

# Microscooter injuries in the paediatric population

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**Objectives:** To illustrate the types of injuries seen by the accident and emergency department as a result of the use of non-motorized 'microscooters' in children, and to increase awareness of scooter-related triplane fractures of the ankle.

**Study design:** A retrospective study conducted in an accident and emergency department of a district general hospital on all children who had a scooter-related limb injury over a 6-month period and were referred for orthopaedic review.

**Methods:** The analysis involved a case note review. Information recorded included the injury sustained, protective equipment worn at the time of the accident and management by the orthopaedic team.

**Results:** Scooter injuries accounted for 10 fractures in this period. There were three 'triplanar' injuries, which required operative fixation, and three injuries requiring manipulation

under anaesthesia. No protective gear was worn by any of the patients.

**Conclusion:** The popularity of microscooters seems to represent a significant risk of bony injury in the paediatric population. Medical personnel who manage acute paediatric trauma should be aware of scooter-related triplanar ankle injuries. *European Journal of Emergency Medicine* 11:148–150 © 2004 Lippincott Williams & Wilkins.

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## Introduction

The aetiology of injuries seen in the paediatric population can be seen to vary with time. This variation is partly the result of fashion changes in toys. In recent years skateboards, roller skates and in-line skates have all been associated with injuries [1,2]. Some of these injury patterns are predictable when one considers the basic mechanism of falling at speed. However, the mechanics of the different riding styles mean that some toys lead to specific injuries. Of particular importance to identify are injuries that are not commonly seen outside a specific setting and are therefore easily missed or mismanaged.

In our department it was noted that there was a disproportionate number of triplane injuries requiring management in our paediatric population. The common link to each of these cases was the microscooter. Microscooters have been well documented as a source of paediatric morbidity [3,4]. Although their use is still prevalent, it is important that common injury patterns are highlighted.

An awareness of unusual injury patterns produced by microscooter use may prevent unnecessary morbidity in the paediatric population.

## Methods

The accident and emergency computer database of a busy district general hospital was searched using the triage codes 'limb injury', 'wrist injury' and 'ankle injury' for the period August 2001 to February 2002. The search was limited to children aged 1 to 16 years who were referred for orthopaedic team review either on day one or via the fracture clinic.

The notes of these children were then reviewed and those in whom scooter use was integral to the injury were identified.

All cases of scooter-related injury were then reviewed in terms of the mechanism of injury, protective gear use, radiograph findings at presentation and subsequent management.

## Results

Scooter injuries accounted for 10 fractures in the 6-month period August 2001 to February 2002. There were seven male and three female patients. The mean age for male patients was 12 years and 10 years for female patients (range 8–14 years). Three ankle fractures or 'triplanar' injuries required operative fixation. Two injuries were misdiagnosed as simple ankle fractures and had delayed

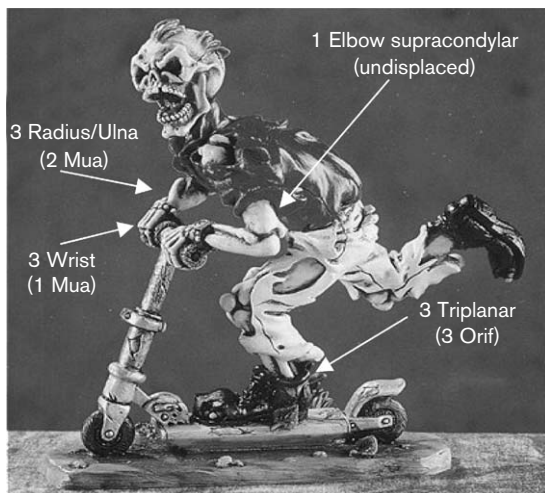
presentation. There were three forearm fractures, three wrist fractures and one elbow supracondylar fracture. Three of the upper limb injuries required manipulation under anaesthesia.

No protective gear was worn by any of the patients. This low uptake of protective gear correlates with previous research [5,6]. The distribution of fractures is illustrated in Fig. 1 and Table 1.

**Discussion**

The triplane fracture tends to occur in older children, approximately one year before closure of the distal tibial physis. The injury occurs as a result of forced external rotation [7]. The fracture is called triplanar because the fracture line runs in three different planes going from the metaphysis along the epiphyseal growth plate and into the epiphysis. There are two types of fractures: two part and three part (see Fig. 2 and Fig. 3) [7,8].

**Fig. 1**



Scooter-related injuries. MUA, Manipulation under anaesthesia; ORIF, open reduction and internal fixation.

