Scientific Osteopathic Approach To Patients With Knee, Ankle Or Foot Pain

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Scientific Osteopathic Approach To Patients With Knee Or Foot Pain

1. Introduction

The knee

The knee is the joint between the hip and the foot. It is the largest joint in the body.

The joint has as well a dynamic as a static, weight bearing function.

The position of the knee between hip and foot in weight bearing situations makes it a vulnerable joint for injury, in all types of patients but especially in athletes. With the body weight on the foot and with body movements in the 3 planes, the knee must withstand strong forces with long levers.

The ankles and the feet

The ankles and feet have two important functions:

- **Mobility:** adaptation in walking and running on every possible terrain.
- **Stability:** being a rigid lever as in for example jumping. Foot lesion can alter the general posture, equilibrium and proprioception of the whole body.

Ankle and foot problems are very common.

The following problems can be present:

- Mechanical.
- Neurological.
- Vascular.
- Metabolic.

The patellofemoral joint:

- This is a planar joint.
- The patella lies between the femoral condyles.
- The medial and lateral facets of the femoral condyles articulate with the patella.
- The patella glides in the femoral trochlear groove.
- Because of the lever mechanism, the joint improves the knee extension with 50%.
- Greatest compression in the joint = when the knee is at 60-90° flexion.

Figure 2 - The patellofemoral joints

Ligaments of the patella:

- Lateral retinaculum.
- Medial retinaculum.
- Medial patellofemoral ligament.
- Lateral patellofemoral ligament (stronger than the medial ligament).

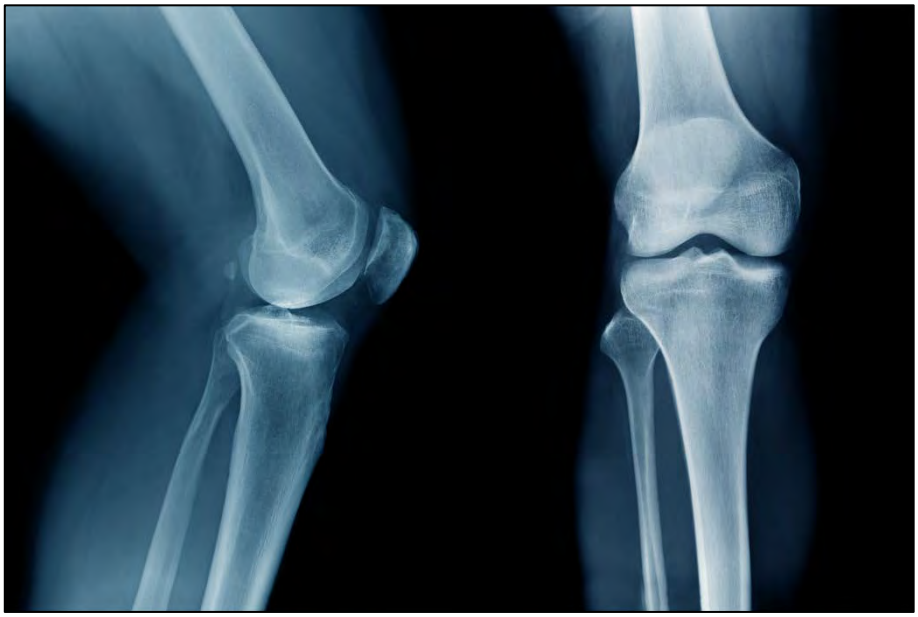

Figure 3 - X-ray normal knee

The femoral condyles:

- Lateral condyle:
  - Small radius of curvature.
  - Smaller in all dimensions.
  - Extends more ventrally.
- Medial condyle:
  - Larger radius of curvature.
  - Extends more distally.
- Intercondylar notch (dorsal side).
- Patellofemoral groove (ventral side).

