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Frequency of injuries, in particular dental injuries, in ski jumping and Nordic combined

Level of knowledge regarding mouthguards and tooth rescue boxes – a questionnaire study

KEYWORDS
dental trauma,
Nordic combined,
ski jumping,
mouthguard

SUMMARY

This study investigates the frequency of injuries, in particular dental injuries, among ski jumpers and Nordic combined athletes. It also examines the level of knowledge regarding tooth protection and tooth rescue boxes in this population. Of the 465 sportswomen and sportsmen who took part in the study, 230 (62.5%) of the 368 ski jumpers and 56 (56.5%) of the 97 Nordic combined athletes had sustained an injury. In both disciplines injury was most likely among professionals. The survey participants reported injuries to the limbs (n = 216), head and lips (n = 273 and n = 253, respectively), torso or spine (n = 249), teeth (n = 246), nose (n = 229) and jaw (n = 26). Dental injuries were more common among professionals than either amateur or junior ski jumpers, whereas, among the Nordic combined athletes, juniors were most likely to sustain a dental injury. Overall, the frequency of dental injury was significantly (p = 0.019) higher among adults 12.7% (n = 234) than junior athletes 6.1% (n = 212). The level of awareness of mouthguards and tooth rescue boxes varied between countries. The high injury rate recorded in this study demonstrates that ski jumping contains a considerable risk of injury, including tooth damage. Consequently, it seems reasonable to inform skiing organisations, trainers and athletes about the potential benefits of mouthguards and tooth rescue boxes in order to reduce the risk of dental injury.

Introduction

Tooth damage is a common sports-related orofacial injury and approximately 10–15% of all dental accidents are sports-related (Filippi et al. 1998, Bemelmanns & Pfeiffer 2000, Filippi & Pohl 2001, Lang et al. 2002, Filippi 2009). Sports that involve close body contact or high speeds carry a higher risk for facial or dental injuries (Kerr 1986, Flanders & Bhat 1995). Age under 24 years, male gender, and sporting activity at a professional level are general risk factors for dental injuries (Quintana & Giralt 2005). Wearing a mouthguard could reduce or even prevent these injuries (Lang & Filippi 2003). The high pressure associated with performing at competition level means that athletes expose themselves to considerable health risks (Filippi 2009). Despite increasing media interest in recent years, data regarding the injury profile of ski jumpers and Nordic combined athletes are scarce (Goertzen et al. 2001). One study examining the nature and frequency of ski jumping competition injuries over a 5-year period reported an accident rate similar to that seen in alpine leisure skiers (Wright et al. 1991). Most of the injuries were mild and did not result in permanent disability (Wright et

al. 1991). A retrospective study looking at ski jumping fatalities in the USA reported a death rate of 6 over 50 years (0.12/year) – neck injuries tended to be a feature of these accidents (Wright 1988). In Norway, over the 5-year period from 1977 to 1981 at least 12 accidents resulted in permanent disabilities although no fatalities were reported: the risk of serious injury was calculated to be between 0.5 and 0.0003% per jump (Wester 1985). There have been many reports about general accidents among participants in the two sports groups, ski jumping and Nordic combined, but almost no scientific data on dental accidents are available. These two groups were chosen because both involve the ski jumping discipline. The aim of this study was to investigate the frequency and severity of injuries, in particular dental injuries, in ski jumping and Nordic combined athletes and to evaluate their knowledge regarding mouthguards and tooth rescue.

Materials and Methods

During international competitions held in Switzerland, athletes from Albania, Bulgaria, Germany, Finland, France, Holland, Japan, Canada, Kazakhstan, Norway, Austria, Romania, Switzerland, Slovakia, Slovenia, Sweden, the Czech Republic and the USA were individually interviewed by the same interviewer. The responses of 465 ski jumpers and Nordic combined athletes (51 females and 414 males) were analysed in this study. The athletes had given verbal consent to participate in this study in advance. The contacting has been carried out by the respective team carer, in order to see that all requested athletes participated in this survey. The response rate was therefore 100%. Since far fewer women than men participated in the events during which the survey took place, the proportion of women was significantly lower than that of men. Professionals, amateurs and junior athletes from both disciplines were included (Tab. I). The questionnaire consisted of eight questions about general injuries, in particular tooth injuries, tooth protection and the tooth rescue box (Tab. II).

Name, age, sex, nationality, discipline and performance level were recorded for each interviewee.

