

1     **MANAGEMENT OF NON-REDUCIBLE LESSER-TOE INTERPHALANGEAL**  
2                     **DISLOCATION: AN UNUSUAL INJURY**

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4     Interphalangeal joint (IPJ) dislocations of the lesser toes are relatively rare in clinical  
5     practice. Most of the non-reducible IPJ dislocations occur as a result of rupture and/or  
6     interposition of the plantar plate or of the collateral ligament in the joint space, thus  
7     hindering a closed reduction and, in most cases, compelling to an open reduction. A  
8     post-reduction radiological exploration is then essential in order to identify such entity  
9     and proceed consequently. In some cases, as the one introduced herewith, a  
10    misdiagnosis, along with an inadequate surgical correction may led to recurrence of the  
11    deformity and ultimately to a salvage arthrodesis.  
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13    **Introduction**

14    Digital traumas are frequent encountered in the emergency rooms; however, they are  
15    usually considered as second-magnitude pathologies. This leads them to hold a scarcely  
16    relevant place within the therapeutic strategy, although, occasionally they may result in  
17    significant sequel, and gait difficulties. Even though non reducible dislocations of toes  
18    are rare injuries, when encountered usually involve the great toe <sup>1-5</sup>. In a retrospective  
19    study with case reviews, Brunet et al demonstrated that half of the IPJ dislocations  
20    appeared as isolated post-traumatic deformities in the affected toe <sup>6</sup>. To date only 13  
21    IPJ dislocations have been reported in the literature <sup>6-14</sup>, most of them occurred at the  
22    proximal IPJ, with the second toe being the one most frequently involved. Such  
23    dislocations may occur in the sagittal plane, producing a dorsal deviation of the toe; in  
24    the transversal plane, producing a medial or lateral deviation; or even in both planes,  
25    simultaneously <sup>12-14</sup>. Most commonly published cases describe are young active  
26    individuals who sustained trauma which led to a dorsal displacement that most  
27    frequently affected the proximal IPJ. Irreducibility resulted from the interposition of  
28    injured soft tissues in the joint space <sup>6-14</sup>. Brunet et al sustain that, virtually all traumatic  
29    dislocations of lesser interphalangeal joints require open reduction; most often, the  
30    plantar plate prevents closed treatment <sup>6</sup>. In the fore mention scenario, unless adequate

31 surgery is performed in order to reduce the dislocation, any attempts of reduction will  
32 be ineffective as a result of the scarring produced by the soft tissues or, as in our case, of  
33 the resulting degeneration of the joint. To the best of our knowledge, there have been  
34 no reports describing recurrences of IPJ dorsal dislocations of lesser toes after open  
35 reductions.

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### 37 **Case report**

38 A 20-year-old man presented with dorsal pain on his left foot October 2009. Noted was  
39 deformity in the sagittal plane and a severe functional impotence around the second toe.  
40 He reported to have been submitted to a surgical procedure after sustaining trauma in  
41 his left foot caused by an impact during a soccer match. He provided an emergency  
42 admission report from the hospital of reference, dated the 24<sup>th</sup> May 2009, indicating that  
43 the patient had presented due to pain at palpation in his second toe with associated  
44 hematoma at the traumatic site. Noted was history of hammertoe deformity (Fig.1).  
45 Based on radiologic studies, which included anteroposterior and oblique views, was the  
46 presence of a dislocation in the proximal IPJ of the second toe was noted (Figs. 2 and  
47 3). Close reduction and bandage immobilization was attempted, however post-  
48 reduction radiographic studies revealed an incomplete reduction of the dislocation (Fig.  
49 4). The patient was discharged and placed on Ibuprofen 600 mg every 8 hours and local  
50 cryotherapy. One month later, after an evaluation by the orthopedic surgery and  
51 traumatology outpatient department, the patient was scheduled for surgery with a  
52 diagnosis of post-traumatic hammertoe. The surgical operation involved tenodesis  
53 of the second toe, temporary fixation with two K-wires, inserted percutaneously across  
54 the joint. The patient reports that the fixations were removed six weeks later and that  
55 following removal of K-wires, the deformity reoccurred. A new radiographic study,

56 anteroposterior and oblique views revealed a dislocation of the proximal IPJ of the  
57 second toe with narrowing of the joint space. The patient reported a “pricking-type”  
58 pain after a slight palpation. A foreign body was palpated at the sub dermal level and a  
59 suspicion arose of the presence of a non-absorbable monofilament suture probably used  
60 during the procedure. Considering that his painful clinical condition handicapped the  
61 patient’s everyday activities, he was proposed a surgical procedure in order to correct  
62 the deformity and remove the suture material. The surgical intervention was performed  
63 on the 11<sup>th</sup> January 2010 and included a dorsal longitudinal incision at the level of the  
64 proximal IPJ, thus confirming the presence of a polypropylene monofilament suture,  
65 which was removed. A transversal incision was made in order to expose the IPJ and a  
66 significant joint degeneration was observed, with exposure of the subchondral bone  
67 dorsally of the head of the proximal phalanx (Fig. 5); consequently, the decision was  
68 made to proceed with arthrodesis via fixation with a K-wire. The tendon was repaired  
69 with an absorbable suture and the skin with a monofilament suture. His post-surgical  
70 evolution was favorable; the fixation was maintained for seven weeks and the desired  
71 surgical correction was attained with a normal walking pattern and the patient’s full  
72 satisfaction (Fig.6).

