

## Case Report

## Traumatic Mallet Toe of the Hallux in a Paediatric Patient: A Case Report — 兒科病人患上創傷性的拇趾槌趾：病例報告

Chow Jason\*, Pun Alvin, Freihaut Richard

Department of Orthopaedics, Lismore Base Hospital, Lismore, New South Wales, Australia

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## ABSTRACT

We describe a case of traumatic avulsion fracture of the distal phalanx of the hallux in a paediatric patient. The patient had a Salter Harris type III fracture of the distal phalanx with 40% of the articular cartilage involved and a clinical extension lag. We treated the injury non-operatively with applying a fibreglass dorsiflexion interphalangeal plaster for 6 weeks. An excellent outcome was achieved with normal range of interphalangeal motion and solid painless union of fracture at 12 weeks.

## 中文摘要

我們描述一兒科病人的拇趾骨末節患上創傷性撕脫骨折，病人確診為索爾特 - 哈里斯第三類型骨折，並涉及百分之四十的關節軟骨和臨床指間關節伸直受限。我們使用非手術治療方法並應用玻璃纖維指間關節背屈石膏六個星期。在第十二週取得一個很好的結果，指間關節活動範圍正常，骨折癒合良好及無痛徵。

## Introduction

An acute mallet deformity of the hallux has been described in adults,<sup>1–4</sup> however to our knowledge, it has not been described in a paediatric patient previously. The main difference between an adult and a paediatric patient is that a physis is present on the distal phalanx in the latter. Extensor hallucis longus inserts on the dorsal side of the distal phalanx base, for which its primary function is to extend the great toe and assist in dorsiflexion of the ankle.<sup>5</sup> It is antagonized by flexor hallucis longus and brevis.<sup>6</sup> A mallet toe hallux results from damage to the extensor mechanism of the digit from trauma, tendon abnormality or an avulsion fracture.<sup>1</sup> The antagonistic tendons on the flexor side will flex the interphalangeal joint (IPJ). If more than one third of the joint surface is involved, or the displacement is more than 2–3 mm, treatment is indicated.<sup>7</sup> Otherwise, joint incongruity can lead to early degenerative changes and difficulty with propulsion on walking.<sup>1–4,7</sup> The treatment for adult mallet toe hallux was described with non-operative immobilization<sup>1,2</sup> and K-wire fixation,<sup>3,4</sup> however, the outcomes were similar. The mechanism of injury and management of an isolated avulsion fracture of the hallux, resulting in mallet toe hallux in a paediatric patient is described in this case report.

## Case Report

A 13-year-old male presented to the Accident and Emergency department with swelling and pain of his right big toe.

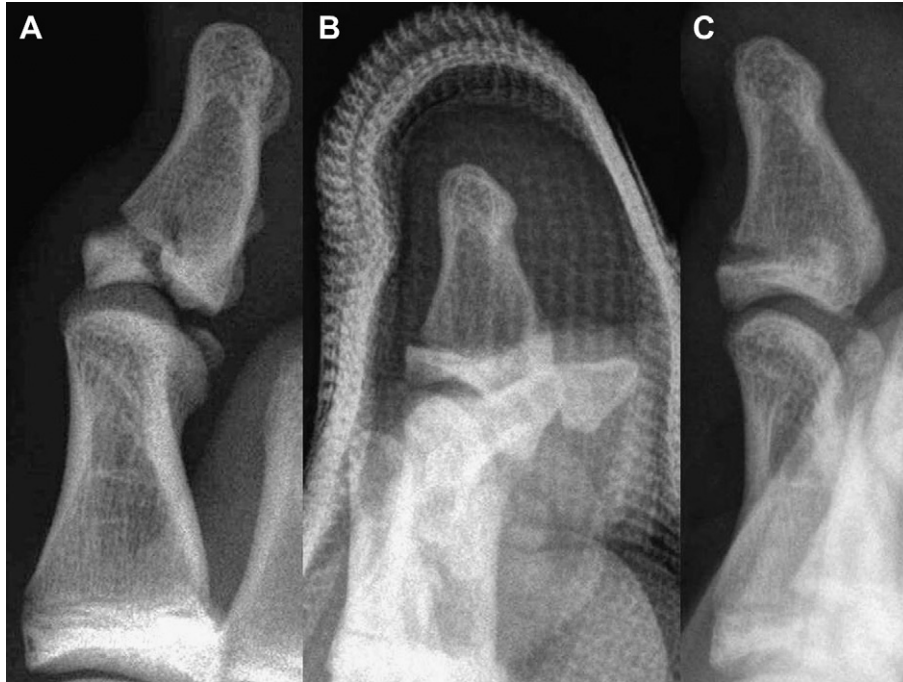
He reported that he stubbed his big toe on the kerb while skateboarding in bare feet, resulting in extreme plantar flexion of the hallux; he had difficulty weight bearing afterwards.