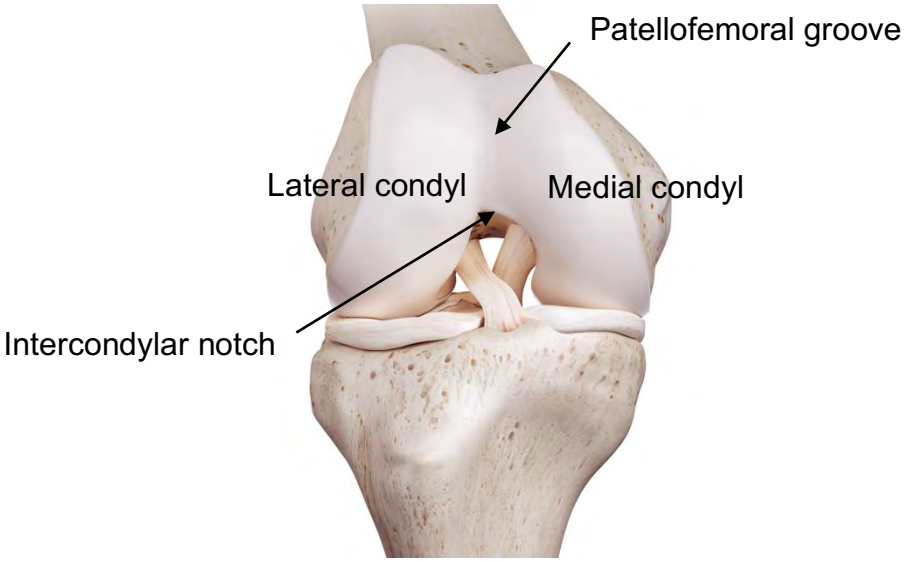

Figure 4 - The femoral condyles

Vastus intermedius	Anterior lateral femur.	Tibial tuberosity via the quadriceps tendon and the patellar ligament.
Vastus medialis	Medial linea aspera of posterior femur.	Tibial tuberosity via the quadriceps tendon and patellar ligament.
Gracilis	Originates from pubic tubercle & inferior ramus of pubis. Anterior aspect of lower 1/2 of symphysis pubis and medial of inferior ramus of pubic arch.	Pes anserinus.
Semitendinosus	Ischial tuberosity with tendon of biceps femoris.	Pes anserinus.
Semimembranosus	Upper and lower aspect of ischial tuberosity.	Posterior surface of medial condyle of the tibia.
Biceps femoris	Long head: ischial tuberosity and the sacrotuberous ligament. Short head: lateral lip of linea aspera, lateral supracondyle of femur and lateral intermuscular septum.	Lateral sides of the head of the fibula, lateral condyle of the tibia and the deep fascia on the lateral side of the leg.
Popliteus	Lateral condyle of femur.	Posterior proximal tibial shaft.
Gastrocnemius	Medial head: medial epicondyle of femur. Lateral head: lateral epicondyle of femur.	Calcaneus via Achilles tendon.

Segmental innervation and functions

Muscle	Innervation	Action
Sartorius	L_2, L_3. Femoral n.	Flexion of the thigh at the hip and flexion of the leg at the knee. Rotation of the femur externally as it flexes at the hip and knee. When knee is flexed, rotates tibia medially. Reversed origin insertion action: when femur and knee are fixed, flexes the pelvis on the hip and gives anterior stabilization to the pelvis.
Tensor fasciae lata	L_4, L_5, S_1. Superior gluteal n.	Thigh flexion at the hip, abduction, and internal rotation. Stabilizes the knee laterally.

3.3. The Ankle and the Foot

3.3.1. General

The ankle and foot consist out of some 28 bones and 25 joints.

This makes the ankle and foot mechanics complicated.

The big number of bones and joints make it however a very mobile structure.

General mobility

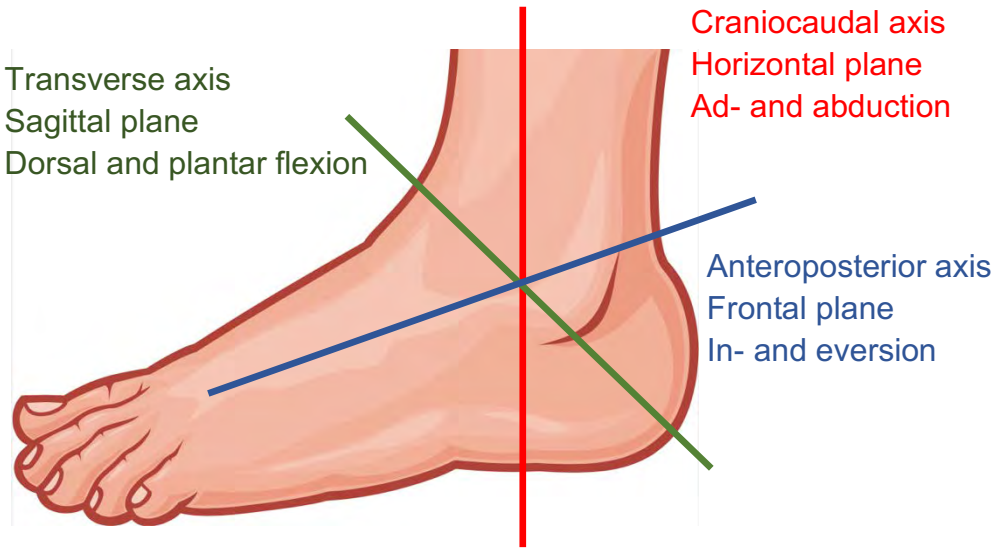

Figure 73 - General mobility axes

The 3 basic motions of the ankle and foot that approximate the main planes and axes are:

- **Dorsal flexion and planter flexion** (sagittal plane, transverse or laterolateral axis).
    - Dorsal flexion decreases the angle between the leg and the dorsum of the foot.
    - Plantar flexion increases this angle.
    - At the toes, motion around a similar axis is named extension (bringing the toes up), whereas the opposite motion is flexion (bringing the toes down or curling them).
- **Adduction and abduction** (horizontal plane, craniocaudal axis).
    - Abduction is when the distal aspect of a segment moves away from the midline of the body (or away from the midline of the foot in the case of the toes).
    - Adduction is the opposite.

3.3.2. The Ankle

Axis of mobility: transversal axis.

Figure 75 - Transverse axis ankle

Mobility:

- Dorsal flexion = 10 to 30°.
- Plantar flexion = 40 to 65°.
- Rotation: some degrees of rotation (inversion 7° and eversion 10°) are possible when the foot is plantar flexed.
- Some frontal plane movements (side to side tilt of 5°).
- Normal gait requires 10° of dorsal flexion and 20° of plantar flexion with the knee fully extended.

