the palm is applied without momentum.

Fig.80 : Reduction of an inferior fibular head subluxation

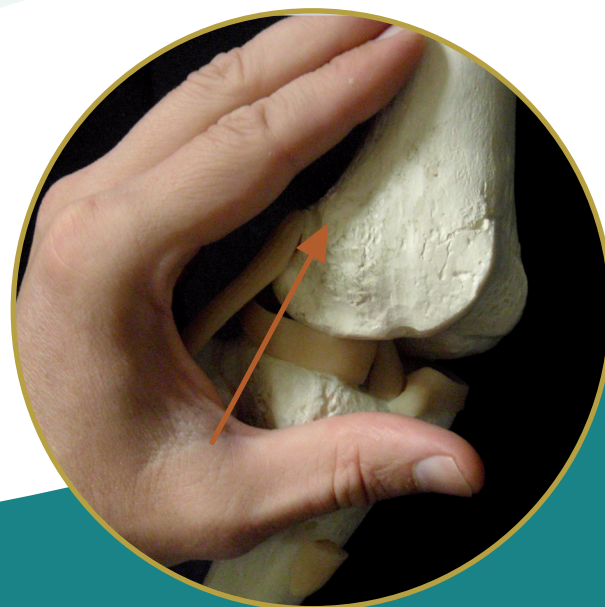


Fig.81 : Chair technique - toothpaste

Firmly grasp the leg just **below the fibular head**.

It is the **metacarpophalangeal articulation of the index**, which indicates the orientation of the force to be applied.

NB: An antero-inferior subluxation and/or internal rotation is the most difficult to normalize, as the fibular head has become used to "enclaving" in the posterolateral aspect of the lateral tibial condyle and consolidation can only be achieved by laying strapping.

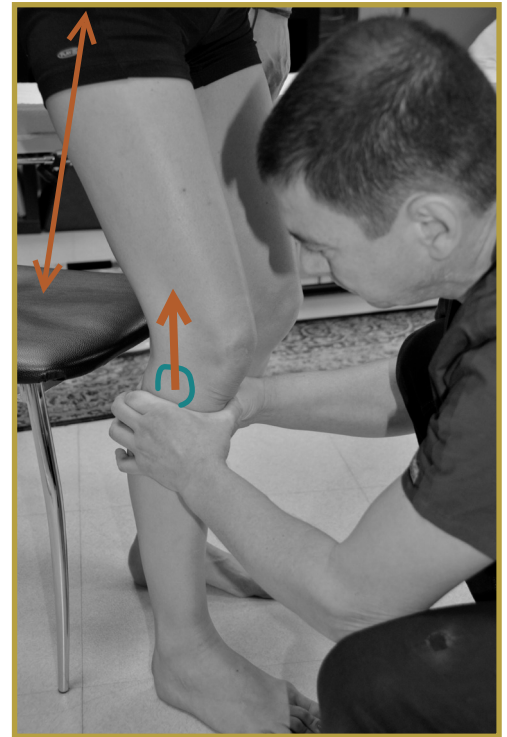


Fig.82 : Isometric contraction of the Quadriceps

After the Adhesiolysis, re-align the muscles and patella for an isometric contraction of the quadriceps (Fig. 82).



6.4 NORMALIZATION OF THE SUBLUXED LATERAL

Flex the knee and hip to the maximum. Then, abruptly straighten the lower limb, all while keeping strong pressure with the fingers on the lateral spacing. Perform this operation once with the foot in lateral rotation and then in medial rotation.

NB: If the extension is too slow, the meniscus can "escape." The maneuver is safe as long as there is no acute injury.

Fig.83 a :

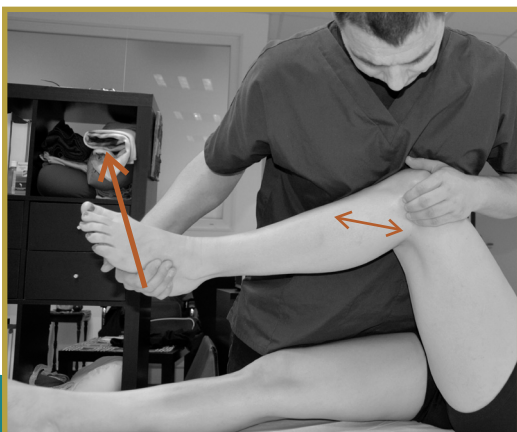


Fig.83 c: Foot in medial rotation



Fig.83 d: Foot in lateral rotation



6.5 CAPSULAR LIBERATION

6.5.1 CONSERVATIVE CLASSICAL TREATMENT

A review of the literature, together with a meta-analysis [27], shows that conservative treatment is ineffective.

CONSERVATIVE CLASSICAL TREATMENT:

- | Rest with limitation of painful activities
- | Analgesics, A.I.N.S. local and for bone, cryotherapy, intra-plical and intra-articular steroid injections...[47, 48]
- | Common manual therapies: fibrolysis of the plica by deep friction, hooking and scrapping (Chinese technique of grating across lubricated skin "Gua Sha")...; manipulations of the knee, the pelvic joints, the ankle...
- | **Taping** to relax overloaded muscles (TFL, fibular muscles), to facilitate weak muscles (gluteus medius) and analgesic on the plica.
- | Muscle relaxants (Pes Anserinus, sural triceps, TFL) and reinforcement of the quadriceps, abductors, and external rotators of the hip.
- | Overall postural reprogramming...

CONCLUSION : In spite of all these therapies, the healing rate is low. Arthroscopy must be considered after 6 months of failed conservative treatment. 34% of patients are healed and 65% can begin again with athletic activity [49]. If the plica is torn, arthroscopic resection is the only treatment possible.

6.5.2 ADHESIOLYSIS OF A SYNOVIAL SNAPPING

Manual liberation of a snapping of a synovial fold or plica is effective if functional impairment is reduced or disappears from the moment the patient gets off the examination table!

ADVICE :

Once the anatomy is repaired, perform the adhesiolysis through the clothing or a towel to spare the cutaneous receptors and reduce the manipulation pain. It is more comfortable when the lower limb is warm and softened (i.e. preparation), then iced to avoid superficial hematomas and to be able to begin again with adhesiolysis the next day without discomfort or pain.

a. OPEN JOINT LIBERATION of a plica (Fig .84)

Fig.84 : Example of an inferolateral plica



After every capsular liberation, re-evaluate flexion, which should become less and less painful!

b. ASPIRATION of a plica by “deep feeling and rolling” (Fig. 85a, b) in the vertical and horizontal directions (Fig. 86, 87, 88).

