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Eye injuries and orofacial traumas in floorball – a survey in Switzerland and Sweden

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Abstract – The objective of this study was to investigate the occurrence of eye injuries and orofacial traumas in floorball. In addition, the athletes' habits of wearing protective goggles and mouthguards was surveyed, and an assessment was made of the general level of knowledge amongst athletes and coaches about preventive and first aid measures after a dental trauma and the resulting consequences. The study was conducted by the same interviewer in Switzerland and Sweden during the 2009/2010 season using a standardized questionnaire. A total of 608 individuals (565 athletes and 43 coaches) belonging to the amateur and semi-professional leagues in the two countries were individually interviewed. Although 72.7% of all athletes had observed and 27.7% of field players had sustained an injury to the eye or its vicinity, only 25 athletes (4.9%) wore protective eyewear. Similarly, despite 31.7% of all players having observed a dental or jaw injury and 11.3% of interviewed field players having suffered one, only one athlete wore a mouthguard on a regular basis. Participants from Switzerland were significantly better informed than participants from Sweden with regard to first aid measures. The results of this study show that floorball has an equally high risk for dental trauma as handball. Further investigations of dental injuries in floorball would be valuable in order to provide players, coaches, parents and sporting federations with the necessary information to make decisions regarding the use of mouthguards. It is strongly recommended that protective eyewear should be made mandatory.

Floorball is a fast-growing indoor team sport that has become very popular in Europe during the last decades. The number of licensed players is rising every year totalling 272 656 registered players in 47 different countries worldwide by June 2009. In addition, a large number of unlicensed players take part in floorball as a leisure activity. The largest member associations are in Sweden, Finland, Czech Republic, Switzerland and Norway (1).

Floorball can be described as hockey played indoors in a rink surrounded by a low barrier. Play consists of two teams of six players (including the goalkeeper) using graphite sticks to score goals with a plastic, hollow ball. The goalkeepers have to wear approved facemasks and usually wear other protective gear for knees, elbows and hands. For field players the use of protection devices is not mandatory (2). As floorball is a fast-paced sport it is known to produce a variety of injuries with joint sprains being the most common. The most frequently injured sites are the knees and ankles (3–6), followed by the head and neck (5). It has been reported that floorball injuries represent a large part of the sports-related eye injuries in Northern Europe (7–9) and the sport is estimated to belong to the highest risk group in sports for eye injuries (9). Eye protection in sports is increasingly advised as a considerable proportion of these eye injuries could be prevented with appropriate equipment (10–13).

Sport is among other reasons a frequent cause for traumatic dental injuries (14). The Federation Dentaire International places organised sports into two categories based on risk of traumatic dental injuries: High-risk sports (such as American football, hockey, ice hockey, lacrosse, martial sports, rugby, inline skating, skateboarding and mountain biking) and medium-risk sports (such as basketball, soccer, team handball, diving, squash, gymnastics, parachuting and water polo) (15). Floorball is not listed, which is probably due to the fact that, as of date, no data regarding tooth injuries in floorball exists. Data reporting the frequency and nature of dental injuries in floorball would provide the necessary information about dental injury risk for the sports governing bodies to make guidelines regarding the use of mouthguards.

Although sports-related dental injuries cannot be eliminated entirely, many can be reduced in severity or prevented with use of a properly fitted mouthguard (16–20). It has also been suggested that mouthguards can reduce the incidence of temporomandibular and concussive injuries (21–23).

If a dental trauma occurs, then fast and competent decisions must be made in order that the injury does not deteriorate. For a layperson this requires at least some knowledge about dental trauma. For example, the consequence of not knowing what to do with avulsed

teeth is that they are likely to be transported in an unphysiological way leading to cell death and loss of a tooth. This process can only be slowed down and not altogether prevented by storage in certain media such as milk, saline or saliva. Thus, storage under such conditions is limited to short periods of time. Sometimes teeth are even left behind at the place of injury (24–28). Special cell culture media such as those used in different tooth rescue boxes (Dentosafe® Medice, Iserlohn, Germany), SOS-Zahnbox® (Miradent, Duisburg, Germany) and Curasafe® (Healthco-Breitschmid, Kriens, Switzerland) are easy and effective storage solutions that maintain the vitality and proliferative capacity of the cells in the periodontal ligament for extended periods (29, 30). As a minimum requirement, the awareness that dental injuries can necessitate immediate treatment and knowledge of emergency service numbers would seem to be essential.