3.3.3. The Subtalar Joint

Axis of mobility

The triplane axis of the subtalar joint runs diagonally from the posterior, lateral, plantar surface to the anterior, medial, dorsal surface.

The axis is situated approximately 42° in the sagittal plane and 16° in the transverse plane.

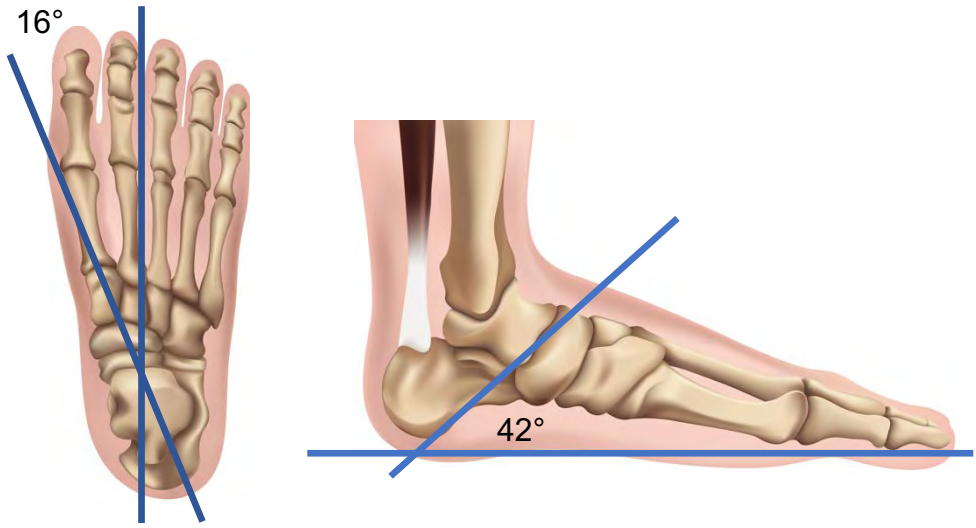

Figure 76 - Axis of mobility subtalar joint

Mobility:

- Supination:
  - Adduction.
  - Inversion.
  - Plantar flexion.
  - The talus moves:
    - Postero-externally on the calcaneus.
    - Direction hollow foot.
- Pronation:
  - Abduction.
  - Eversion.
  - Dorsal flexion.
  - The talus moves:
    - Antero-internally on the calcaneus.
    - Direction flat foot.

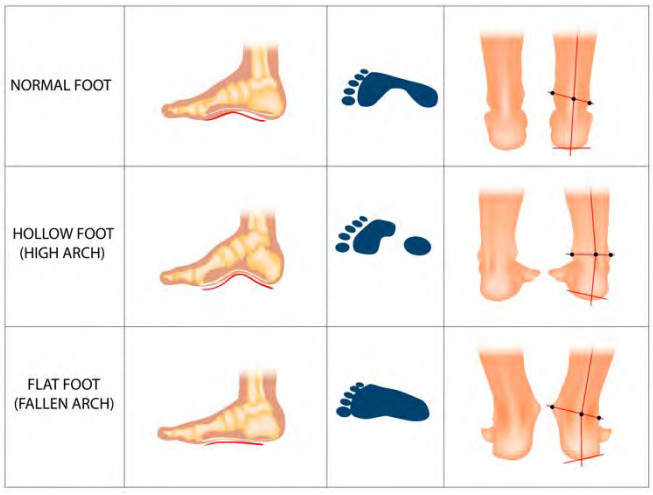

Figure 77 - Hollow foot - flat foot

Mobility:

- Flexion.
- Extension.
- The phalanges work to transfer weight from one foot to the other during gait.

3.3.10. Arches of the Foot

The arches of the foot are:

- The lateral longitudinal arch.
- The medial longitudinal arch (high rand and larger than the lateral arch).
- The transverse arch.

The keystone of the longitudinal arches is the talus. All weight transferred from the body to the heel or the forefoot must pass through the talus.

The keystone of the transversal arch is the second metatarsal.

