

Traumatic Thumb Carpometacarpal Joint Dislocations

B. Bosmans, MD, M. H. J. Verhofstad, MD, PhD, T. Gosens, MD, PhD

Isolated traumatic dislocation of the thumb carpometacarpal joint, also called the trapeziometacarpal joint, is a rare injury. Controversy still exists concerning which ligaments are the true key stabilizers for the joint and therefore need to be damaged to result in dislocation, and optimal treatment strategies for thumb carpometacarpal joint dislocations are the subject of continuing debate. We give a review of the literature concerning traumatic dislocations of the carpometacarpal joint of the thumb and propose a treatment algorithm. (*J Hand Surg* 2008;33A:438–441. Copyright © 2008 by the American Society for Surgery of the Hand.)

Key words Carpometacarpal, dislocation, pathophysiology, thumb, treatment algorithm.

A PURE TRAUMATIC DISLOCATION of the first carpometacarpal joint is very rare, in contrast with the fracture-dislocation variant, the so-called Bennett fracture. Carpometacarpal dislocation of the thumb accounts for less than 1% of all hand injuries.¹ It usually results from axial loading with flexion of the thumb metacarpal base that forces the joint to dislocate in a dorsal direction.^{2,3} Because the volar ligaments are very strong, avulsion of the metacarpal base is usually seen.

Although for years the volar oblique ligament has been believed to be the key stabilizer of the thumb carpometacarpal joint,⁴ controversy concerning which ligaments are damaged in joint dislocation and which ligaments are the true key stabilizers for joint stability still exists.⁵

Optimal treatment strategies for thumb carpometacarpal joint dislocations are still a subject of debate. Strategies have ranged from closed reduction and immobilization in a thumb plaster cast to closed or open reduction and temporary fixation using K-wires with or without reconstruction of capsule and ligaments.^{6,7}

This article aims to review the relevant literature concerning traumatic dislocation of the carpometacarpal joint of the thumb and its treatment.

From the Department of Surgery and the Department of Orthopaedic Surgery, St. Elisabeth Hospital, Tilburg, The Netherlands.

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Corresponding author: B. Bosmans, MD, St. Elisabeth Hospital, Hilvarenbeekseweg 60, 5022 GC Tilburg, The Netherlands; e-mail: Bas_Bosmans@hotmail.com.

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ANATOMY OF THE THUMB CARPOMETACARPAL JOINT

Management of dislocations of the thumb carpometacarpal joint in a proper way requires a fair understanding of its anatomy and function. Several authors have reported on the specific characteristics of the thumb carpometacarpal joint regarding its surfaces and ligaments. Since as early as 1742, when Weitbrecht (quoted by Kaplan⁸) reported on 4 ligaments around the thumb, the anatomy of the thumb carpometacarpal joint has been studied. It has been called a saddle joint: the trapezium is convex on anteroposterior views and concave on lateral views, whereas the metacarpal is the opposite.^{9,10}

This unique configuration provides a wide range of motion varying from abduction to opposition while the joint remains stable. The thumb can thus withstand loading and yet allow mobility, resulting in powerful pinching and grasping. This is achieved by means of the so-called screw-home torque mechanism.⁵ When the thumb is moved into opposition, a slight internal rotation of the metacarpal takes place and the dorsoradial ligament tightens. At the same moment, the volar beak of the thumb metacarpal is compressed into its recess in the trapezium and the joint gains articular congruence. As a result, a dynamic force couple (ie, abducting force through the abductor pollicis longus in combination with tension on the dorsal ligament and locking of the volar beak resulting in articular congruence) for stability is created and the carpometacarpal joint is converted from an incongruent lax joint in the static resting position to a congruent rigid and stable joint in opposition. Normal function of the carpometacarpal ligaments in this situation is essential.

PATHOPHYSIOLOGY IN THUMB CARPOMETACARPAL JOINT DISLOCATION

In the late 1960s, the anterior oblique ligament was considered to be the key stabilizer of the thumb carpometacarpal joint.⁴ This observation was subsequently debated in the following years by Harvey and Bye¹¹ and Pagalidis et al¹² who respectively proposed that the posterior



FIGURE 1: **A** A 27-year-old man sustained injury to his left wrist in a motor vehicle accident resulting in dislocation of the left thumb carpometacarpal joint. A closed reduction with a palpable clunk was performed. **B** After applying a cast, the joint was and remained congruent. The cast was removed after 6 weeks and physiotherapy started. More than 3 years after his accident, he was still able to work in construction with a completely painless thumb carpometacarpal joint. Range of motion in all directions and thumb strength using a pinch gauge (Saehan hydraulic pinch gauge SH 5005 [also known as Jamar hydraulic pinch gauge]; Saehan Corporation, Korea) were normal.

oblique and intermetacarpal ligaments were the most substantial contributors to joint stability. Several clinical reports on the open treatment of thumb carpometacarpal joint dislocations have described other ligamentous pathology. Shah and Patel² found the dorsal structures to be disrupted in their 4 cases of thumb carpometacarpal dislocations, while the anterior oblique ligament was intact. In a large cadaver study by Strauch et al¹³ studying 38 cadaver thumbs, the dorsoradial ligament complex was found to be the primary restraint to dorsal dislocation. When cutting all ligaments of the thumb carpometacarpal joint except the dorsoradial ligament, the least joint dislocation was found. On the other hand, when all ligaments were intact and the dorsoradial ligament was cut, the largest degree of joint (sub)luxation occurred. This was confirmed by several anatomic and biomechanical studies of Bettinger et al,¹⁴ van Brenk et al,¹⁵ and Colman et al,¹⁶ and also in accordance with the study of Pieron.¹⁰ It has been shown in his cadaver studies that the ulnovolar capsule is reinforced by the volar ligament, also called the anterior oblique ligament, which is short and strong. It is rather close to the joint margin and runs in an oblique direction from proximal-radial to distal-ulnar. A second reinforcement comes from the infratendinous layer of the tendon of the abductor pollicis longus, which inserts on the volar aspect of the base of the first metacarpal. The capsule on the radiovolar and dorsal side is thin and inserts at a distance

from the articular edge, allowing for mobility. An exception to this is the radiodorsal ligament, which is strong and inserts closely to the articular cartilage.

Therefore, axial loading with flexion of the thumb metacarpal base will force the joint to dislocate in a dorsal direction with a rupture of the thin dorsal capsule. Because the reinforced volar capsule is strong, an avulsion of the metacarpal base can be seen frequently.

TREATMENT APPROACH

Because thumb carpometacarpal dislocation results in ligamentous injury, several surgeons have treated this condition with ligamentous reconstructions. Already in the early 1940s, traumatic thumb carpometacarpal dislocations had been treated with free tendon grafts of various origins with good to excellent results. Eggers⁷ used a part of the extensor carpi radialis longus as a tendon transfer through a drilled hole on the ulnar side of the thumb metacarpal base, and Slocum¹⁷ and Kestler¹⁸ had treated traumatic thumb carpometacarpal joint dislocations with a palmaris longus graft or an extensor pollicis brevis graft, respectively. In later years, several authors have used other ligaments such as the flexor carpi radialis^{3,4} and abductor pollicis longus.^{19,20}

Because nonsurgical or minimal invasive (percutaneous pinning) treatment can result in good outcome,^{6,21} treatment strategies are still the subject of discussion despite the earlier reports. Simonian and Trumble²² have tried to

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