Fig.85 : Liberation of an superior plica

a: In vertical direction



b: In horizontal direction



Fig.86 : Liberation of a medial plica

In the horizontal
direction



Fig.87 : Liberation of an inferior plica



Fig.88 : Liberation of a lateral plica

In the horizontal direction



C. ASPIRATION of a plica with KOCHER'S FORCEPS (Fig. 89a ,b)

If one does not have enough power in the fingers, or if the area of the skin is too tense: use blue plastic Kocher's forceps(which are sold as single units or as a bandages) – while protecting the cutaneous receptors with a cloth. Keep the ends of the clamp closed between the fingers of the free hand, then pull lightly.

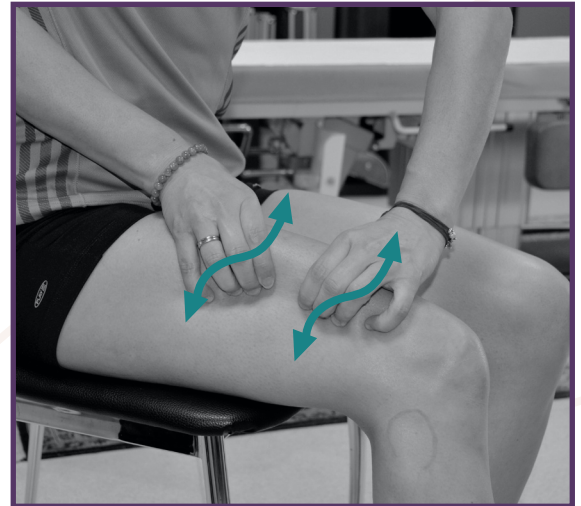
Fig.89 : Capsular liberation with plastic Kocher's forceps



7. CONSOLIDATION

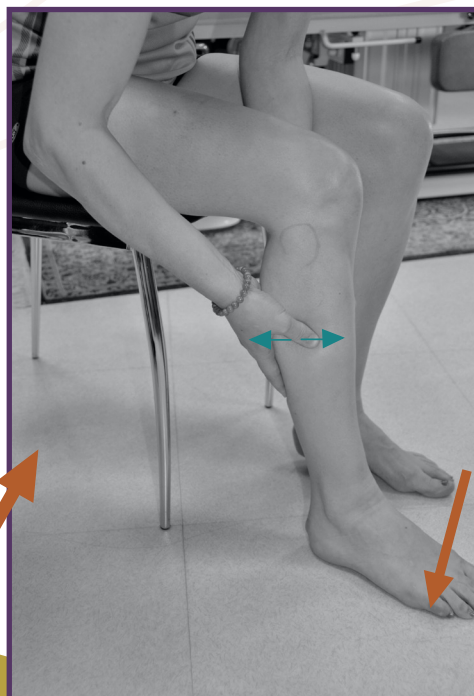
7.1 SELF-MANIPULATION OF ADHESIONS (FIG.90,91,92,93)

Fig.90 : Self-Adhesiolysis of the Anterolateral THIGH



- 1) Lift the leg, then insert the fingers between the muscles
- 2) Lower the leg and mobilize the superficial layer: rectus femoralis, vastus lateralis+++, TFL, femoral biceps – all while separating them from the deep layer: vastus intermedius+++

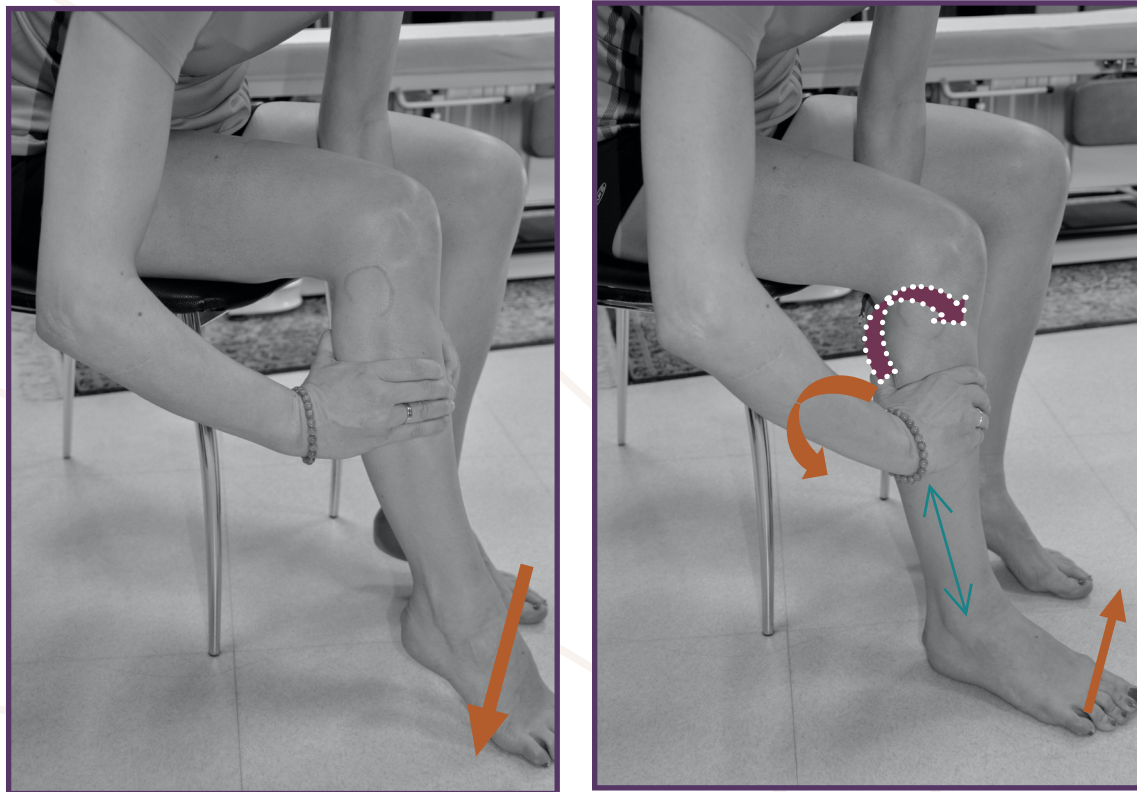
Fig.91 : Self-Adhesiolysis of the Anterolateral Area of the Leg



- 1) Dorsal flexion of the ankle to insert their fingers between the muscles of the anterolateral area.

- 2) During plantar flexion: deeply mobilize each of the fascia among themselves.

