

Original article

PIP joint volar rotatory dislocation: An anatomical study to explore extensor system lesions and the Stener effect

Luxation palmaire rotatoire de l'articulation interphalangienne proximale : étude anatomique des lésions de l'appareil extenseur et de l'effet Stener

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Abstract

Volar rotatory dislocation of the proximal interphalangeal joint results from volar rotation of the condyle around an intact opposite collateral ligament. A cadaveric study was performed to better understand the mechanisms of this injury. Thirty-two long fingers (II to V) were studied. After partial section of the triangular ligament, the radial collateral ligament was cut (partly or completely, at proximal or distal insertion) and volar rotatory dislocation was induced. We studied the incidence of a fixed dislocation, the distal extension of the triangular ligament lesion, and the Stener lesion of the radial collateral ligament. A buttonhole lesion was produced by a dislocated lateral band in all cases with complete section of the collateral ligament. When the lesion of the triangular ligament extended distally, dislocation became irreducible. A Stener effect (interposition of the lateral band between the condyle and the collateral ligament) was observed after reduction in 21% of cases with proximal lesions of the radial collateral ligament.

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Keywords: Dislocation; PIP Joint; Stener effect; Lateral band entrapment; Collateral ligament; Extensor system

Résumé

Les luxations palmaires rotatoires des interphalangiennes proximales sont une rotation palmaire d'un condyle autour d'un ligament collatéral opposé intact. Nous avons mené une étude cadavérique sur 32 doigts longs pour mieux comprendre le mécanisme de ces luxations. Après ouverture du ligament triangulaire et section partielle puis complète de l'insertion distale ou proximale du ligament collatéral radial, nous avons induit une luxation rotatoire. Nous avons étudié la survenue d'une luxation irréductible, l'agrandissement de la lésion du ligament triangulaire, et la survenue d'un effet Stener avec incarceration de la bandelette latérale. Dans tous les cas avec section complète du ligament collatéral, la luxation de la bandelette latérale a provoqué un doigt en boutonnière. Lorsque la lésion du ligament triangulaire s'étendait, les luxations devenaient irréductibles. Dans les lésions proximales du ligament collatéral radial, une interposition de la bandelette latérale entre le condyle et le ligament collatéral radial a été observée dans 21 % des cas après réduction.

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Mots clés : Articulation interphalangienne ; Luxation ; Lésion de l'appareil extenseur ; Lésion de Stener ; Ligament collatéral

1. Introduction

Upper limb injuries, predominantly hand injuries, are very common in hand and ball-striking sports, accounting for 11% of orthopedic consultations for these types of ballplayers [1]. The incidence is lower amongst rugby championship and American National Football League players [2] who do have, however, a

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high incidence of finger injuries. Specifically, these two sports are responsible for two major hand injuries, namely proximal interphalangeal (PIP) joint dislocations and metacarpal fractures. PIP joint dislocations can be divided into three groups: dorsal, volar and lateral [3,4]. Amongst PIP joint dislocations, one less well-known lesion, resulting from a volar rotation of the phalangeal condyle around an intact opposite collateral ligament acting as a pivot point, is classified as PIP joint volar rotatory dislocation [3,5–7]. If there is a central slip avulsion concomitant with the lateral band injury, conservative treatment leads to PIP instability. In this case it is usually advisable to repair the tendon avulsion surgically. But if the lateral band is injured without central slip avulsion, a closed reduction is often performed followed by casting. In this specific situation, there is a risk of misdiagnosing an unreduced dislocation or partial reduction and subsequent poor outcome. Partial reduction generally results from soft tissue entrapment within the joint; open reduction is required. As an explanation, in some cases, a Stener effect of the lateral extensor band has been described, consisting in an interposition of the band between the condyle and the injured collateral ligament [6,8]. We have also observed this type of lesion in rugby players, leading to the typical sequelae of pain and PIP stiffness.

We therefore conducted an anatomical study of volar rotatory dislocation to better understand the mechanism of this injury and to evaluate the incidence of soft tissue entrapment and the Stener lesion.

