Locked Metacarpophalangeal Joint: Case Series, Anatomical Study, and Literature Review

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ABSTRACT

Introduction: Metacarpophalangeal (MCP) joint locking is a rare condition characterized by the sudden inability to achieve full extension. **Objectives:** To present the results of our case series, describe the anatomical study conducted, and propose a treatment protocol for this condition. **Materials and Methods:** We report on nine patients treated between 2006 and 2023 who sought medical attention for loss of MCP joint extension after performing forceful manual tasks. **Results:** Eight patients underwent surgical treatment, while one achieved joint release through a reduction maneuver. All patients fully recovered their range of motion without complications or recurrences. **Conclusions:** MCP joint locking is an uncommon condition. As a treatment protocol, we recommend initially attempting closed reduction. If surgery is required, a palmar approach for the middle finger or a palmar-radial approach should be used, as these provide optimal exposure of the accessory collateral ligament for release and allow for the resection of the bony spur to prevent recurrence.

Keywords: Metacarpophalangeal joint locking; metacarpophalangeal joint; hand; trigger finger.

Level of Evidence: IV

Articulación metacarpofalángica bloqueada. Serie de casos, investigación anatómica y revisión bibliográfica

RESUMEN

Introducción: El bloqueo articular a nivel metacarpofalángico es un cuadro infrecuente que se caracteriza por la pérdida repentina de la extensión máxima. **Objetivos:** Presentar los resultados de nuestra serie de casos, describir la investigación anatómica realizada y proponer un protocolo de tratamiento para este cuadro. **Materiales y Métodos:** Se presentan a 9 pacientes tratados entre 2006 y 2023, que concurrieron a la consulta por pérdida de la extensión de la articulación metacarpofalángica mientras realizaban alguna tarea manual de fuerza. **Resultados:** Ocho fueron operados y, en uno, se logró el desbloqueo con su respectiva maniobra de reducción. Todos recuperaron el rango de movilidad completo sin complicaciones ni recidivas. **Conclusiones:** El bloqueo metacarpofalángico es infrecuente. Como protocolo, aconsejamos intentar una reducción cerrada y, si es necesaria la cirugía, utilizar un abordaje palmar para el dedo mayor o palmar-radial, ya que expone el ligamento colateral accesorio por destrabar y resecar el pico óseo a fin de evitar la recidiva del enganche.

Palabras clave: Bloqueo metacarpofalángico; articulación metacarpofalángica; mano; dedo en gatillo.

Nivel de Evidencia: IV

INTRODUCTION

Metacarpophalangeal (MCP) joint locking is a rare condition characterized by the sudden loss of both passive and active maximum extension of the MCP joint following a forced fist clench. Mobility in the interphalangeal joints remains unaffected.

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The aim of this article is to present the clinical results of a series of patients treated for MCP joint locking at our institution, to share our anatomical research on this condition, to describe the different classifications used for this entity, and to analyze current treatment options. The goal is to establish a protocol for the management of this condition in daily clinical practice.

We hope to contribute to the biomechanical understanding and adequate treatment of MCP joint locking.

MATERIALS AND METHODS

We present a case series of nine MCP joint locking events in seven patients treated between 2006 and 2023. The cohort included two women, one of whom experienced bilateral non-simultaneous locking, and five men, one of whom had locking in two fingers of the same hand. The affected fingers were the index finger in eight cases and the middle finger in one case (Table). All patients presented to the clinic due to the sudden loss of maximum extension in the MCP joint while performing tasks involving forced fist clenching (Figure 1).

Table. Population data.

	Age	Sex	Finger	Side	Classification
Case 1	31	M	Index	Right	Idiopathic
Case 2	35	M	Index	Right	Idiopathic
Case 3	36	M	Index	Left	Idiopathic
Case 4	21	F	Index	Left	Idiopathic
Case 5	36/40	F	Index	Left and right	Idiopathic
Case 6	29	M	Index	Right	Idiopathic
Case 7	84	M	Index and middle	Left	Degenerative

M = male; F = female.

Figure 1. Interphalangeal extension and metacarpophalangeal locking in flexion with full fist closure.

Eight patients underwent surgical treatment, achieving joint release via a palmar approach (for the middle finger) or a lateral radial approach (for the index finger) with MCP arthrotomy performed between the volar plate and the affected collateral ligament. This approach facilitated the release of the accessory collateral ligament (ACL) from the protuberance, restoring full range of motion. In all these cases, an osteophyte was identified on the metacarpal head, where the ligamentous attachment causing the lock had occurred. Following ligament release, the bony deformity was resected to prevent future recurrence. In one patient, closed reduction using the Masaharu maneuver was successfully performed, which will be discussed in detail later.