The purpose of this work was to survey the frequency of eye injuries and orofacial traumas in floorball in Switzerland and Sweden. Furthermore, the general level of knowledge amongst athletes and coaches regarding the prevention of and first aid measures after a dental trauma and resulting consequences were investigated.

Materials and methods

Standardized interviews were conducted with 608 individuals involved in floorball during the 2009/2010 season. This included 565 athletes from 21 Swiss and 18 Swedish teams as well as their 43 coaches.

The participants were both male and female and either semi-professionals, playing in the highest league, or amateurs, playing in the two lowest leagues of their respective countries (Table 1). The interview contained 18 questions about observed and experienced ocular, dental and jaw injuries, emergency measures and protection habits (Table 2). Similar questionnaires have already been used in previous studies (31–35). The age, gender, nation, league status, training sessions per week and years playing (players) or being involved with floorball (coaches) of each interviewee were also recorded. All participants were interviewed individually and by the same investigator. All interviews took place during training sessions.

The statistical evaluation of the athletes differentiated between country (Switzerland/Sweden), league (semi-professional/amateur) and gender. Coaches constituted an independent group. Because of goalkeepers wear facemasks they were excluded in the analysis of the questions about sustained ocular, dental and jaw trauma and their habits of wearing protection. By means of a general linear model, ANOVA was carried out in order to determine significant dependencies. The level of significance was set at $P < 0.05$. For the analysis the software program SPSS/WIN 13.0 was used (SPSS Inc., Chicago IL, USA).

Table 1. Interviewees in Switzerland and Sweden

		Switzerland		Sweden		
		Semi-pro	Amateur	Semi-pro	Amateur	Total
Coaches		14	5	12	12	43
Field players	Women	59	61	60	65	245
	Men	78	60	57	66	261
Goalkeepers	Women	6	9	9	6	30
	Men	8	8	8	5	29
Total		165	143	146	154	608

Table 2. Questionnaire

No.	Question
1	Have you ever observed an injury to the eye or its vicinity?
2	Have you ever experienced an injury to the eye or its vicinity yourself?
3	If yes: What was the cause?
4	What kind of injury? (bruise, laceration, ocular)
5	Have you ever observed a dental or jaw injury?
6	If yes: What kind of injury? (concussion, crown fracture, dislocation, avulsion, jaw injury)
7	Have you ever experienced a dental or jaw injury yourself?
8	If yes: What was the cause?
9	What kind of injury? (concussion, crown fracture, dislocation, avulsion, jaw injury)
10	Did you know, that it is possible to replant an avulsed tooth?
11	Have you ever heard of the tooth rescue box?
12	Did you know that immediate action is essential for a successful outcome?
13	Do you know, how to reach a dentist in an emergency situation?
14	How high do you estimate the life-long costs after the loss of an anterior tooth?
15	Do you know about the existence of mouthguards?
16	If yes: Do you know different types of mouthguards? (stock mouthguard, custom-made, none)
17	Do you wear a mouthguard yourself?
18	If not: Why?

Results

A total of 565 athletes were interviewed with an average age of 22.5 years (SD 4.9), a mean duration of playing floorball of 10.4 years (SD 4.3) and an average of 2.8 training sessions per week. Their 43 coaches showed an average age of 37.7 years (SD 7.7), were on average present at 3.1 trainings per week and had been involved in floorball on average 17.1 years (SD 6.1). The mean duration of playing floorball was slightly higher for semi-professionals (11.5 years, SD 3.5) than for amateurs (9.3 years, SD 4.7) and the former attended more training sessions per week (3.6/week) than amateurs (1.9/week). This count does not include matches.

