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Orofacial/cerebral injuries and the use of mouthguards by professional athletes in Switzerland

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Abstract – The objective of the present study was to measure the occurrence of orofacial and cerebral injuries in different sports and to survey the awareness of athletes and officials concerning the use of mouthguards during sport activities. Two hundred and sixty-seven professional athletes and 63 officials participating in soccer, handball, basketball and ice hockey were interviewed. The frequency of orofacial and cerebral trauma during sport practice was recorded and the reason for using and not using mouthguards was assessed. A great difference in orofacial and cerebral injuries was found when comparing the different kinds of sports and comparing athletes with or without mouthguards. 45% of the players had suffered injuries when not wearing mouthguards. Most injuries were found in ice hockey, (59%), whereas only 24% of the soccer players suffered injuries when not wearing mouthguards. Sixty-eight percentage of the players wearing mouthguards had never suffered any orofacial and cerebral injuries. Two hundred and twenty-four athletes (84%) did not use a mouthguard despite general acceptance by 150 athletes (56%). Although the awareness of mouthguards among officials was very high (59%), only 25% of them would support the funding of mouthguards and 5% would enforce regulations. Athletes as well as coaches should be informed about the high risk of oral injuries when performing contact sports. Doctors and dentists need to recommend a more intensive education of students in sports medicine and sports dentistry, and to increase their willingness to become a team dentist.

Olivier Lieger, Thomas von Arx

Department of Oral Surgery and Stomatology, School of Dental Medicine University of Berne, Switzerland

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PD Dr med. dent. Thomas von Arx, Department of Oral Surgery and Stomatology, Freiburgstrasse 7, CH-3010 Berne, Switzerland
Tel.: +41 31 632 2549
Fax: +41 31 632 2503
e-mail: thomas.vonarx@zmk.unibe.ch

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Sporting accidents are one of the most common causes of facial injuries. Studies on large groups have shown that sports account for 31% of such trauma in adults and children (1, 2). The current public popularity of contact sports and the willingness to take high risks in sport have led to an increase of sport-injuries (3–7). When the face and head are involved, this often results in tooth or mouth traumas. A blow to the face can not only cause tooth or soft tissue injuries, but can also result in fractures of the jaw or facial bones, or even cerebral damage. The subsequent aesthetic, functional, psychological and economic impacts (often with high follow-up costs) demonstrate, the importance of prevention. Different studies have demonstrated that wearing a mouthguard can significantly reduce the incidence of orofacial injuries (3, 8–14).

Since the 1950s mouthguards have been instituted in US American football at high school and college levels. In 1962 the National Alliance

Football Rules Committee (NAFRC) enacted a rule to mandate the use of facemasks and mouthguards for the first time for football players in high school and junior college. Heintz reported that in the US this regulation has significantly reduced the rate of orofacial injuries (9). The National Collegiate Athletic Association (NCAA) mandated a similar rule in 1973 (15).

McNutt et al. (16) reported that all football trainers now ask their players to wear mouthguards, whereas only 16% of trainers from other sports currently do. Different studies have shown that trainers and coaches have a great influence on players' behaviour to wear mouthguards (17–19). In Switzerland, the use of mouthguards is only mandatory for ice hockey players younger than 20 years according to the IIHF regulation (International Ice Hockey Federation) (20). Data of the frequency of orofacial sport-injuries and of the use of mouthguards in Switzerland are only available for Handball (21) and for different sport teams in the city of Berne (22).

The objective of this study was to assess the attitude of professional athletes and officials in ice hockey, basketball, handball and soccer towards the use and benefit of mouthguards, and to evaluate the frequency of orofacial and cerebral injuries in the interviewed athletes.

Material and methods

Invitational letters were sent to all sport clubs of the highest national leagues in handball, ice hockey, basketball and soccer, to participate in this study. Clubs were enrolled after the club president gave his approval for taking part. Subsequently, questionnaires were sent to six (of eight total) handball clubs, five (of 11) ice hockey clubs, five (of 10) basketball clubs and six (of 12) soccer clubs. The survey was performed between November 2002 and April 2003. When composing the questionnaire, questions from previous studies on mouthguards were used (13, 22–23). The surveys consisted of 21 questions for the athletes and 10 questions for the officials (Tables 1 and 2). The questionnaires were available in German, French, English and Italian, and were translated by multilingual dentists.