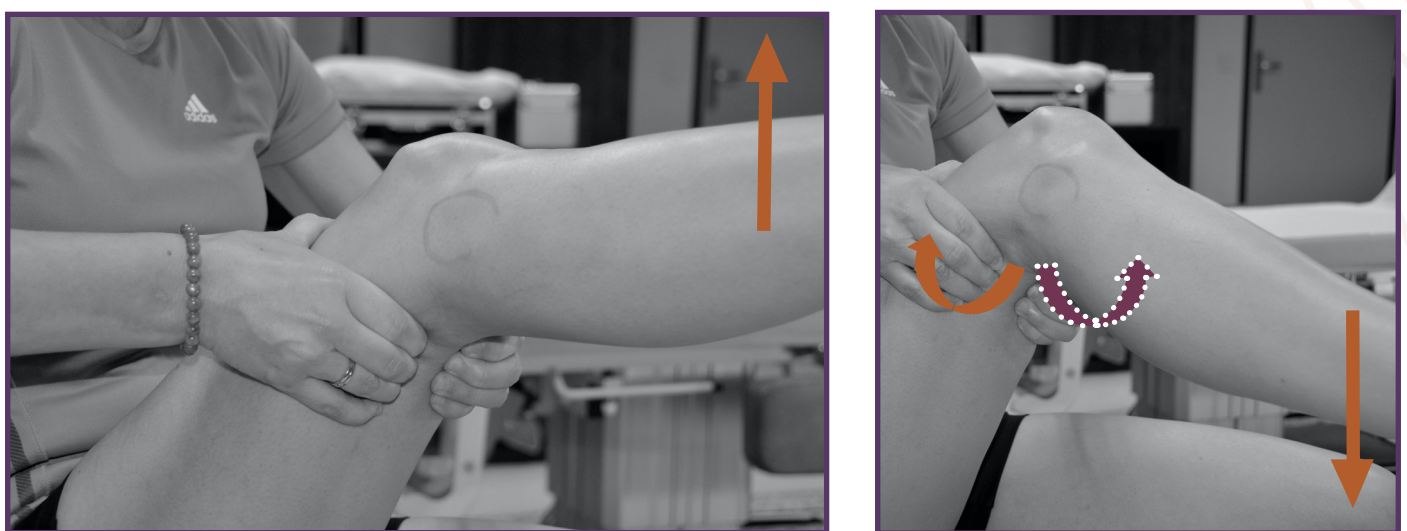
Fig.92 : Self-Adhesiolysis of the CALF



1) Plantar flexion of the ankle to insert their fingers between the calf muscles: medial and lateral gastrocnemius and the soleus on the toe flexors, the tibialis posterior.

2) During dorsal flexion: deeply mobilize each fascia.

Fig.93 : Self-Adhesiolysis POPLITEAL and Hamstring areas



1) Lift the leg: makes it possible to insert fingers between the muscles of the posterior thigh

2) Lower the leg: mobilize all musculotendinous fasciae

7.2 SELF-MANIPULATION OF THE FIBULAR HEAD

ANTERIOR AND SUPERIOR SUBLUXATION OF THE FIBULAR HEAD

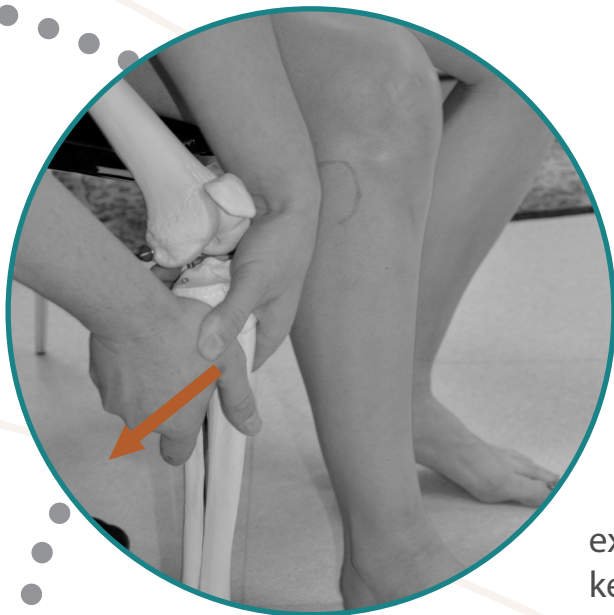


Fig.94 : Chair exercise: “hammering a nail”

Place their thenar eminence on the fibular head, held firmly by the other thumb. Stand up and sit down, while keeping the fibular head down and to the back. Repeat 3x: morning, evening, and after exercise until the re-aligned muscles of the lower limb keep the fibula in all their movement. There is no risk for adults of subluxing the fibular head in the other direction, as the patient uses their own force.



NB: check to ensure that the patient is not pressing on the anterolateral tibial plateau (a common error, thankfully not serious).



Variation:
The palm of the hand
can replace the thumb

POSTERIOR AND SUPERIOR SUBLUXATION (FIG. 95, 96)

Fig.95 : Chair exercise: crossed thumbs

Cross the thumbs on the posterior side of the styloid process of the fibular head. Stand up and sit down while keeping the fibula forward and down. 3x morning and evening.

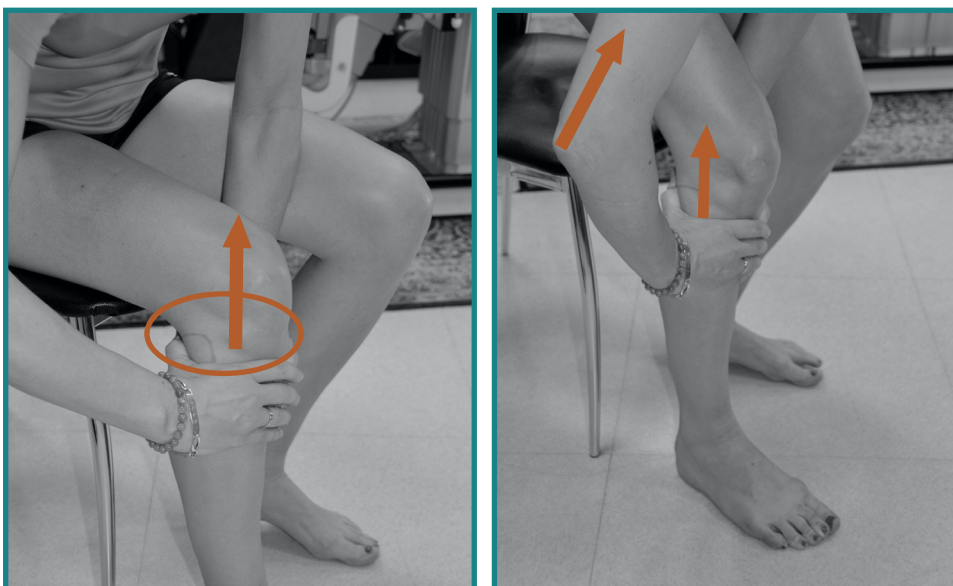


Fig.96 : Easier variation +++ stacked thumbs



INFERIOR Subluxation of the FIBULAR Head (Fig. 97)

Fig.97 : Chair exercise: toothpaste



Grasp the leg firmly just below the fibular head.

