

Internal derangement of the knee

*Historical review since 1800 up to date:
from clinical diagnosis to imaging diagnosis*



“Looking is a not a substitute for thinking”

J.Cyriax

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In current scientific literature, **internal derangement** is a generic term indicating any type of **acute injury** affecting joint structures: menisci, ligaments as well as cartilage and bone fragments (1,2).

Following an acute event at knee level, examination procedures such as radiography or magnetic resonance imaging are often used in order to reach a **diagnosis**.

The examiner and the patient are usually eager to “see” the injury. However, are such costly examinations really necessary in order to obtain a diagnosis? Are the results obtained by these examination methods more reliable than clinical assessment?

In order to reach the answer, we must now step backwards.

Internal derangement of the knee was first noticed, described and treated in the early 19th century. Back in 1809, Dr Clark described the story of a 30-year-old sergeant who was forced to leave the army because of his articular problems. The assessment revealed that his left knee was swollen, while no ligament or bone surface thickening was observed. He could normally walk; however, his leg would frequently collapse without warning, and subsequently the patient would find himself on the ground with a locked knee. Since similar incidents had been experienced repeatedly by the patient, he had learned to unlock his knee on his own by executing certain “unusual moves”. The problem was resolved after undergoing a surgical procedure and removal of cartilaginous loose bodies from the joint (3). This was probably one of the first descriptions ever given to this pathology. In the following decades, several authors helped enhance the original definition: in 1855, Dr Steele completed the clinical picture description by adding limitation of joint mobility as well as the usual toe walking; he also suspected such dysfunction to be caused by partial subluxation of the semilunar cartilages (menisci). In that same article, Dr Steele also described a manipulation technique aiming to unlock the knee (4).

In 1867 Dr Paget, in his wonderful publication “Cases that bone-setters cure”, introduced **differential diagnosis** between two different scenarios leading to internal derangement of the knee: his description pointed out that, whenever these symptoms are caused by a **cartilaginous loose body**, joint lock seems to happen spontaneously; it is not persistent over time and can be generally unlocked by the patient himself. On the contrary, when **semilunar cartilages** are at the root of the issue, the joint becomes locked in a bent, rotated position; in that case, it is usually required to unlock the joint by means of manipulation.

In the following years, and partly due to the introduction of X-ray as a diagnostic instrument, an intense debate took place on the very existence and nature of the so-called loose bodies (5,6), which led to questioning the diagnosis and treatment procedures for internal derangement (7).

However, continuous collaborative research, clinical experience and the development of radiology eventually allowed to obtain, in 1931, one of the first complete classification systems of knee pathologies and their surgical treatment (8). This classification included thorough descriptions of several types of fractures, ligament lesions, synovitis as well as intra-articular cartilage and meniscus dysfunctions.

They lacked, nevertheless, unambiguous criteria when it came to run differential diagnosis as well as a valid alternative to the surgical treatment of such conditions. Ultimately, it was **James Cyriax** who filled this gap. He developed a genuine **diagnostic system**: a process making use of a **standardized clinical examination**, based on the **selective tissue tension** principle along with his exhaustive research of a **clinical picture**. His diagnostic system laid the foundation to develop differential diagnosis for knee injuries as well as today’s clinical orthopaedic medicine. A rational approach that clashed with the research from other contemporary authors, who placed **palpation** at the centre of their clinical assessment methods (9).

According to Cyriax’s classification, internal derangement of the knee is caused by an intra-articular tissue interposed between two bone structures, typically a meniscus fracture or a loose body (cartilaginous, bony/cartilaginous bodies or a meniscus fragment).

In both cases, the patient will report an unexpected and painful lock, immediately followed by functional impairment, perceived unsteadiness and pain upon joint loading.

Upon inspection, the knee will feel locally swollen and warm. Upon functional examination, a locked extension movement will be identified, featuring a typical end-feel which varies depending on the root cause: a “springy block” feel on subluxation of the meniscus, and a “soft” feel on loose bodies.

A pain “shifting from one side of the knee to another” reveals “a moving injury”: if acknowledged, this will be a clear symptom of the presence of a tiny loose body (see Table #1).

Table #1

	Loose body	Meniscal subluxation
Onset	Spontaneous	Traumatic (load + deflection + rotation)
Pain	Moving	Localized
Other symptoms	Twinges, unsteadiness	Typical toe walking
Limitation	Extension +	Extension ++
End-feel	Soft	Springy block
Unlocking	Spontaneous / Through manipulation	Manipulation

Patients suffering from early gonarthrosis may experience tiny fragments of cartilage detaching from their matrix, thus forming a tiny intra-articular loose body, sometimes small enough to remain undetected by a radiography, CT scan or magnetic resonance imaging.

The clinical picture of pain and functional inability, along with a functional examination limited to a mere -and often painful- palpation procedure on the joint space, may lead a superficial examiner to misinterpret the internal derangement and label it as an arthrosis/arthrititis attack. The usually prescribed radiography would not reveal such diagnostic error.

