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Case Report

Complex hallucal interphalangeal joint dislocation with incarcerated sesamoid: percutaneous reduction with K-wire and literature review

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ABSTRACT

Irreducible dislocation of the hallucal interphalangeal (IP) joint is an uncommon injury, often complicated by incarceration of the sesamoid–plantar plate complex. While traditional management has relied on open reduction with or without sesamoid excision, minimally invasive approaches are gaining traction. This report presents a rare case of Miki type 2 IP joint dislocation with sesamoid interposition in a 22-year-old male who sustained a dorsiflexion injury while playing badminton barefoot. Initial closed manipulation converted the pattern to type 1, resulting in an elongated, stiff toe. Under general anaesthesia, a 2-mm Kirschner wire (K-wire) was inserted medially into the IP joint and advanced dorsally to plantarly to disengage the incarcerated sesamoid. An audible click signified successful reduction, and stability was confirmed through 30° of passive dorsiflexion. The joint was immobilized with an extension-blocking thermoplastic splint for three weeks. The patient returned to full activity by two months and remained asymptomatic at one-year follow-up. A systematic review identified 31 reported cases of hallucal IP dislocation. Type 2 injuries with sesamoid entrapment were consistently resistant to closed reduction; while early literature favoured open approaches, recent reports demonstrate the efficacy of percutaneous or ultrasound-guided techniques. This case supports percutaneous K-wire manipulation as a safe, minimally invasive alternative to open reduction, offering tactile mechanical advantage and a reduced risk of chondral injury. Percutaneous reduction under true lateral fluoroscopic guidance provides a tissue-preserving solution with excellent functional outcomes when combined with early recognition of the injury pattern.

Keywords: Hallux, Interphalangeal joint, Dislocation, Sesamoid, Percutaneous reduction, K-wire fixation

INTRODUCTION

The hallucal interphalangeal joint is stabilized on the plantar aspect by a thickened plantar plate and the flexor hallucis longus tendon. The hallucal interphalangeal sesamoids are accessory ossicles of the interphalangeal joint of the hallux. Although termed sesamoids, they are classified as accessory ossicles, as they are located outside the flexor hallucis longus tendon.[1] True sesamoid bones are within the substance of the tendons. Dyre Trolle remarked upon the ubiquity of this sesamoid, present in the 56% of the sectioned embryonic feet. Bizarro demonstrated with x-rays the prevalence to be within the range of 5 to 13%.[2,3] These small, pyramidal-shaped osseous structures are characteristically found in pairs, situated beneath the proximal phalanx of the hallux. They are fully enveloped by articular cartilage and articulate with the interphalangeal joint.

Their dimensions exhibit variability, ranging from 0.5 to 10 mm², and although typically situated in the midline, they may also be in medial or lateral positions. Their oval-shaped, osseous bases are embedded within the dorsal surface of the plantar plate, positioned outside the flexor hallucis longus tendon.[4] Dislocation of the hallucal IP joint is rare and often results from an axial force on an extended

toe. Miki et al described two patterns: type 1, where the sesamoid and plantar plate become interposed within the joint; and type 2, where the sesamoid lies dorsal to the proximal phalanx (Table 1).[8]

When interposed, the sesamoid functions as a rigid mechanical wedge preventing reduction (type 2), and repeated closed man oeuvres risk converting the injury into a more complex pattern, producing the characteristic elongated toe (type 1).

CASE REPORT

We present a case of a 22-year-old man who sustained an injury while playing badminton barefoot. He landed awkwardly on the tip of his hallux and presented to the emergency department with a deformed toe. Initial x-rays revealed a type 2 dislocation, which was manipulated under sedation. The technique involved holding the ankle in plantar flexion to relax the flexor hallucis longus (FHL), gently hyperextending the interphalangeal joint, and applying traction. This inadvertently converted the dislocation into a type 1 injury, resulting in an elongated, stiff toe.

Subsequently, the decision was made to reduce the joint surgically under general anesthesia. The sharp end of a 2 mm K-wire was gently inserted into the interphalangeal joint from the medial paraxial border of the toe at the junction of the glabrous and non-glabrous skin. Then, the blunt end of the K-wire was used to avoid injuring the articular cartilage. The K-wire was placed dorsal to the sesamoid and pushed in a plantar direction to reduce the sesamoid, which was accompanied by an audible click. The joint was noted to be stable to 30 degrees of passive dorsiflexion, and a thermoplastic extension blocking splint was applied for 3 weeks. The patient returned to sports activities two months post-injury and has no symptoms at 1 year.