Statistics were calculated according to nationality, sex, age, discipline and performance level using Fisher's exact test. For the comparison of categorical data, contingency tables were produced with numerical values and percentages. The corresponding p-values were calculated using Fisher's exact test with a significance level set at 0.05 (2-tailed). All analyses were performed using the "Statistical package R (The R Foundation for Statistical Computing, Version 2.9.2)".

Tab. I Number of athletes categorised by discipline and performance level

	Juniors	Amateurs	Professionals	Total
Ski jumping	153	76	139	368
Nordic combined	45	16	36	97
Total	198	92	175	465

Tab. II Questions and potential answers

1.	Have you already sustained an injury from ski jumping or Nordic combined events? Yes or no
2.	If yes, what was the nature of your injury? Limb, head, spine or torso, lip, dental, nose, jaw
3.	Have you already sustained a dental injury from ski jumping or Nordic combined events? Yes or no
4.	If yes, have you experienced an avulsion? Yes or no
5.	Have you heard of mouthguards? Yes or no
6.	Do you wear a mouthguard? Yes or no
7.	If yes, what sort of mouthguard? Ready-for-use or mouthguard individually produced by a dentist
8.	Have you heard of the tooth rescue box? Yes or no

Results

Frequency of injuries

The average age of the 465 interviewees (51 females; 414 males) was 22.9 years (6–96 y, SD 13.6). The females were, on average, younger (19.8 y, 6–57 y, SD 10.3) than the males (23.4 y, 7–96 y, SD 13.9).

Two hundred and thirty of the 368 ski jumpers (62.5%) and 56 of the 97 Nordic combined athletes (56.6%) in this study had sustained an injury. Significantly more professional ski jumpers (78.4%, n = 109) had been injured than amateurs (53.9%, n = 41) or juniors (52%, n = 79) ($p < 0.0001$) (Fig. 1).

In the Nordic combined, professionals were also more commonly injured (72.2%, n = 26) than juniors (53.3%, n = 24) and amateurs (31.2%, n = 5) ($p = 0.019$) (Fig. 2).

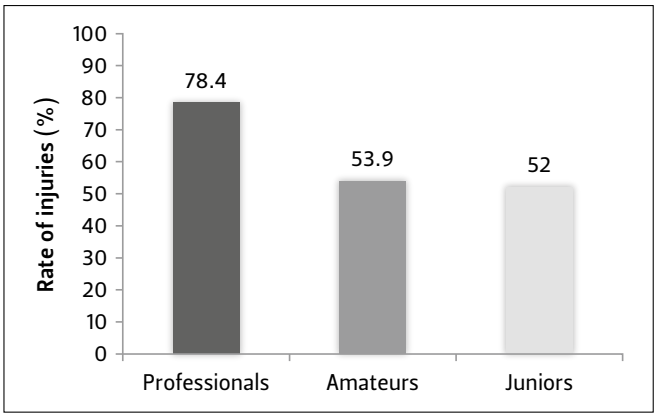

Fig. 1 Rate of injuries among ski jumpers

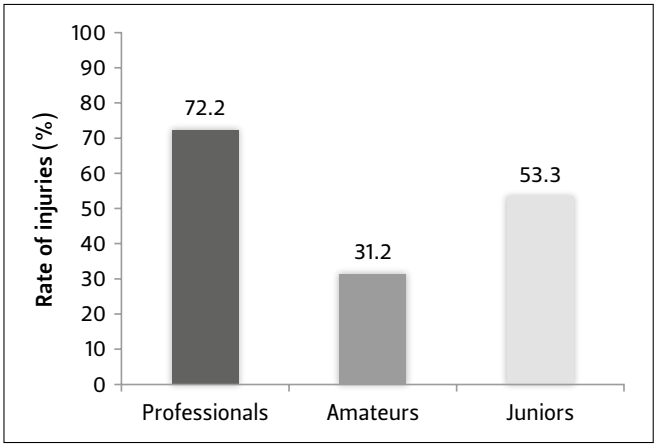

Fig. 2 Rate of injuries in Nordic combined athletes

Tab. III Type of injuries sustained categorised by discipline

Type of injury	Ski jumpers (%)	Nordic combined (%)	Total (%)
Limb	173 (46.8)	43 (43.4)	216 (46.5)
Head	59 (15.9)	14 (14.1)	73 (15.7)
Spine or torso	37 (10)	12 (12.1)	49 (10.5)
Lip	46 (12.4)	7 (7.1)	53 (11.4)
Dental	39 (10.5)	7 (7.1)	46 (9.9)
Nose	23 (6.2)	6 (6.1)	29 (6.2)
Jaw (fracture)	5 (1.4)	1 (1)	6 (1.3)