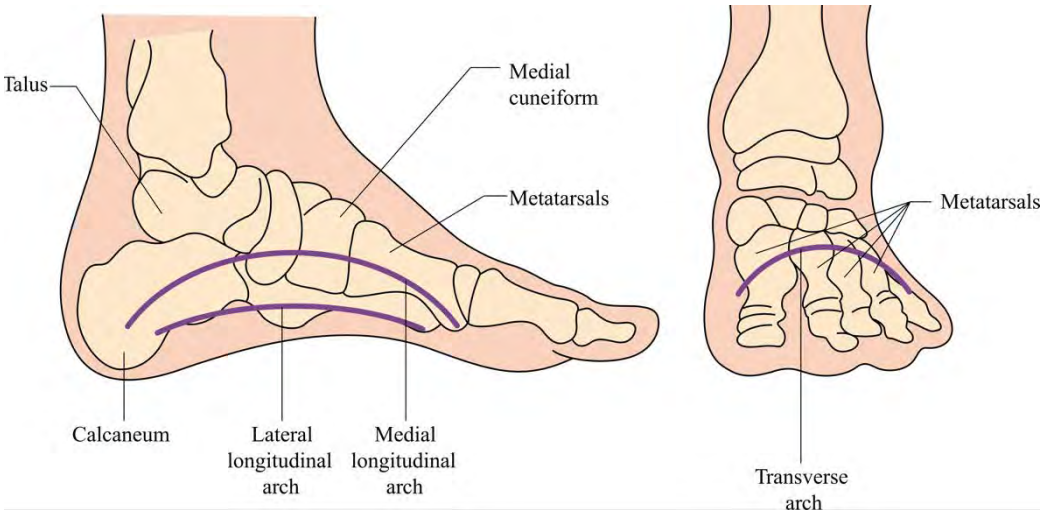

Figure 88 - Arches of the foot

Functions:

- Support and protection of soft tissues.
- Shock absorption (medial longitudinal arch).
- Weight transmission (lateral longitudinal arch).
- Elastic propulsion during gait or running.
- Increase mobility.

Although the structure of the tarsal bones provides a certain inherent stability to the arches, the arches would collapse without additional support from ligaments and muscles.

4.1.4. Rheumatoid Arthritis – RA

RA is an autoimmune disease that affects multiple joints.

RA is most commonly associated with joints of the hands and wrists, it can also affect larger joints, such as the hips, knees, and shoulders.

Symptoms:

- Severe knee joint pain.
- Stiffness of several joints, also sometimes in the knee.
- Swelling around the affected joints (especially fingers).
- Fatigue.
- Loss of appetite.
- Fever.

RA symptoms can come gradually or suddenly and in episodes.

RA can be:

- **Inactive (in remission).** Remissions can occur spontaneously or with treatment and can last weeks, months, or years.
- **Active:** with more acute pain and inflammation.

The course of RA varies amongst patients, and periods of flares and remissions are typical.

RA can affect all races and all ages.

The disease most often starts between 40 and 60 years of age.

There can be a genetic base for the disease.

Certain infections or factors in the environment might trigger the activation of the immune system in susceptible individuals.

Diagnosis:

The antibody that can be found in the blood (rheumatoid factor) is present in 80% of the patients with RA when they have their RA already for 18 months.

Earlier in the disease the percentage is much lower.

Unfortunately, about 7% of people over the age of 70 test positive for rheumatoid factor, even though they do not have rheumatoid arthritis.

Figure 94 - RA with valgus deformity

Treatment:

- Rest.
- NSAID's (non-steroidal anti-inflammatory drugs).

Osteopathic possibilities:

- **Excess of acid.** All forms of arthritis – osteoarthritis, rheumatoid arthritis, gout – are associated with excess acidity in the body.
- **Improve the Oxygen/CO_2 balance.** Take all measures to improve the Oxygen/CO_2 balance in the body:
    - Treat the heart-lung segment.
    - Provide of a good functioning excretion system.
    - Reduce acid food intake.

4.1.5. Avascular Necrosis - AVN

Avascular necrosis of the knee, or osteonecrosis, is when cells in the bones of the knee die because of lack of good blood supply.

When enough bone cells die, the bones begin to weaken and break down.

This causes pain, arthritis, and difficulty moving the knee.

It is a rare cause of knee pain and disability.

patella and the femur. Repetitive contact at any of these areas, sometimes combined with maltracking of the patella that is often not detectable by the naked eye, is the likely mechanism of patellofemoral pain syndrome. The result is the classic presentation of retro patellar and peripatellar pain. This pain should not be confused with pain that occurs directly on the patellar tendon (patellar tendonitis).

- The cause is multifactorial.

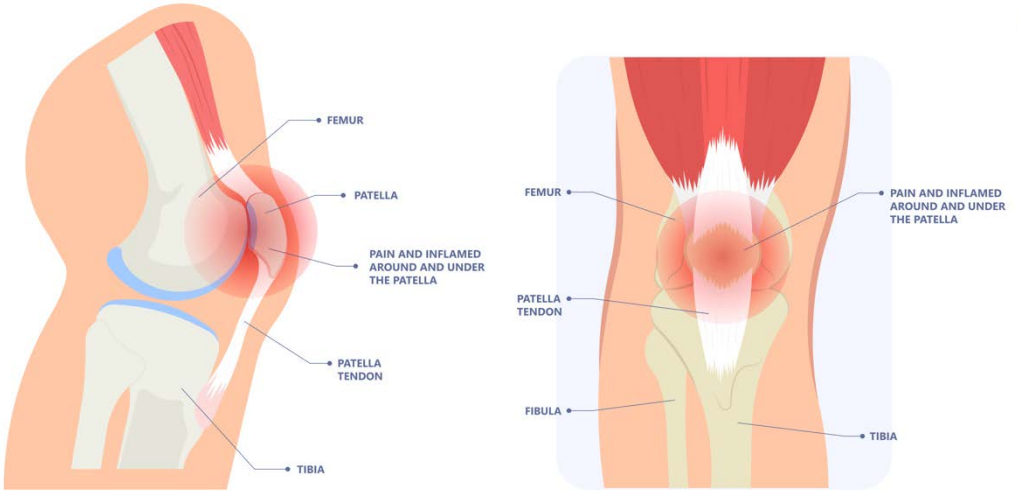

Figure 103 - Patellofemoral pain syndrome

Treatment:

- Rest.
- Icepacks.