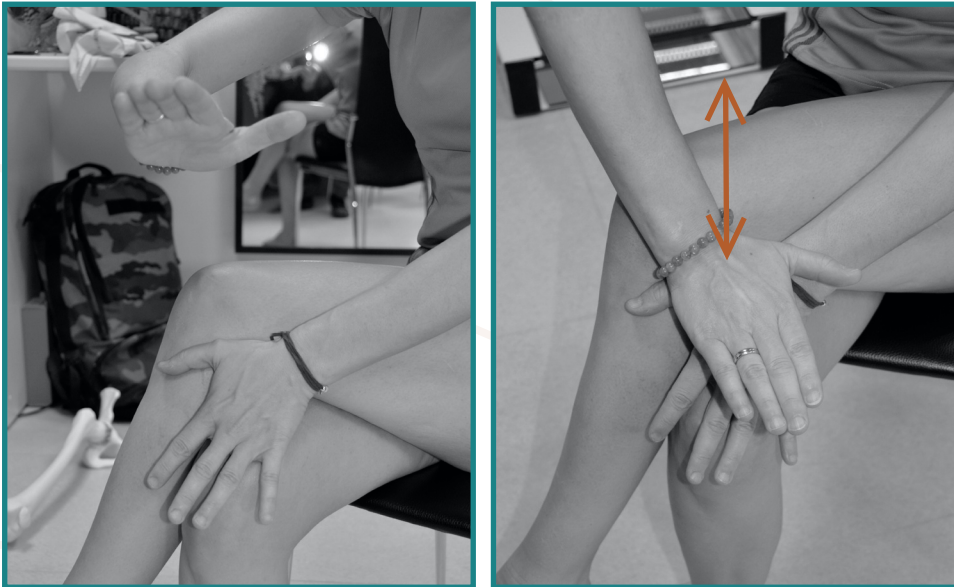
The metacarpophalangeal joint of the index which shows the direction to apply force.

3x morning and evening

If self-manipulations are not effective, and the diagnosis is certain, it is likely because the superior component is more important than the anteroposterior component. In this case, I lower the fibular head ("bear claw" technique) and improvement is immediate

SUPERIOR subluxation of the fibular head (Fig.98)

Fig.98 : Chair exercise: "bear claw"



This means that the superior fibular head is too "embedded" in the tibia, so the patient is neither able to pull it back nor push it forward. In this case only, I would use the "bear claw" technique. The thenar eminence is placed horizontally on the superior part of the fibular head and the other palm of the hand gives an abrupt light push, focusing on the rapid return of the palm.

7.3. CONSOLIDATION OF THE FIBULAR HEAD

a. Elastic adhesive contention of the fibular head = STRAPPING (Fig. 99, 100, 101)

After reduction, consolidation strapping is applied for ≈ 5 days in order to keep the fibular head in place at all times.

Remember to clean the skin to limit any risk of allergy.

Shaving is not necessary (the more hair, the better it holds!), under the absolute condition that an anti-adhesive is used to remove the bandage, in order to respect the cutaneous receptors!

Remove the fibers at the end of the band, so that the strapping will be more water resistant.

Fig.99 : Strapping



Fig.100: STRAPPING: ANTEROSUPERIOR right fibular head



Pull the band tightly backwards

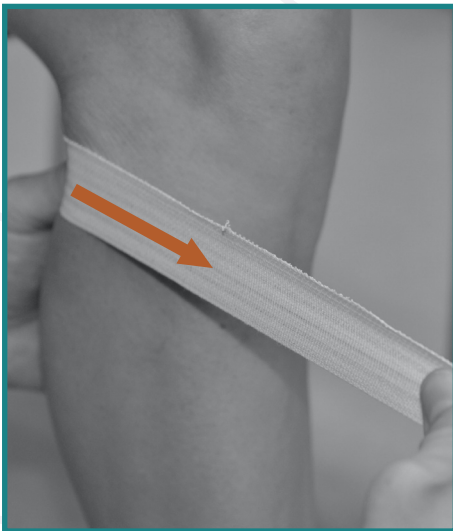


Then, relax the band to respect circulation



The second layer is pulled down and backwards

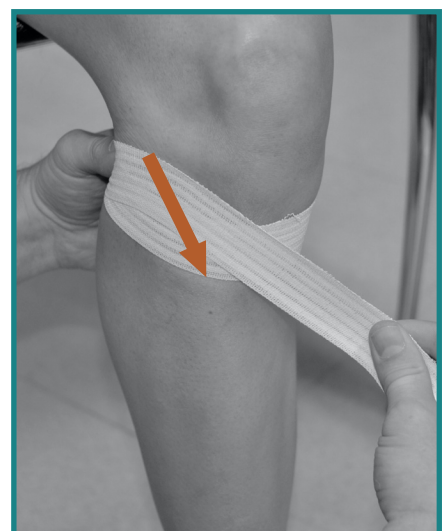
Fig.101 : STRAPPING: POSTEROSUPERIOR right fibular head