After contacting each club president, the required number of questionnaires for athletes and officials were sent. In order to do a follow-up questionnaire, lists with codes were included to protect the anonymity of participants. The code-lists matched the numbers on the questionnaires. The club presidents were asked to assign each code on the list to an athlete or official and to archive the lists.

The distribution and the collection of the questionnaires were done by an official, who had been appointed by the club president. The 30 April 2003 was determined as the deadline for returning the questionnaires.

Table 1. Questionnaire for the athletes

Number	Questions	Without mouthguard	With mouthguard
1	Age?	x	x
2	Your sport?	x	x
3	Your position?	x	x
4	What is your attitude towards wearing a mouthguard?	x	x
5	Do you wear a mouthguard?	x	x
6	Have you already had injuries in the mouth-, tooth-, or skull-area without a mouthguard?	x	x
	If yes, what sort of injury and with which frequency?	x	x
7	Have you already had injuries in the mouth-, tooth-, or skull-area with a mouthguard?		x
	If yes, what sort of injury and with which frequency?		x
8	Was an accident essential for the purchase of a mouthguard?		x
9	Where did you buy your mouthguard?		x
10	Was an impression taken for making your mouthguard by your dentist?		x
11	When do you wear the mouthguard?		x
12	Where did you get the advice to use a mouthguard?		x
13	How long does your mouthguard last in average?		x
14	If you had to replace a mouthguard, what were the reasons for?		x
15	Have you altered your mouthguard yourself?		x
	If yes, in which form and why?		x
16	How does the mouthguard feel when being worn?		x
17	Which problems do you have, when wearing the mouthguard?		x
18	What are the reasons for not wearing a mouthguard?	x	
19	Is the use of a mouthguard mandatory, advised or voluntary in your club?	x	x
20	Does the club pay for the mouthguard in total, partially or not at all?	x	x
21	Is it necessary to make the use of a mouthguard mandatory in your sport	x	x

Results

In total, 267 players and 63 officials were interviewed (Table 3). All players were male (average age 26). The question 'do you wear a mouthguard?' was positively answered by only 43 athletes (16%). Among the 43 athletes wearing a mouthguard, 35 were ice hockey players.

One hundred and nineteen players (45%) stated that they had suffered injuries to the

Table 2. Questionnaire for the officials

Number	Question
1	Age?
2	In which sport are you involved?
3	Your field of function?
4	Does your club participate in a prevention program?
5	Is there any sort of education of sport injuries in your club?
6	Are there any preventive programs especially on the junior level, concerning sport injuries?
7	Do you think that a mouthguard influences the athlete's performance?
8	Note possible reasons why athletes don't wear a mouthguard?
9	In which form would you support the wearing of a mouthguard: advice, rule or none?
10	Should the club pay for the purchase of an athlete's mouthguard completely, partially or not at all?

Table 3. Usage/support of mouthguards by athletes and support of mouthguards by officials

	Soccer	Handball	Basketball	Ice hockey	Total
Athletes [no. (%)]					
n	71	73	42	81	267
Mouthguard users	1 (1)	4 (5)	3 (7)	35 (43)	43 (16)
Mouthguard supporters	17 (24)	41 (56)	21 (50)	71 (88)	150 (56)
Officials [no. (%)]					
n	16	26	10	11	63
Mouthguard supporters	6 (38)	11 (42)	9 (90)	11 (100)	37 (59)

mouth-, tooth- or skull-area not wearing a mouthguard (Table 4). The distribution of injuries without a mouthguard is given in Table 5. The players could indicate the number of each particular injury according to the type of injury. Soft tissue lesions and fractured teeth were the most frequent findings. In the category 'others' seven nasal bone fractures and one zygomatic fracture were noted.