Out of the 565 players interviewed, 411 (72.7%) had observed an injury to the eye or its vicinity (Fig. 1). This number also includes minor, temporary injuries, such as bruises or a blurred vision.

Participants from Sweden (219/276, 79.3%) had observed significantly more eye injuries than participants from Switzerland (192/289, 66.4%, $P < 0.001$) and semi-professionals (237/285, 83.2%) observed more than amateurs (174/280, 62.1%, $P < 0.001$).

In the question 'Have you ever experienced an injury to the eye or its vicinity yourself?' only the answers of the

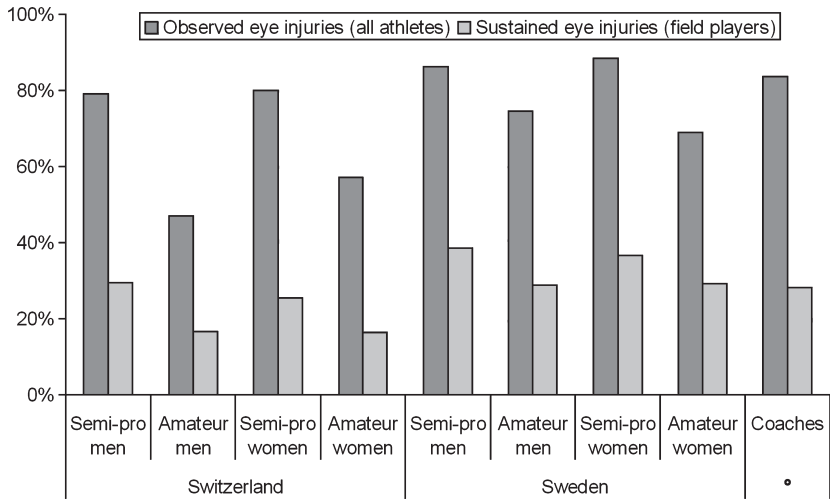

Fig. 1. Observed and sustained eye injuries in the different groups.

field players were analysed. Out of 506 field players, 140 (27.7%) had suffered a trauma of or around the eye at least once (Fig. 1). Significant differences could be determined between the countries and the leagues: Participants from Sweden (82/248, 33.1%) had received significantly more injuries to the eye and its vicinity than participants from Switzerland (58/258, 22.5%, $P = 0.009$) and semi-professionals (82/254, 32.3%) had received more than amateurs (58/252, 23.0%, $P = 0.022$). The most frequent reason for an injury was the ball (73 times, 52.1%), followed by the stick (29 times, 20.7%) and a collision with another player (20 times, 14.3%). Two (1.4%) ocular traumas were due to the structural environment of a rink (goal and barrier). In 16 cases (11.4%) the reason for the injury could not be remembered. The injuries accounted for were 60 periocular bruises (42.9%), 28 lacerations of the skin around the eye (20.0%) and in 51 cases (36.4%) the eye itself was injured. One person could not recall the actual injury. If several of these injuries were described, only the most significant one was recorded, a periocular bruise being the least and an eye injury the most significant. Most players, who had suffered an injury of the eye, described a temporarily reduced visual acuity with no further complications. Seven players had experienced a 'bloodshot eye' or a burst blood vessel in the eye, which was most probably caused by a subconjunctival haemorrhage. Other eye injuries involving different structures of the eye were reported by 15 players. Six of those resulted in a permanent visual impairment of the injured eye affecting the visual acuity, the pupillary light reflex or deficiencies in the field of vision (Fig. 2).

Only 25 (4.9%) of the 506 field players played with protective eyewear. A clear statistical difference could be found between the countries and the gender. In Switzerland 22 (8.5%) out of 258 used protective eyewear whereas of the 248 Swedish players there were only three (1.2%, $P < 0.001$). Women were 3.6 times more likely to wear protective eyewear than men ($P = 0.006$).