Pull the band tightly forwards



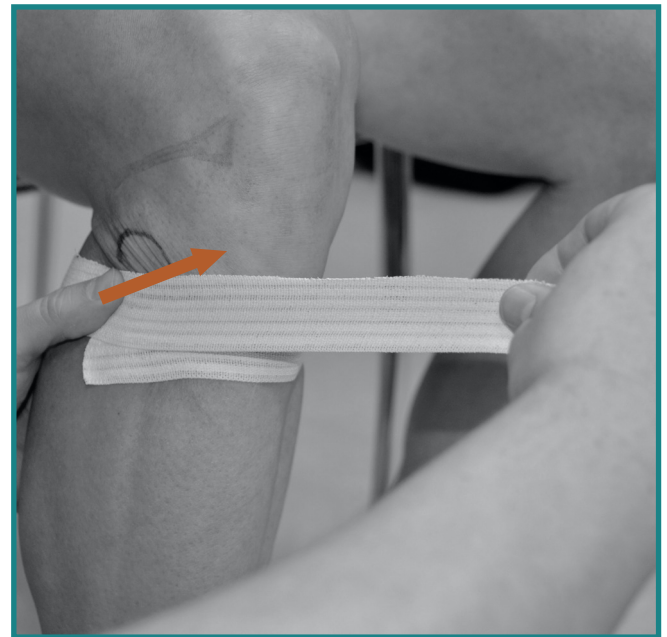
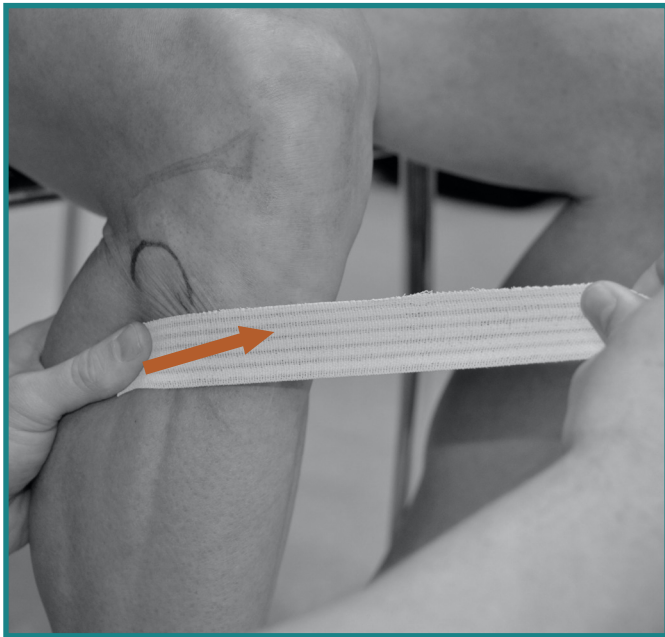
Then, relax the band to respect circulation



The second layer is pulled down and forwards

In the case of an inferior subluxation of the fibular head, strapping (Fig . 102, 103) is more difficult to apply, but much more efficient than using a flexible brace that does not allow the fibular head to be “mounted.” Thankfully, these cases are not common ($\approx 10\%$).

Fig.102 : STRAPPING: ANTEROINFERIOR right fibular head



- | Apply pressure **BENEATH** the fibular head!
- | Tightly pull the layers of the band upwards and forwards
- | Remember not to compromise the calf muscles in order to respect circulation!

Fig.103 : STRAPPING: ANTEROINFERIOR right fibular head



- | Apply pressure **BENEATH** the fibular head!
- | Tightly pull the layers of the band upwards and backwards
- | Remember not to compromise the calf muscles in order to respect circulation!

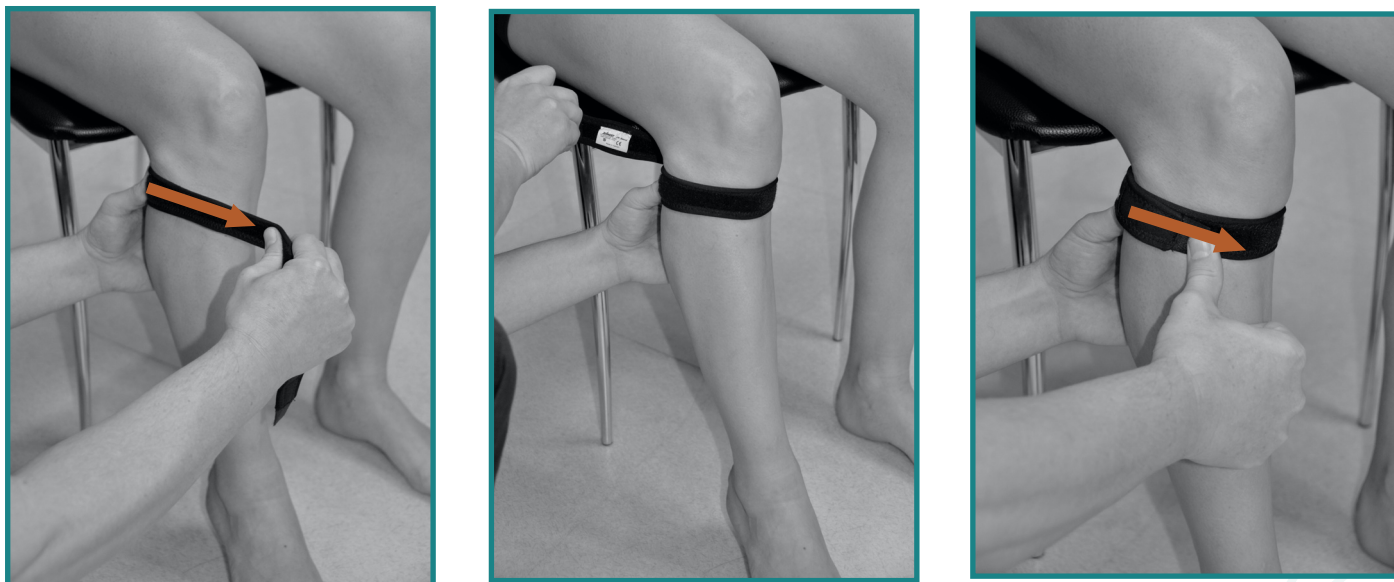
TO NOTE

If there is any doubt in the diagnosis, especially when both sides are affected, the comparative diagnosis is difficult, as the normal aspect is uncertain. In these cases, a “contention test”, keeping the fibular head in the direction of the desired normalization, is the diagnostic test.

b. Brace contention of the Fibular Head

In order to preserve the skin when strapping, we use a flexible neoprene contention brace (Fig. 104, 105, 106, 107), normally used for patellar tendinopathies, which we use to properly maintain the fibular head. The brace is worn during the day for two weeks (the time needed for the Superior Tibiofibular to heal), thereafter when the patient begins to exercise again – if they haven't already – and then only during dangerous activities. The foam cushioning the patellar tendon is not essential in the way we are using it. Thus, it should be removed for patients whose skin is irritated by this foam!

Fig.104 : POSTERIOR Subluxation of the Fibular Head



- | Contrary to strapping, a brace can even be tightened behind the calf
- | Continuously maintain pressures towards the front of the fibular head, especially when it is closed.

