



# Ice Skating Injuries: A Review of Literature on Nature of Injuries and the Role of Preventive Strategies

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## Abstract

Despite the fact that ice skating is one of the most popular sports, its risks of potential injuries are often underestimated. There are a variety of injuries associated with this sports ranging from acute injuries like fractures to chronic manifestations like tendon injuries and tendinoses. Some and quite few of these injuries are preventable by good planning and good education. Skaters should be educated on best methods of breaking their falls and freely supplied with protective measures at the ice rink. The aim of this study was to review the characteristics of injuries caused by ice skating, to compare them in children and adults, to identify risk factors associated with such injuries and to review the role of injury prevention strategies. We evaluated these injuries, were able to identify the risk factors and were able to formulate prevention strategies.

**Keywords:** Ice skating; Sport injuries; Fractures

## Introduction

Ice skates, unique combination of athleticism, strength, endurance, gracefulness and artistry on ice, first developed as a means of locomotion at least 3,000 years ago [1]. Ice skating, one of the most competitive and recreational sports, has become more popular recently. One of the explanations for this is the fact that temporary ice skating rinks are becoming more common place in UK towns especially over the Christmas period. Four percent of the UK population takes part in ice skating each year.

## Method

We searched through Cochrane data bases, MEDLINE & PubMed searches, and Google Scholar searches and selected the relevant articles and assess them in terms of relevance and efficacy and power of studies.

## Review of Literature

In various studies ice skating related fractures have been reported as high as 82.8% of all sports-related fractures. In a study of over 500 synchronized skaters, 42% had sustained an acute injury at some point during their sport career, with the majority affecting the limbs [2]. The potential injury risks are often underestimated by skating participants. Ice skating-related injuries have been reported to be more serious than other forms of skating [3]. An ice-rink may be free but adds significant burden to the healthcare system including Other chronic injuries include tendonitis, muscle strains, lower back problems, patellar tendonitis due to repetitive falls and Osgood Schlatter disease. The two later injuries are common in junior skaters. Physical therapy should be considered for all skaters with chronic knee pain [4]. Cost of hospital stay and operative procedure [5]. Additional costs to The Royal Hampshire County Hospital (RHCH) for a temporary ice rink were calculated as £33,718.50 in 2007. However, this did not include the considerable further cost of out-patient follow-up and the socioeconomic cost of days lost from work [6]. The purpose of this review is to examine the patterns and mechanism of injuries, identifying high risk group and examine the role of prevention strategies.

## Types of Injuries

Ice skaters, like most other athletes, are at risk of acute and chronic injuries. The commonest reported injuries sustained involve upper (80%) and lower extremity injuries (11%) followed by head injuries. Most common fractures reported have been ankle and distal radius fractures. Majority of the patients are adults. Studies have reported that about third of patients sustaining injury required an orthopedic consult and similar number of patients needed operative treatment [5]. Children are

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**Figure 1:** X-ray anteroposterior and lateral views showing fibular stress fracture, one of the commonest chronic injuries following ice skating.

at risk for injury even when they are around skaters and body regions injured in this group are similar to adults [7]. The differences in the prevalence of various injuries among studies may reflect differences in skater behavior and education.

### Acute injuries

Pair skaters and ice dancers are at higher risk of acute injuries due to increased speed, momentum, and force in falls and severity of injuries with pair skaters lifts and throws [8]. Due to nature of the ice skating, acute injuries such as fractures, abrasions and sprains are mainly due to falling on the ice [2].

### Chronic injuries

Chronic overuse injuries are more common in single skaters. Other chronic injuries include tendonitis, muscle strains, lower back problems, patellar tendonitis due to repetitive falls and Osgood Schlatter disease. The two later injuries are common in junior skaters. Physical therapy should be considered for all skaters with chronic knee pain [4].

### Stress fractures

Stress fractures are the commonest overuse injury in skaters secondary to repetitive forces on bones. Most frequent sites are first and second metatarsals of the skaters' take off leg for toe-pick jumps followed by tibia, fibula and navicular bones (Figure 1 and 2).