To the question 'Have you ever seen a dental or jaw injury in floorball?' 179 (31.7%) of 565 interviewed athletes replied yes (Fig. 3). Men (118/290, 40.7%) had observed significantly more orofacial injuries than women (61/275, 22.2%, $P < 0.001$) as well as semi-professionals (125/285, 43.9%) compared with amateurs (54/280, 19.3% $P < 0.001$). Some players had seen combinations of injuries occur hence the number of reported injuries was 206. The most common observed

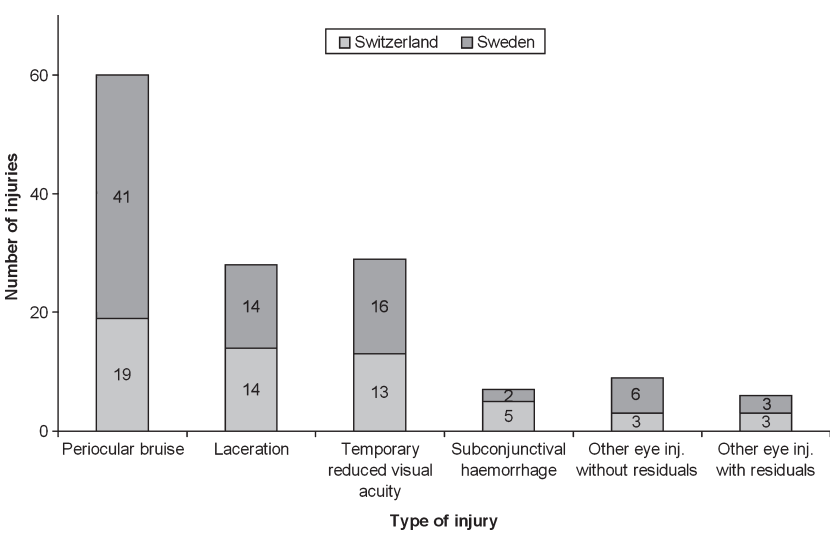

Fig. 2. Comparison of different types of sustained eye injuries according to country.

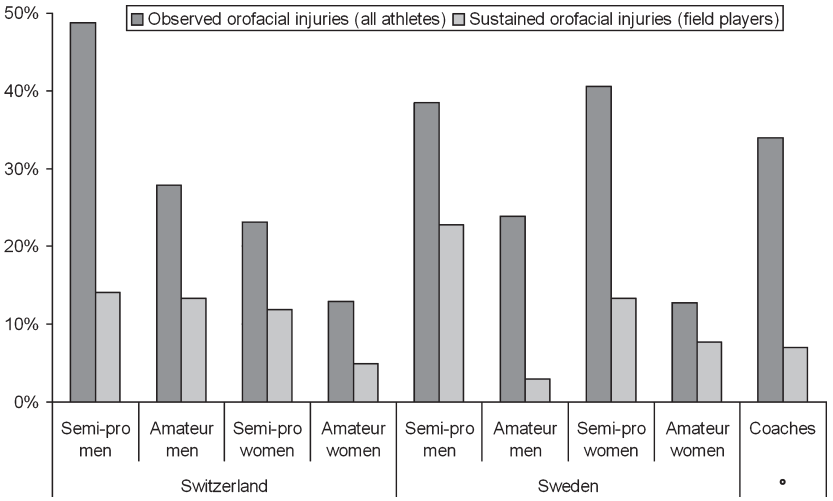

Fig. 3. Observed and sustained orofacial injuries in the different groups.

dental injuries were crown fractures (144/206, 69.9%), dislocations (26/206, 12.6%), avulsions (24/206, 11.7%) and concussions (10/206, 4.9%). Two individuals reported to have seen a jaw fracture (1.0%).

Of 506 interviewed field players 57 (11.3%) had sustained 68 orofacial injuries (Fig. 3): 60 dental injuries including one or more teeth and eight jaw injuries. The number of injured teeth was not recorded. Five players reported to have suffered an orofacial injury more than once. Statistically significant differences could be determined only between leagues ($P = 0.004$); semi-professionals had suffered more injuries (39/254, 15.4%) than amateurs (18/252, 7.1%). The group that had suffered most orofacial injuries were the semi-professional Swedish men with 22.8% (13/57).