Osteopathy:

- Pay attention to the foot; often a pronated foot is seen.
- Pay attention to the valgus position of the knee (often an increased angle is seen).
- Re-enforce the quadriceps m., especially the medial head.
- Relax the tensor fascia lata because this tends to increase the valgus.
- Relax the hamstrings.
- Treat the hip muscles because for example short external rotators tend to cause a pronated foot.
- Relax the calf muscles because they also tend to increase the foot pronation.
- Treat foot, knee, hip, pelvis and low back dysfunctions.

Stutter test

The patient is sitting relaxed on the table.

The osteopath stands in front of the patient.

He/she crouches down to knee level and places the index and middle fingers on the center of the patella.

He/she asks the patient to extend the knee slowly while keeping the fingers on the patella and watches its movement.

The test is positive if the patella stutters or jumps during the course of the movement.

It is an indication of a plica.

This is typical in the range of 45 to 70° towards extension.

Crepitation can also be felt.

Video 3 - Stutter test

4.1.12. Infrapatellar Fat Pad Syndrome

The infrapatellar fat pad is also sometimes known as Hoffa's pad.

It is a soft tissue that lies beneath the kneecap which can get impinged, causing knee pain.

This knee injury can be caused by a severe impact which traps the pad between the patella and the femoral condyle.

This entrapment causes inflammation of the fat pad.

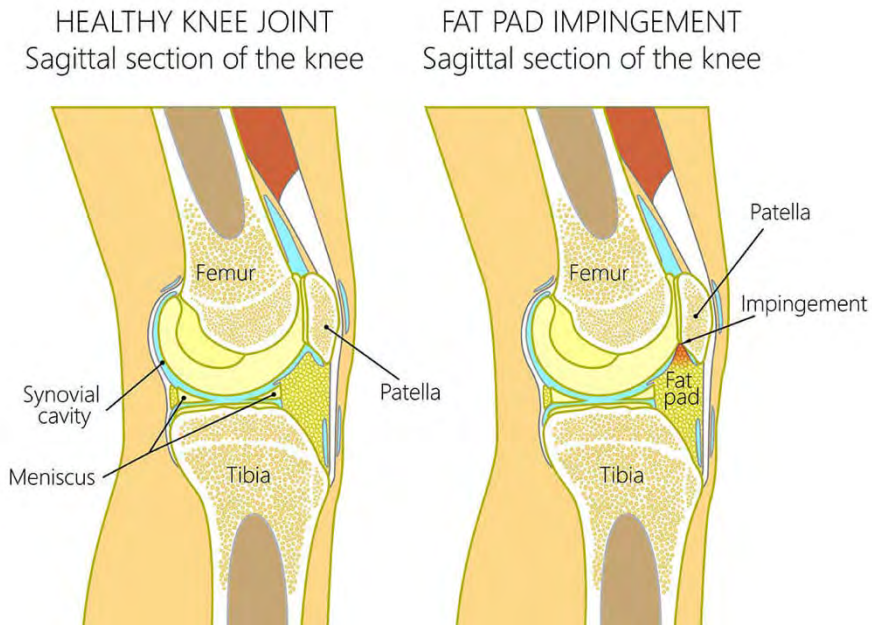

Figure 107 - Infrapatellar fat pad syndrome

Symptoms:

- Pain below the kneecap, on the front of the knee.
- More pain with kneeling activity.
- More pain with repeated bending and stretching of the knee.
- Palpation pain just below the patella.
- Pain with hyperextension of the knee.

Cause:

- Direct trauma on the knee (fall on knees).
- Overload of the quadriceps as in kicking a ball.
- Repeated kneeling.
- Poor running mechanics.

4.1.13. Patellar Tendonitis (Jumper's Knee)

This affection is a tendonitis of the patella tendon.

This inflammation of the patella tendon can lead to weakening and even tear of the tendon.

Cause:

- Overuse such as in frequent jumping on hard surfaces. In the landing when jumping, the hamstrings cause the knee to flex and to absorb the impact of the jump. The quadriceps m. then contracts eccentrically.
- Mostly sport related.
- High deceleration or eccentric forces of the quadriceps m.

Symptoms:

- Pain and tenderness around the patella tendon.
- Local swelling.
- Pain when jumping, walking or climbing stairs.
- Pain when bending the knee.