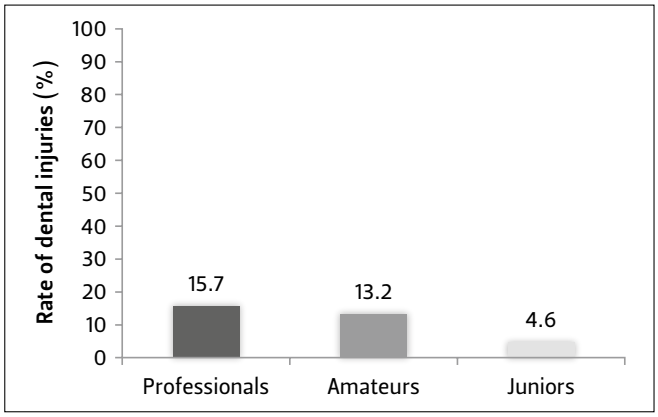

Fig. 3 Rate of dental injuries in ski jumpers

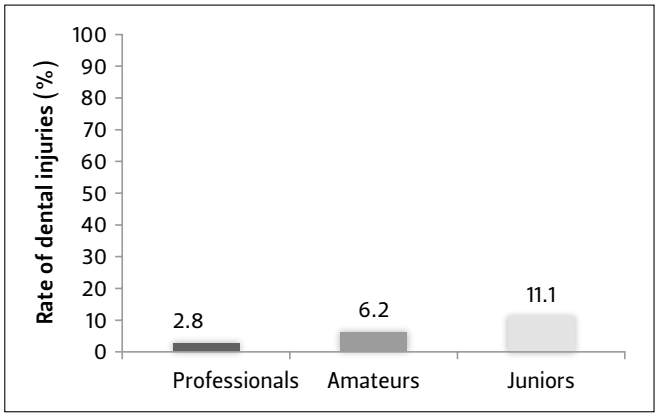

Fig. 4 Rate of dental injuries in Nordic combined athletes

Of the injuries reported by ski jumpers in this study the majority involved the limbs, the head and lips, whereas injuries to the torso and spine had been sustained by only a few of the athletes. Athletes also reported specific injuries to the teeth, nose and jaw (Tab. III).

Of the 97 Nordic combined athletes, most had sustained injuries to the limbs, head, torso and spine. Fewer athletes reported injuries to the lip, teeth or nose and one athlete had sustained a fractured jaw (Tab. III).

Overall, injuries of the limbs, head, lip, torso/spine, teeth, nose and jaw had been experienced by 46.5%, 15.7%, 11.4%, 10.5%, 9.9%, 6.2% and 1.3% of athletes, respectively.

Spinal and torso injuries had been sustained by 15% (n = 21) of professionals, 7.8% (n = 12) of juniors and 5.3% (n = 4) of amateur ski jumpers (p = 0.44). There was a statistically significant difference in the occurrence of limb injuries between the ski jumping performance levels: professionals 64.3% (n = 90), amateurs 43.4% (n = 33) and juniors 32% (n = 49) (p < 0.0001). This trend was also seen among Nordic combined athletes where professionals (61.1%, n = 22) sustained more limb injuries than juniors (37.8%, n = 17) or amateurs (18.8%, n = 3) (p = 0.01).

Frequency of dental trauma

There was a statistically significant difference in the occurrence of dental injuries between the different performance levels of ski jumpers: professionals 15.7% (n = 22); amateurs 13.2% (n = 10); and juniors 4.6% (n = 7) (p = 0.004) (Fig. 3).

The percentage of dental injuries in Nordic combined athletes was higher among juniors (11.1%, n = 5) than amateurs (6.2%, n = 1) or professionals (2.8%, n = 1), but there was no statistically significant difference (p = 0.327) between the groups (Fig. 4).

In total, 46 of the 465 athletes had sustained a dental trauma. Overall this represents 10% (n = 42) of male and 7.8% (n = 4) of female athletes.

A statistically significant difference was evident in the frequency of dental injuries experienced by juniors and adults (professionals and amateurs) (p = 0.019). Of the 198 juniors and 267 adults taking part in the study 12.7% (n = 34) and 6.1% (n = 12), respectively, had sustained a dental injury. Four adults (1.5%) had experienced an avulsion.

