Trampoline injuries in children

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We reviewed the records of children referred to our hospital between April and September 2005 who had been injured whilst trampolining.

Of 88 such children there were 33 boys and 55 girls with a mean age of 8 years 6 months (2 years 4 months to 15 years 9 months). Most of the injuries (53; 60%) occurred when bouncing and 34 (39%) were secondary to falls from the trampoline. The cause of injury was unknown in one child. The injured child was supervised in only 35 cases (40%). In 31 (35%) cases, the injury was related to the presence of others on the trampoline. A total of 36 (40%) children required surgery. Fractures of the upper limbs occurred in 62 cases (70%).

Injuries related to the recreational use of trampolines are a significant cause of childhood injury. Our results suggest strongly that there is a need for clear guidelines on safe and responsible use of domestic trampolines.

The trampoline, invented in 1936 by George Nissen, a circus acrobat,¹ has become a common sporting and recreational piece of apparatus.²

The American Academy of Orthopaedic Surgeons reported that in 1995 there were over 52 000 trampoline-related injuries in children under 15 years of age.³ They estimated that the total cost of medical, legal and insurance expenses exceeded \$272 million in 1995. A follow-up statement in 2005 indicated that in 2003 there were more than 211 000 trampoline-related injuries in patients under 19 years of age in the USA, with associated costs of \$4.2 billion.⁴ Data from the National Electronic Injury Surveillance System in the USA have shown that injuries to children aged 18 years and younger increased by 98% from 29 600 in 1990 to 58 400 in 1995.⁵ During this period, there was an increase of 114% in such injuries in children under five years of age.

Earlier figures from the Consumer Product Safety Committee in the USA showed that 63 870 orthopaedic injuries in one year in children aged under 16 years, were trampoline-related.^{6,7}

The dangers of trampolines were recognised by the American Academy of Paediatrics⁸ which advocated a ban of their use in schools and colleges.⁷ A second statement in 1981⁹ was more lenient and advised a trial period of limited and controlled use. However, it highlighted that the trampoline should never be used in the

home or in recreational settings. A further policy statement reinforced this and recommended that the recreational use of trampolines was not suitable in the home or in schools.¹⁰

Whereas trampoline injuries are a considerable cause of morbidity in children,¹¹⁻¹³ data are lacking regarding their orthopaedic effect, along with an absence of safety guidelines. Our study therefore aimed to quantify trampoline injuries in children presenting to a regional orthopaedic unit.

Patients and Methods

We reviewed the records of patients aged 16 years or under who sustained trampoline-related injuries between April 2005 and September 2005. Our hospital serves a summer-time population of approximately 500 000.

The patients' records were reviewed for clinical details, the date, mechanism, location and type of injury, the length of stay in hospital and treatment received. Those children injured between April and June were interviewed by telephone, while those injured from July to September were assessed clinically.

There were 88 children, 33 boys and 55 girls with a mean age of 8 years 6 months (2 years 4 months to 15 years 9 months; Fig. 1). Of those, 29 (33%) were under six years of age.

Results

Most injuries occurred during the warmer months (school holidays), especially August,

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Fig. 1

Distribution of injuries by age and gender.

Fig. 2

Incidence of trampoline injuries in children.

Table I. Mechanism of injury in the 88 children

Mechanism of injury	Number of patients
Fall from trampoline	34
Fall on trampoline	
Collision	34
Dismount	13
Flip/handstand	6
Unknown	1

Table II. Site of injury in the 88 children

Site of injury	Number of patients
Distal radius	19
Radius/ulna	15
Supracondylar humerus	12
Tibia/fibula	12
Ankle	9
Elbow	7
Humerus	4
Hand	4
Foot	4
Knee	2

when 19 children (22%) were injured (Fig. 2). This incidence is consistent with the overall seasonal pattern of paediatric fractures.¹⁴

The mechanism of injury was noted in 87 (99%) of the children. Of these, 53 (60%) were injured while bouncing and 34 (39%) when dismounting from the trampoline. The cause was unknown in one patient (1%). Injury occurred in 34 children (39%) as a result of collision with another trampolinist (Table I).

Injuries to the upper limb were the most frequent, occurring in 61 patients (69%) (Table II). The most common sites of fracture were the distal radius and/or ulna then the tibia. Supracondylar fractures of the humerus occurred in 12 patients (14%), seven of which required operation (8%). The growth plate was involved in 13 cases (15%).

Of the children in this study, 36 (41%) required operation. The remaining 52 (59%) were treated as outpatients. Most fractures were treated by manipulation under anaesthesia and application of a moulded plaster cast, but 19 inpatients (22%) underwent open reduction and internal fixation. There were nine children (10%) who had an additional visit to theatre, two (2%) for remanipulation and seven (8%) for elective removal wires. The mean hospital stay for those requiring operation was 1.4 days (1 to 4).

Most injuries (50; 57%) were from trampolines in back gardens. In 84 cases (95%) the trampoline measured 13 feet in diameter and was located on grass; 33 children (38%) were injured in a neighbour or friend's garden. One eight-year-old girl was participating in a supervised class on an Olympic-sized apparatus.

The children were supervised by an adult in only 35 cases (40%) and there were no protective barriers around the trampoline in 62 cases (70%). A total of 73 children (83%) said the injury occurred when they were accompanied on the trampoline by one or more children. The mean number of other children on the trampoline at the time of injury was two (1 to 10) and in 39% of cases (34 children), the injury was due directly to their presence.

Discussion

Most trampoline injuries do not occur by falling from the apparatus. In the series of Larson and Davis² only 29% of children were injured by falling from the trampoline. Black and Amadeo⁶ reported similar figures, noting that 65% of injuries occurred on the mat and not by being catapulted onto a hard surface. In our series, only 34 children (39%) were injured by falling off the trampoline. Our analysis of the site of injury showed that 61 injuries (69%) occurred in the upper limb and almost half of the fractures occurred in the forearm. This agrees with the findings of Black and Amadeo.⁶ Their review, and The American Academy of Paediatrics policy statements,⁸⁻¹⁰ suggest guidelines on the use of trampolines.⁶ These include advice to parents on the

hazards of recreational trampolining, supervision of play and prohibiting the use of the trampoline by more than one person at a time and use by children under six years of age.

Our study shows that these guidelines are not being followed. In our series 29 children (33%) were six years of age or younger. There was no adult supervision in 53 children (60%) and 73 injuries (83%) involved the presence of other jumpers on the trampoline. This figure is higher than those of Woodward et al¹ and Larsen and Davis² with figures of 77% and 64%, respectively.

Of particular concern are the findings of Chalmers et al¹² which state that fractures account for only 30% to 40% of trampoline injuries, suggesting that our figures are drawn from a much larger cohort of injured children. Also, they suggest that for every patient admitted, 12 are treated in the Emergency Department. This again questions the true incidence of trampoline injuries in children.

In conclusion, our study confirms the need for more effective advice and education on the dangers of trampolining and for clarification of safety guidelines.

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