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A case series of pediatric seymour fractures related to hoverboards: Increasing trend with changing lifestyle



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ABSTRACT

BACKGROUND: Several recreational activities such as roller skating, skateboarding, and scooter riding create the risk for hand injuries, which are the fourth most commonly injured body part in relation to their use. Seymour first identified a specific pattern of digit injury as an open fracture affecting the distal phalangeal physis associated with nail avulsion from the eponychial fold. In this article, we report a series of Seymour fractures associated with misuse of the newly emerging recreational/transportation vehicle, the hoverboard.

METHOD: The study includes a retrospective chart review of patients who presented to a tertiary hospital between December 2015 and October 2016 with a Seymour fracture caused while operating a hoverboard. **RESULTS:** A total of 13 patients were treated for Seymour fractures. The majority were male patients, and the group had a mean age of 10.3 years (± 2.21). The affected digits were primarily the middle and ring fingers of the non-dominant hand. The injury mechanism reported by patients or families indicated that the child was operating the hoverboard in a sitting position with the hands grasping the wheel rim parts. **CONCLUSION:** We report a case series of a fracture pattern resulting from the improper/unsafe use of a hoverboard. This type of fracture occurs with a tremendous load of energy. Although improper use was a factor, design fault also plays a role in causing the injury. Parent awareness and supervision are important to prevent such injuries.

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1. Introduction

In the pediatric population, the hand is a frequently injured body part. The prevalence of hand injury in this population is attributed to their curiosity, minimal motor coordination, and limited fear of pain, while adolescents tend to sustain hand injuries by participating in contact sports [1]. Hand injuries comprise 2.6% of hospitalized pediatric traumas [2], and 19% of all pediatric hand injuries consist of fractures [3]. As many as 20% to 30% of pediatric hand fractures involve the physis [4]. The Seymour fracture, which was first reported by Seymour in 1966 [5], represents a transverse extra-articular open fracture of the distal phalanges associated with nail bed injuries. The fracture includes Salter-Harris type I and II fractures as well as juxta-epiphyseal injuries [5–7].

Hoverboards are self-balancing scooters designed for short-distance transportation and recreation, similar to skateboards. Sales of hoverboards are reported to have reached 2,578,000 units

purchased in the US alone [8]. The device comprises two wheels spanned by a flat surface where the user places his feet and that contains a lithium battery-powered motor. The user operates it by standing upright on the device and leaning forward or backward to propel the device. Some brands can reach speeds of 12 miles per hour [9,10]. Hoverboard users are regarded as vulnerable to falls and other dangers of the road and, together with pedestrians and bicyclists, account for approximately 50% of the total fatalities worldwide as reported by the World Health Organization (WHO) in 2013 [11]. The United States Consumer Product Safety Commission (CPSC) has received several injury reports related to the use of these vehicles due to fire ignition, smoke inhalation, falls, and collision, following which safety statements were issued recommending the use of padding and helmets, avoiding bystanders and traffic, and using the boards only over flat surfaces [12].

In this article, we present a case series of distal phalangeal fractures associated with nail avulsion (Seymour fracture) that occurred with the improper use of hoverboards. We discuss patient presentation, details of the associated mechanism of injury, and the overall management of these cases. This work has been reported in line with the SCARE criteria [13].

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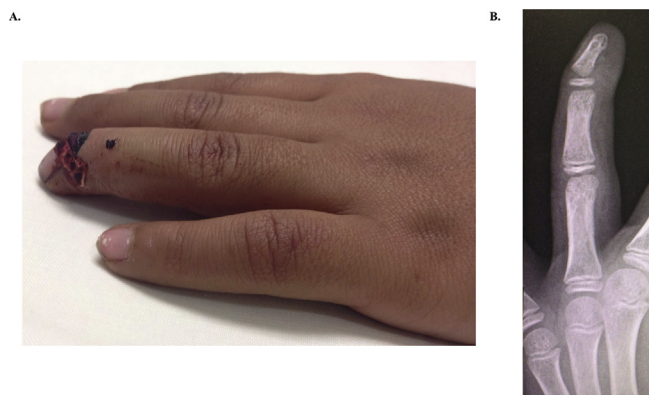


Fig. 1. Clinical presentation of Seymour fracture. A. The clinical involvement of the left ring finger with open fracture of the distal phalanx together with nail avulsion. B. Radiographic image showing the radiologic findings with open juxta-epiphyseal fracture of the distal phalanx.

2. Patients and methods

A retrospective chart review was performed of all patients who presented with Seymour fracture that occurred while operating a hoverboard in a tertiary care academic hospital. The review period was December 2015 to October 2016. Demographic data including age, sex, hand dominance, digit involved, mechanism of injury, the line of fracture (Salter-Harris or juxta-epiphyseal), and initial and definitive management offered were documented. In addition, outcome/complications were recorded. Data were coded in Excel and analyzed with SPSS (version 22; 0.0.0). Results are presented as frequency distributions and mean values with standard deviation (SD). Consent was given by patients and parents/guardians for their data to be used for scientific publication. The work has been reported in line with the PROCESS criteria [14].

