

Knowledge and Implementation of Protective Measures for Oral and Maxillofacial Injuries of Ice Hockey Players in Primary and Secondary Schools in Beijing

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Abstract

Background: There is little information regarding knowledge and implementation of sports-related oral and maxillofacial injury prevention measures of ice hockey players in primary and secondary schools. Thus, we investigated methods to improve the safety of juvenile ice hockey players in Beijing and reduce the incidence of oral and maxillofacial injuries, including tooth avulsions, tooth fractures, and jaw fractures.

Methods: Using a convenience sampling method, we obtained consent from young ice hockey players from five primary and secondary schools and six special sports training institutions in Beijing; we administered a total of 280 questionnaires.

Results: Only 12.50% of respondents reported wearing mouth guards during ice hockey; 62.50% of respondents reported never wearing a mouth guard; 43.58% did not know the risk of sports-related oral injury. Not understanding the necessity of wearing teeth protection was the most common reason reported why athletes do not wear protective gear (89.64%). Inconsistent behaviour among teammates (67.14%) was the psychological factor related to refusal to wear the mouth guard. Wearing discomfort (34.33%) and communication influence (33.14%) were also mentioned; 77.14% of the parents reported that the formulation and enforcement of the relevant regulatory agencies' standards were important to encourage young athletes to wear protective gear.

Conclusion: Young ice hockey players in Beijing lack knowledge of sports-related oral injuries and effective protective measures, despite the high risks. The most effective way to improve compliance is to draw up and enforce the Ice Hockey Association's relevant standards and the coach's guidance.

Background

The incidence of sports injury has increased as participation in youth sports increases, and the length of training time extends. The incidence of sports injury is higher in antagonistic sports due to the close even indirect physical contact between the athletes. The National Federation of High Schools and the University Sports Association require wearing a mouth guard in hockey, rugby, ice hockey, lacrosse, and other sports [1–2]. According to the statistics of soccer sports injuries by the national electronic injury monitoring system of the United States in 2001, 175,000 people in the United States are injured playing football every year, of which 43% are 8 to 14 years old; 30% of the injuries are oral and maxillofacial injuries, including tooth avulsions, tooth fractures, and jaw fractures [3–6]. Several studies have shown that dental protectors in sports can significantly reduce oral and maxillofacial injuries [7–9]. The American Dental Association and the American Society of Pediatric Dentistry also recommend using dental protectors in competitive sports. At present, China's youth participate in more aggressive sports, including football, basketball, ice hockey, rugby, baseball, hockey, and others [10]. However, there is no large sample statistical data of the injury caused by these sports, and there is little mention of wearing of tooth guards during sports.

Using a questionnaire, we investigated primary and secondary school students who participated in ice hockey, hoping to understand the current situation of oral sports protection of primary and secondary school students in our city, and to analyse causes and countermeasures, to reduce the occurrence of sports injuries of Chinese teenagers and to promote their healthy growth.

Methods

A questionnaire was distributed to the players from ten primary and secondary schools in Beijing and 13 special sports training institutions using convenience sampling.

Questionnaire design

As a result of a literature review, we learned about sports injury prevention experience and problems outside of China. In the context of China's national conditions, we considered ten problems related to the implementation of tooth protection measures in primary and secondary school students in sports.

Ethical approval and consent to participate

The ethics committee has approved this study of the Chinese PLA General Hospital, and the committee's reference number is 20180454. The survey content does not investigate the personal privacy of the interviewees. The interviewees signed paper informed consent forms before the investigation began.

Questionnaire distribution

Using a convenience sampling method, through a network query, recommendations from friends, and other methods, we contacted principals of ten primary and secondary schools and 13 special sports training institutions in Beijing. We explained the purpose, method, and significance of the study. Finally, with the consent of five primary and secondary schools and six special sports training institutions, athletes and parents of primary and secondary school students participating in ice hockey in their schools and institutions were invited to participate in the survey. Based on the principle of voluntary participation, parents of athletes were asked to fill in the questionnaire according to their sports experiences.

Quality control

Two researchers explained the content of the questionnaire at the point of contact, assisted the parents in completing the questionnaire, and ensured that the questions' meanings were understood accurately and that the answers were complete.