Thirty (68%) players wearing a mouthguard said that they had never suffered any injuries to the mouth-, face- or skull-area when wearing a mouthguard. Only ice hockey players with mouthguards said that they had suffered injuries despite wearing a mouthguard. The injury patterns among these mouthguard wearers were similar while using or

Table 4. Injuries to the mouth-, tooth- or skull-area in athletes without a mouthguard, depending on the type of sport [no. (%)]

	Soccer	Handball	Basketball	Ice hockey	Total
n	71	73	42	81	267
Yes	17 (24)	35 (48)	19 (45)	48 (59)	119 (45)
No	54 (76)	38 (52)	23 (55)	33 (41)	148 (55)

Table 5. Type of injuries to the mouth-, tooth- or skull-area in athletes without a mouthguard*

Type of injury	Soccer ($n = 17$) (%)	Handball ($n = 35$) (%)	Basketball ($n = 19$) (%)	Ice hockey ($n = 48$) (%)	Total ($n = 119$) (%)
Soft tissue lesion	14 (29)	36 (40)	47 (57)	84 (42)	181 (42)
Tooth fracture	14 (29)	32 (35)	22 (27)	62 (30)	130 (31)
Tooth dislocation	2 (4)	1 (1)	5 (6)	7 (3)	15 (4)
Avulsion	2 (4)	5 (5)	3 (4)	17 (8)	27 (6)
Lower jaw fracture	1 (2)	1 (1)	0 (0)	5 (2)	7 (2)
Cerebral concussion	13 (27)	7 (8)	5 (6)	30 (15)	55 (13)
Severe craniocerebral injury	0 (0)	1 (1)	0 (0)	0 (0)	1 (0.4)
Others	2 (4)	8 (9)	0 (0)	0 (0)	10 (2)
Total	48 (100)	91 (100)	82 (100)	205 (100)	426 (100)

*Multiple injuries per athlete possible.

not using a mouthguard (Table 6). Only 10 players with a mouthguard (23%) said that an accident had been the decisive factor to purchase a mouthguard. Thirty-seven of the players (86%) had their mouthguard made by their dentist, two (5%) had it made by a dental technician, and four (9%) bought it in a sport shop. The mouthguards purchased from dentists and dental technicians were constructed making impressions. 16 of the wearers (37%) said that they used the mouthguard in training as well as in competition, 24 (56%) wore it only in competition and 2 (5%) wore it irregularly. The advice to wear a mouthguard was given to 15 athletes by their dentist (35%), to nine (21%) by a team-mate, to two (5%) by friends, to 16 (35%) from different sources, to only one (2%) by the trainer, and to none through the media. As to reasons for mouthguard replacement, 12 players (28%) said that they had bitten it through, seven players (16%) broke it, seven players

Table 6. Types of injury to the mouth-, tooth- and skull-area without* vs. with a mouthguard in athletes who own a mouthguard ($n = 43$)**

Type of injury	Injuries without a mouthguard (%)	Injuries with a mouthguard (%)
Soft tissue laceration	58 (54)	13 (49)
Tooth fracture	31 (28)	7 (27)
Lateral dislocation/ Intrusion/Extrusion	4 (4)	1 (4)
Avulsion	7 (6)	1 (4)
Lower jaw fracture	0 (0)	1 (4)
Cerebral concussion	9 (8)	3 (12)
Mild and severe craniocerebral injury	0 (0)	0 (0)
Others	0 (0)	0 (0)

*Players who own a mouthguard, but do not always use it.
**Multiple answers possible.

(16%) lost it, four players (9%) had to replace it because of bad fit, and five players (12%) stated other reasons. Nine athletes (21%) said that they had modified the mouthguard themselves. The modification consisted of shortening the mouthguard posteriorly, because it was uncomfortable.

Twenty-two (51%) answered the question 'how does the mouthguard feel during wear?' with pleasant, 17 (40%) with moderate and four (9%) with uncomfortable. Problems or possible side-effects of mouthguards are listed in Table 7. Only nine players (eight ice hockey players) received recommendations to wear a mouthguard. Only one ice hockey player stated that he had been instructed to wear a mouthguard. One handball player reported of a partial financing and two ice hockey players reported a complete financing by the club. The approval for a mandatory use of mouthguards ranged from 7 (soccer players) to 19% (ice hockey players).

