CASE REPORT

Simultaneous Double Dislocation of the Interphalangeal Joints in One Finger: A Case Report and Literature Review

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Abstract

The simultaneous double dislocation of the distal interphalangeal joint (DIPJ) and proximal interphalangeal joint (PIPJ) in one finger is a rare injury. We present the case of a right-hand dominant male in his late teens who sustained a hyperextension injury to the tip of his left ring finger while playing football. A physical examination followed by anteroposterior and lateral radiographs confirmed dorsal dislocations at both the PIPJ and DIPJ in a "stepladder" deformity. His finger was subsequently splinted for 1 week after which hand physiotherapy was initiated. At 6 weeks follow-up, the patient demonstrated full functional recovery with a full range of motion in both DIPJ and PIPJ with no pain or stiffness. We also provide an up-to-date review of PubMed-indexed case reports regarding simultaneous double dislocations of the DIPJ and PIPJ.

Level of evidence: V

Keywords: Ball sports, Double dislocation, Finger dislocation, Finger injury, Interphalangeal joints

Introduction

The simultaneous double dislocation of the distal interphalangeal joint (DIPJ) and proximal interphalangeal joint (PIPJ) in one finger is a rare pattern of injury that was first described by Bartels in 1874.[1] Most commonly, an acute hyperextension force applied to the fingertip tears the volar capsule of the DIPJ, dislocating it dorsally while any additional force not dissipated by the DIPJ dislocation is transmitted further, disrupting the volar capsule of the PIPJ and causing it to also dislocate dorsally.[2,3]

Case presentation

We present the case of a right-hand dominant male in his late adolescence who sustained a hyperextension injury to the tip of his left ring finger while playing football. He presented with complaints of pain and swelling within the same day of the injury. A physical examination revealed tenderness and deformity of the left ring finger at the PIPJ and DIPJ with reduced sensation. He was unable to actively move his finger. There was otherwise no evidence of severe neurovascular deficit and there were no bruises or skin lacerations. The physical examination was suggestive of simultaneous dislocations of the PIPJ and DIPJ.

Initial plain radiographs of the left-hand ring finger were taken [Figure 1]. These revealed dorsal dislocations at both the PIPJ and DIPJ in a "stepladder" deformity with no evidence of fractures.

Closed reduction was obtained with manual longitudinal traction followed by flexion under ring block anaesthesia. Afterward, a malleable, foam-padded aluminium splint (Zimmer Biomet, Inc., Warsaw, IN, USA) was applied to the left-hand ring finger in slight flexion. A post-reduction physical exam found the stability of the DIPJ and PIPJ to be satisfactory. There was also an improvement in sensation. Post-reduction radiographs confirmed that the PIPJ and DIPJ had been successfully reduced [Figure 2].

The finger was immobilised in the splint for 1 week. After 1 week, he underwent day-time buddy-strapping with the little finger for the next 3 weeks. At this time, the patient had no complaints of pain but there was some stiffness in the finger. He was referred to a physiotherapist to begin finger range of motion exercises. This regime included fist pumps for swelling and finger tendon glides. Each position was held for 20 seconds and the hand physiotherapy routine was done 4 times a day. At a 6-week follow-up, the patient demonstrated full functional recovery with a full range of motion in both DIPJ and PIPJ with no pain or stiffness. The DIPJ, PIPJ, and collateral ligaments were found to be stable

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on a clinical examination. At this time, he was able to return to his baseline physical activities.

Discussion

A literature search was conducted on PubMed using the following combination of keywords: "double dislocation" and "interphalangeal". Results were restricted to English publications with available full-texts and case reports involving a double dislocation of the distal and proximal interphalangeal joints in any finger (index, middle, ring, or little) without any date restrictions. A summary of 20 cases reported across 14 articles can be found in the Supplementary Material [Table S1].

Among 20 case studies, 11 (55%) patients were under 35-years-old with 10 (50%) being injured while playing ball sport while 9 (45%) were older than 50-years-old with 6 (30%) being injured in a fall. The ratio of male to female cases was 18:2 with the female cases belonging to the older age group. Our case is typical of a younger patient presenting with a double dislocation of the PIPJ and DIPJ in a single finger being a young male injured during ball sports. This pattern of dislocation appears to have a bimodal distribution, with ball sports being the main cause in younger patients, usually males and falls being the main cause in older patients. Cases most commonly presented with pain,[3-11] swelling,[3,4,6-12] and deformity.[2,3,5-10-12-14] Finger movement was impaired in some cases.[5,9,11] This was similar to our case who primarily presented with pain, swelling, and an inability to mobilise his finger.