Table 1: Miki classification of hallucal interphalangeal joint dislocations.

Type 1 dislocation	Type 2 dislocation
Sesamoid and volar plate interposed within the IP joint	Sesamoid dorsal to proximal phalangeal head
Elongated toe without sagittal plane deformity	Hyperextension deformity with dorsal skin puckering

Table 2: Summary of reported cases of hallucal interphalangeal joint dislocation with sesamoid involvement.

No	Author	Year	No. of cases	Mechanism	Type (Miki)	Reduction	Immobilization	Follow-up
1	Eibel[6]	1954	1	Axial loading, plantar laceration	2	Dorsal approach with sesamoid excision	Splinting (3 weeks)	5 weeks: full recovery
2	Nelson et al[7]	1981	1	Dorsiflexion	1	Patient did not have a sesamoid bone. Attempted closed reduction, then dorsal approach to reduce plantar plate	Nil	15 months: no residual instability
3	Kursunoglu et al[8]	1987	1	Dorsiflexion	2	Attempted closed reduction-converted to open reduction with medial approach with sesamoid reduction	Splinting	Good recovery
4	Miki et al[8]	1988	2	Dorsiflexion	2	Failed closed-open dorsal approach	Splinting (3 weeks)	Good recovery
5	Miki et al[8]	1988		Dorsiflexion	1	Failed closed-open dorsal approach	Splinting (3 weeks)	Good recovery
6	Szucs et al[9]	1989	1	Accidental fall on the foot	1	Closed reduction	N/A	6 weeks: hallux without alterations
7	Wolfe J[10]	1989	1	Dorsiflexion	1	Failed closed dorsolateral approach with division of the extensor tendon and excision of sesamoid	Splint with finger extension (6 weeks)	2 months: asymptomatic and normal joint balance
8	Yasuda T[11]	1990	2	Attempted suicidal jump from height	2	Failed closed reduction-medial mid lateral approach - K wire fixation	Cast boot (6 weeks)	3 ½ years follow up plantarflexion was impossible although 10 degrees of dorsiflexion was

Continued.

No	Author	Year	No. of cases	Mechanism	Type (Miki)	Reduction	Immobilization	Follow-up
								possible at the IP joint.
9	Yasuda T[11]	1990		Road traffic accident	2	Failed closed reduction-plantar approach - no plantar plate repair.	K wire fixation for 3 weeks	Follow up at 6 months- pain free flexion 30 degrees and 0 degrees extension
10	Weiss AP[12]	1992	1	Dorsiflexion	2	Failed closed dorsal EHL splitting approach with sesamoid excision	Nil	8 months: full range of motion; painless
11	Dave D[13]	1993	1	Fall from height	1	Closed reduction	Cast boot (3 weeks)	Complete recovery
12	Crosby et al[14]	1995	1	Jumping over a spill at home while barefoot	2	Failed closed reduction-medial approach for open reduction (release of interposed tissue by swiping in dorsal to volar direction) stable	Rigid sole boot	Asymptomatic
13	Ward SJ[15]	1996	1	Stubbing injury while playing soccer	2	Closed reduction converting type 2 to type 1 and successful closed reduction thereafter	Nil	Normal joint
14	Berger JL[16]	1997	1	Dorsiflexion	2	Dorsal approach, plantar plate repair stable	Buddy splinting and discharge (3 weeks)	6 weeks: full recovery
15	Sorene et al[17]	2006	1	Dorsiflexion injury while playing soccer	1	Closed: gentle longitudinal traction, exaggeration of the extension deformity to unlock the joint, and then rapid flexion of the distal phalanx with a downward pushing motion to sweep the sesamoids and plantar plate out of the joint.	Buddy splinting (3 weeks)	Asymptomatic, stable with complete joint range of motion
16	Leung et al[18]	2002	1	Dorsiflexion	2	Closed failed dorsal approach, plate reduction: stable initially, increased joint space	Rocker sole and Kirschner needle (4 weeks)	Excellent recovery
17	Banerjee R[19]	2003	1	Axial load	2	Closed reduction with traction with extension and rapid toe flexion	Nil	Complete joint balance
18	Davies et al[20]	2003	1	Dorsiflexion	2	Closed (traction, pronation and plantar translation of the distal phalanx)	Buddy splinting (3 weeks)	6 weeks: asymptomatic
19	Hatori et al[21]	2006	1	Axial loading and hyperextension force- hit against a pipe	2	Injury was neglected for 4 years. Open reduction and resection of sesamoid with arthrodesis of the IPJ	Nil	Follow up of 4 years- nil pain
20	Woon et al[22]	2010	2	Dorsiflexion	2	Percutaneous sesamoid reduction - noted to have intraoperative laxity, dorsal incision to confirm absence of residual tissue	Kirschner wire 1.25 mm (4 weeks)	6 months: mild interphalangeal stiffness, playing basketball
21	Woon et al[15]	2011	2	Motor vehicle accident	2	Failed closed-percutaneous reduction with K wire	Kirschner wire 1.6 mm (4 weeks)	At 2 years, mild interphalangeal joint stiffness that did not bother the patient

