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The Rise of Hoverboard Related Finger Injuries

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Abstract

overboards, also known as self-balancing scooters, gained tremendous popularity in the last two years. Various manufacturers hHoverboards, also known as self-balancing scooters, gained tremendous popularity in the last two years. Various manufacturers have built a compact and agile electronic scooter that resembles the futuristic concept of a levitating skateboard depicted in science fiction movies. Unfortunately, the recent surge of the use of hoverboard among adolescents has resulted in a rise of hoverboard related injuries witnessed in various emergency departments around the world.

One of the common presentation is phalangeal fracture, specifically Salter Harris type II fracture of the distal phalanx, which is caused by entrapment of the finger between the wheel and the wheel-well. Over the last 9 months we have recorded 78 cases with such injury of children aged between 8-14 years. In light of this rise in hoverboard related injuries in children we recommend clear and strict guidelines for parents, adequate safety precautions and absolute restriction of underage use of the hoverboard.

Introduction

Hoverboards, also known as self-balancing scooters, gained tremendous popularity in the last two years. Various manufacturers have built a compact and agile electronic scooter that resembles the futuristic concept of levitating skateboards depicted in science fiction movies. The recent surge of "Hoverboarding" phenomenon has made it an exciting gift for all adolescents. The device is intended for use by agile adolescents who are at least 13 years old, but it has also attracted some parents to give it a try. The technology of the hoverboard creates a forward and backward motion with two small wheels on the side. It is automated and can reach a formidable speed of over 25 km/h relying on body movement for navigation. This piece of technology has become so trendy that it became the vehicle of choice for adolescent in shopping centers, around the house and down the street.

Unfortunately, with no recommended safety wear, the speed and maneuverability of this device is resulting in high impact falls and collisions. Emergency rooms and hospitals around the world including Qatar are witnessing a rise of a new type of hand injury that was very rare before. Some physicians went even as far as calling these hoverboard related injuries the "Hoverboard Pandemic". There have been several reported cases of accidents related to hoverboards around the world. In United Arab Emirates, there were two cases of teenagers who died as a result of falling off this device. One was a 6-year-old child run over by a car as he was using the hoverboard in public road [1]. Those tragic accidents have led the Traffic Council to ban the use of these boards on public road. In the United Kingdom, following the death of a teenager in London in a collision with a bus as he was riding his hoverboard [2], there have been a ban on the use of hoverboard in many public places. Several incidents of hoverboard batteries exploding or catching fires have led to a review of the hoverboards available in the market. U.S. Consumer Safety Product Commission declared hoverboards unsafe in February 2016. In March 2017, a recharging hoverboard ignited a fire in Pennsylvania, United States causing the death of a 3-year-old girl [3]. Many countries have banned hoverboards completely while others have enforced certain laws pertaining to safety of the users. A number of retailers have stopped selling hoverboards, but the online market is still thriving.

Background

Existing literature is scarce in injuries related to hoverboards. However, orthopedic surgeon Dr. Apurva Shah, has reviewed a number of cases at Children's Hospital of Philadelphia and reported the two most common injuries caused by hover boards. These

include distal radius fractures caused by fall on outstretched hand and phalangeal fractures caused by the finger being caught in the wheel and the wheel-well of a hoverboard [4]. Injuries of the hand in children are frequently seen in the Emergency Department. Early recognition and appropriate management is critical in avoiding child's growth disturbances or angular growth deformities. In our Emergency Department and Hand Clinic we are accustomed to encounter children with trauma to the fingertips (commonly the middle or ring fingers) by door trap or accidental falls. These injuries are generally simpler in nature and can results in combined nail bed injury and shaft/tuft distal phalanx fracture. However, distal phalanx Salter Harris type II fractures were until recently rare fractures to see in children in Qatar. The rise of such injuries is directly linked to injuries related to the use of Hoverboard "see Figure 1".

Figure 1: Hoverboard.

Salter Harris fractures are fractures involving the physis or growth plate [5,6]. They are classified according to the involvement of epiphysis, physis and metaphysis in 5 main types and 4 further rare types. Physeal fractures are fairly common in pediatric age group with 20 to 30 % of all phalangeal fractures involving the physis in children [7]. Displaced distal phalanx fractures which involve the physis and have an associated nail bed laceration are termed Seymour fractures [7]. Base of distal phalanx fractures in children can clinically mimic a mallet fracture with a different pathoanatomy [8]. In this case series we review 78 cases with mixed Seymour fractures and closed Salter Harris type 2 fractures.

Discussion

In Qatar, hand physicians at Hamad Medical Corporation are acutely alarmed by the rise in the number of finger injuries particularly distal phalanx Salter Harris Type II fractures due to hoverboard injuries. With the alarming lack of safety standards and recommended safety gear/wear, healthcare providers and retailers are equally concerned. Children are trying all sorts of positions and maneuvers that put their wellbeing at big risk. Age limit seems to be overlooked by parents too. For instance, one of the cases reported squatting whilst on board using one hand on the wheel for emergency breaking and the other hand on the floor to balance and stop them from falling off which can be a very risky maneuver. Consequently, in a squatting position, children as young as 8 years old get their fingers entrapped into the wheel of this fast-moving device sustaining serious damage to their fingers and even concussions at times. This typical injury affects mainly the distal phalanx causing Salter Harris Type II Fracture (Salter & Harris, 1963).