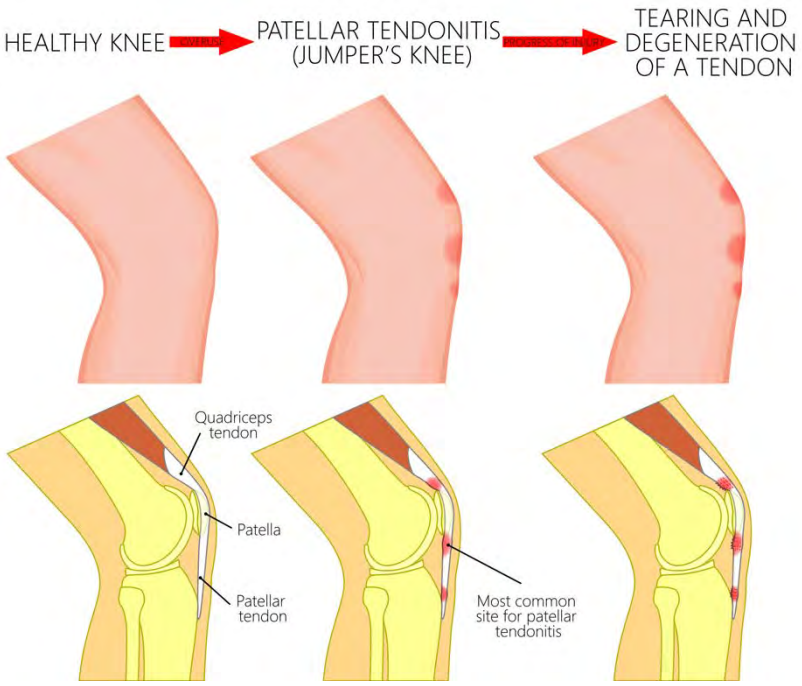

Figure 108 - Patellar tendonitis

- Pain increases when walking stairs.
- Pain after prolonged sitting.
- Crepitus is possible although crepitus in young people is not necessarily pathological.

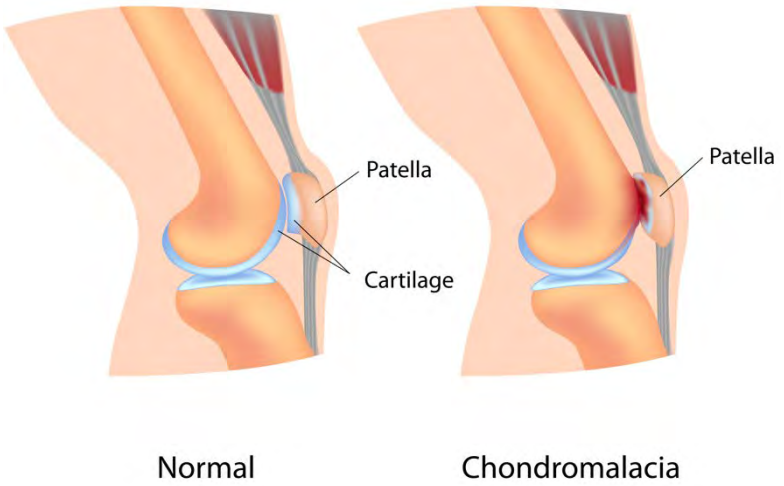

Figure 111 - Chondromalacia patellae

Figure 112 - Damage to the cartilage of the patella

Osteopathy:

- Mechanical:
    - Pay attention to the alignment of the lower extremity. Often, there will be a high Q-angle, flatfoot and an external rotation of the tibia.
    - This brings the patella in a lateral position with retraction of the lateral retinaculum.
    - Stretch the lateral retinaculum.

    - Stretch the lateral capsule, lateral collateral ligament, capsule of the fibular head and the iliotibial tractus.
    - Decoapt the lateral joint compartment of the knee.
    - Balance the muscular system with muscle energy techniques.

- Vascular:
    - Treat somatic dysfunctions in the region of T_{12}-L_2.
    - Check and treat eventual vascular entrapments.

- Neurological:
    - Treat somatic dysfunctions in the lumbar region.

- Metabolic:
    - Check and treat the immune system.
    - Pay attention to the segment of the adrenals (T_{10-12}).

4.1.15. Sinding Larsen Johansson Syndrome - SLJ

This is an inflammation of the bone at the bottom of the patella, where the tendon from the tibia attaches.

It is an overuse knee injury rather than a traumatic injury.

It is a juvenile osteochondrosis and traction epiphysitis affecting the extensor mechanism of the knee which disturbs the patella tendon attachment to the inferior pole of the patella.

The tenderness of the inferior pole of the patella is usually accompanied by roentgenographic evidence of splintering of that inferior pole.

Most patients with SLJ also show a calcification at the inferior pole of the patella.

The syndrome usually appears in adolescence (10-15 years of age), during the growth spurt.

Cause:

- Repetitive microtrauma.

Symptoms:

- Anterior knee pain.
- Swelling.
- Local tenderness.

Figure 127 - Posterolateral structures

Fabella syndrome

This is an uncommon cause for posterolateral knee pain.

It concerns irritation or inflammation of the fabella.

Symptoms:

- Posterolateral knee pain.
- Clicking sound with knee flexion.
- Pain when sitting with crossed legs or walking stairs.
- Pain on active and passive internal rotation of the knee.
- More pain with an extended knee.
- Pain when palpating the fabella.
- It can cause an irritation of the peroneal nerve (tingling, drop foot or steppage gait).

Treatment:

- Stretch the gastrocnemius m.
- Decoapt the lateral compartment of the knee.
- Treat (stretch) the posterolateral corner of the knee.
- Treat the valgus position of the leg.
- Treat the fascial ascending or descending chains.

Figure 129 - In-toeing

4.1.34.2. Femoral Anteversion

Also called kissing patellae.

Both patellae face each other.

Femoral anteversion is the angular difference between the axis of the femoral neck and the transcondylar axis of the knee.