Continued.

No	Author	Year	No. of cases	Mechanism	Type (Miki)	Reduction	Immobilization	Follow-up
22	Paulus[23]	2013	1	Crush injury	1	Failed closure dorsal approach, collateral ligament rupture persistent increase in joint space	Kirschner wire (6 weeks)	Walks without discomfort, satisfactory result
23	Bin[24]	2015	1	Axial loading and dorsiflexion it went unnoticed for 4 weeks	2	Failed closed reduction followed open dorsal approach	Kirschner wire (6 weeks)	Return to sports activities at 3 months
24	Sundaranjan[25]	2016	1	Fall from a height of 6 ft	2	Failed closed reduction - open medial approach and reduction with K wire stabilization	Kirschner wire (4 weeks)	No pain at 6 months
25	Shaifuzan AR[26]	2016	1	Motor vehicle accident	1	Failed closed reduction and refused surgical management	Nil	Lost to follow up
26	Imao K[27]	2018	2	Motorcycle accident	2	Open reduction with the dorsal tendon sparing approach and K wire 1.2mm stabilization	Kirschner wire (6 weeks)	Was able to walk with no pain at 2.5 months
27	Imao K[28]	2018		Car ran over the foot	2	Conversion to type 1 by closed reduction and the open reduction with dorsal approach and K wire stabilization	Kirschner wire (3 weeks)	Able to walk with full rom at IPJ at 3 months after surgery
28	Özdemir et al[28]	2020	1	Wood block fell on the hallux	1	Mini open incision to avoid injuring the EHL tendon and reduction with K wire manipulation and K-wire fixation	Kirschner wire (6 weeks)	Able to walk and nil stiffness at 6 weeks
29	Takeda et al[29]	2020	1	Kicked floor causing hyperextension	1	Converted type 2 to type 1 and percutaneous reduced under ultrasound with 18 g needle	Buddy splinting for 3 weeks	No symptoms at 18 months
30	Kang et al[30]	2023	1	Stepped on while playing soccer	2	Traction followed by K wire insertion from dorsal aspect and reduction of sesamoid under X ray	K wire stabilization for 4 weeks	No symptoms at 8 months follow-up
31	Sajeev[31]	2025	1	Stepped on while playing badminton	2	Converted type 2 to type 1 and percutaneous reduced with K-wire	Extension blocking splint for 3 weeks	No symptoms at 1 year

DISCUSSION

Interphalangeal joint (IPJ) dislocations of the hallux remain rare injuries, with approximately 30-35 cases reported in the literature, including the present report. Most injuries occur following hyper dorsiflexion or axial loading mechanisms and may present either as simple dorsal dislocations or as irreducible injuries with incarceration of the sesamoid–plantar plate complex, classically described as Miki type 2 dislocations. This distinction is clinically important because type 2 injuries are consistently resistant to closed reduction due to soft-tissue interposition, most commonly involving the plantar plate and sesamoid apparatus. Our findings are concordant with previous reports demonstrating that failure of closed reduction is a hallmark feature of sesamoid-entrapped dislocations and should prompt early consideration of minimally invasive or open techniques.[5-7]

Earlier case series predominantly described open dorsal, medial, or plantar approaches to achieve reduction, often accompanied by partial or complete sesamoid excision.[5-7] While these methods reliably restore alignment, they are associated with increased soft-tissue access trauma and longer recovery. More recent literature reflects a shift toward minimally invasive strategies, including percutaneous sesamoid manipulation, ultrasound-guided reduction, and temporary Kirschner wire stabilization.[15-17] The present case supports this and demonstrates that percutaneous sesamoid reduction under fluoroscopic guidance can achieve stable reduction while preserving surrounding soft tissues.