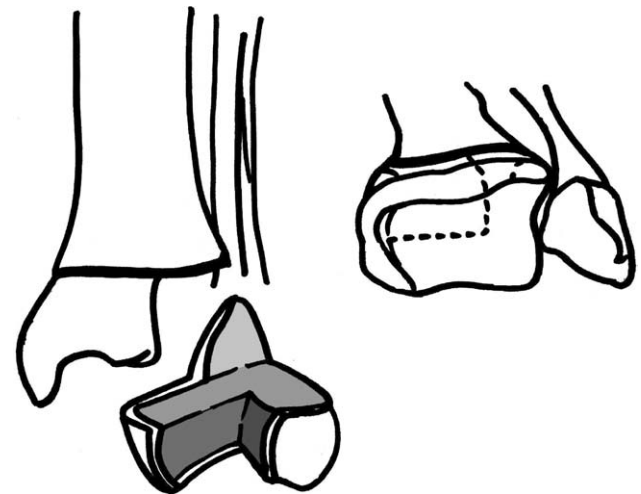
The two-part fracture is a form of Salter–Harris type 4 injury. It occurs when the medial portion of the distal epiphysis is closed. The three-part fracture is a combina-

**Fig. 2**



The pattern of injury in a two-part triplanar injury.

**Fig. 3**



The pattern of injury in a three-part triplanar injury.

**Table 1. Patient demographics and associated injuries.**

Patient no.	Sex	Age (years)	Principal injury	Other injuries
1	Female	11	Triplane # – left ankle	None
2	Female	13	Triplane # – left ankle	None
3	Male	14	Triplane # – left ankle	Abrasion – left palm
4	Male	15	# Right wrist	Abrasion – both palms and elbows
5	Female	9	# Right wrist	None
6	Male	8	# Right wrist	None
7	Male	14	# Right radius/ulna	Facial abrasion and 'mild' head injury
8	Male	12	# Right radius/ulna	Abrasion right knee/thigh
9	Male	12	# Left radius/ulna	None
10	Male	13	# Left elbow	Abrasion left palm, facial abrasion

tion of Salter–Harris type 2 and Salter–Harris type 3 fractures. It occurs when only the middle portion of the distal tibial epiphysis is closed.

In total, 49 ankle fractures were seen by the orthopaedic department in the study population during the 6-month trial period. Scooter injuries accounted for three of these injuries (6%). In the trial period three triplanar injuries were identified; all of these injuries were associated with scooter use and a rotational injury.

Investigations should include ankle radiographs and an ankle computed tomography scan. The computed tomography scan assesses the degree of displacement and the location of fragments. The complex fracture pattern of a triplane ankle injury can easily be missed on the ankle radiograph. Often the only finding on the anteroposterior ankle radiograph is a sagittal fracture line in the epiphysis.

The injury was misdiagnosed as a simple ankle fractures in two of our cases. This led to a delayed presentation to the orthopaedic service of 5 days (next fracture clinic).

Management may be non-operative as most two-part fractures can be treated by closed reduction under a general anaesthetic and a long leg cast for 4–6 weeks. The indication for operative treatment is significant displacement (> 2 mm) and the failure to maintain an adequate closed reduction. Operative treatment consists of screw fixation for the metaphyseal fragment alone in two-part fractures and both metaphyseal and epiphyseal screw fixation in three-part fractures [8].

All our three cases required open reduction and internal fixation for satisfactory reduction of the ankle joint surface. The two delayed cases were operated on 5 days post-injury; although the fracture fragments were beginning to unite, they were still able to be manipulated to achieve satisfactory reduction.

We attempted to determine similar features that may alert the attending physician to associated features of triplane fractures. As patient demographics show, there was no 'injury complex' that might have linked these cases, but review of the cases confirmed that all patients were peripubertal and all had weights above the 75th percentile on their age/sex-matched growth charts.

These fractures need to be assessed early so that a reduction of the growth plate can be achieved. Physeal fractures tend to heal very quickly and can become fixed at 7–10 days. After this initial window further damage may be done to the growth plate and manipulation has to

be carefully balanced with the risk of further damage. The long-term consequences of malreduction may be malunion and growth arrest with secondary ankle deformity. The prognosis is generally good if adequate reduction has been achieved by closed or open means [9].

All three children had a pain free stable ankle at final follow-up. In all our cases there was no clinical or radiographic evidence of growth arrest or secondary joint changes.

It is now 3 years since microscooters were first marketed in both the UK and USA. During this time it has been reported that scooter-related injuries represent a significant risk to children. A triplane pattern of ankle fracture occurred in three of our cases and a high index of suspicion is required in children presenting to casualty with microscooter-related ankle injuries.

Our findings differ from previous observational studies in that we found a higher proportion of lower limb injuries. These injuries are associated with torsional forces, and are presumably a result of forces experienced as a child slips off the scooter footplate.

These ankle injuries may not be reduced by the wider use of protective gear. Whereas it is apparent that the use of protective gear affords protection from injuries to the head, knee and upper limbs [6], it would appear that only through continued efforts in the field of public awareness will these ankle and other injuries be reduced.

Our research illustrates the need to promote public education about scooter safety and medical personnel education about the emergent patterns of injury.

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