2. Material and method

We performed an anatomical study on eight fresh cadaveric hands. We limited the study to long fingers (II to V) so the series included 32 long fingers. Our experimental PIP dislocation was created in three steps. The first step consisted in exposing the extensor apparatus from the metacarpophalangeal joint to the distal interphalangeal joint. The lateral and medial bands were systematically exposed and the radial triangular ligament, which connects the ulnar lateral band to the radial lateral band, was cut on each long finger. We reproduced volar dislocation by axial compression and radial rotation on a semi-flexed PIP joint with an intact radial collateral ligament (Fig. 1). This maneuver can be considered equivalent to low-energy trauma. In the second step, we cut 50% of the fibers of the radial collateral ligament, distally in eight fingers and proximally in 24 fingers. We then repeated the same low-energy trauma maneuver – radial rotation on a semi-flexed PIP joint – on each finger. Finally, the third step completely released the bony insertion of the radial collateral ligament (eight distally and 24 proximally), followed by one more low-energy trauma maneuver.

In each situation we studied:

- volar dislocation;
- palmar plate injury occurring during dislocation;
- volar entrapment of the lateral band between the two condyles producing a fixed dislocation (buttonhole lesion);
- entrapment of the lateral band between the radial condyle and the injured collateral ligament (Stener lesion) when the PIP

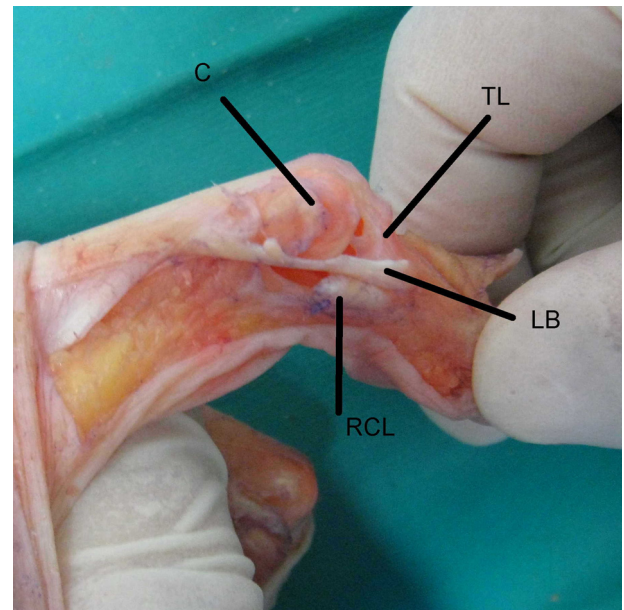


Fig. 1. Third finger dissection: after opening the triangular ligament (TL) proximal to the base of the middle phalanx and 100% release of the radial collateral ligament (RCL), an axial compression is applied on the semi-flexed PIP joint with rotation. The lateral band (LB) moves volarly to the condyle (C).

joint was again extended.

3. Results

Entrapment of the lateral band was never observed when the collateral ligament was not totally cut (0 and 50% sections).

When the collateral ligament was released distally, fixed dislocation and entrapment of the lateral band between the condyle and the injured collateral ligament did not occur.

When the collateral ligament was released proximally, putting the joint in flexion and ulnar tilt produced a classical buttonhole lesion experimentally (Fig. 2).

The Stener effect (entrapment of the lateral band between the condyle and the injured collateral ligament) was observed during extension five times out of 24 (Fig. 3). No palmar plate lesion was observed.

4. Discussion

PIP injuries are very common in sports like American football and rugby [2,9]. PIP dislocations, frequently observed, are divided into three groups: dorsal, volar and lateral [3]. Dorsal dislocations are the most common and result from a hyperextension mechanism associated with axial compression in the action of catching the ball. In these lesions, collateral ligaments are distended but usually remain continuous. Lateral dislocations are less common and result from a unilateral lesion of a collateral ligament with a partial tear of the palmar plate. They occur via a mechanism of forced valgus or varus applied to the PIP joint. Volar dislocations are the rarest and can be rotatory when one of the collateral ligaments stays intact [3,10]. The mechanism of volar rotatory dislocation associates axial compression on a semi-flexed PIP joint with rotation; we tried

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