### Low back pain

Lumbar sprains, facet pain, posterior iliac crest injuries, spondylolysis and spondylolisthesis are common causes of low back pain. This may be due to the fact that skaters usually have reduced ankle and knee motion due to stiff boots and as a result attempt to maintain their balance by increased hip flexion and back extension. Another cause of low back pain is sacroiliac joint dysfunction secondary to repeated unilateral shearing forces from landings and missed jumps [8].

### Ice skating injuries in various body sites

**Lower limbs injuries:** Falls were the most common mechanism of injury [8]. When a skater attempts to keep their balance and resist a fall, they are more likely to sustain a twisting injury of their lower limb [2]. Third most common cause of sport-related ankle fracture has been reported to be ice skating after soccer and rugby [9]. It has been suggested that increased risk of ankle sprain may be due to the fact that skaters have relatively weak peroneal muscle as a result of stiff support boots. Patellofemoral syndrome is common among skaters



**Figure 2:** X-ray showing stress fracture of femur and its management with open reduction internal fixation.

because of over-development of vastus lateralis and poor flexibility of hamstring and quadriceps muscles (Figure 3 and 4) [6].

**Upper limb injuries:** Upper limb injuries are likely to occur if a skater uses their outstretched hand to break ones' fall. This usually results in wrist sprain and fractures. Other types of upper limb injury are rotator cuff injuries secondary to repetitive lifting and wrist ganglions [6,10].

**Head injuries:** Ice skaters are at high risk of sustaining head injury. Hockey/Skating has been reported as the most common specific cause of pediatric sports-related concussions [11]. They also experience greater proportion of concussions [12].

### Skating by Standers Injuries

Mechanisms of injury for skating bystanders have been reported as being stepped on, dropped, or kicked by skaters and collision with skaters. Head injuries have shown to occur more in children who were dropped than other mechanisms. Younger children were at higher risk of head injury. Children stepped on by skaters experienced more injuries to the extremities [9].

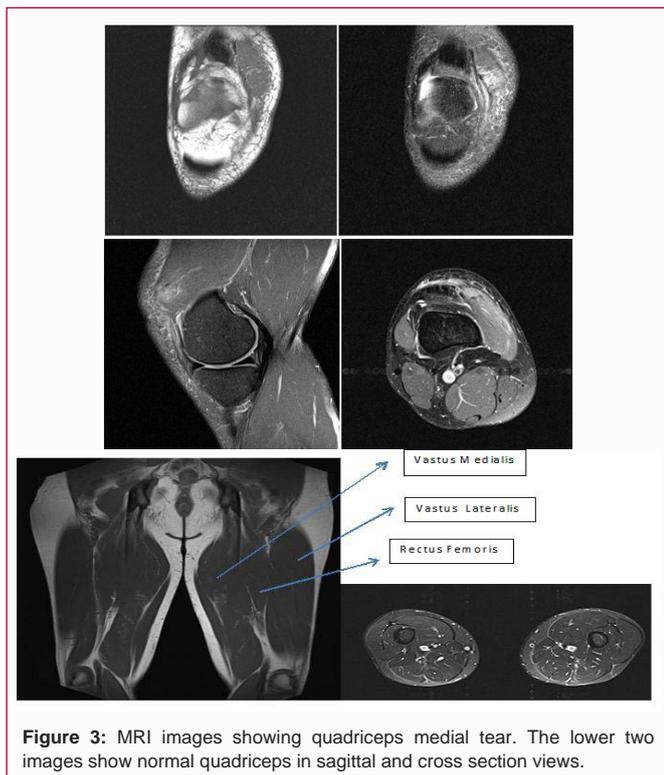
### Adults Injuries vs. Pediatric Injuries

Younger ice skaters are more likely to have parental assistance or use other type of stability assistance. As a result, injuries may be underestimated in this group. Studies have shown that 6 year olds or younger ice skaters, experience a greater proportion of head and facial injuries than older children [9]. This may be due to the fact that younger children have a higher center of gravity, which can cause them to fall on their head first. In addition, younger children may have less arm strength which may cause difficulty in preventing their head from striking the skating surface when attempting to break the fall with their arms or hands [10].