Anatomic Research

An anatomical dissection of four cadaveric specimens was performed, analyzing 16 MCP joints in triphalangeal fingers (thumbs were excluded). The collateral ligaments of the MCP joint consist of two well-defined fascicles:[1] the phalangeal and the glenoid (also referred to as the accessory) (Figure 2). Both fascicles originate proximally at a lateral tubercle of the metacarpal head. From this point, the phalangeal fascicle extends toward the base of the proximal phalanx, inserting in its most volar aspect, while the glenoid fascicle extends toward and integrates with the volar plate.[2]

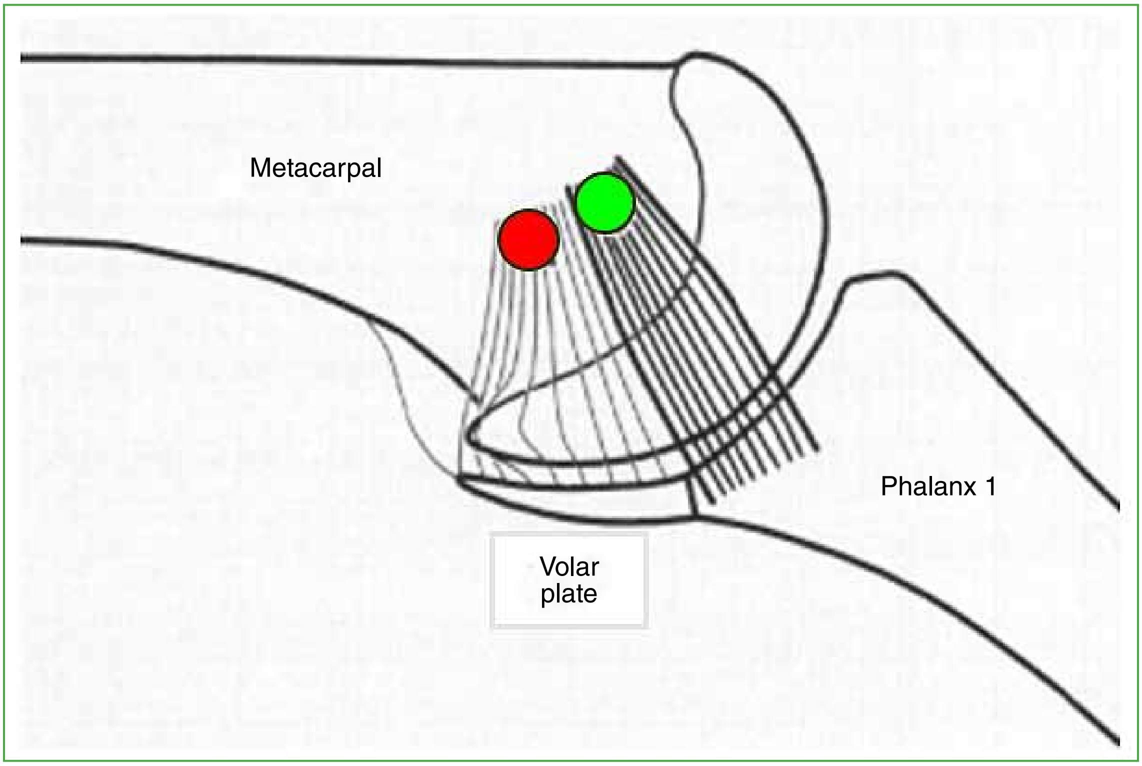

Figure 2. Collateral ligaments of the metacarpophalangeal joint.

From a biomechanical perspective, the phalangeal fascicle tightens during flexion, relaxes in extension, and acts as a lateral stabilizer of the joint, whereas the glenoid fascicle serves as a support for the volar plate, forming a fibrous cuff with it.

In our dissections, we consistently observed a groove between the phalangeal and glenoid fascicles of the collateral ligament. This groove was more pronounced and deeper on the radial side of the index and middle finger ligaments (Figures 3 and 4).

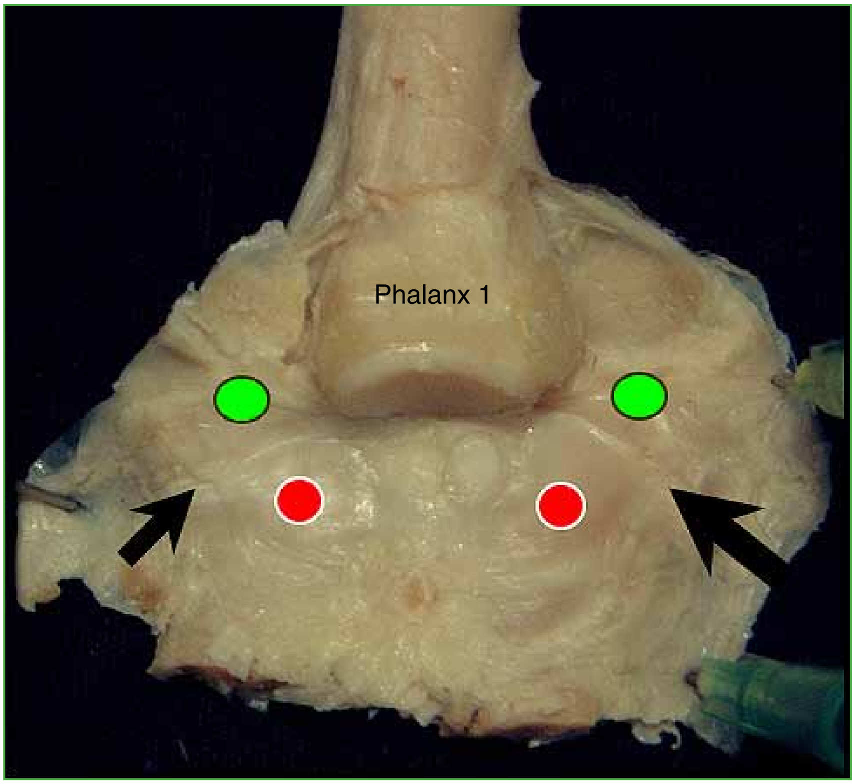

Figure 3. Difference between the radial and ulnar side in the groove. Dorsal view of the metacarpophalangeal joint.