Figure 130 - Femoral anteversion, in-toeing, bowlegs, metatarsal adductus

4.1.34.3. Internal Femoral Torsion

This is seen in children age 3-5 and usually most severe in children age 4-6.

The condition is mostly bilateral.

The mechanism is unknown, genetic factors are suspected and also the position of the fetus in the uterus can possibly play a role.

It is more common in females: approx. 2:1 ratio and often familial.

An approximated muscle (where the ends of the muscle are found close to each other) generally feels softer than the resting tension felt in a stretched muscle.

Tendons come in different shapes, long, thin, broad (aponeurosis).
Ligaments feel dens but elastic.
Fascia is dens connective tissue, feels like a sheet under the skin and around muscles. Fascia can be thin (back of hand) or thick (foot sole).
A **retinaculum** can be distinguished by the direction of the transverse fibers, perpendicular to the tendons.
Arteries can be located because of their pulsation. Veins cannot. Some veins can be palpated (superficially).
A **bursa** feels like a small fluid filled sack. In everybody there are some 600 bursae. Bursitis feels tender and with crepitation. Normal bursae cannot be palpated.
Nerves are tube shaped, mobile and tender.
Entrapment with inflammation of a nerve gives sharp, shooting pain in a downward direction of the nerve.
Lymph nodes are bean shaped and can differ in shape and form. Also, groups of lymph nodes can be palpated. In healthy condition, they are round, movable and not tender. We palpate for size, shape, mobility, consistency and tenderness. Hard or fixed nodes suggest malignancy and tenderness suggest inflammation.
Glands feel bigger and more irregular than lymph nodes.
Fat tissue can be palpated in the subcutaneous layers between skin and superficial fascia. It has a gelatinous consistency.
Edema is tissue swelling. It feels soft, not tender and when slowly pressed a depression becomes visible or palpable.
Visual observation is closely related to palpation. Skin color and thickness can support the palpation findings.

5.1.5. Palpation of the Knee – Medial Side

- Joint line.
- Adductor tubercle.
- Medial epicondyle.
- Medial collateral ligament
- Pes anserinus with:
    - Semitendinosus m.
    - Gracilis m.
    - Sartorius m.

Video 8 - Palpation of the medial side of the knee

Example 1

In this observation, the left knee is in strong valgus.

For the knee, this means that:

- The lateral soft tissues are shortened.
- The medial soft tissues are overstretched.
- The lateral knee compartment has more compression.
- This makes the medial meniscus even more mobile and therefore vulnerable for lesion.

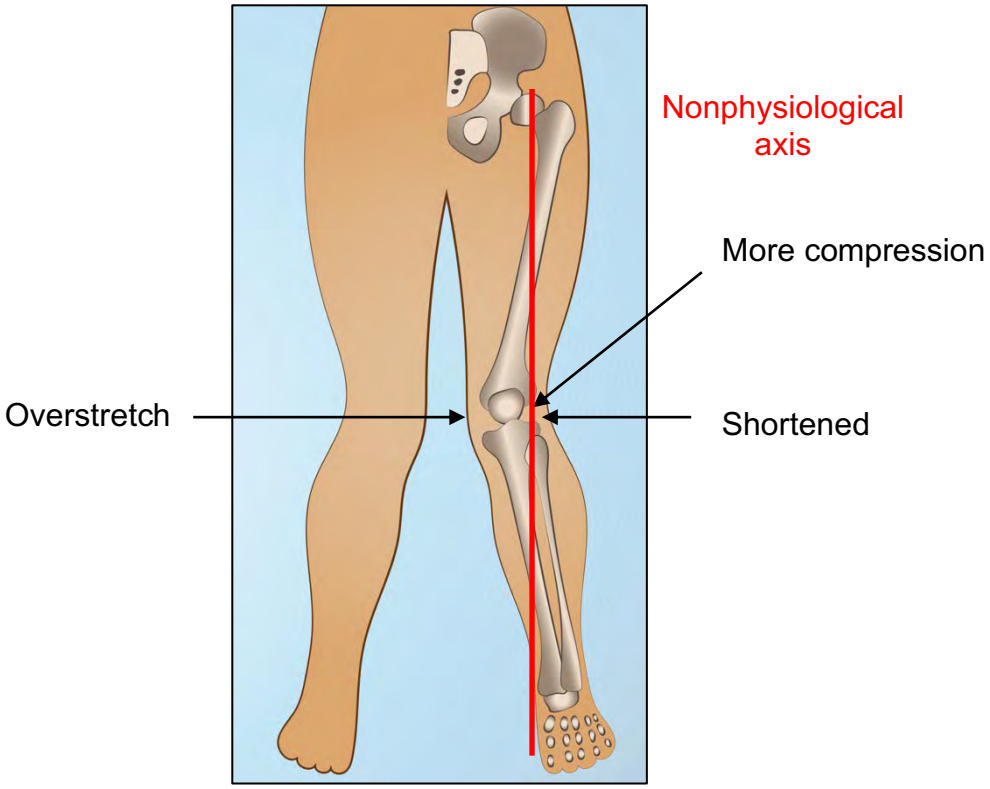

Figure 196 - Left knee in valgus

5.3.2. The Ankle and Foot Provocation Tests

5.3.2.1. Testing for Acute Ankle Trauma

When a patient comes in with an acute ankle trauma, we have to:

- See whether he/she can still have weight on the foot. If not, this is an indication for a fracture, and we have to refer the patient for X-ray.
- Observe the ankle and foot for:
  - Swelling.
  - Coloration: bleeding means structural damage.
  - Skin damage, infection, inflammation.
  - Deformations: possible fracture.
  - Compare with the other foot.

