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## Commentary

Diagnosis and treatment of ligament injuries to the knee is always an interesting and topical issue. In this pithy article written in 1955, Dr. Moragas proposed a change in the therapeutic approach to recent ligament injuries to the knee, and especially of the medial and lateral collateral ligaments (MCL and LCL). In contrast, he only touches on the diagnosis and treatment of injuries to the anterior and posterior cruciate ligaments (ACL and PCL) briefly and rather superficially.

Dr. Moragas wrote this article drawing on the experience gained in the past 4 years, during which he operated 26 knees with different ligament lesions in people from the world of sports. His decision to apply surgical treatment to these cases came as a result of the poor clinical results obtained by conservative treatment of recent ligament injuries to the knee (stiffness, muscle atrophy) and of the opinion expressed by renowned international authors that «only surgical treatment can achieve *ad integrum* restoration» further to these types of injury<sup>1</sup>. The usual treatment of these ligament injuries at the time was conservative, with cast immobilization for a variable period that could extend to up to 12 weeks; in a significant number of cases such treatment led to functional and sport-related limitations.

As mentioned, in his paper the author discusses mainly the treatment of tears in the collateral ligaments, mainly the MCL, in the belief that these were the ligaments most frequently involved in the pathology of the knee. Isolated ACL injuries were much less frequently observed by Dr. Moragas; when they appeared they were usually associated to a MCL tear and to a medial meniscus tear. This condition, involving the three structures mentioned, was already known as the «unhappy triad» (described by O'Donoghue)<sup>1</sup>. Furthermore, there is no mention of other ligament associations

that are well known today, such as the possible association between a tear in the LCL and the cruciate ligaments. Moreover, the author found it exceptional to find a PCL tear. In spite of this, Moragas made a point of checking the condition of both cruciate ligaments when a tear was suspected, extended the indications for a knee arthrotomy, and repaired the cruciate ligaments if suspicions were confirmed.

The paper goes into a detailed description of the pathology of MCL injuries. Dr. Moragas states that these injuries most frequently occur in the lower part of the ligament (40%), followed equally by injuries to its middle and superior parts; superior avulsions only occurred in association with a bone fragment. The author also aptly describes the two layers that make up the medial ligament, stating that the superficial layer is chiefly responsible for stability and the deep layer is merely dedicated to providing support to the medial meniscus. Lateral collateral ligament injuries are also mentioned succinctly. Dr. Moragas reports that they can be injured throughout their length and they can sometimes be accompanied by inframeniscal capsular avulsions in the tibial region. This is what is nowadays known as a «Segond fracture»<sup>2</sup>, a sign that is indicative of an ACL tear that can occur together with tears of the MCL and/or knee posterolateral complex, which will be described below. Although all of these morphofunctional descriptions still remain valid, the anatomical realities of both the MCL and the LCL have somewhat changed in the last few years on account of the results reported by a series of studies<sup>3,4</sup>, which have concluded that collateral ligaments are not isolated entities but rather form part of a series of capsular-ligamentous complexes, i.e. the posteromedial and posterolateral complexes, both of which provide additional medial and lateral stability. Thus, the MCL is reinforced by the stability provided by

the structures forming the posteromedial complex, which includes the posterior oblique ligament, the oblique popliteal ligament and the expansions of the semimembranosus muscle<sup>3</sup>. On the other hand, the LCL is part of the posterolateral complex that also includes the popliteal muscle tendon, the popliteofibular ligament and the biceps femoris tendon<sup>4</sup>. This means that currently, when confronted to any injury that compromises the medial or lateral stability of the knee, one should rule out the existence of an associated lesion to the structures that are part of these complexes so as to prevent a subsequent treatment from failing simply because we just did not previously explore such structures. Both complexes also contribute to the knee's rotational stability so that if the MCL tear causes a slight anteromedial instability (revealed by the anterior drawer test performed with the knee flexed at 90 degrees and in external rotation), such instability increases mainly when there is a rupture of the posterior oblique ligament<sup>5</sup>. Moreover, rupture of the structures of the posterolateral complex are also accompanied by posterior and lateral rotational instability<sup>4</sup>. Nowadays we know that these «slight rotational instabilities» tend to go unnoticed and result in the failure of well-performed cruciate ligament reconstructions.

Mention has been made already of the fact that the author only rarely found isolated ACL tears. He found three main types of ACL ruptures: complete ruptures (generally at the femoral attachment), avulsions from the anterior tibial spine with a bone fragment and partial ruptures. Of these he claims that only the first two are amenable to surgical treatment, which should consist in the reattachment of the ligament by means of perlon sutures applied through bone tunnels – a fairly straightforward process, as shown in the paper, affording very good clinical results.