Crown fractures were the most frequent tooth injuries recorded in this survey (31/68, 45.6%). Concussions (15/68, 22.1%) and dislocations (11/68, 16.2%) occurred less frequently. Five players, who had experienced the injuries described above, needed root-canal-treatment. Two players reported to have suffered avulsions of anterior teeth. One player suffered a vertical tooth fracture of a central maxillary incisor, which resulted in its removal. Furthermore, eight jaw injuries (8/68, 11.8%) were reported: six temporomandibular injuries (five dislocations, one contusion) and two mandibular fractures (Fig. 4). In more than 85% of the cases a collision with another player (45.3%) or the stick (40.6%) were the reasons for an injury, in 11.0% a fall into or onto the structural environment of a floorball rink, i.e., the goal, the barrier, the floor, etc. was the cause.

Only 178 of 565 interviewed athletes (31.5%) were aware of the fact that avulsed teeth can be replanted. A statistical difference could be found between the countries ($P = 0.009$). Participants in Switzerland (106/289, 36.7%) were better informed than participants in Sweden (72/276, 26.1%). 39.5% of the coaches (17/43) were informed about the possibility of replantation.

As tooth rescue boxes are not available in Sweden only the participants in Switzerland were asked about them. Only 20 (6.5%) out of 308 were familiar with the box, which allows avulsed teeth to be preserved up to 24 h in a cell-physiological environment.

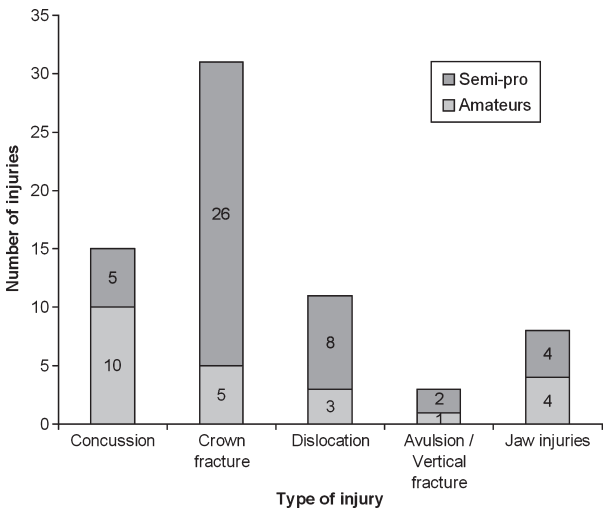

Fig. 4. Comparison of different types of sustained orofacial injuries according to league.

Of the interviewed athletes (385/565) 68.1% knew that a successful outcome after a tooth injury depended on immediate action. There were significant differences between the countries and the leagues: In Switzerland 84.1% (243/289) of the participants would visit a dentist as fast as possible whereas in Sweden only 51.4% (142/276) would do so ($P < 0.001$). The difference between semi-professionals (208/285, 73.0%) and amateurs (177/280, 63.2%) seeking immediate treatment was also significant ($P = 0.01$). Coaches were well informed: 36 out of 43 (83.7%) would act immediately.

How to reach a dentist in an emergency situation was known by 69.0% of the participating athletes. Significant statistical differences could be determined between the countries and the leagues. Participants from Switzerland (217/289, 75.1%) and amateurs (218/280, 77.9%) were altogether better informed than participants from Sweden (173/276, 62.7%, $P = 0.001$) and semi-professionals (172/285 60.4%, $P < 0.001$). Best informed of all were the coaches (93.0%).

Estimations about the life-long costs after the loss of an anterior tooth varied greatly. The median value was

USD 9360 in Switzerland and USD 4200 in Sweden. The estimations were given in Swiss Francs and Swedish Crowns and were converted at the currency exchange rate of the 03.03.2010.