X-rays (dorsoplantar and lateral) were taken and a Salter Harris type III avulsion fracture was noted on the dorsal aspect of the distal phalanx of the hallux with approximately 2 mm of displacement (Figure 1A).

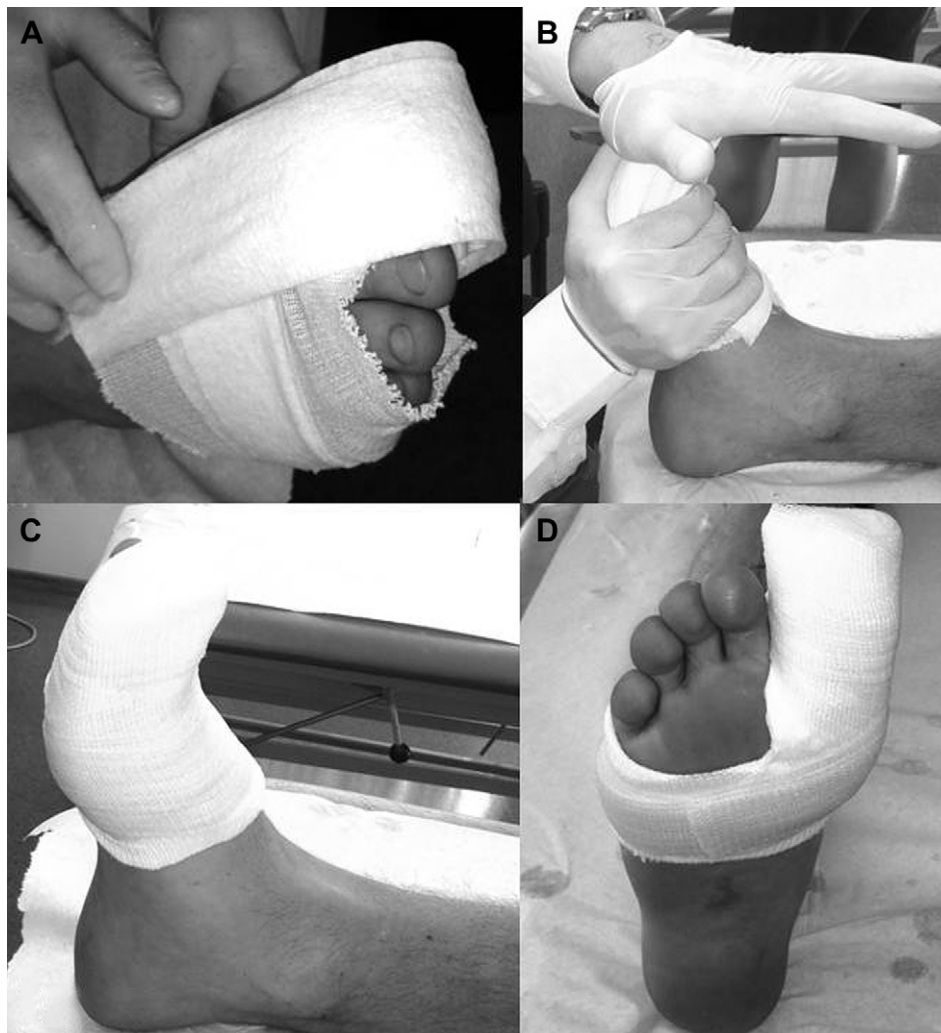
On examination, no superficial abrasions or nail bed injury was apparent. Swelling and an extension lag of 30 degrees were observed with the inability to dorsiflex the hallux actively. However, it could be dorsiflexed passively. Initially, his toe was taped into extension with a tongue depressor and the patient was referred to follow up in the orthopaedic fracture clinic for a review within the week.