Exploration of the collateral ligaments is still performed using the same maneuvers described in Dr Moragas' paper, albeit with some modifications. The exploration of the MCL is carried out by Dr. Moragas with the knee flexed at 10 degrees («articular gap» maneuver) and he decides whether there is an isolated collateral ligament tear or whether there is an associated ACL tear on the basis of the identified, by comparison with that of the healthy knee. Nowadays the usual technique is to explore the MCL with the knee flexed at 30 degrees and in full extension, since a gap in this position is indicative of injury to other ligament structures. The LCL is inspected using the Moragas maneuver, described by the author, which consists in placing the ankle of the injured leg on the healthy knee and perform a forced adduction, pressing the involved joint downward. This maneuver is still in common use. The author insists on the importance of this exploration to detect any areas of edema or ecchymosis and stresses the need to palpate the course of the collateral ligaments in order to identify the location of the injury and to rule out a rupture of the medial meniscus. As regards the cruciate ligaments, Dr Moragas

only mentions the exploration of the ACL with the anterior drawer maneuver at 90 degrees of flexion, although he admits that on some occasions such a maneuver is not conclusive, a final diagnosis being possible only intraoperatively. Today we know that the anterior drawer maneuver is not specific enough to detect an isolated ACL injury, its role having been replaced by other maneuvers like Lachmann's maneuvers or the pivot shift test. However, the drawer maneuver is still useful to detect combined rotational instabilities.

Dr. Moragas also devotes a detailed explanation of the ways to approach the collateral ligaments and, albeit more briefly, the cruciate ligaments. He suggests operating all sorts of full MCL ruptures, which means that the location of the injury does not make him change his therapeutic strategy. Nevertheless, it is nowadays widely accepted that most isolated MCL injuries can be addressed conservatively and that distal avulsions of the ligament can either be operated acutely or, alternatively, treatment can be deferred until the result of conservative treatment becomes apparent<sup>5,6</sup>. It is distal MCL ruptures that can occasionally be accompanied by a symptomatic anteromedial rotational instability. This distal avulsion can be operated in acute cases, as the author recommends, by a direct reattachment of the ligament by means of a transosseus suture, although currently bone anchors have made reattachment easier and in symptomatic (unstable) chronic or deferred presentations the use of allografts may be necessary to reconstruct the MCL, once the integrity of the posteromedial complex has been confirmed. If the complex is damaged, it should first be repaired<sup>5,6</sup>. The author provides a useful technical tip, namely that when it is necessary to repair the MCL and/or the posteromedial complex the same suture must not include the superficial and the deep strands since this would lead to restrictions in the knee's ROM. As regards the collateral ligament, conservative treatment could be applied in partial isolated tears but, given its bundle-based morphology, when the patient presents with a complete tear surgical treatment is mandatory; ruling out any potential associated lesions to the remaining structures of the posterolateral angle.

At the time Dr. Moragas wrote his paper, cruciate ligament tears were treated either conservatively or surgically in the two presentations described. Of the three types of injuries described in the paper, we currently know that reattachment can only be clinically successful if associated with a bone block. In the 60s received wisdom indicated that most sutures applied in cruciate ligaments, excepting tears accompanied by a bone fragment, failed in the end in spite of a good initial clinical result, with patients subsequently developing clear symptoms of instability.

In short, Dr. Moragas' contribution in this paper was to reconsider the treatment of recent ligament injuries to the knee, analyzing the poor results and complications of conservative treatment. The author focused especially on medi-

al collateral ligament injuries, accurately describing its anatomy and the most usual mechanisms of injury.

Dr Moragas did not deal with cruciate ligament injuries with great detail, but he should be recognized for initiating surgical treatment of cases in which cruciate ligament ruptures were diagnoses. The anatomical and biomechanical studies of recent years, promoted possibly by the sharp increase in knee injuries both in the occupational and sporting contexts, have provided us with accurate descriptions of all ligament structures of the knee as well of information on the role played by each of them in the knee's stability. Nowadays, most MCL injuries are addressed conservatively, with only symptomatic distal avulsions subjected to surgery, often chronically. To conclude, it should be emphasized that an appropriate inspection of the traumatic knee should always include a detailed assessment of the condition of the collateral ligaments and of the structures that make up the posteromedial and posterolateral complexes in order to allow the restoration of lateral and rotational stability provided by these structures.

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