Plain radiography was used in all cases to identify simultaneous dorsal dislocation of both interphalangeal joints.[2-15] A proximal fracture of the distal phalanx was identified in one case,[11] and a condylar fracture of the proximal phalanx was identified in one case.[15] Post-reduction radiographs identified an avulsion fracture of the volar proximal rim of the middle phalanx in one case,[14] a volar rim fracture in one case,[14] and a small avulsion fracture at the volar base of the middle phalanx in one case.[15] Plain radiography was also the main mode of investigation in our case and has proven effective in identifying the dislocation clearly while ruling out any associated fractures.

Figure 1. (A) Anteroposterior view and (B) lateral view radiographs of the left-hand ring finger taken before reduction showing double dorsal dislocation of both proximal and distal interphalangeal joints in a "stepladder" deformity

Figure 2. (A) Anteroposterior view and (B) lateral view radiographs of the left-hand ring finger taken after reduction showing that both joints were well reduced

The most common initial management was closed reduction using longitudinal traction.[2,3,5-9,11,14,15] Three cases specified applying pressure over the base of the dislocated digit,[11] the dorsal aspect of the distal phalanx,[9] or the base of the caudal phalanx at the DIPJ followed by the PIPJ.[15] Three cases involved hyperextending the injury before reducing it.[5,8,10] Digital nerve block or ring block anaesthesia was used in eight cases,[4-8,13,15] and a peripheral nerve block in one case.[10] Cases in which closed reduction failed describe the use of general anaesthesia,[12] open reduction,[15] and Kirschner wire fixation.[12,15] In one case, post-reduction stress tests found no firm endpoint at the PIPJ while a stress radiograph showed radial instability, requiring the radial collateral ligament to be repaired with a Mitek suture anchor (DePuy Mitek, Raynham, MA, USA) 4 days after the injury.[7]

Methods of splinting were specified to be malleable, foam-padded aluminium splints in 5 cases,[3,5,10,11,13] and buddy taping in 6 cases.[4,8,9,12,14] In one case, an unspecified splint was applied for 1 week but this was replaced with buddy taping since there were no complaints of pain or joint instability.[14] In another case in which Kirschner wire fixation was initially used, buddy taping was later favoured to avoid further joint damage and only after the DIPJ and PIPJ were confirmed to be relatively stable despite the anterior capsule and radial collateral ligament of the PIPJ having ruptured.[12] The finger was splinted in slight flexion in the intrinsic plus position in 6 cases,[4,6-8,10,15] and in flexion in 2 cases.[12,13] In the intrinsic plus position, the metacarpophalangeal joints are flexed at approximately 60 – 90°,[4,8] and the proximal and distal interphalangeal joints are either extended,[4] or flexed at approximately 10 – 15°.[8] One case splinted the finger in 45° of metacarpophalangeal joint flexion and 15° of PIPJ and DIPJ flexion.[11] Duration of splinting varied between 2 weeks,[5,7,9,13] 3 weeks,[2,5,6,11,14,15] and 4 weeks.[10] Final follow-up times ranged from 3 weeks,[2] to as long as 72 months.[10] In our case, the duration of splinting was 1 week after which early mobilization was initiated. We found that although the duration of splinting was shorter than cases published in the literature, early mobilization resulted in positive functional results at a 6-week follow-up at which the patient was able to return to his baseline level of physical activity.

Conclusion

In conclusion, the simultaneous double dislocation of the DIPJ and PIPJ is a rare injury often caused by ball sports in younger patients and falls in older patients. Cases are often managed with closed reduction using longitudinal traction followed by a period of splinting and physiotherapy afterward.

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Supplementary Table

Table S1. Summary of the literature

Year	Authors	Age (years)	Gender	Hand	Finger (d/n.d)	Cause of Injury	Mechanism of Injury	Presentation	Treatment	Follow-up	Follow-up results
1980	Espinosa and Renart	30	M	L	Ring (n/r)	Handball	n/r	Pain, swelling. Dorsal displacement of the middle phalanx on the proximal phalanx	Closed reduction and splinting	6 months	PIPJ active flexion of 80°. DIPJ active flexion of 70°
1992	Curran et al.	17	M	R	Little (d)	Gaelic football	Hyperextension	Open volar dislocation of the head of the proximal phalanx	Closed reduction and splinting. Mobilisation initiated at 2 weeks	2 years	Pain-free, stable, full ROM
1993	Andersen and Johannsen	66	F	L	Index (n.d)	Fall	Hyperextension	Pain, swelling	Closed reduction and splinting. Physiotherapy initiated at 3 weeks	3 weeks	Tenderness on the volar aspect of the PIPJ
										5 weeks	Pain-free, stable, some swelling, some reduction in PIPJ volar flexion
										11 months	No discomfort
2000	Takami et al.	35	M	R	Ring (n/r)	Softball	n/r	Step-ladder deformity. Volar skin laceration at the PIPJ	Closed reduction and splinting. Gentle exercises initiated at 2 weeks	3 months	Pain-free, full active ROM, some PIPJ swelling
		53	M	L	Index (n/r)	Softball	n/r	Double silver fork deformity, impaired movement	Closed reduction and splinting for 3 weeks	6 months	PIPJ active ROM of 0 – 95°. DIPJ active ROM of 0 – 55°. PIPJ discomfort on strenuous use
		26	M	L	Little (n/r)	Basketball	n/r	Pain, deformity	Closed reduction and splinting for 2 weeks	4 months	Pain-free, full ROM

