Trampolining injuries

Trampoline-related injuries have increased dramatically over the last few years. This article presents a review of the literature summarizing the different types and mechanisms of sustaining such injuries and looks at current recommendations to prevent them.

In 1936 George Nissen, a competitive gymnast and diver, introduced the trampoline into his circus performances (Woodward et al, 1992). During the Second World War, US and British fighter pilots used trampolines in their training to help improve their aerial orientation skills. Post-war, the huge growth in trampolining in the US and Europe has focused on sporting competition and latterly as a recreational activity – made hugely popular by the availability of cheap domestic-sized trampolines for use in the back yard or garden.

Reports about the potentially serious hazards of trampolining emerged from the 1970s, including spinal cord injuries with permanent paralysis (Kravitz, 1978; Torg, 1987; Brown and Lee, 2000); indeed, at one point the American Academy of Pediatrics advocated banning trampolines in schools and competitive sports (American Academy of Pediatrics Policy Statement, 1977). It subsequently modified its position, saying that trampolines might be used safely in a controlled environment but not at home or in recreational settings (American Academy of Pediatrics, 1999). But the introduction of trampoline gymnastics at the Sydney summer Olympic Games in 2000 gave the trampoline another popularity boost, helping to secure its domination of domestic lawns throughout the US and Europe.

There are no reported injury rates for trampoline use in a formal, supervised educational setting or in the available National Collegiate Athletic Association Injury Surveillance System Summary (Dick et al, 2007) or research by the National Centre for Catastrophic Sports Injuries (Mueller and Cantu, 2008). However, evidence from the literature shows that over 90% of trampoline-related injuries occur in children using a trampoline in residential locations (Woodward et al, 1992; Larson and Davis, 1995; Smith and Shields, 1998).

In comparison with other sports such as diving, football, bicycle and horse riding, trampolines have been associated with fewer injuries and deaths (Oklahoma State Department of Health, 2003). However, an estimation of the relative risk of injury per hour of exposure for these more common sports has not been reported, hence an objective comparison between them and trampolines and the benefit-risk ratio for using trampolines cannot be established. This article summarizes the available data on trampoline-related injuries and current recommendations for using them.

The hazards

The main hazards of trampolining are:

- Falling off onto the surrounding surface
- Colliding with the frame
- Colliding with another jumper
- Falling onto the trampoline bed.

More than 9 out of 10 trampoline-related injuries happen to youngsters aged less than 18 years (Woodward et al, 1992; Larson and Davis, 1995; Hume et al, 1996). Having more than one person at a time on the trampoline increases the risk (Larson and Davis, 1995; McDermott et al, 2006), especially when children under 10 years of age are trampolining with a heavier person (Boyer et al, 1986; Woodward et al, 1992).

Beginners who attempt tricky manoeuvres such as somersaults or flips put themselves at risk of neurological injuries, even when they manage to stay in the centre of the trampoline bed; the problem is that supervisors standing at the side are nearly always unable to intervene to prevent a bad movement at the centre of the bed turning into injury (Smith and Shields, 1998). Full-sized trampolines have also been associated with higher risk of injuries causing hospitalization than mini-trampolines when used in the home setting (Shields et al, 2005).

Types of injury

Injuries can be classified as:

- Soft tissue (abrasion, haematoma)
- Fractures and dislocations
- Lacerations
- Strain or sprain
- Others (such as crush injuries or internal organ injuries).

Fractures of the upper limbs, sprains and strains involving the lower limbs have been reported as the commonest types of injuries encountered. For example, Chalmers et al (1994) published a 10-year epidemiological study on trampolining injuries from the National Hospitalisation Mortality Data in New Zealand, where they had found that two-thirds (68%) of injuries were

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fractures, with upper limb involvement in 53% of cases. Hume et al (1996) reported that among 114 patients who presented with trampoline injuries, 40% had sprains and strains with a lower limb involvement rate of 46%. Furthermore, Smith and Shields (1998) reviewed 214 children, aged between 1 and 16 years, who had been treated for trampoline-related injuries and concluded that fractures were more likely in arms than legs, while soft tissue injuries were more common in legs.