Similarly, the occurrence of dental injuries differed in a statistically significant way between disciplines and age groups. Dental injury in adults was more common among ski jumpers (14.8%, n = 32) than Nordic combined athletes (3.8%, n = 2) (p = 0.0036). Conversely, in the junior category, in percentage terms dental injury was more common in Nordic combined athletes than in ski jumpers (11.1%, n = 5; 4.6%, n = 7, respectively) (p = 0.15).

Awareness of mouthguards and tooth rescue boxes

Mouthguards were worn by a total of six athletes (1.3%): two of 80 German athletes (2.5%), one of 31 Austrian athletes (3.2%) and none of the Swiss athletes. All mouthguards worn by athletes taking part in this study were tailor-made. Three hundred and four (65.5%) of the 465 athletes participating in the study had heard of mouthguards.

The level of awareness about tooth rescue boxes varied between countries. Overall 7.9% (n = 29) of ski jumpers had heard of the tooth rescue box. Awareness was greatest among the

German ski jumpers (n = 12, 8.1%), whereas fewer Austrian and Swiss ski jumpers (6.67%, n = 5, and 2.25%, n = 2, respectively) were aware of the tooth rescue box.

Of the Nordic combined athletes in this study only 5% (n = 5) had heard of the tooth rescue box (7.1% of the Swiss athletes [n = 1], 6.4% of the Austrian athletes [n = 2] and 3.9% of the German athletes [n = 2]).

Discussion

In this questionnaire study, athletes were asked about the injuries they had sustained. It can be assumed that athletes, and especially professional athletes, can reliably remember having sustained an injury, because injuries may have a great influence on their career. In this study, no information about athletic exposure was collected. The high injury rate recorded in this study demonstrates that ski jumping carries a considerable risk of injury. This contrasts with the perception of athletes and trainers who consider ski jumping to be safe and associated with only a slight risk of injury (Wright 1988). The professional athletes taking part in this study were injured significantly more frequently than either amateurs or juniors. This seems realistic, as professional athletes usually train a lot more than amateurs and are thus exposed to a higher risk of injury. A previous report observed that junior athletes sustained more injuries but, because of the smaller jumps involved, these tended to be less severe (Goertzen et al. 2001). It was noted that with junior ski jumpers, accidents were most often caused by mistakes made during the landing phase of the jump (Goertzen et al. 2001). In contrast, world cup athletes were more likely to sustain injury after mistakes made in the flight phase of the jump (Goertzen et al. 2001).

Although this study found that limb, head and lip injuries were most common, an earlier study reported that shoulder injuries were the most frequent, followed by head and ankle injuries (Wright et al. 1991). A further study reported that injuries to the head, back/neck and shoulder were the most common (Yamamura et al. 1993).

Forty-six of the 465 (10.1%) interviewees had sustained a dental injury: the rate of this type of injury was highest among professionals and lowest among juniors. In comparison to other investigations that used a very similar study design, there are large discrepancies between different sporting activities. The data show a similar incidence of dental injuries to that reported for inline skating (9.2%) (Fasciglione et al. 2007), floorball (11.3%) (Maxen et al. 2011) or handball (10.7%) (Lang et al. 2002), a much lower incidence than in basketball (16.6%) (Perunski et al. 2005) and a higher incidence than in squash (4.5%) (Persic et al. 2006) or mountain-biking (5.7%) (Müller et al. 2008).

Only six of the 465 athletes who took part in this study reported wearing a mouthguard. Despite numerous studies indicating that wearing a mouthguard can reduce the risk of sustaining dental injury during sports, the results of the present study suggest that the prevention of dental injury was not considered a high priority by ski jumpers and Nordic combined athletes (McNutt et al. 1989, Chapman 1993, Woodmansey 1997, Mischkowski et al. 1999, Labella et al. 2002). Furthermore, a meta-analysis of papers published between 1930 and 2006 shows that not wearing a mouthguard puts athletes at a 1.6–1.9 times higher risk of sustaining an orofacial injury (Knapik et al. 2007). In this study, 65.6% of athletes were aware of mouthguards. While this is a similar awareness to that reported among inline skaters, similar studies on sports such as handball, basketball and squash have reported much greater levels of awareness of mouthguards (90%) (Lang et al. 2002, Perunski et al. 2005, Persic et al. 2006, Fasciglione et al. 2007).