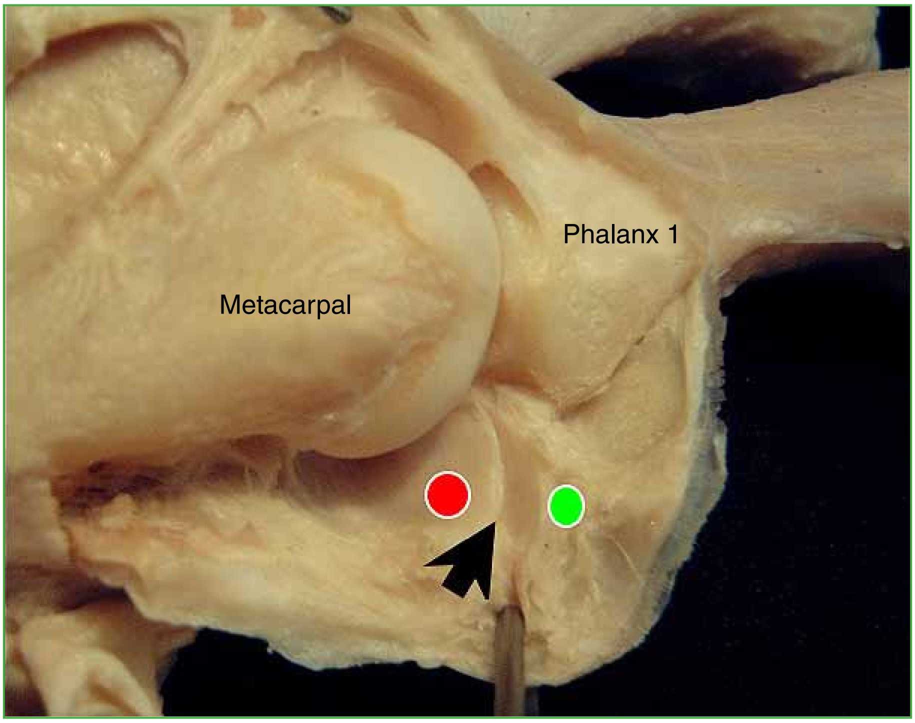

Figure 4. Lateral view of the metacarpophalangeal joint. The arrow marks the groove between the fascicles.

The deep transverse intermetacarpal ligament, which spans the heads of the second, third, fourth, and fifth metacarpals, prevents their separation and stabilizes the collateral ligaments. However, this ligament is absent on the radial side of the index finger and the ulnar side of the pinky finger. Consequently, the collateral ligaments in these areas exhibit greater laxity and mobility.

This characteristic predisposes the MCP joint of the index finger to locking when a 'horn' deformity of the metacarpal head occurs. Such deformities, first described by Poirier in 1889, can become caught in the aforementioned groove of the collateral ligament. Furthermore, the concave shape of the palm exposes the radial side of the second metacarpal head, the typical location of this deformity (Figure 5).

All these factors make the MCP joint of the index finger the one that anatomically meets all the conditions for this phenomenon to occur.

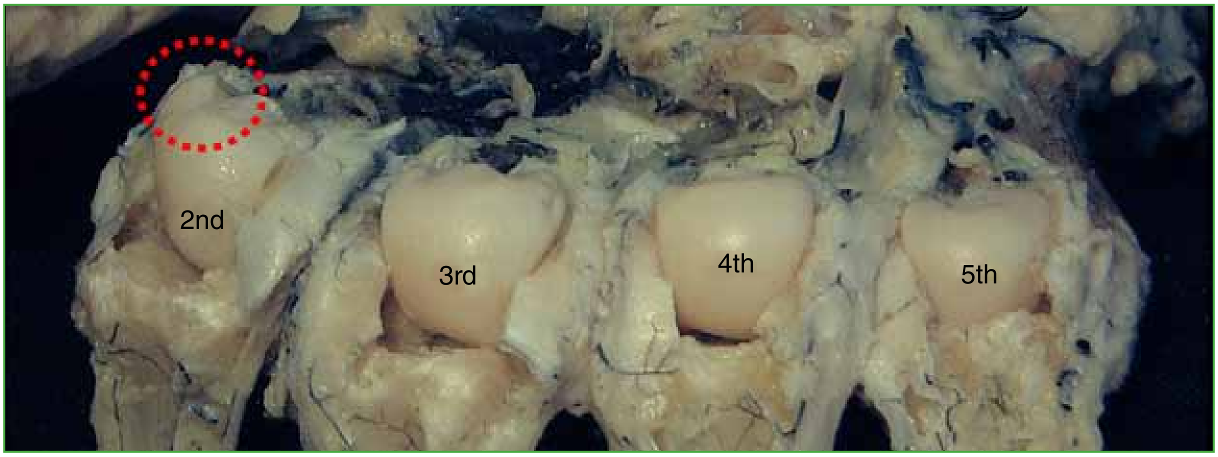

Figure 5. Anatomical alteration predisposing to metacarpophalangeal locking.