Data analysis

Excel (version 15.11.2, Microsoft, USA) was used for data entry, and Stata statistical software (version 14.2, StataCorp, USA) was used to conduct a descriptive analysis of the data using a chi-square test.

Results

Object of studies

A total of 280 athletes participated in the survey, for a participation rate of 54%, including 213 males and 63 females. The average age was 11.47 ± 3.54 years (Table 1).

Table 1
Athletes' backgrounds

Items		Distribution (Percentage)
Age		11.47 ± 3.54
Gender	male	213 (76.07%)
	female	67 (23.93%)
Time for ice hockey	< 1 year	53 (18.93%)
	1–2 years	68 (24.29%)
	2–5 years	74 (26.43%)
	> 5 years	85 (30.36%)
Previous mouth injuries	Injury of skin and mucosa around the lip and mouth	8 (2.86%)
	Tooth defect	8 (2.86%)
	Tongue bite	1 (0.36%)
	Others*	3 (1.07%)

*There was one case of orthodontic fixator loosening, one case of lip swelling, and one case of gingival bleeding.

Investigation on wearing and implementation of tooth guard

According to the survey, only 12.50% of teenagers often wear tooth guard in ice hockey, and 9.64% of players only wear them in formal competitions. A total of 62.50% reported never having worn a mouthguard.

Table 2
Implementation of the tooth guard

Groups	Cases	Number of students always wearing tooth guard	Number of students often wearing tooth guard	Number of students only wearing tooth guard in official competition	Number of students seldom wearing tooth guard	Number of students never wearing tooth guard
Primary school	188	0	15 (7.98%)	10 (5.32%)	18 (9.56%)	155 (82.44%)
Junior middle school	55	0	10 (18.18%)	5 (9.1%)	28 (50.91%)	12 (21.80%)
High school	37	0	10 (27.03%)	12 (32.43%)	8 (21.62%)	8 (21.62%)
Total	280	0	35 (12.50%)	27 (9.64%)	54 (18.93%)	175 (62.50%)

Athletes' and parents' understanding of tooth protection in sports

Among the participants, 2.14% of the respondents said that they knew the risk of oral injury in ice hockey, and 54.29% of the respondents said that they had only heard about it but did not know much about it; 12.14% of the respondents did not know the existence of sports injury risk, and 31.43% of the respondents reported believing sports injuries would not happen.

A total of 47.86% of the respondents reported knowing that they needed to wear tooth protectors in ice hockey matches, according to notices issued by the ice hockey association, and 22.14% of the parents learned about it by browsing sports or shopping websites. Only 10 (3.57%) were obtained through dental guidance. Eight had a history of oral injury, and two parents reported that they were dentists. A total of 8.57% of the respondents reported never having obtained any relevant information. If more relevant information was needed, the most popular way for parents to obtain information was through the coach's guidance (41.78%) or the ice hockey association publicity (33.92%).

Some parents reported believing that social publicity (12.14%) and dentist guidance (10.36%) were the most effective ways to spread information. Only four parents (1.43%) reported believing that the mutual influence between athletes and parents' recommendation is the best way to spread information (Table 3).

Table 3

Knowledge on the part of parents of young athletes regarding sports-related oral injury and protective measures

Questions	Options	Numbers	Percentage
Do you know about sports-related oral injury?	Yes, I know it very well	6	2.14%
	Yes, but I don't know much	152	54.29%
	Never heard of it	34	12.14%
	Yes, but I don't think that will happen	88	31.43%
How do you get the information about wearing the mouthguard in sports?	Coach's advice	54	19.28%
	Notice of sports association	134	47.86%
	Media publicity	62	22.14%
	Recommended by teammates	44	15.71%
	Guidance from dentists	10	3.57%
	Never heard of it	24	8.57%
Which channel would you like to know more about it?	Dentist	29	10.36%
	Coach	117	41.78%
	Hockey association	95	33.92%
	Social media	34	12.14%
	Communication between team members and parents	4	1.43%

Influencing factors and obstacles to wearing tooth guards

A total of 89.64% of the parents thought that *Don't understand the necessity* was the most important reason why the athletes did not wear the tooth protector. *Inconsistent behaviour among other teammates* (67.14%), *discomfort* (34.33%), *image changed caused by wearing* (17.50%), and *affect communication* (33.21%) are also important reasons for athletes not to wear tooth guards. Only 2.85% of the athletes reported obvious discomforts such as suffocation and nausea.