Black and Amadeo (2003), in a retrospective study, reviewed 80 under-16-year-olds with trampoline-related injuries and similarly showed that three out of four children had sustained a fracture or fracture-dislocation, with 80% of the injuries involving the upper extremity. McDermott et al (2006) also reviewed 88 children with trampoline-related injuries and found that arm fractures occurred in 70% of the cases. Nysted and Drogset (2006) conducted a prospective study of 556 patients and reported that fractures were the most common injury type (36%), alongside injury to ligaments (36%). Legs and arms accounted for 79% of damage, with the legs being most vulnerable (44%). The single most commonly reported diagnosis was an ankle ligament injury (20%), followed by an overstretching of ligaments in the neck (8%) and elbow fracture (7%).

A correlation between age and injury type has also been suggested in a number of studies. For example, Larson and Davis (1995), in a retrospective study of 217 patients, found that 88% of the patients were under 14 years old and their most frequent injury was an arm fracture whereas among over-15-year-olds the main problems were sprains, strains and lacerations to the leg. Shields et al (2005), on the other hand, compared mini-trampoline-related injuries with full-sized trampoline injuries and found that injury patterns were similar for both types, with children under 6 years old sustaining predominantly head lacerations and those over 6 years of age developing leg strains or sprains.

Recommendations

A number of measures have been recommended by the American Academy of Pediatrics (1999) to reduce trampoline-related injuries, including:

1. Trampolines should not be used as backyard play equipment for children because most of the injuries reported in the literature occur in such an environment
2. The use of trampolines should be limited to supervised training programmes such as gymnastics, diving and other competitive sports
3. Children under the age of 6 years should not use trampolines even in supervised training programmes because of their immature motor skills and associated high risk of injury upon falling off the trampoline
4. There should only ever be one person at a time on the trampoline, and users should be taught to stay in the middle of the mat
5. Flips, somersaults and high-risk manoeuvres should be strongly discouraged without training or if they are beyond the capability of a youngster
6. Set the trampoline in a hole so that the jumping surface is at ground level to reduce collisions with the frame of the trampoline and ensure that the surfaces surrounding the trampoline have impact-absorbing characteristics
7. Place the trampoline away from other structures to allow an area of unobstructed space surrounding it to minimize injuries
8. Trampolines should meet safety standards with application of safety nets and pads to all portions of the steel frame and springs and should be checked regularly
9. Educate the public about the potential dangers of trampolines to children.

Further recommendations by the US Consumer Product Safety Commission (2000) and UK authorities such as the Local Government Association (2008) and the Royal Society for the Prevention of Accidents (2007) have modified the section on children under the age of 6 years stating that such children must only use trampolines designed for their age range and size under close supervision and that trampolines are not suitable for very young children and toddlers.

Unfortunately compliance with the above recommendations remains an issue as more recent studies have shown that trampolines continue to be used for leisure purposes with inadequate supervision of children (Brown and Lee, 2000; McDermott et al, 2006; Wootton and Harris, 2009) and even when an adult was present Smith and Shields (1998) reported that an injury was unavoidable in more than 55% of supervised children.

KEY POINTS

- More than 9 out of 10 trampoline-related injuries happen to youngsters aged less than 18 years of age.
- Despite recommendations for safer use of trampolines, inadequate supervision of children remains a major problem.
- Trampolining is a high-risk activity when used by children in a back yard or garden and therefore should be limited to supervised training programmes.
- It is important to educate the public about the potential dangers of trampolines to children.

Conclusions

Trampolining is a high-risk activity when used in a home setting by children. Despite current recommendations, trampoline-related injuries continue to occur at an ever-increasing rate which might also reflect the number of trampolines now available for recreational use. The authors would question of whether the sale of trampolines for private recreational use is appropriate. BJHM

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