In two anatomical specimens, the prominence failed to engage with the groove during maximum flexion due to its rounded edges (Figure 6).

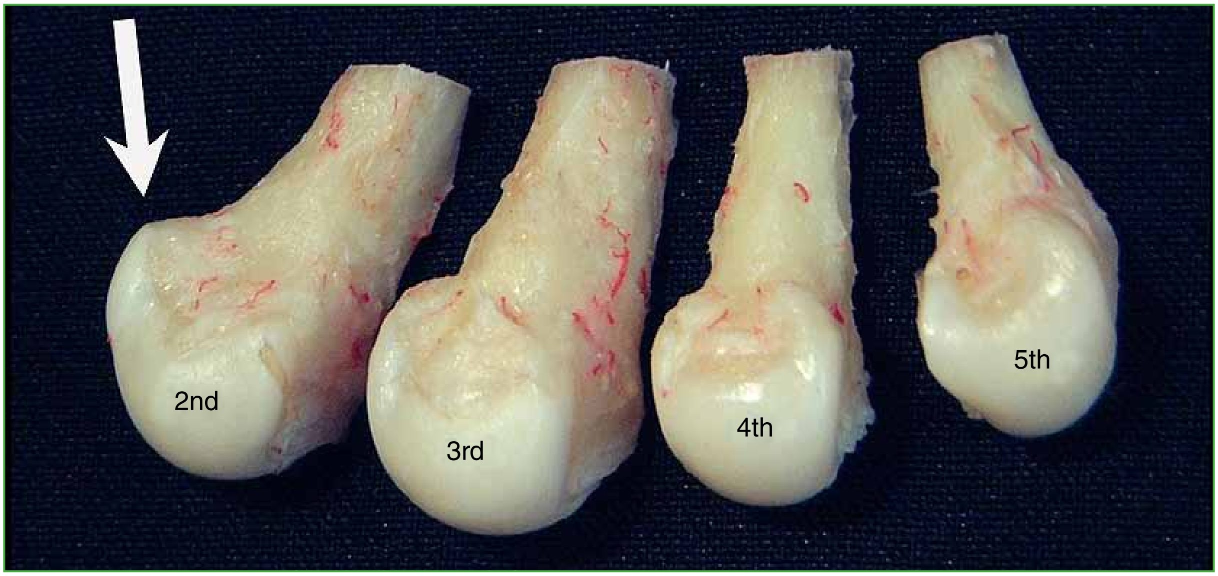

Figure 6. Prominence with rounded edges that does not generate engagement.

We hypothesize that a sharp edge and sufficient size (though we have not quantified it) are necessary for the prominence to engage in the groove (Figures 7 and 8). To date, no quantification of the deformity's size has been reported in the literature.

Figure 7. **A.** Oblique radiograph of the hand. **B.** Magnification at the head of the second metacarpal, note the bony prominence with sharp edges.