Figure 1: Clinical and radiographic presentation of hallucal interphalangeal joint dislocation and percutaneous reduction technique.

(A and B) type II dislocation: clinical photograph and radiographs demonstrating dorsal skin puckering and hyperextension deformity, with sesamoid positioned dorsal to the proximal phalangeal head, (C and D) type I dislocation following attempted closed reduction: clinical photographs and radiographs showing characteristic elongated toe appearance with sesamoid interposed within the widened joint space, (E-G) percutaneous reduction technique: stepwise demonstration of 2-mm Kirschner wire introduction through the medial mid-axial border at the junction of glabrous and non-glabrous skin, with subsequent manipulation using the blunt end to displace the interposed sesamoid in a plantar direction and (H and I) post-reduction verification: image intensifier views in anteroposterior and lateral projections demonstrating successful congruent reduction of the interphalangeal joint.

Clinical outcomes across published cases are uniformly favourable, regardless of the reduction technique employed. Most patients regain full or near-full range of motion, experience minimal residual pain, and return to normal activities within weeks to months.[22,29,30] Similar to these reports, our patient achieved excellent functional recovery without stiffness or instability. These consistent outcomes suggest that timely restoration of joint congruity—rather than the specific surgical approach—is the dominant determinant of prognosis. Immobilization strategies across published cases ranged from 3 to 6 weeks, using buddy splinting, cast boots, or rigid soled footwear.[14,22,28] Our patient was immobilized with an extension-blocking thermoplastic splint for three weeks. Return to full sporting activity was achieved at two months, which compares favourably with Woon et al who reported mild interphalangeal stiffness at six months following percutaneous reduction, and with Kang et al who reported no symptoms at eight months.[22,30] The absence of residual stiffness in our patient may reflect the benefit of minimally invasive technique and the shorter immobilization period, though conclusions are limited given the single-case nature of this report.

Miki et al originally proposed a two-type classification system based on the final position of the sesamoid and plantar plate after attempted reduction.[5] Although widely cited, subsequent authors have highlighted important limitations of this system. Several reports describe conversion of type 2 injuries into type 1 patterns following traction-based manipulation, indicating that the classification may reflect the post-reduction state rather than the initial injury morphology.[22,28] Our case similarly demonstrates dynamic migration of the sesamoid–plantar plate complex, supporting the notion that the Miki classification has limited value for guiding real-time management. Instead, a functional assessment emphasizing the presence of a mechanical block, intra-articular sesamoid position, and post-reduction stability may be more clinically meaningful. Authors advocating this approach report improved decision-making and earlier selection of percutaneous or open techniques when closed reduction is unlikely to succeed.[15,16] Diagnosis remains challenging, and delayed recognition is common. Characteristic findings include dorsal skin puckering, loss of active plantarflexion, and widening of the IPJ space on radiographs.[5,9,14,17,18,20-22] True lateral views are essential, as sesamoid displacement may be subtle or occult on anteroposterior projections. Our experience reinforces previous recommendations that early identification prevents repeated forceful manipulations that may cause chondral injury or worsen soft-tissue interposition.

Most authors agree that gentle closed reduction may be attempted initially using ankle plantarflexion to relax the flexor hallucis longus and exaggeration of deformity to disengage the joint.[5] However, once a mechanical block is encountered, further forceful attempts should be abandoned in favor of percutaneous or open techniques. The present case demonstrates that percutaneous Kirschner wire–assisted sesamoid reduction represents an effective intermediate strategy between closed and open methods, combining direct mechanical leverage with minimal soft-tissue disruption. The advantage of using a Kirschner wire lies in its small caliber and controlled flexibility, which provides tactile feedback and reduces the risk of sesamoid fracture compared with rigid instruments such as Freer elevators or dental probes.[28,29] This technical nuance aligns with previously described minimally invasive techniques and may contribute to the excellent outcomes reported with percutaneous approaches.

CONCLUSION

Irreducible hallux IPJ dislocations with sesamoid incarceration require a high index of suspicion and careful radiographic evaluation. Reliance solely on the Miki classification may be misleading; instead, a functional assessment based on mechanical blockage and joint stability is more useful for guiding treatment. Percutaneous lateral-view–guided sesamoid reduction offers a minimally invasive, tissue-preserving solution with reliable outcomes. Early recognition and technique-appropriate intervention remain the cornerstones of successful management.

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