### Who is at High Risk for Injuries?

#### Age

Studies have reported that people above 50 years have a higher



**Figure 3:** MRI images showing quadriceps medial tear. The lower two images show normal quadriceps in sagittal and cross section views.

risk of sustaining more severe injuries; particularly the risk of head injuries was significantly higher for people above 50 years [3]. Furthermore, children of 6 years of age or younger suffer more head and facial injuries than older children [12].

### Sex

Women had a much higher rate of injuries compared to their male counterpart and the ratio gets more worst in the older (above 50 years of age) age group [13].

### Muscle tightness

Studies have suggested an association between ankle sprains and knee enthesitis with muscle tightness in skating athletes, or in other words untrained athletes and athletes performing the activities without priming up have a higher incidence of sports related injuries.

### Joint laxity

An association between lower back pain and generalized joint laxity has been described only for the male skaters in some studies [14].

### Skills and trainings

Being novice skaters and not wearing any protective gear have

been shown to increase the risk of injuries [15].

### Nature of the skating

Stress fracture have been describe to happen more often in singles skaters as a result of their different training regimen with emphasis on difficult jumps and resultant high impact landing. More than one fourth of junior figure skaters have been described to sustain an acute injury during their relatively short careers [15].

### Time of skating

Some studies have suggested that the evening hours on weekends were the time frames during which the most injuries occurred [16]. Various factors have been attributed to it including general fatigue, time strains and poor equipment availability etc.

## Ice Skating Injuries Compared to Rollerblading/Inline Skating

Majority of ice skaters, similar to roller/inline skaters, fall forward. Ice skaters are nearly five times more at risk of head injury than roller/inline skaters. This is due to the fact that ice skating occur on a low friction surface. In contrast to roller/inline skaters, ice skaters usually fail to break falls with arms, resulting in head and face injuries [17]. Studies have shown that ice-skaters are more likely to have adult supervision than skateboarders, roller skaters and in-line skaters. Ice-skating related injuries happen more often in indoor skating facilities, compared with skateboarding, roller skating and in-line skating injuries [17].

### Prevention Strategies

Studies have shown that up to 80% of skating injuries are preventable [8]. Raising awareness among the public and physicians of the risks associated with ice skating is of paramount importance in order to promote further educational interventions and the use of protective gear [3]. Cadaveric biomechanical studies have shown that wrist protectors significantly reduce forces transmitted through the forearm bones. These biomechanical studies have shown no evidence of increased bone strain at the proximal end of the protectors. Using protective gloves have also been recommended to help prevent common soft tissue lacerations of the hand [2].

For full protection against head and face injuries, ice skaters need to wear full hockey style helmets with facemasks. Practicality may be an issue especially younger children may find this difficult. Wearing gloves with a grip palm surface is an alternative head injury preventive measure which might make the attempts to break a fall with the arms or hands more successful in stopping the head from striking the ice by preventing the hands from sliding. However, this may led to an increase in risk of upper extremity fractures similar to roller/inline skaters who do not wear wrist guards. Requiring ice skater children to



**Figure 4:** X-ray showing ankle fracture in form of bimalleolar fractures which has been managed with open reduction internal fixation.

wear a wrist guard with a palm that allows them to grip the ice may be a simple method to stop them from striking the head, protect against upper extremity fractures, and unlike a bulky helmet, not discourage children from skating [7].

Studies have shown that strength, endurance and cardiovascular fitness are essential in sport injury prevention as these sports involve high velocities and impact forces. Specific exercises and training recommendations is important in injury prevention and reducing the incidence, severity and cost associated with alpine winter sports injuries including ice-skating in order to meet the technical demands of these sports [18]. Ankle stabilization and proprioceptive training during off-ice training may help to prevent ankle sprains.