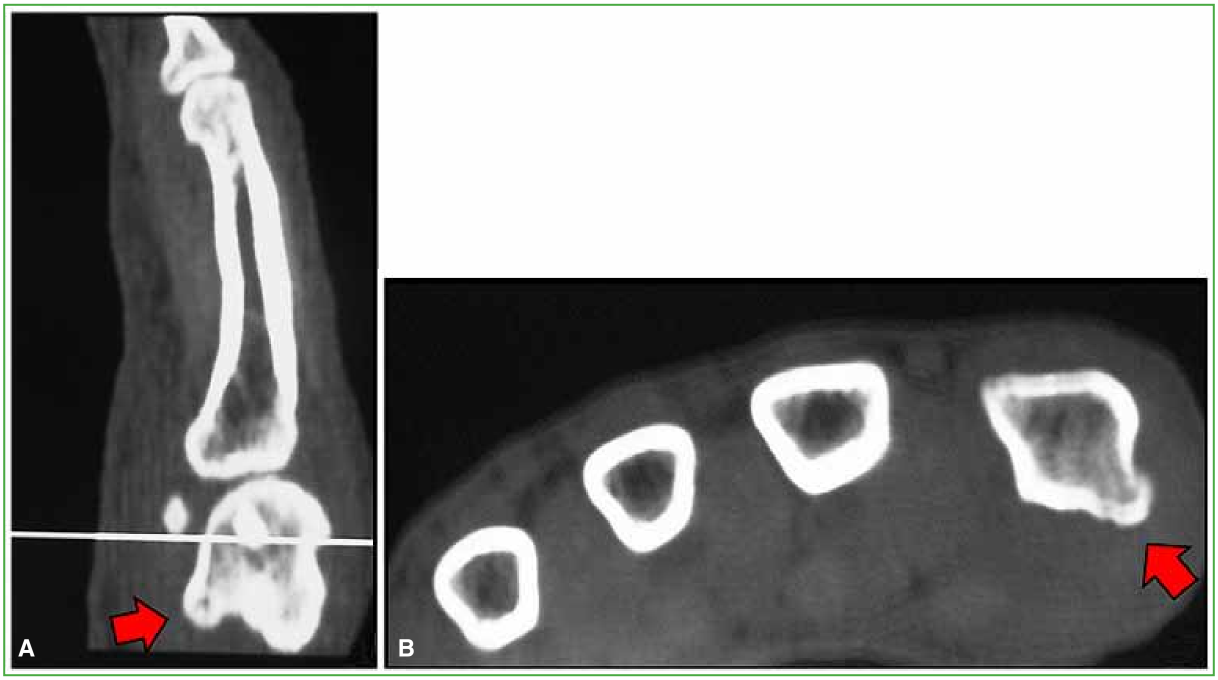

Figure 8. **A.** Computed tomography of the hand, sagittal view. The prominence is observed. **B.** The same image in the axial plane.

Imaging Studies

Among the imaging studies requested for patients, we begin with simple anteroposterior, oblique, and lateral radiographs of the hands. The most useful view is the oblique projection of the metacarpal head, which allows visualization of the palmar exostosis (Figure 7). Conventional computed tomography, particularly with 3D reconstruction, can be helpful when radiographs are inconclusive, as it clearly highlights the metacarpal horn (Figure 8).

RESULTS

Surgical treatment was performed in nine cases of MCP locking. The patients in this study were divided into two groups according to age. The average age in the idiopathic group was 41 years, while in the degenerative group, it was 82 years. In the idiopathic cases, the index finger was affected in all instances, and a metacarpal head protrusion was identified as the cause of the condition (Figure 9). One woman experienced a bilateral, non-simultaneous MCP locking, with a two-year interval between the events.

In the degenerative case, the index finger was initially involved and successfully reduced using the disengagement maneuver. However, the middle finger required surgical intervention due to irreducibility (Figure 10).