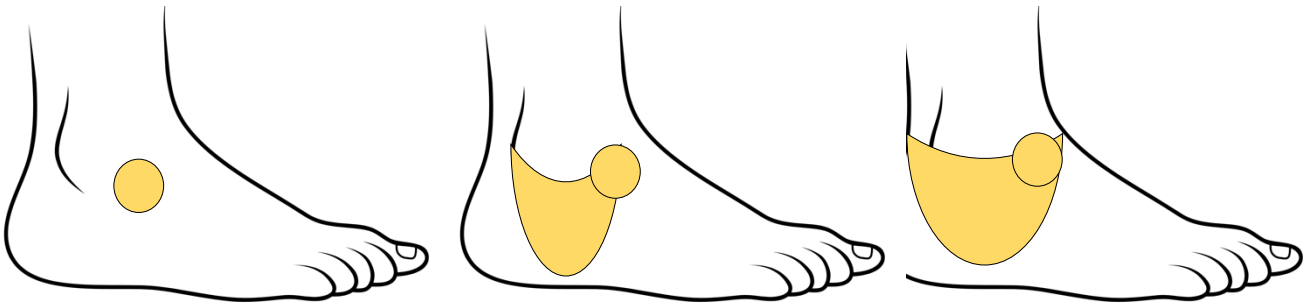

Figure 200 - Possible swelling in grade 1 - 2 - 3

X-ray is necessary in the following cases (Ottowa rules):

- Weight bearing not possible. Inability to walk more than four steps.
- Pain on palpation of the 6 distal centimeters of the posterior side of the tibia or on the internal malleolus.
- Pain on palpation of the 6 distal centimeters of the posterior side of the fibula or on the external malleolus.
- Pain on palpation of the navicular bone.
- Pain on palpation of the base of the metatarsal 5.

6.1.2. Mobilization of the Patella in Laterolateral Direction

The patient is supine on the table.

The osteopath stands next to the patient.

He/she mobilizes the patella medially with the thumbs and pulls back laterally with the fingers.

This stretches the retinaculum patellae.

This retinaculum is often shortened on the lateral side because of the valgus position of the knee.

Video 97 - Mobilization of the patella in laterolateral direction

6.2. Manipulations

6.2.1. General Approach

A manipulation of a joint is also called a HVLAT (High Velocity Low Amplitude Thrust).
It is a short thrust in a specific direction and the execution is very fast.

The aim of a manipulation is different, depending on the lesion and joint being treated.

The aim of a manipulation can be:

- Repositioning of a joint subluxation.
- Interrupt neurologically a muscular spasm in shortened muscles.
- Stretching a capsular and/or ligamentous retraction (correction of non-physiological axis – shortened structures).

In some situations, manipulation is essential, most notably in cases of an articular 'blocked' fixation or subluxation. However, this is can be difficult to differentiate from a restriction (mobility loss with elastic end feel).

Manipulations are, in some cases, the most efficient treatment for restriction.

Where an elastic end feeling is present mobilizations can be used but, if no contra indications exist, manipulation is an option.

Before the age of 20, 'real' articular blocked joints seldom occur.

The occiput/atlas/axis (OAA) region is an exception because no discs are present but articular blocked joints can occur here. Even in small children subluxations can be found here. Manipulations however are not indicated in this region.

Contraindications

Before the osteopath decides to manipulate a joint, he/she must be sure that no contraindications are present.

Contraindications fall into several categories:

- **Trauma**
  - The osteopath will not manipulate directly after a trauma, without radiological testing showing any osseous lesions.

6.2.4. Manipulation of the Fibular Head Towards Anterior

The patient lies supine on the table.

The osteopath stands next to the patient and supports the knee and foot.

The osteopath puts one hand dorsal of the caput.

With his/her thumb he or she palpates the ventral side of the joint.

With his/her other hand he/she takes contact on the foot, thumb on the ventral side of the external malleolus.

The osteopath contacts the tibial tuberosity with the sternum.

The manipulation is done with the lever into flexion/external rotation.

Video 137 - Manipulation of the fibular head towards anterior

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Disclaimer

The author cannot be held responsible for the wrong use of the described tests, techniques or procedures.

The author does not take responsibility for your patients.

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Luc Peeters is an osteopath since 1985. He was the Joint-Principal of the largest Academy of Osteopathy in Europe from 1987 till 2020. He provided curricula, syllabuses and academic recognition from several universities.

This book gives a practical overview on how osteopaths treat patients with knee, ankle or foot pain. The case history, assessment, techniques used, and treatment strategy are explained with text, figures, schedules and streaming videos with audio.

The reader can communicate with the author and fellow readers and therefore contribute to the content of this dynamic concept.

The theory and procedures in this book are checked on their scientific background and esotericism is avoided.

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