In comparison to a previous study on dental trauma among inline skaters, which reported that 32.5% of athletes knew of the tooth rescue box, the level of awareness among athletes in the present study was four times lower (Fasciglione et al. 2007). A similar finding was made in a study investigating the incidence of tooth injury among water polo players, which reported a level of awareness of 10.4% and an incidence rate of avulsion of 1.4% (Hersberger et al. 2012). The highly specialised cells on the root surface can only survive for a significant amount of time if placed in a tooth rescue box (SOS Zahnbox, Fa. Hager & Werken, Duisburg; Dentosafe, Fa. Medice Arzneimittel Pütter, Iserlohn; EMT ToothSaver, Fa. SmartPractice, Phoenix, USA). Such a box contains all the necessary nutrients and amino acids and ensures the extraoral survival of the cells and therefore the survival of the tooth for at least 25 to 30 hours (Filippi 2009).

Consequently, it seems reasonable to inform skiing organisations, trainers and athletes about the potential benefits of mouthguards and tooth rescue boxes in order to reduce the risk of dental injury.

Résumé

La présente étude vise à analyser la fréquence des blessures, notamment des blessures dentaires, parmi les athlètes en saut à ski et en combiné nordique. En outre, cette étude permet également d'évaluer le niveau de connaissances en matière de protection dentaire et de boîtes de secours dentaires au sein de cette catégorie de population. 465 sportifs des deux sexes ont participé à cette étude. 230 athlètes sur 368 (62,5%) en saut à ski et 56 athlètes sur 97 (56,5%) en combiné nordique ont déjà subi des blessures. Dans les deux disciplines, c'était le groupe des professionnels qui présentait la fréquence la plus élevée de blessures. Les athlètes en saut à ski et en combiné nordique interrogés ont signalé des blessures aux membres (n = 216), à la tête (n = 73), aux lèvres (n = 53), au torse ou à la colonne vertébrale (n = 49), dentaires (n = 46), au nez (n = 29) et à la mâchoire (n = 6). En saut à ski, les blessures dentaires étaient plus courantes chez les professionnels que chez les amateurs ou les juniors, tandis que ces derniers avaient plus tendance que les autres à se blesser aux dents en combiné nordique. Dans l'ensemble, les blessures dentaires étaient beaucoup plus fréquentes (p = 0,019) chez les adultes (12,7%, n = 34) que chez les juniors (6,1%, n = 12). Le degré de sensibilisation aux protège-dents et boîtes de secours dentaires variait selon les pays. Le taux élevé de blessures relevées dans la présente étude montre que le saut à ski présente un risque important de blessures, y compris les blessures dentaires. Il paraît donc utile d'informer les associations de ski, les entraîneurs et les athlètes des avantages potentiels des protège-dents et des boîtes de secours dentaires afin de réduire le risque plutôt élevé de blessures dentaires.

Zusammenfassung

Die vorliegende Studie untersucht die Häufigkeit von Verletzungen, insbesondere Zahnverletzungen, bei Skispringern und Nordisch-Kombinierern. Ebenfalls wird in dieser Studie der Wissensstand in Bezug auf den Zahnschutz und Zahnrettungsboxen in der genannten Population geprüft. 465 Sportlerinnen

und Sportler nahmen an der Studie teil. 230 (62,5%) der 368 Skispringer und 56 (56,5%) der 97 Nordisch-Kombinierer hatten bereits eine Verletzung erlitten. In beiden Disziplinen traten in der Gruppe der Professionellen am häufigsten Verletzungen auf. Die befragten Skispringer und Nordisch-Kombinierer berichteten über Arm- oder Beinverletzungen (n = 216), Kopfverletzungen (n = 73), Lippenverletzungen (n = 53), Rumpf- oder Wirbelsäulenverletzungen (n = 49), Zahnverletzungen (n = 46), Nasenverletzungen (n = 29) und Kieferverletzungen (n = 6). Bei den Skispringern kamen Zahnverletzungen öfter bei den Professionellen als bei den Amateuren oder Junioren vor, während bei den Nordisch-Kombinierern die Junioren am häufigsten eine Zahnverletzung erlitten. Insgesamt war die Häufigkeit von Zahnverletzungen bei den Erwachsenen mit (12,7%, n = 34) signifikant (p = 0,019) höher als bei den Junioren (6,1%, n = 12). Der Bekanntheitsgrad des Zahnschutzes und der Zahnrettungsbox variierte zwischen den Nationen. Die hohe Verletzungsrate, die in dieser Studie erfasst wurde, zeigt, dass Skispringen ein erhebliches Verletzungsrisiko birgt, einschliesslich Zahnverletzungen. Daher scheint es sinnvoll, dass Skiorganisationen, Trainer und Athleten über den potenziellen Nutzen eines Zahnschutzes und der Zahnrettungsbox informiert werden, um dem erhöhten Zahnverletzungsrisiko entgegenwirken zu können.

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