Only one of the 608 interviewees was not familiar with the mouthguard. About half of the participating athletes did not have any knowledge of different types of mouthguards; amongst the other half the mass-produced and custom-made mouthguard were equally well known. However, there were statistical differences between the countries, league levels and the gender (Fig. 5). Altogether Swiss participants were better informed about mouthguards as 55.7% knew at least one type compared with 44.6% of Swedish participants ($P = 0.009$); the custom-made version was better known to semi-professionals than to amateurs ($P = 0.016$); the stock mouthguard was better known to men than to women ($P < 0.001$).

Only one semi-professional player used a mouthguard on a regular basis. Two players reported using mouthguards sometimes at matches. All of these players were Swedish and had experienced one or several tooth or jaw injuries. Different reasons for not wearing a mouthguard were stated by the remaining 503 field players. The most frequent answer was by far 'I do not see any need to wear one' (47.0%). Many had never thought about dental trauma or wearing a mouthguard at all (26.1%). Another frequent reason stated was that the use of mouthguards is not common in floorball as there are no discussions about the use of mouthguards among floorball officials and no recommendations about it (22.1%). Other reasons such as impaired communication, restriction of breathing, bothersome aesthetics or financial reasons were rarely expressed. Multiple answers were possible.

Discussion

This study focused on the frequency of floorball-associated eye, dental and jaw injuries, as well as assessing the knowledge about emergency measures after a dental trauma and preventive measures (mouthguards). Most coaches and athletes were surprised but interested when asked to participate in the survey. They reported that the topic of 'prevention of dental injuries' and 'mouthguards' is rarely discussed in connection with floorball. This might be due to the fact that, to the best of our knowledge, no previous study has analysed orofacial injuries in floorball. On the contrary eye injuries were well known facial injuries to occur among coaches and athletes. In this study the risk for both injury types as well as the usage of respective protective gear was assessed.

Of all interviewees, 73.5% had observed and 27.7% of the field players had sustained an injury of the eye or its vicinity themselves. It is noteworthy that 1.2% suffered an eye injury that resulted in a permanent visual impairment. Although most of the reported injuries were minor, the occurrence is alarmingly high. It should be remembered that only active floorball players took part in this study and that those floorball players, who could not continue playing because of severe eye injuries, are not included. Despite this high frequency of injuries only a very low proportion – 25 athletes (4.9%) – wore protective eyewear. Based on the results of this and other studies (7–9) it is strongly recommended that the wearing of protective eyewear by all floorball players is made mandatory. The long-term effects of sports-inflicted eye injuries on the individual are considerable. In the worst case, vision can be permanently impaired with consequences in multiple areas of life.

Of the interviewed field players 11.3% had suffered an orofacial injury themselves and about one-third had observed one. Semi-professionals had suffered significantly more orofacial injuries than amateurs. One explanation might be that their intensity level during play and their exposure time to the game (more training sessions and matches) is higher. On average semi-professionals had also been playing floorball 2 years longer than amateurs.

If jaw injuries are excluded from this study, then the percentage of athletes who had sustained solely dental injuries was 10.3%. This result can be compared with similar studies about the prevalence of tooth injuries in squash (4.5%) (33), basketball (16.6%) (32) and handball (10.7%) (31). Floorball has almost the same risk for dental trauma as handball, which is considered a medium-risk sport for suffering dental trauma (15) and