The average age of the interviewed officials was 42 years. The distribution according to their function is listed in Table 8. The group 'others' consisted partly of physiotherapists and masseurs.

The participation in preventive programs was poor. Only four soccer-, one handball- and two ice hockey officials stated that their club was taking part in a preventive program. These were programs from the Swiss National Accident Insurance Fund (SUVA) and the Swiss Soccer Association (SFV). The knowledge of preventive programs concerning sport injuries ranged from 20 (basketball) to 81% (soccer). The athletes were mainly informed about injuries and received correct training on the musculo-skeletal system. No official made any comments about orofacial injuries. According to the officials, preventive programs or information about sport-injuries were done in 66% of all ice hockey and soccer clubs and in 33% of all handball clubs on the level of 'juniors'. Only one basketball official knew of such a program.

Twenty-one (33%) of all officials thought, that wearing a mouthguard would impact on the performance of the athletes. Among these 21 officials, 10 were from soccer (63%). Of possible reasons why athletes don't wear a mouthguard, breathing impairment was most often stated (18; 29%) (Table 9).

Six soccer officials (38%), 11 handball officials (42%), 9 basketball officials (90%) and 11 ice hockey officials (100%) would support the use of a mouthguard (Table 3). Of these officials, only one handball official and two ice hockey officials would make the wearing of mouthguards mandatory. Regarding the question of financing the mouthguard through the club, 75% of all officials, independent of the sport, denied receiving any financial support (Table 10).

Table 7. Problems of players wearing a mouthguard vs. reasons of players to refuse to wear a mouthguard*

	Player with mouthguards ($n = 43$) (%)	Players without mouthguards ($n = 224$) (%)
Not necessary	–	114 (43)
Impaired breathing	9 (21)	67 (25)
Impaired talking	15 (35)	52 (20)
Is uncomfortable	6 (14)	48 (18)
Dry mouth	6 (14)	19 (7)
Too expensive	0 (0)	15 (6)
Fits badly	1 (2)	11 (4)
Does not look good	2 (5)	11 (4)
Causes nausea	0 (0)	5 (2)
Others	0 (0)	19 (7)

*Multiple answers possible.

Table 8. Field of function of the officials ($n = 63$)

Function	Quantity (%)
Club management	16 (25)
Trainer/Coach	17 (27)
Team doctor	4 (6)
Others	26 (41)

Discussion

Injuries to the orofacial area often mean life-long sequelae with considerable follow-up costs. Different studies have shown that such injuries could be significantly reduced or even avoided by wearing a mouthguard (5, 9, 16, 23–24).

Table 9. Possible reasons for not wearing a mouthguard stated by the officials ($n = 63$)*

Possible reason	Quantity (%)
Impaired breathing	18 (29)
Impaired talking	8 (13)
Is not necessary	12 (19)
Disturbing/uncomfortable	9 (14)
Does not look good	7 (11)
Too expensive	1 (2)
Increased saliva production	1 (2)

*Multiple answers possible.

Table 10. Attitudes of club officials towards financing the athletes' mouthguards ($n = 63$)

Financing model	Soccer (%)	Handball (%)	Basketball (%)	Ice hockey (%)	Total (%)
Completely	3 (19)	2 (8)	0 (0)	2 (18)	7 (11)
Partly	2 (13)	4 (15)	2 (20)	1 (9)	9 (14)
None	11 (69)	20 (77)	8 (80)	8 (73)	47 (75)

This study examined the type and frequency of orofacial injuries and the use of mouthguards by professional athletes (soccer, handball, basketball and ice hockey) in Switzerland. Furthermore, the attitude of officials towards the use of mouthguards was analysed. Although international studies have reported on this topic, there is little data about the situation in Switzerland (21–22). As previous studies have emphasized (13, 22, 25), there are large variations between the different sports concerning the acceptance of wearing a mouthguard. Although over 50% of all players approve the use of a mouthguard, only 16% actually use one. The least acceptance was found in soccer players. It could be shown that the frequency of injuries to the mouth-, tooth- and skull-area was clearly less in soccer compared with the other sports (24%). In ice hockey, in which orofacial and cerebral injuries were most often reported (59%), the acceptance of mouthguards was the highest (48%). In handball and basketball, there was no need to use a mouthguard according to the interviewed players, despite high injury rates (45–48%). Similar results have been noted in other studies (3, 21, 25–26).