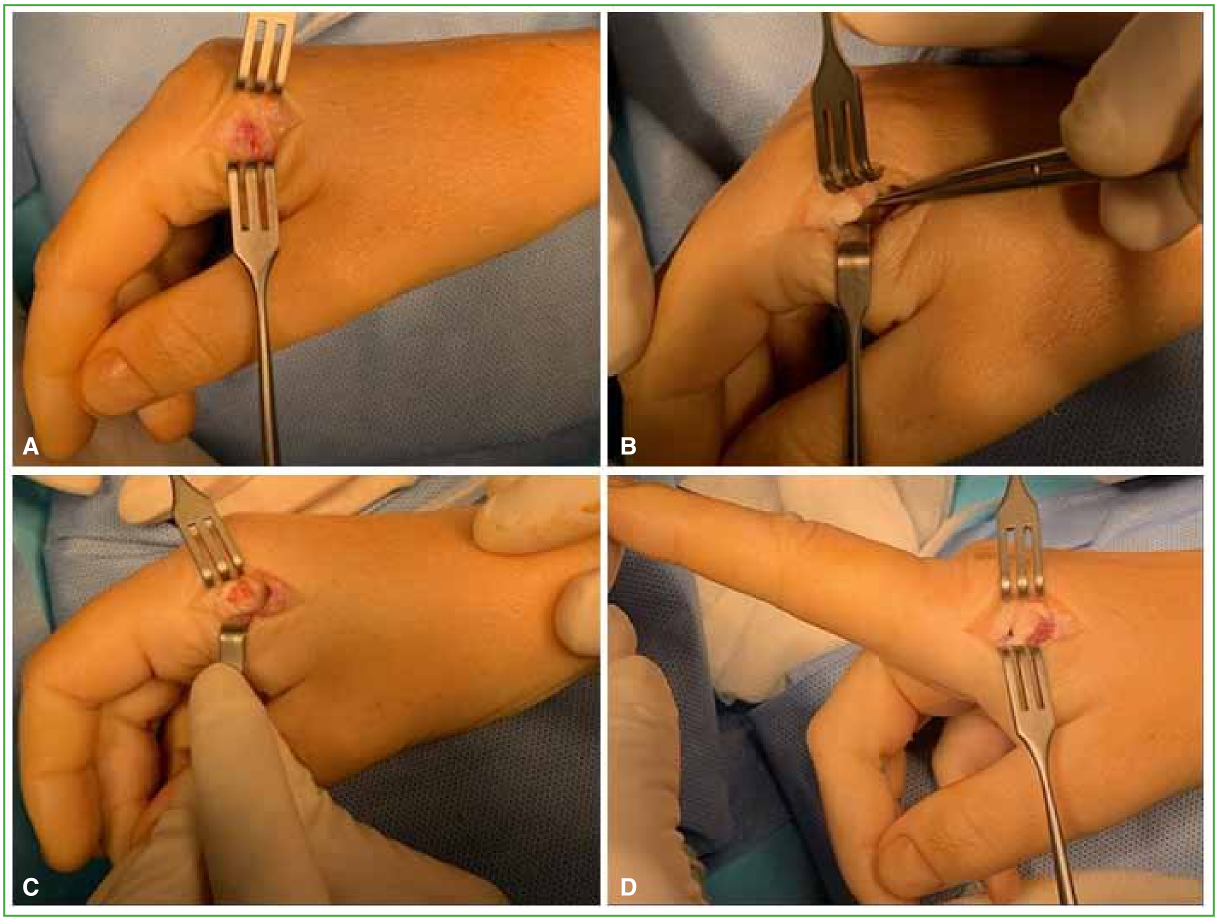

Figure 9. **A.** Lateral approach to the metacarpophalangeal joint. **B.** Prominence between collateral ligament bundles. **C.** Resection. **D.** Ligament repair.

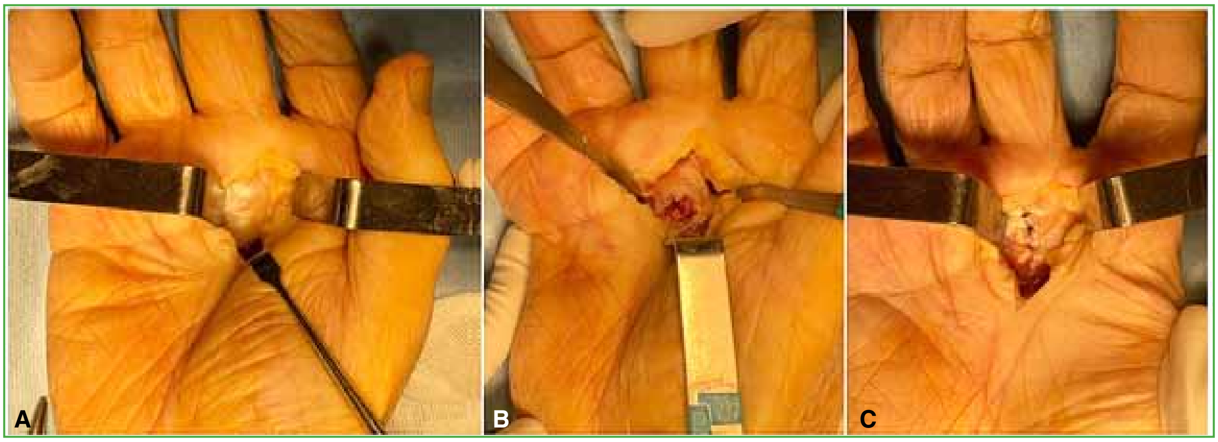

Figure 10. **A.** Palmar approach. **B.** Resection of the osteophyte that produced the engagement. **C.** Closure of the palmar plate.

All patients began active flexion-extension exercises 48 hours after surgery. The outcomes were favorable, with complete flexion-extension achieved and no residual pain reported over time.

The long-term results of the surgical procedure were analyzed, showing no recurrence of the lesion. The range of motion remained complete, with no loss of function or limitations. The patient with bilateral locking reported differences between the two surgeries. She experienced tenosynovitis and joint stiffness in the index finger of her right hand, which required three months of occupational therapy to achieve full fist clenching and unrestricted range of motion (Figure 11).

Figure 11. Patient with bilateral locking 2 years after surgery.

DISCUSSION

MCP locking can be caused by various factors, including entrapment of the glenoid fascicle of the ACL by an abnormal protrusion on the head of the metacarpal. In such cases, the entrapment leads to flexion locking of the MCF joint, preventing full extension of the finger. Although this condition is uncommon, the index and middle fingers are the most frequently affected, accounting for approximately 80% of cases. However, there is limited literature on this entity.

The most common presentation in our case series was flexion locking with the classic symptomatology of an inability to actively or passively extend the MCP joint, full flexion of the MCP joint, and normal interphalangeal range of motion.

In most cases, the cause was an alteration in the shape of the metacarpal head, characterized by a prominent osteophyte or condyle on the radial side, resulting in engagement of the glenoid fascicle (ACL) during MCP flexion. The larger size of the second metacarpal head, combined with the absence of a transverse intermetacarpal ligament on the radial side, may explain the higher frequency of locking in this area.

In our series, no cases of locking were observed on the ulnar side of the MCP joint.

According to the reviewed literature, MCP locking can have different etiologies, including cases where it occurs exclusively in flexion, exclusively in extension, or in both flexion and extension. In MCP locking caused by ACL entrapment, the condition is typically due to entrapment of the radial or ulnar ACL over an abnormal metacarpal protrusion. This protrusion may arise idiopathically or degeneratively, from an osteophyte, or due to conditions such as acromegaly, achondroplasia, bone tumors, or malunited fractures. Cases of ACL fiber laceration, likely caused by repetitive flexion-extension movements, have also been reported. In MCP joint locks occurring in extension, the primary cause is joint entrapment secondary to a tear of the palmar plate. Locks that occur in both flexion and extension are typically due to intra-articular loose bodies, such as those seen in osteochondromatosis.[3] In all cases, alterations in the geometry of the metacarpal head may be the underlying cause of MCP locking.