Over the last 9 months, Emergency Department and Hand Clinic in Hamad Medical Corporation in Qatar have received 78 cases of children aged between 8-14 years old who sustained Salter Harris Type II Fracture "see table 1". 23 of those had distal phalanges of the left middle finger, 7 cases had the left ring fingers and one case involving the left index. 29 of these cases were below the age limit for which hoverboard were designed for. All of these children were under 12 years old with exception of two children who are 13 and 14 years old (Table 1).

Total number of patients	**78 patients:** **11 patients 7 years old** **17 patients 8 years old** **21 patients 9 years old** **10 patients 10 years old** **8 patients 11 years old** **7 patients 12 years old** **2 patients 13 years old** **2 patients 14 years old**	
Age	**Youngest 7 years old** **Eldest 14 years old**	
Location of incidence	**75% of cases occurred in the open areas (park-playground areas- malls)**	
gender	**All males**	
Injured finger	**85% of patient left middle finger (66.3 patients)** **10% left ring finger 7.8 patients** **3.2% left index 2.7 patients** **2% right middle finger 1 patients**	
mana gement	3.8% of patients needed one axial trans articular 0.8mm k wire fixation +nail bed repair	96.2% of patients needed only closed reduction and nail bed repair +splinting
Follow up	The k wire was removed in 3 weeks Wound well healed	The wound healed nicely and discontinue of splinting at 3 weeks' time
outcome	At 5 months follow up all healed nicely with normal nail growth	All healed nicely with normal nail growth at 6 months' time

Table 1: Demographics of Reported Cases.

Presentation

On presentation, we found that 80% of children had sustained the injury while squatting on the hoverboard and placing their hands on the wheel to get an additional support and accidentally the left middle finger was trapped into the device wheel. The other 20% had the injury happened when they lost their balance and squatted to stop the device. We noticed that all the affected children were males and right handed which could mean that in left handed children the right middle finger could be the injured finger. In this article we describe the case of 8 years old child with a hoverboard related Salter Harris Type II Fractures presenting to Hand Clinic in Hamad Medical Corporation in Qatar.

On Examination

The injury sustained was a compound distal phalanx fracture in which the injured digit had its nail plate avulsed proximally with germinal matrix transverse laceration at the site of the fracture. The distal phalanx bone was deformed and protruding proximally under the nail bed. The injured digits had normal blood supply and sensation to the tip with less than 2 seconds capillary refill and 2-3 mm two points discrimination. X-ray showed Salter Harris Type 2 Fracture with apex dorsal angulation of the distal phalanx with significant displacement of the injured bone see below "see Figure 2".

Figure 2: X-ray on Assessment.

Management

After detailed explanation to the parent and the child, informed consent was obtained for closed reduction and nail bed repair under local anesthesia. Closed reduction under local anesthesia was done with successful reduction and realignment of the fractured bone. Recovery was uneventful with good post reduction stability.

Nail bed was repaired with 6-0 vicryl after removal of the nail plate which was reinserted as splint to prevent the adhesions. Additional metal splint was applied, and patient was instructed to avoid sports for at least 6 weeks and return for a follow up in a week. At one-week post reduction and repair, X-ray was repeated and showed good alignment "see Figure 3". The wound was clean and healing nicely. On 3 weeks post reduction and repair the patient was reviewed again and new X-ray was taken and showed signs of healing of the fracture while the wound was completely healed. The metal splint was removed.

Figure 3: X-ray 1-week post operatively.

Prognosis and Recommendation

All of the children seen had regained almost full range of motion on 3 months post reduction and repair with no pain or deformity to report. All children were instructed to avoid sports for at least 6 weeks from the time of the injury. Though, the emotional trauma for the children and their families going through this was one to forget. Often parents were shocked and bemused that such a product will be allowed to be sold in our high streets and shopping centers. In fact, several countries round the world have realized the scale of the problem and the danger such a device could pose on our beloved kids. In the UK, after several incidents of devices catching fire and seriously injuring the riders, followed by several calls by leading physicians and public health groups, government has ordered the recall and banning of these risky devices from all major retailor. Similarly, Qatari authorities saw the very same risk and wisely banned all hoverboards from being sold in Qatar shopping centers and major retailers.

We, as professionals dealing with the consequences of accidents caused by hoverboard, while praising the decision to ban them in Qatar, call on other nations to consider banning the trade of such a device due to the serious risk it poses on our young beloved children well being. For those who are still using these hoverboards, there are some universal safety precautions one must comply with including:

1. Do not ride near vehicular traffic and wear safety gear when using a hoverboard.
2. Since the lithium battery tend to explode while charging, do not charge a hoverboard overnight or when you are not able to observe the board.
3. Do not Charge directly after riding. Let the device cool for an hour before charging.
4. Charge and store in an open dry area away from combustibles in case it catches fire, the damage will be minimal.

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