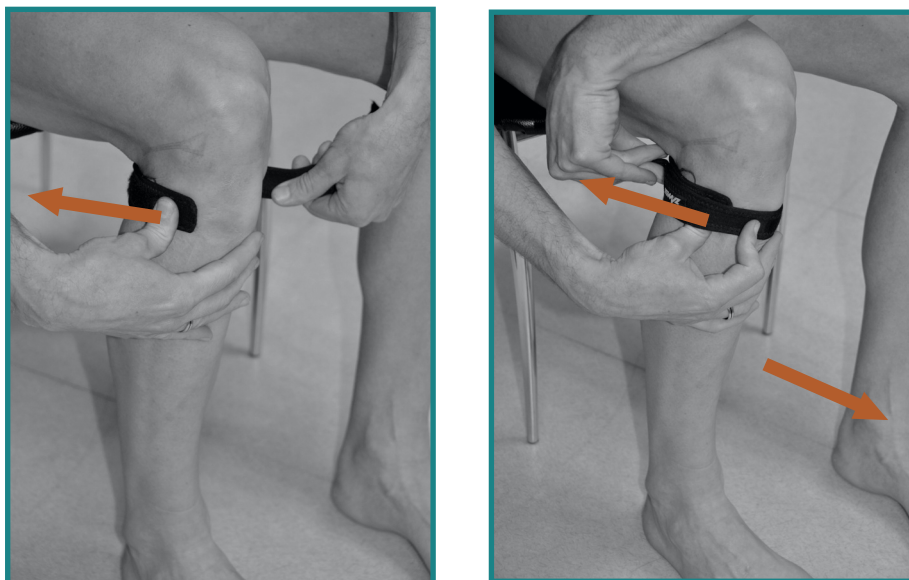
Fig.105 : ANTERIOR Subluxation of the Fibular Head



- | Contrary to strapping, a brace can even be tightened behind the calf
- | Continuously maintain pressures towards the rear of the fibular head, especially when it is closed.

After **8 weeks**, the body should be rebalanced (the adhesions gone, the patella realigned, the muscles reinforced... which will keep the fibula in place), thus the bandage is only needed during dangerous sports.

Fig.106 : ANTERIOR Subluxation of the Fibular Head



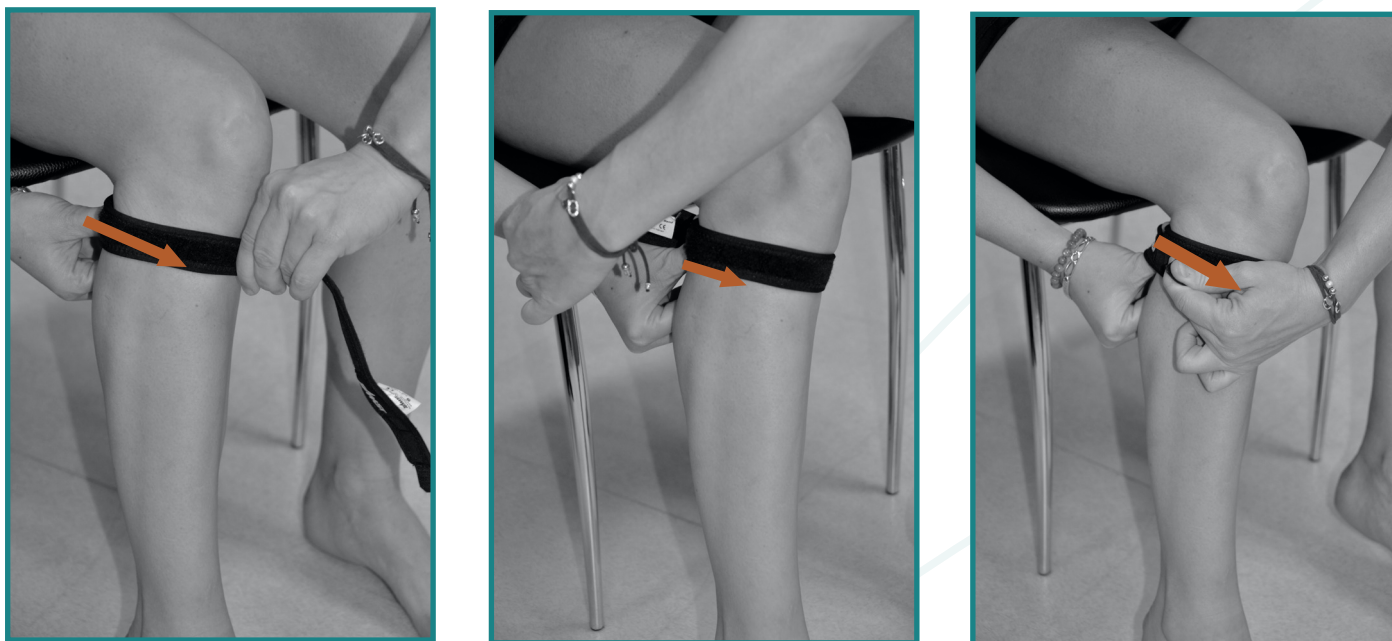
The implementation of the flexible brace "by themselves" is a bit "acrobatic" at the beginning. Therefore, we advise the patient to practice while the strapping is still in place! This brace is ineffective for inferior subluxations of the fibular head, or we prefer to teach the patient a modified kind of strapping.

NB: this brace can be used by swimmers.

CONTRARY TO STRAPPING, A BRACE CAN EVEN BE TIGHTENED BEHIND THE CALF

| Continuously maintain pressures towards the rear of the fibular head, especially when it is closed.

Fig.107 : POSTERIOR Subluxation of the Fibular Head



CONTRARY TO STRAPPING, A BRACE CAN EVEN BE TIGHTENED BEHIND THE CALF

C. Active reinforcement and Stretching of the fibular muscles

Recidivism is common (15%), especially when the malpositioned PTF is old or hypermobile. A reinforcement protocol of the tibiofibular region should be proposed in order to limit these relapses and to reinforce the muscles keeping the fibula in the right position. However, manipulation is easier after each relapse and the patient, knowing how to self-manipulate and apply bandages, can take up the effort quickly. A simple strengthening exercise is presented to the patient. In the so-called "chair" position, with the back to the wall, knees bent to 90° to unlock them. They perform a series of isometric contractions of 8 seconds, changing position from the balls of the feet to the heels. Active stretching first requires isometric muscle contraction (without visible motion, from 1 to 3 seconds) in order to stretch the muscles.

ANTERIOR Subluxation of the Fibular Head

Focus on active stretching of the anterior line of the lower limbs and the strengthening of the posterior muscles (remaining longer (12 seconds) on the balls of the feet, the heels raised (Fig. 108).

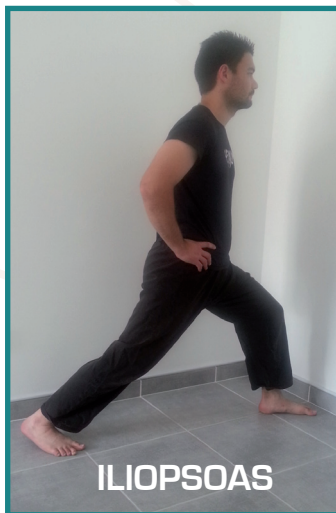


Fig.108a : Active stretching of the anterior line

Fig.108b : Strengthening of the posterior line

POSTERIOR Subluxation of the Fibular Head

Focus on strengthening the anterior muscles: quadriceps, elevator muscles of the feet (balls of the feet lifted) (Fig. 109) and active stretching of the posterior line (Fig. 110) of the lower limbs.