3. Results

We report on 13 cases of hoverboard-related injuries occurring between December 2015 and October 2016. The injuries were identified specifically as being open fractures of the distal phalanges with associated nail bed injuries, known as Seymour fracture (Figs. 1 and 2). Five of thirteen patients were found to have a juxta-epiphyseal type of injury, whereas the remaining patients had a Salter-Harris type of Seymour fracture. Affected patients were children aged between 6–12 years, with a mean age of 10.3 years (SD 2.21). All patients presented to the emergency department (ED), where initial wound management was initiated, followed by referral to a hand surgery service. On primary assessment, most of the patients received primary wound suture followed by admission to receive appropriate operative management. One patient was managed by emergency physicians with wound irrigation and primary suture approximations followed by hand surgery. The average time of presentation to the hospital was 1.61 days (SD 1.66), with a maximum of 7 days until definitive management was given. The most affected digit was the middle finger (six patients), followed by the ring finger (five patients), and the index finger (two patients). The left hand was affected in 61.5% of the injuries. The majority of the children (92.3%) were right-handed. The data are summarized in Table 1.

During the patient and family interview, all patients described a similar mechanism of injury in which the child was operating the vehicle in a sitting position with the hands grasping the wheel rim. The injured finger was impacted between the wheel and the wheel rim, as the child’s weight activated the propulsion of the wheels. The force applied from the wheel in direct contact with the

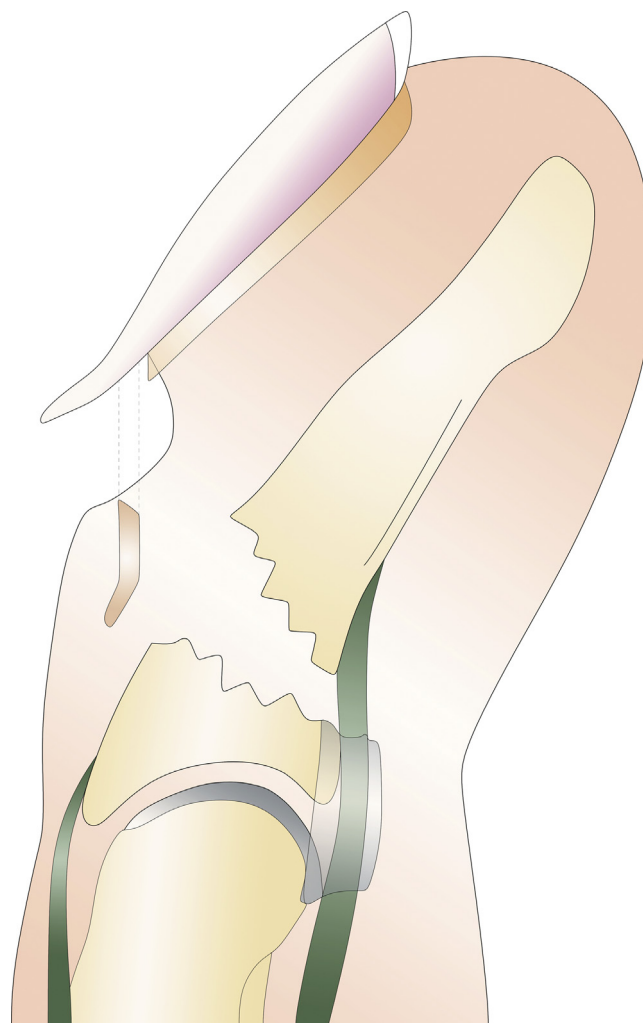


Fig. 2. Schematic illustration of Seymour fracture showing the lateral view with open avulsion fracture at the base of the distal phalanx and avulsion of the nailbed.

Table 1
Demographics of patients with Seymour injuries.

Characteristics	No. (%)	
Gender	Males	10 (76.9%)
	Females	3 (23.1%)
Age	6 years	1 (7.7%)
	7 years	2 (15.4%)
	10 years	2 (15.4%)
	11 years	2 (15.4%)
	12 years	6 (46.2%)
	Mean (SD)	10.3 years (SD 2.21)
Digit involved	Index finger	2 (15.4%)
	Middle finger	6 (46.2%)
	Ring finger	5 (38.5%)
Side involved	Right	5 (38.5%)
	Left	8 (61.5%)
Handedness	Right	12 (92.3%)
	Left	1 (7.7%)
Fracture Type	Salter-Harris	8 (61.5%)
	Juxta-epiphyseal	5 (38.5%)

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