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#### 74 **Discussion**

75 In most of the non reducible IPJ dislocations reported, the main reason for irreducibility  
76 was a rupture of the plantar plate and its interposition in the joint space<sup>6,12</sup>. After the  
77 original trauma, dorsal dislocation of the middle phalanx takes place and in turn results  
78 in weakening and or rupture of the plantar plate (most commonly in its proximal  
79 insertion), leading to its interposition in the joint and ultimately in its irreducibility<sup>6</sup>.  
80 Furthermore, if the extensor mechanism is involved, the distal insertion of the plantar

81 plate will also be affected. Miki et al sustain that, for a complete dislocation to occur as  
82 a result of the interposition of the plantar plate, a complete rupture must take place in  
83 both the proximal and distal insertions <sup>1</sup>. Once the plantar plate is compromised, the  
84 extensor tendon exerts a deforming force because of its insertion in the middle and  
85 distal phalanges resulting in a dorsal displacement of the IPJ. Other structures may  
86 prevent the reduction of the joint, such as the collateral ligaments, which also can  
87 equally break and interpose in joint space. In this case, the lateral insertion of the short  
88 extensor of the toes may exert a deforming force towards the lateral side and this is  
89 why, in combined dislocations, the lesser toes deviate in the dorsal and lateral directions  
90 <sup>13</sup>. In our case, considering that the dislocation took place in the sagittal plane, the  
91 plantar plate interposed itself in the joint space, preventing a complete reduction of the  
92 deformity, a fact that was overlooked after the closed reduction and produced a  
93 recurrence of the deformity.

94 Debates have been raised questioning whether or not to perform closed reductions of  
95 these deformities systematically. Some authors suggest that most of these dislocations  
96 in the lesser toes can be easily reduced by traction and a conservative immobilization  
97 treatment <sup>7, 8</sup>. On the other hand, based on the observation of the few cases appearing in  
98 the literature, open reductions are necessary <sup>6, 9-11</sup>.

99 Tenodesis with fixation of the distal IPJ using K-wires has been a widely used  
100 procedure for treating mallet finger deformities associated with the rupture of the  
101 extensor and or dislocation of such <sup>15,16</sup>. Contrarily, no cases have been reported to the  
102 application of this technique for the correction of IPJ dislocations in the feet. There are  
103 very scarce references in the technical literature concerning the correction of digital foot  
104 deformities <sup>17</sup>. Commonly, dislocations are accompanied by associated injuries, such as

105 fractures and or joint capsule damages with extensor tendon lacerations <sup>8,9</sup>. In our case,  
106 the damaged joint capsule was accompanied by longitudinal extensor tendon laceration.  
107 In diagnosing, radiographic anteroposterior and medial oblique views should be used, so  
108 as to obtain adequate appreciation of any phalangeal displacements, and or avulsion  
109 fractures <sup>8</sup>. A few cases of IPJ dislocations have been described in which an immediate  
110 x-ray exploration did not reveal a poor alignment but a widened joint space <sup>11</sup>.

111 Some authors suggest for the performance of closed reductions by means of  
112 longitudinal traction and under local anesthesia in dislocations affecting children <sup>8</sup>.  
113 However, we agree with other authors concerning the fact that closed reductions must  
114 not be performed by means of forced maneuvers that may easily intensify the lesion <sup>14</sup>.  
115 Brunet et al sustain that, almost all interphalangeal joint dislocation require open  
116 reduction principally because of an interposed unyielding plantar plate. Open  
117 management is more easily and safely accomplished through a dorsal approach;  
118 temporary pin fixation must be indicated only if the reduced joint is very unstable <sup>6</sup>. In  
119 our case, as the closed reduction was fruitless, an open reduction with a dorsal approach  
120 had to be made in order to identify and repair the broken or interposed anatomic  
121 structures that were hindering the reduction. We agree with some authors who argue  
122 that if the reduced joint appears to be very unstable, temporary transarticular pin  
123 fixation may be necessary; however, prolonged use of a pin could result in significant  
124 joint stiffness or, as in our case, result in a damaged joint <sup>6,8</sup>.

## 125 **Conclusion**

126 Non reducible IPJ dislocations of lesser toes are rare injuries and can be neglected by  
127 closed reduction and/or inadequate surgical treatment. Precautions should be taken, as  
128 these dislocations can hardly be visualized clinically and may go unnoticed after closed

129 reduction. Performance of a thorough radiological examination becomes essential in  
130 determining whether or not the closed reduction was carried out successfully. Although  
131 closed toe injuries in children rarely require operative treatment, severe and non  
132 reducible dislocations in adults are indications for surgery, which should be performed  
133 in a timely matter.

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205 **Figure legends**

206 Figure1. Photograph of the left second toe proximal IPJ dislocation. Important  
207 deformity is noted compared with the non-injured right foot.

208 Figure2. Antero-posterior radiograph revealing dislocation of the middle phalanx in  
209 the proximal IPJ of the second toe.

210 Figure3. Oblique radiographic projection.

211 Figure4. Antero-posterior post-reduction radiological projection: incomplete  
212 reduction joint can be observed.

213 Figure5. Intraoperative image showing the presence of cartilage damages affecting  
214 the proximal IPJ. Significant joint degeneration with exposure of the subchondral  
215 bone dorsally in the head of the proximal phalanx can be observed.

216 Figure6. Photograph at 5 months follow-up. Adequate alignment of the second toe  
217 can be observed.

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