Fig.109 : Strengthening of the anterior line



Fig.110 : Active stretching of the posterior line



7.4. Self-manipulation of the subluxed lateral

If, after fibular reduction, pain remains in the popliteofibular or popliteomeniscal ligament: even if the lateral spacing is painless upon palpation, it is necessary to attempt a reduction maneuver of a possible subluxation of the lateral meniscus (Fig. 111a, b). If flexion is improved, we can immediately teach the patient to self-manipulate the lateral meniscus so that it can heal.

Fig.111a : Find the lateral tibiofemoral joint space



Perform a dorsal flexion of the ankle and mobilize it from right to left several times while pressing with the flesh of the fingers to feel the joint space, which moves less than the tibia and the femur. Rarely, this is enough to reduce the lateral meniscus subluxation.

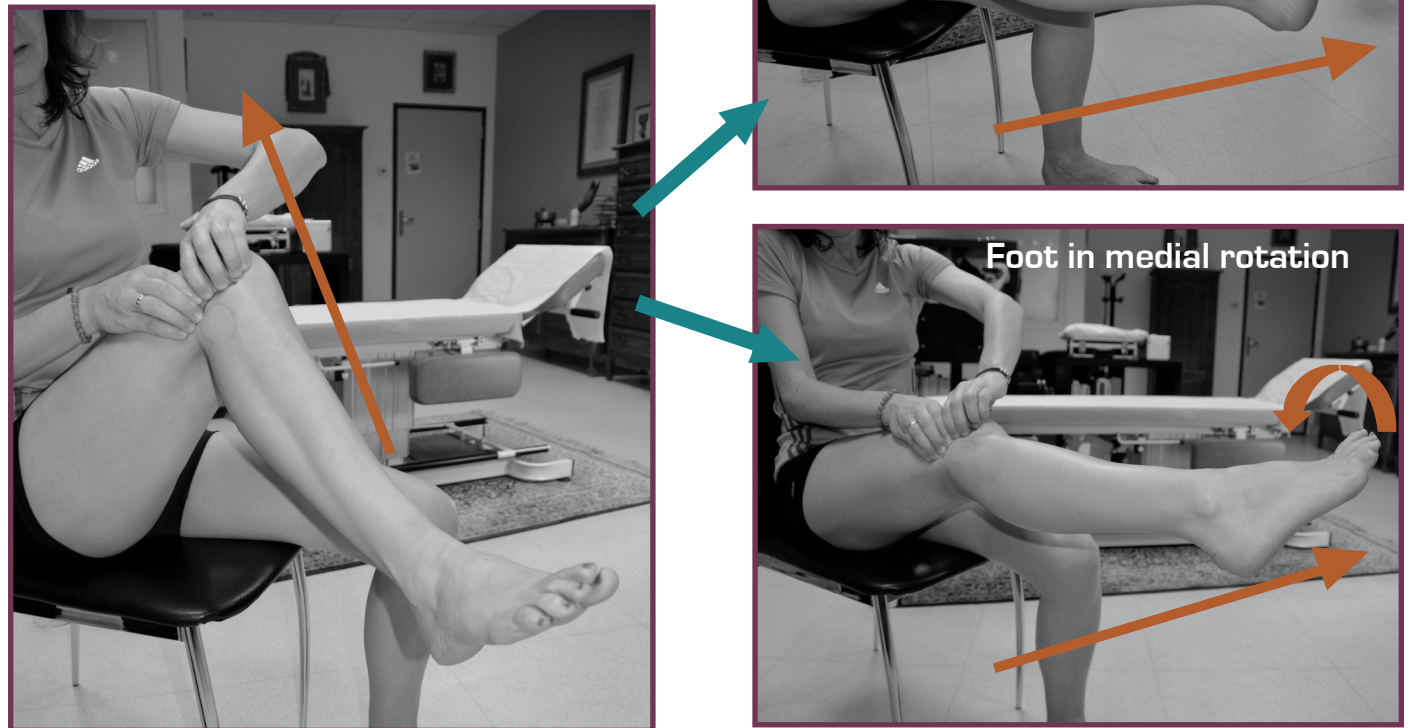
NB: This maneuver on the medial joint space is very useful in subluxations of the medial meniscus, much more common but often surgical!



Fig.111b : Reduction of the lateral meniscus

Flex the knee and hip as much as possible. Then, abruptly extend the lower limb, while keeping strong pressure with the fingers on the lateral joint space. Perform this maneuver once with the foot in lateral rotation and then with the foot in medial rotation.

NB: If the extension is too slow, the meniscus can "escape". There is no risk involved, unless there is an acute injury present.



7.5. SELF-MANIPULATION of a PLICA and a SNAPPING CAPSULE

SELF LIBERATION OF A SYNOVIAL FOLD:
Example of a medial pathologic plica(Fig.112,113,114)

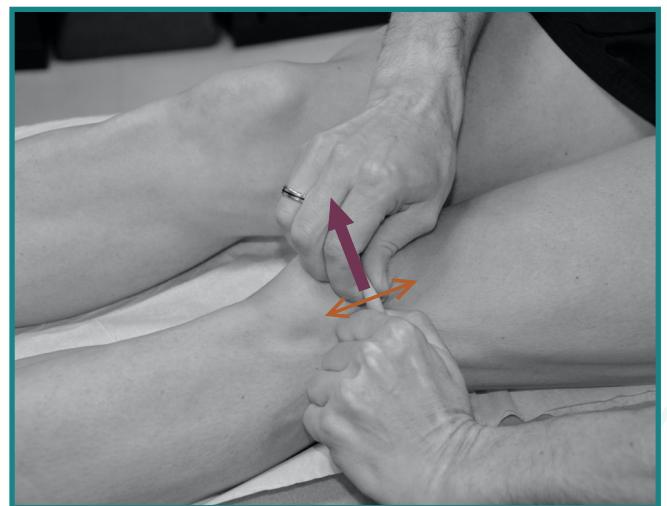
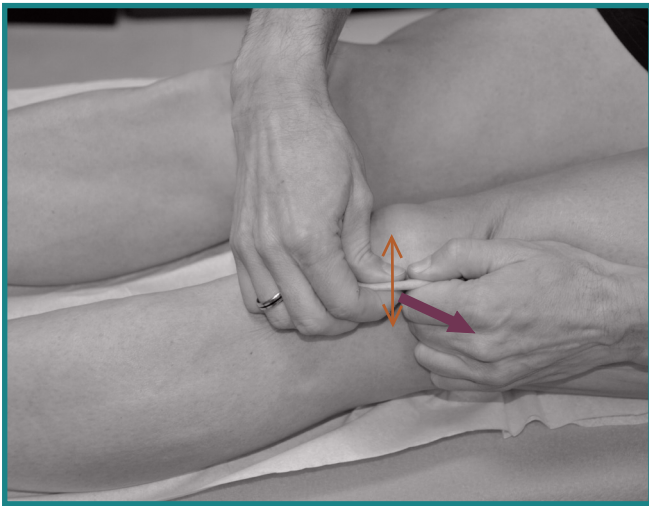
ADVICE: Once the anatomy is repaired, perform the adhesiolysis through the clothing or a towel to spare the cutaneous receptors and reduce the manipulation pain. It is more comfortable when the lower limb is warm and softened (i.e. preparation), then iced to avoid superficial hematomas and to be able to begin again with adhesiolysis the next day without discomfort or pain.