At the fracture clinic, the follow-up X-rays at 1 week showed displacement of the fragment. Under a digital nerve block, the hallux was manipulated and the fracture was reduced with the IPJ being placed into dorsiflexion. A fibreglass extension plaster was fabricated. One-inch fibreglass was folded and placed longitudinally starting 2 cm proximally to the metatarsal phalangeal joint dorsally and ending on the plantar surface 2 cm proximally to the metatarsal phalangeal joint (Figure 2A). The fibreglass was

\* Corresponding author. E-mail: [ycchow100@gmail.com](mailto:ycchow100@gmail.com).



**Figure 1.** (A) lateral projection showing Salter Harris type III fracture of the distal phalanx of the hallux; (B) initial post reduction X-ray showing the reduced bony fragment; and (C) lateral X-ray at 12 weeks showed healing of the fracture.



**Figure 2.** (A) One-inch fibreglass being placed longitudinally; (B) moulding of hallux IPJ with dorsiflexion; (C) and (D) re-enforced circumferentially with soft ban fibreglass wrap.

moulded with dorsiflexion pressure to enable the IP joint of the hallux to remain in extension (Figure 2B). The toe area was then reinforced circumferentially with fibreglass soft-ban (Figure 2C,D). Post reduction X-rays were taken to confirm the reduction of the fragment in the fabricated fibreglass plaster (Figure 1B). The patient was then placed in a heel wedge boot to enable him on heel weight bearing only.

The patient was observed regularly with serial X-rays at 1 week, 2 weeks and 6-week post reduction. The fracture alignment and condition of the plaster was acceptable at all the follow-up appointments. The initial plan was to review the patient clinically at 8 weeks and to decide if the plaster was able to be removed. However, the patient had removed his own plaster at 6 weeks and had begun weight bearing for 2 weeks before he was reviewed at 8 weeks. The X-rays taken at 8 weeks showed union of the fracture and the alignment was acceptable. He had no pain at rest, movement or on palpation. Furthermore, the patient had no residual extension lag with a range of motion of 0° in extension and 55° in flexion, which was comparable to the unaffected hallux. He had a final review at 12 weeks with radiographic (Figure 1C) and clinical check.

## Discussion

Traumatic mallet toe of the hallux can occur in adults and in children. The deformity is a result of direct trauma or by an avulsion<sup>1–4</sup> injury. It affects the propulsion on walking and the biomechanics of the foot.<sup>1,3</sup> There is not much literature on the treatment of mallet toe of the hallux, however surgical and non-surgical options of the mallet finger have been well described.<sup>7</sup> This may be applied to the hallux since the thumb and the hallux have similar anatomy.<sup>1–3</sup>

The surgical option was closed reduction with K-wire fixation under image intensifier.<sup>3,4</sup> However, this would have required the patient receiving anaesthesia, along with crossing the physis and articular cartilage with a K-wire. The advantage of this approach is that immobilization is easier with less follow-up checks and the patients are able to wear normal shoes and bathe.<sup>3</sup> Our patient still had open growth plates and we anticipated that it would likely take multiple passes with the K-wire to reduce the fracture accurately. This would result in unnecessary damage to the physis and articular cartilage.

We decided to manage the patient non-operatively with plastering of the IPJ in extension, because it would be more appropriate for his age. We initially wanted to use a thermoplastic splint as described by Hennessy,<sup>1</sup> however, we were unable to fabricate one due to limited resources. We decided to fabricate a fibreglass plaster, which has not previously been described. The patient reported that the plaster was comfortable and caused no pain or distress. Nevertheless, the compliance became an issue, because the heel wedge boot was not worn regularly to offload the forefoot and the plaster was also easily removable. Furthermore, the patient became annoyed with the plaster especially in bathing and sleeping. The patient finally removed the plaster on his own so that the plaster time decreased from the recommended 8 weeks<sup>1–3</sup> for an adult fracture to 6 weeks. The main issue with the plastering treatment was the compliance and frequent follow-ups.

In conclusion, a successful treatment of mallet toe of hallux requires a good reduction and its maintenance. This can be accomplished operatively or non-operatively with advantages and disadvantages. Paediatric patients required less time of immobilization and fracture healing, as well as a lower risk of joint stiffness; plastering treatment is definitely a viable option because it can be easily performed in an out-patient clinic. A shorter period of immobilization may be enough; this was 6 weeks in our case. Furthermore, with good patient education and frequent follow-up checks to ensure the compliance and reduction maintenance, a good outcome can be anticipated.

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