A total of 77.14% of the parents reported believing that the formulation and enforcement of the standards of the relevant regulatory agencies were important for encouraging young athletes to wear protective gear, and the coaches' supervision was also an effective method (54.64%). Over 30% of parents reported believing that parents' supervision and teammates' influence can help promote compliance (Table 4).

Table 4
Influencing factors and obstacles to wearing tooth guards

Questions	Options	Numbers	Percentage
The reasons hindering young athletes from wearing a mouth guard	Don't understand the necessity of tooth protection	251	89.64%
	Don't want to be special	188	67.14%
	Slightly uncomfortable when wearing, such as foreign body feeling in the mouth, troublesome to wear	97	34.33%
	Wearing affects language communication	93	33.21%
	Affect appearance after wearing	49	17.50%
	The high price of tooth guard	15	5.36%
	Obvious discomforts when wearing, such as suffocation, nausea, and other symptoms	8	2.85%
	How to improve the wearing rate of tooth guard	Sports associations set standards and enforce them	216
Coach urges wearing		153	54.64%
The interaction between teammates		104	37.14%
Parents urge wearing		90	32.14%
To improve the comfort of tooth guard		18	6.43%
To reduce protection costs		2	0.71%

Discussion

Oral protection measures should be taken for teenagers to participate in ice hockey

With the 2022 Beijing Winter Olympic Games approaching, the implementation outline for 'driving 300 million people to participate in ice and snow sports' issued by the National Ministry of Sports in 2018 came into effect. Ice and snow sports are becoming increasingly popular. One of the sports promotion programs for young people, the General Administration of the People's Republic of China, issued guidelines for the ice hockey program jointly with the Ministry of Education of the People's Republic of China. However, there was no direct relationship between the increase in ice hockey participation and participants' awareness of sports injuries.

Ice hockey is one of the fiercest antagonistic sports, and the incidence of sports injuries is high. Oral injury, especially dental injury, has a long-term effect on injured athletes' function; there are also external

and psychological effects on injured athletes. In recent years, athletes participating in antagonistic sports have paid more attention to oral protection in sports. According to a national electronic injury monitoring system of the United States in 2001, 175000 people were injured playing football every year, of which 43% were 8 to 14 years of age. A total of 30% of the injuries were oral and maxillofacial injuries, including tooth avulsions, tooth fractures, and jaw fractures [11, 12]. Because ice hockey allows a certain degree of collisions, the risk of sports-related injuries is higher. In the present study, 20 individuals reported periodontal injuries (7.14%), and eight reported tooth injuries (2.86%).

Tooth guards are thought to be effective oral protective devices that reduce the impact force in sports via a significant buffering effect; they reduce the incidence of tooth fractures, tooth avulsions, jaw fractures, and other injuries [5]. The National Federation of high schools and the University Sports Association both require mouthguards in hockey, rugby, ice hockey, and lacrosse [1, 6]. The American Dental Association and the American Society of Pediatric Dentistry also recommend using dental protectors for athletes participating in competitive sports [2]. China's 2018 Haidian District Youth Ice Hockey League's competition requirements clearly state that participants must wear dental protectors. However, in the survey, only 22.17% of the athletes reported wearing tooth guards, and 62.5% of the athletes reported never having worn one. One investigation in the United States was not optimistic; Collins et al. surveyed young athletes who participated in basketball, football, and other aggressive sports in 21 middle schools [13]. A total of 22.6% of the athletes never knew that they needed to wear tooth protectors, and only 12.3% often wear them or used to wear them in sports. Chukwudi et al. performed a survey of Nigeria in which 19.16% of young athletes reported wearing tooth guards [14]. It can be seen that, although tooth protectors are known to protect teeth, it remains difficult to promote their use among young athletes. To improve young people's safety in antagonistic sports, we should further understand the difficulties and obstacles they encounter in self-protection to provide targeted help and guidance.