2004	Van Ransbeeck and De Smet	29	M	R	Ring (n/r)	Football	Hyperextension	Pain, swelling, deformity, impaired movement	Closed reduction and splinting. Physiotherapy initiated at 3 weeks	6 months	PIPJ flexion of 85° and extension deficit of 20°. DIPJ flexion of 45° with normal extension. Some PIPJ swelling
2009	Kim	23	M	L	Little (n/r)	Football	n/r	Swelling, stepladder deformity	Closed reduction and splinting. Mobilisation initiated at 2 weeks	16 months	Normal ROM
		59	M	R	Little (n/r)	Fall	n/r	Pain	Closed reduction was unstable. Radial collateral ligament repair carried out 4 days post-trauma	12 months	PIPJ ROM of 10 – 80° DIPJ ROM of 0 – 50°
2012	Jahangiri	62	M	R	Little (d)	Finger caught in a fire door	n/r	Swelling, deformity. Volar skin laceration with the head of the proximal phalanx visible through this	K-wire fixation under general anaesthesia followed by splinting	-	Wound healed, good ROM, no instability or functional deficits
2013	Fu and Dai	54	M	R	Little (n/r)	Fingertip struck by a motorcycle handlebar	n/r	Stepladder deformity	Closed reduction and splinting. Mobilisation initiated at 3 weeks	3 weeks	n/r
2013	Mishra et al.	21	M	R	Little (d)	Cricket	n/r	n/r	Closed reduction and splinting. Physiotherapy initiated at 3 weeks	1 year	Normal PIPJ flexion and extension. Normal DIPJ flexion with an extension deficit of 15° and some swelling
		28	M	R	Little (n/r)	Fall	n/r	/r	Open reduction and K-wire fixation	1 year	Normal PIPJ flexion and extension. Normal DIPJ flexion with an extension deficit of 15° and some swelling
2014	Seki	64	M	R	Little (n/r)	Fall	n/r	Deformity	Closed reduction and splinting. Rehabilitation initiated at 3 weeks	n/r	Pain-free, stable, no complaints of functional deficit. PIPJ flexion of 90° and extension deficit of 10°
		66	M	R	Little (n/r)	Fall	n/r	n/r	Closed reduction and splinting for 1 week followed by buddy taping	n/r	Nearly full ROM
2016	Raval and Jariwala	68	M	R	Little (d)	Fall	n/r	Pain, swelling, deformity	Closed reduction and splinting	3 weeks	Stiffness without pain
										6 weeks	Minimal residual stiffness
										3 months	No stiffness
										6 months	Painless movement
2020	Vasiliadis et al.	13	M	n/r	Little (n.d)	Basketball	Axial compression, hyperextension	Pain, swelling, deformity	Closed reduction and splinting for 2 weeks	3 weeks	PIPJ flexion up to 90° DIPJ flexion up to 50° Normal extension in both joints
										6 weeks	Full active ROM

										3 months	Returned to previous level of piano playing without limitations
		16	M	n/r	Index (d)	Football	Hyperextension	Swelling, deformity, impaired movement	Closed reduction and splinting for 2 weeks	3 weeks	PIPJ flexion up to 75° DIPJ flexion up to 45° Normal extension in both joints
										6 weeks	Full painless active ROM
										5 months	Returned to previous level of sports activities
2022	Sağlam et al.	65	F	R	Ring (n/r)	Fall	n/r	Pain, swelling, deformity	Closed reduction and splinting. Physical therapy initiated at 4 weeks	72 months	Pain-free, stable. PIPJ ROM of 0 – 90°. DIPJ ROM of 0 – 70°
2023	Ozsahin et al.	29	M	L	Little (n.d)	Football	Hyperextension	Pain, mild swelling, ecchymosis	Closed reduction and splinting. Mobilisation and rehabilitation initiated at 3 weeks	6 months	Pain-free, full ROM, no stiffness

Abbreviations: M = male; F = female; L = left; R = right; d = dominant; n.d = non-dominant, DIPJ = distal interphalangeal joint; PIPJ = proximal interphalangeal joint; ROM = range of motion; n/r = not reported