Fig.112 : Self-Capsular liberation while opening the joint (with extended knee)



Pull strongly on the 2 extremities of the fold, while opening the medial femerotibial joint.

Fig.113 : Self-Capsular liberation by “breathing” (“aspiration”)



Pull strongly on the entire cutaneous, sub-cutaneous, and fatty tissue which in turn pulls the capsule (“breathing effect”) outwards: Horizontally...

...then perpendicular

Fig.114 : Self-liberation with Kocher's forceps

If one does not have enough power in the fingers, or if the area of the skin is too tense: use plastic Kocher forceps (which are sold as single units or as a bandages) – while keeping the ends closed in the fingers of the free hand – while making sure to protect the cutaneous receptors with a cloth.



CONCLUSIONS about Pathologic PLICAE

In our experience, even if the medial plica is most commonly pathologic, the 3 other types are also found frequently. We study them extensively, when knee pain under flexion remains after the reduction of the fibula, menisci, and adhesiolysis of the lower limb muscles. Treatment by Capsular liberation makes it possible to treat these pathologic plicae in a few sessions, avoiding surgery. The diagnostic test, capsular liberation in the peripatellar area that is sensitive to palpitation, makes it possible to avoid dynamic ultrasound if the pain is immediately improved, as well as flexion under load.

NB: In the future, we would be interested in the connections between a trapped inferior plica and the Hoffa disorder...

7.6. TREATMENT OF TRAUMATIC SEQUELAE

Fig.115 : Adhesiolysis of the EDL

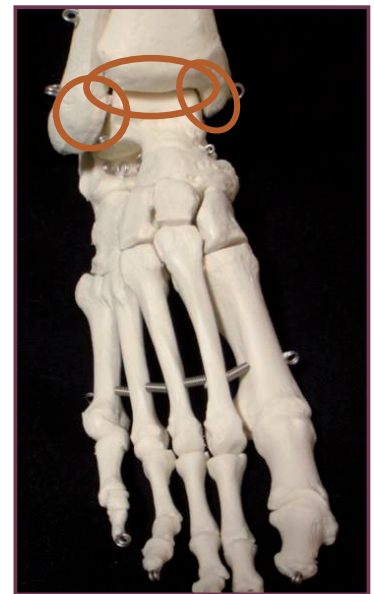
Treat, for example sequellae dysfunctions of a sprained ankle at the beginning of the fibular head subluxation:

I Adhesiolysis of the Extensor Digitorum Longus (EDL), which adheres to the anterolateral part of the ankle (Fig. 115)...

I Aliberation of a trapped capsular fold between the tibia and the talus (Fig. 116)...



Fig.116 : Capsulo-ligamentary snapping of the ankle



7.7. GENERAL REBALANCING

Treat as usual any compensatory dysfunction of the pelvis (Fig. 117), the spine, the contralateral knee, the ankles, and the feet.

Fig.117 : Rebalance the pelvis and the spine



7.8. WHAT KIND OF RESTORATIVE REST AFTER MANIPULATION?

In any case, it is necessary to rest (Fig. 118) at least one night before testing the knee. This is because the night is essential to the reparatory process. The next day, in spite of the multiple pains, knee function should be improved. If the joint is free of inflammation or femoralpatellar cartilage injury, a very progressive repeat treatment is possible as a strapping contention, normally a flexible brace. Ideally, begin physical activities while avoiding rotations of the fibular head (breaststroke, running trails, jumping), so the muscles, once realigned, are solid enough to keep the fibula in place. Bicycling (limiting the rider on steep slopes), the crawl stroke, and in line exercises ("chair", progressive jogging) are perfect! Clearly, if a sporting event is essential for a patient's career or survival, good strapping will help to achieve their goal, at the price of a longer recovery after the event.

Fig.118 : Manual adhesiolysis restarts the self-healing processes which need at least 24 hours of rest.

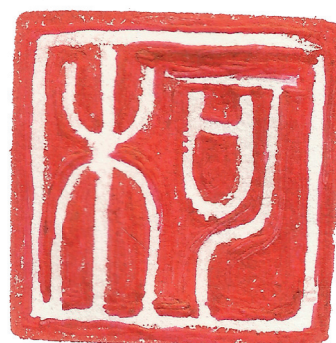


8. CONCLUSION

We believe **that adhesions of the musculotendinous fascia of the anterolateral aspect of the thigh** which are frequently **caused by a malposition of the fibular head, often associated with lateral subluxation of the meniscus**, and the **patello-femoral synovial adhesions** are at the origin of **most of the non-surgical mechanical knee pain**. If untreated, these results in uneven weight distribution of the knee, damage the menisci, and predispose to serious knee sprain. With time, the fragile state of the knee would have repercussions on the ankle, and affect walking, and also give rise to pelvis and spine dysfunction.

Plain radiography allows us to classify **4 major types of subluxation of the fibular head: anterosuperior (50%), posterosuperior (33%), and anteroinferior, and posteroinferior**. The dynamic sonography shows us the real-time **dysfunction of the musculotendinous fascia, the pathologic plicae or subpatellar capsular snapping, and the lateral subluxation of the meniscus**.

Our study made us revise the clinical and osteopathic examination for a more reliable clinical diagnosis, and to provide an effective manual therapeutic method: Dynamic Manual Adhesiolysis. By following our algorithm, the novice practitioner should achieve quick results. The more experienced practitioner will certainly improve on our current method. We hope that health care practitioners will have the opportunity to validate our observations.





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