In terms of differential diagnosis, the most frequent condition that may be confused with MCP joint locking is trigger finger. Unlike MCP joint locking, trigger finger is characterized by locking of the MCP joint, proximal interphalangeal joint, and distal interphalangeal joint in flexion. Therefore, establishing an accurate differential diagnosis is essential to ensure proper treatment.

In 1974, Harvey proposed a classification system that divides MCP locking into three groups: degenerative, spontaneous, and miscellaneous.[4] In the degenerative group, the impingement of the volar plate or collateral ligament to a bony prominence in the palmar region of the metacarpal head is caused by a degenerative osteophyte. Patients in this group are typically older than 50 years, and the middle and ring fingers are most commonly affected, with the index finger rarely involved. Degenerative joint changes are visible on radiographs.

In the spontaneous group, impingement is attributed to anatomical variation. Patients in this group are typically aged 20–50 years, and the index finger is exclusively affected. Radiographs in this group reveal no articular changes but may show prominences of the metacarpal head on oblique projections.

The miscellaneous group includes metacarpal alterations secondary to trauma or congenital causes, as well as intra-articular loose bodies.

There is no consensus in the current literature regarding the treatment of MCP locking. In some cases, manual closed reduction is impossible, and due to the high risk of fractures, surgery is often the initial treatment. Yagi et al.[5] reported a 100% success rate with closed reduction of the joint, whereas other authors, including Langeskiöld,[6] Yancey and Howard,[7] Alldred,[8] and Harvey,[4] have described associated injuries caused by the maneuver and have advised against its use.

In 2000, Yagi et al. introduced an effective closed reduction technique consisting of four steps performed without local anesthesia.[5] The first step involves gradually flexing the MCP joint to allow the ACL to move through the area of engagement (Figure 12A). In the second step, when the joint is in maximum flexion, traction is applied, and radial deviation is performed, which produces an audible 'click' in some patients (Figure 12B). The joint is then gradually extended and, with the patient's help, the radial offset is maintained. In the third step, if reduction is not achieved, rotational movements are applied to the proximal phalanx, transmitting force to the MCP joint and the ACL (Figure 12C). In most cases, disengagement occurs during this step. The fourth step involves gradually extending the joint while maintaining external rotation with the patient's assistance. No resistance or pain should be felt; if these symptoms occur, the reduction attempt has failed (Figure 12D). When closed reduction is unsuccessful, surgical treatment should be considered.

The palmar approach is one option for surgical treatment. Magnetic resonance imaging studies published by Kim et al.[9] suggest that this approach involves deeper dissection, which restricts access to the bony prominence. Retraction of the digital arteries and nerves is necessary to visualize the surgical field, posing a risk to these structures. Despite these limitations, this approach allows access to both sides of the metacarpal condyle. The radial approach, on the other hand, provides easy access to the condyle on the radial side of the index finger. However, it is only appropriate when the condition is confirmed to be caused by a lesion in this area, as it does not provide access to the ulnar side.