Cyriax introduced the concepts of **end-feel** and **capsular pattern**, which helped set a clear, unambiguous clinical picture of arthrosis and arthritis as opposed to an internal derangement of the knee caused by a loose body (see Table #2).

Table #2

	Arthrosis	Arthritis	Loose body
Onset	Painful and slow Generalized upon joint load	Painful and swollen Generalized on whole joint	Painful and unexpected Localized, twinges, unsteadiness
Pain at rest	No	Yes	Occasionally, localized
Swelling	No	Yes	Yes
Warmth	No	Generalized	Localized
Synovial thickening	No	Yes	No
Scope of limitation	Capsular	Capsular	Non-capsular
End-feel	Hard	Muscle spasm	Soft
Miscellaneous	Crackling sound	Depending on arthritis type	Pain upon testing ligament sprain

The examples above lead to define one of the key points in the present diagnostic system: Diagnosis is not obtained by means of a single reading of the results of an individual test, but only after using such results together with additional elements in the patient's medical history as well as in previous/subsequent inspections and a functional examination, all of which make up the so-called clinical picture.

Not only did Cyriax create a clinical diagnostic system: during those years, he also developed effective **treatment techniques** such as: articular and vertebral manipulation procedures, deep friction transverse massage and infiltrations.

Hence, in the event of internal derangement of the knee, once the root of the issue and the type of patient have been identified (e.g. a cartilaginous loose body in an adult showing early stages of arthrosis), then the goal was to find a technique that could guarantee a working conservative treatment. A technique which could allow the practitioner to move the **loose body** to a different joint zone where articular movement would not be compromised or cause pain: an area defined by Cyriax as "silent zone".

In order to reach the defined objective, Cyriax developed 4 different loose body **manipulation** techniques. Manual therapy was at its earliest stages; however, the manipulation techniques devised by Cyriax to treat internal derangement have not been superseded as of today (10).

Nearly 50 years have passed since, during which medicine and surgery, helped by modern technology, have witnessed a series of major revolutions (11). Nevertheless, as our everyday experience as healthcare professionals along with many different studies show, when it comes to run the diagnostic process of an internal derangement of the knee, MRI does not represent a better method than clinical assessment does; similarly, arthroscopy seems not to be the only solution in order to reach an accurate diagnosis (12,13,14,15).

Conversely, over-reliance of examiners on imaging diagnosis has led many of them to limit the clinical examination procedure to a fast and incomplete medical history check-up, followed by a functional examination consisting in a rushed palpation of the affected structures.

This widely spread M.O. does not allow examiners to reach an accurate diagnosis; instead, an unspecific diagnosis is often formulated (“knee pain”, “arthrosis attack”) or, alternatively, imaging diagnosis is used as the sole source of the diagnostic outcome -subject to the risk of such images being **wrongly interpreted**. Performing a full clinical assessment allows the examiner to evaluate the radio-holographic medical report as well.

The consequences of an **incorrect diagnosis** might lead to either an unnecessary surgery procedure or an **unspecific, ineffective conservative therapy**.

The origins of orthopaedic medicine date back a long time ago: it was built on clinical practice, observation skills and applied anatomy studies. As of today, modern technology has not led orthopaedic medicine to successfully replicate the revolutions observed in other areas in medicine; it is still unknown whether this will ever happen, particularly as far as diagnostic methodology is concerned.

Therefore, putting back the art of **clinical assessment at the centre of the diagnostic process** becomes a matter of key importance, given that the visual identification of an injury is not always possible; and, in any case, even when it is possible, it can never replace the clinical reasoning of a skilled examiner.

BIBLIOGRAPHY:

- 1.Diagnosis and management of the soft tissue knee injuries: internal derangement, NZGG 2003
- 2.Internal derangement of the knee, Dr Fisher 2008
3. A case of cartilaginous substances successfully extracted from the cavity of the knee joint, Clark 1809
- 4.Internal derangement of the knee, Steele 1855
- 5.On the origin of the loose body in the knee joint - Marsh 1888
- 6.Detached pieces of articular cartilage forming loose bodies in both knee joints- Lane 1893
- 7.A possible fallacy in the diagnosis of internal derangement of the knee joint - Mort 1914
- 8.Diagnosis and treatment of common injuries of the knee joint, BMJ, Laughton Dunn 1931
- 9.The art of orthopaedics: diagnosis of diseases of the knee joint, Tippet 1945
- 10.Textbook of orthopaedic medicine, J.Cyriax
- 11.Arthroscopic removal of large loose body: an improved technique, Gallacher- Ann.Coll.Surg.Eng. 2011
- 12.Accuracy of clinical diagnosis knee arthroscopy Ann.R.C.S.E., Stuart Brooks-Morgan 2002
- 13.Accuracy of clinical diagnosis in patients undergoing knee arthroscopy, Dickinson et al. Int.orthop. 2008
- 14.Reliability of the clinical assessment in predicting the cause of internal derangements of the knee Terry-Arthroscopy 1995
- 15.Clinical examination of the knee: know your tools for diagnosis of knee injuries, Rossi et all. SMARTT 2011