The most common injuries reported were soft tissue lacerations and tooth fractures. Altogether, they accounted for 60–80% of all orofacial and cerebral injuries in each sport.

Surprisingly in soccer, cerebral concussion was a common finding (27%). Whether the use of mouthguards should be regarded as necessary in soccer, despite the relatively low rate of orofacial injuries, remains a controversial issue. In fact, the study by Labella et al. (27) could not show any differences in the concussion rate of basketball players with or without mouthguards.

The present study showed that 68% of all players who use a mouthguard have not suffered another orofacial or cerebral injury.

The patterns of injuries with or without mouthguards were very similar, except that relatively more mandibular fractures and concussions were found in players with mouthguards. This might be explained by the fact that such injuries only occurred in ice hockey players, who represented the majority of mouthguard users in this study and who sustain frequently more violent collisions and hits because of the character of this sport paired with high velocity.

Only 23% of the athletes purchased a mouthguard following an accident. This confirms the results of the study by Tschan et al. (22), who showed that just 15% of the professional athletes in six different sport clubs in Bern did buy a mouthguard after an orofacial trauma.

Over 90% of the players using a mouthguard had a custom-made mouthguard. Most of the athletes paid for the mouthguard themselves. The advice to wear a mouthguard was most frequently (33%) given by a dentist. The trainer recommended a mouthguard in only one case. Half of the athletes wearing a mouthguard did not complain about the device. The other half, reported only minor problems and said the main issues were the restricted communication and impaired breathing. Players who did not wear a mouthguard described the same two concerns as important criteria against the use of a mouthguard, besides the main point that a mouthguard is not mandated at all. Whether these issues are rather psychological against protective gear (28) or may cause loss of performance (29–31) is controversial.

The efforts to prevent sport injuries by means of preventive programs or internal education vary considerably. Unfortunately, no club reported any preventive campaign being conducted either on a professional level or on a junior level concerning orofacial injuries and the use of a mouthguard. The attitude of the officials towards mouthguards corresponded with the acceptance of the players for each particular sport. In ice hockey, the officials said that a mouthguard is necessary. In handball, for which the present and other studies have shown a high risk of injuries while not wearing a mouthguard (48%)(21, 32), the need was only approved by a moderate percentage of officials (42%). The fact that none of the soccer officials found it necessary to use a mouthguard is not surprising. They also represented the majority of officials (63%) who thought that mouthguards impaired the athlete's performance. The officials stated that impaired breathing, restriction of communication, a sense of the guard being unnecessary and uncomfortable were the main reasons why athletes didn't use mouthguards. It is satisfactory that 59% of officials would support the use of mouthguards in the form of a recommendation or rule. Unfortunately only 25% of the officials would support a partial or complete financing of mouthguards.

The large discrepancy between the acceptance of the mouthguard by officials and athletes and its use in sports demonstrates that a commitment by team dentists and officials is required. This includes the education of dental-students in the fabrication and application of mouthguards, and also the instruction and motivation of players and trainers. Our goal should not only be to reduce the risk of injuries for professional athletes but also to utilize the important role of these athletes in the education of our youth.

Because of the successful results of mandatory mouthguard use in American football, and the results of the present and other studies (21–22), the initiation of a mouth-protection plan for basketball and handball as well as the expansion of the

mouth-protection regulation of the IIHF (International Ice Hockey Federation) for all age groups appears to be an appropriate goal to achieve.

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Soccer: FC Aarau, SR Délemont, Grasshopper-Club Zürich, FC Luzern, FC Thun, FC Zürich.

Handball: Grasshopper-Club Zürich, Kadetten Schaffhausen, Pfadi Winterthur, TSV St. Otmar St. Gallen, TV Endingen, Wacker Thun.

Basketball: BBC Monthey, Fribourg Olympic, Geneva Devils, Morges Basket, Zürich Bluewings.

Ice hockey: HC Ambri-Piotta, HC Fribourg-Gotteron, HC Lugano, SCL Tigers Langnau, SC Bern.

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