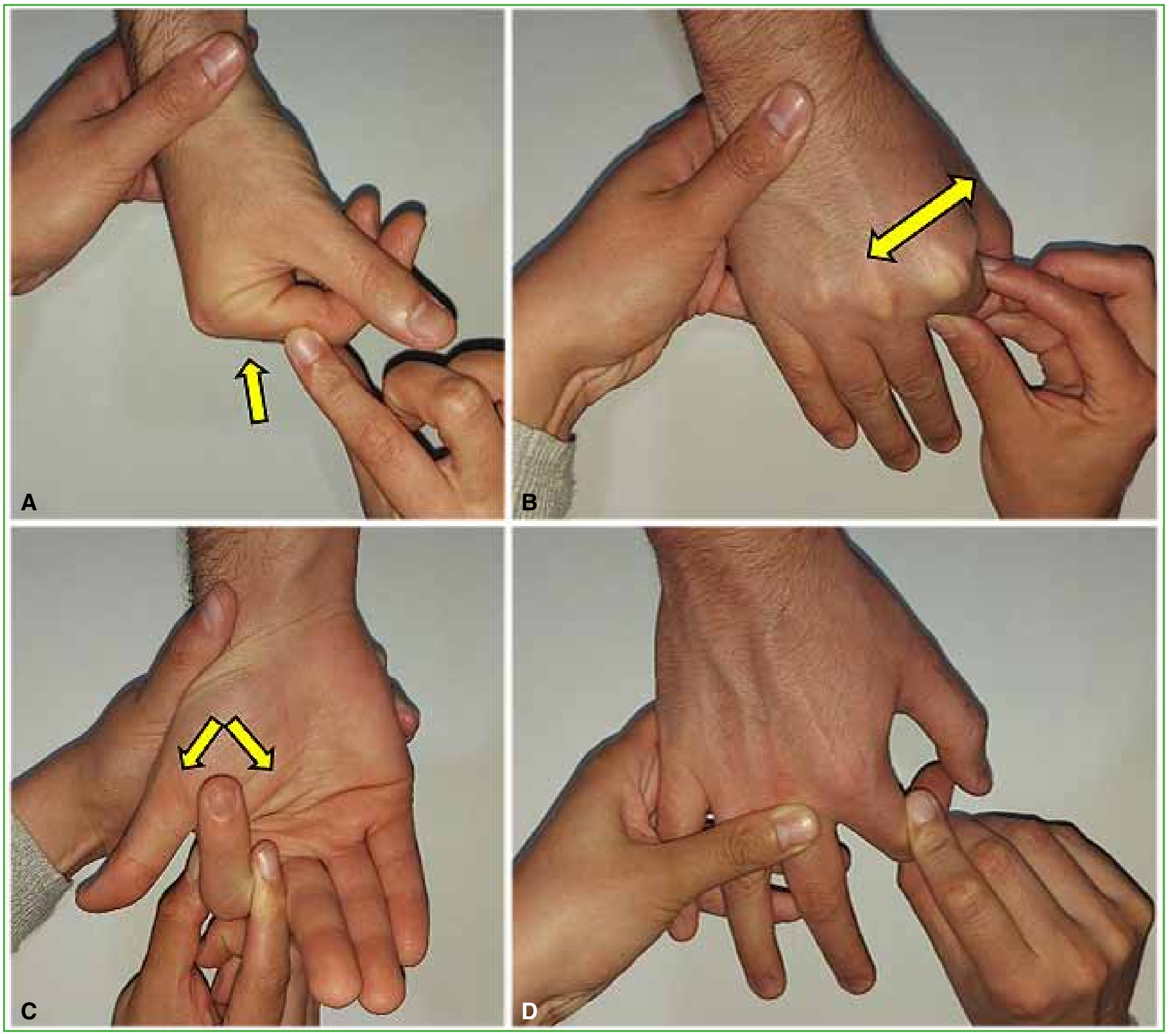

Figure 12. **A.** Metacarpophalangeal flexion. **B.** Traction and radial deviation. **C.** Rotational movements from the proximal phalanx. **D.** Extension with external rotation.

Regarding the treatment of MCP locking due to ACL entrapment, proposed options range from expectant management in mild cases to surgical intervention in severe cases. Excision of the abnormal protrusion may prevent future ACL locking. Treatment should always be individualized based on the etiology and severity of the condition.

CONCLUSIONS

MCP locking is a rare condition but poses a significant challenge in terms of accurate diagnosis and appropriate treatment. It is often confused with other conditions, making it crucial to include it in the differential diagnosis and to understand its biomechanics for effective management.

Our recommended evaluation and treatment protocol includes starting with radiographs, primarily oblique projections, to evaluate the prominence, and requesting a CT scan as a complementary study. For treatment, we recommend attempting closed reduction as the first step. If surgery is required, we suggest a palmar approach for the middle finger or a palmar-radial approach for the index finger. This allows exposure of the volar plate, which is incised longitudinally along its radial or ulnar border, depending on the ACL to be released. The osteophyte or bony prominence should be resected to prevent recurrence of the impingement.

Conflict of interests: The authors declare no conflicts of interest.

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REFERENCES

1. Testut L, Latarjet A. *Tratado de anatomía humana.* 8va ed. Barcelona: Salvat; 1944.
2. Zancolli EA, Cozzi EP. *Atlas de anatomía quirúrgica de la mano*. Buenos Aires: Panamericana; 1993.
3. Thomsen L, Roulot E, Barbato B, Dumontier C. Locked metacarpophalangeal joint of long fingers: classification, definition and treatment based on 15 cases and literature review. *Chir Main* 2011;30(4):269-75. https://doi.org/10.1016/j.main.2011.01.019
4. Harvey FJ. Locking of the metacarpo-phalangeal joints. *J Bone Joint Surg Br* 1974;56(1):156-9. PMID: 4818845
5. Yagi M, Yamanaka K, Yoshida K, Sato N, Inoue A. Successful manual reduction of locked metacarpophalangeal joints in fingers. *J Bone Joint Surg Am* 2000;82(3):366-71. https://doi.org/10.2106/00004623-200003000-00007
6. Langeskiöld A. Habitual locking of the metacarpophalangeal joint by a collateral ligament, a rare cause of trigger finger. *Plastic Reconstr Surg* 1950;6(2):175. Available at: https://journals.lww.com/plasreconsurg/citation/1950/08000/Habitual_Locking_of_the_Metacarpophalangeal_Joint.19.aspx
7. Yancey HA, Howard LD Jr. Locking of the metacarpophalangeal joint. *J Bone Joint Surg Am* 1962;44(2):380-2. PMID: 14040363
8. Alldred AJ. A locked index finger. *J Bone Joint Surg Br* 1954;36-B(1):102-3. https://doi.org/10.1302/0301-620X.36B1.102
9. Kim JK, Chung MS, Baek GH. Locked metacarpophalangeal joint of the index finger: consideration about the surgical approach. *J Hand Surg Eur Vol* 2009;34(2):278-80. https://doi.org/10.1177/1753193408100956