## Recommendations

Use of protective equipment, such as wrist guards, knee pads, and elbow pads and focused training on methods to break falls safely, should be encouraged for prevention of injuries to the extremities during ice-skating. Caution should be used when allowing young children to participate in recreational ice-skating. Appropriate training for the skaters' age and skills in order to maintain flexibility and strength is advised.

## References

- Formenti F, Minetti AE. Human locomotion on ice: the evolution of ice-skating energetics through history. *Journal of Experimental Biology*. 2007;210:1825-33.
- Barr LV, Imam S, Crawford JR, Owen PJ. Skating on thin ice: a study of the injuries sustained at a temporary ice skating rink. *Int Orthop*. 2010;34(5):743-6.
- Ostermann RC, Hofbauer M, Tiefenböck TM, Pumberger M, Tiefenböck M, Platzer P, et al. Injury severity in ice skating: an epidemiologic analysis using a standardised injury classification system. *Int Orthop*. 2015;39(1):119-24.
- Knox CL, Comstock RD. Nonparticipant injuries associated with skating activities. *Pediatr Emerg Care*. 2006;22(3):164-7.
- Schwarzkopf R, Nacke EA, Tejwani NC. The impact of orthopaedic injuries sustained at an urban public ice skating rink: is it really free? *Bull Hosp Jt Dis*. 2014;2(4):263-5.
- Kelsall NK, Bowyer GW. Injuries sustained at a temporary ice-skating rink: Prospective study of the Winchester experience 2007-2008. *Injury*. 2009;40(12):1276-8.
- Dillon JP, Geurin S, Laing AJ, Ryan D, Dolan M. The impact of ice-skating injuries on orthopaedic admissions in a regional hospital. *Ir Med J*. 2006;99(1):7-8.
- Porter EB, Young CC, Niedfeldt MW, Gottschlich LM. Sport-specific injuries and medical problems of figure skaters. *WMJ*. 2007;106(6):330-4.
- Robertson GA, Wood AM, Aitken SA, Court Brown C. Epidemiology, management, and outcome of sport-related ankle fractures in a standard UK population. *Foot Ankle Int*. 2014;35(11):1143-52.
- Knox CL, Comstock RD. Video analysis of falls experienced by paediatric ice skaters and roller/inline skaters. *Br J Sports Med*. 2006;40(3):268-71.
- Macpherson A, Fridman L, Scolnik M, Corallo A, Guttmann A. A population-based study of paediatric emergency department and office visits for concussions from 2003 to 2010. *Paediatr Child Health*. 2014;19(10):543-6.
- Aitken SA, Watson BS, Wood AM, Court-Brown CM. Sports-related fractures in South East Scotland: an analysis of 990 fractures. *J Orthop Surg*. 2014;22(3):313-7.
- Okamura S, Wada N, Tazawa M, Sohmiya M, Ibe Y, Shimizu T, et al. Injuries and disorders among young ice skaters: relationship with generalized joint laxity and tightness. *J Sports Med*. 2014;5:191-5.
- McGeehan J, Shields BJ, Smith GA. Children should wear helmets while ice-skating: a comparison of skating-related injuries. *Pediatrics*. 2004;114(1):124-8.
- Cleary K, Levine D. Pediatric and young adult injuries sustained while ice skating at an urban temporary rink: A prospective observational study. *Ann Emerg Med*. 2012;60(4):4.
- Clarke HJ, Ryan D, Cullen I, Cusack S. The impact of a temporary ice rink on a local emergency department service. *Eur J Emerg Med*. 2006;13(4):204-8.
- Knox CL, Comstock RD, McGeehan J, Smith GA. Differences in the risk associated with head injury for pediatric ice skaters, roller skaters, and inline skaters. *Pediatrics*. 2006;118(2):549-54.
- Hébert-Losier K, Holmberg HC. What are the exercise-based injury prevention recommendations for recreational alpine skiing and snowboarding? A systematic review. *Sports Med*. 2013;43(5):355-66.