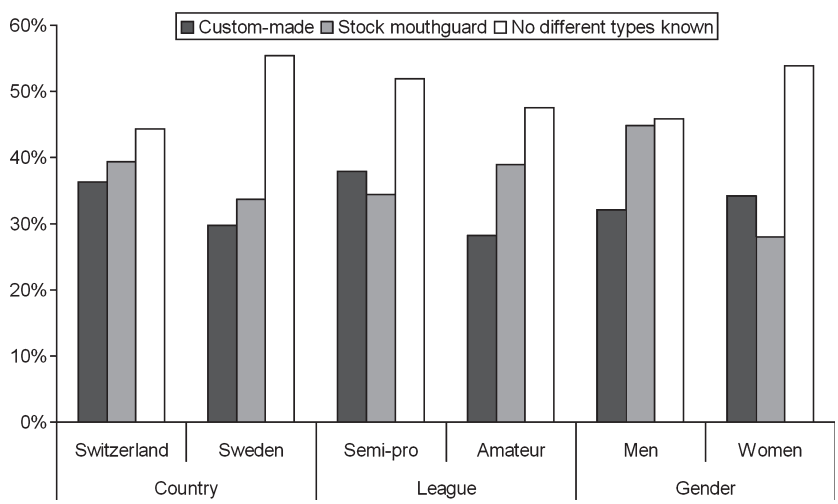

Fig. 5. Knowledge about different types of mouthguards according to country, league and gender.

is, like squash and basketball, on the list of the American Dental Association, that recommends the use of a mouthguard for 29 sports and exercise activities (36). In floorball the use of mouthguards is almost non-existent. Only one athlete out of 506 field players reported wearing a mouthguard on a regular basis and this was because he had suffered serious dental trauma thrice resulting in multiple non-vital, crown fractured teeth.

Regarding the knowledge about emergency measures after dental trauma, participants in Sweden knew significantly less than participants in Switzerland. It is unsatisfactory that less than a third (31.5%) of the interviewed athletes was aware of the fact that an avulsed tooth can be replanted. The tooth rescue box was known to only 20 (6.5%) of the Swiss players; similarly low numbers as have been reported amongst athletes of other sports (31–33, 35). Swedish participants were not asked, as the box is not yet available in Sweden. The rescue box is not only an important link in the rescue chain but also increases the athlete's and official's awareness of dental accidents (37).

Knowledge of these aspects of first aid was equally poor in coaches and players, which highlights the requirement for education from sports associations and dentists to players and coaches alike. Coaches play an important role in helping and instructing their players, when an injury occurs (38). Therefore, it is satisfactory that 84% of the coaches knew, that a successful outcome after a tooth injury depended on immediate action and 93% were informed about how to reach a dentist in an emergency situation.

In contrast to many other body tissues, most dental tissues have a low potential for recovery when damaged. A crown fracture, the most common dental injury in this study (47%), is irreversible and can, depending on its extent, only be repaired but never 'healed'. Even a seemingly minor dental injury like a concussion can potentially cause pulp tissue to become necrotic. More severe injuries such as dislocations or avulsions may result in the loss of the tooth due to ankylosis or infection-related root-resorption (39).

An injured tooth often requires extensive treatment just to become functional again and can create a lifetime of expensive, long-term problems for the affected athlete (40–42). Estimations about life-long costs for the loss of a single tooth are difficult to make and differ from country to country. The US-based National Youth Sports Safety Foundation in 2005 judged the costs of treating an avulsed permanent tooth and the provision of follow-up care to be in the range of USD 5000–20 000 over a lifetime (43). In this study, the median value of the participants' estimations were USD 9360 in Switzerland and USD 4200 in Sweden. A comparison of these estimated life-long costs is difficult, as the health care systems and the financing of dental costs are very different in the two countries and also living costs are somewhat lower in Sweden (44). However, the results of this study do reveal that the participants were not aware of how costly the loss of an anterior tooth can be as the interviewees' estimates were in general too low. An awareness of the financial aspects of a tooth injury could influence the opinions of some athletes regarding the wearing of mouthguards.

The results of this study show that floorball has an equally high risk for dental trauma as handball. Despite the frequency of injuries to the eyes and teeth, and an awareness of the risk of eye injury, athletes rarely wear protective gear. All bar one of the interviewees knew of the existence of mouthguards but the wearing of them was frequently considered unnecessary. Further investigations of dental injuries in floorball would be valuable in order to provide players, coaches, parents and sports federations with the necessary information to make guidelines regarding the use of mouthguards. Based on the results of this study it is strongly recommended that the use of protective eyewear by all floorball players is made mandatory.

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