Young ice hockey players and their parents lack knowledge of sports-related oral injury

Although the mouthguard wearing rate in this survey was not high, more than half of the respondents reported knowing that athletes are at risk of oral injury; however, they reported not knowing much about it. A total of 43.58% of the respondents reported not knowing that the injuries could occur and even believed that oral injury would not occur. A total of 48.10% of the respondents reported knowing that they need to wear tooth protectors in ice hockey matches because of notices issued by the ice hockey association. Most of these notices came from the ice hockey association's requirements regarding protective gear in competition but do not mention the necessity or correct method of wearing tooth protectors. Only 18.31% of the respondents' information came from coaches' guidance. It can be seen that the ice hockey coach's understanding of the mouthguard is not profound. Although modern medicine has been paying increasing attention to oral health care, oral health professionals, and social health propaganda do not provide Titles in *BMC Oral Health* appear to be in sentence case (only first words, proper nouns, and acronyms capitalized health guidance for athletes. Among the respondents who reported being guided by stomatologists, eight reported oral injuries and learned relevant information during treatment. Two

parents of athletes reported that their occupation was stomatologist. Also, 8.31% of the respondents had never obtained any relevant information.

Most of the respondents expressed their desire to know the relevant information through ice hockey coaches or sports associations' publicity and requirements. Because the respondents reported believing that they should understand the risks associated with ice hockey, athletes contact them most, it is easier for them to obtain information. The athletes have higher compliance with coaches' guidance. Only 10.23% of the respondents chose oral health care personnel as the best way to obtain information, even lower than social media. This may indicate that China's medical resources remain deficient at present, and the focus of dental specialists remains focused on the treatment of oral diseases. Lack of community service, inability to provide routine oral examinations, prevention, and treatment of potential oral diseases, and other health care services all suggest that there remains a long way to go to achieve ideal 'national oral health.' Respondents reported believing that it takes a long time to wait in line to listen to stomatologists or nurses' professional guidance, and doctors often did not have time to provide detailed health guidance for patients. Without oral diseases, there is no opportunity to meet dental professionals; therefore, it is difficult to obtain health guidance. To achieve national oral health, dental specialist medical staff must go deep into community hospitals to ensure that the community can obtain convenient oral health guidance, regular examinations, and other basic services.

How to improve the rate of wearing tooth guards among Chinese teenagers

To further study the tooth guard wearing rate among teenagers in China, we investigated the factors that affect the wearing of dental protectors. According to our previous analysis, 89.64% of the parents stated that this was the most important reason why the athletes did not wear tooth protectors. This is consistent with the survey results of Chukwudi et al. [14] who found a significant correlation between compliance with wearing oral protective equipment and the athletes' knowledge of the risk and consequences of oral injury. We believe that our athletes lack the channels to obtain information regarding oral protective equipment and that oral health education related to sports is very important.

A total of 67.14% of the respondents reported not wanting to be different from others because of wearing the mouthguard. Another 17.50% of respondents reported unwillingness to accept the change of the image entailed in wearing a mouthguard. The discomfort and communication difficulties after wearing the mouthguard also reduced compliance. However, in ice hockey, helmets, padding, and other protective equipment are very common, and there is no movement resistance. Therefore, the perfect implementation of the relevant regulations of competition requirements and sports safety are the best measures to promote the use of teeth guards. A total of 77.14% of the parents reported believing that the formulation and enforcement of the relevant regulatory agencies' standards were important measures to encourage young athletes to wear mouthguards. Coach supervision was reported to be the most important (54.64%). At present, many countries require coaches of antagonistic sports to receive safety education related to injuries and to master emergency treatment interventions for tooth avulsions, tooth fractures, and other

injuries. The coaches must pass a strict examination before they can obtain the qualification. This can reduce the impact of sports-related injuries and the adverse consequences of injury worthy of our learning and reference.

Future efforts of oral medical professionals should focus on the comfort of tooth guards and reduce the costs of wearing them. There are three main types of tooth guard sleeves: The first type is the ordinary tooth guard. It is preformed and is ready to wear. It is inexpensive; however, it is uncomfortable. It causes pain, nausea, dyspnoea, and other symptoms. The second type is the heated and occlusive type of tooth guard, worn for the first time after being heated in water, to make it suitable for various people to wear. This kind of tooth guard is the most popular one; it is more comfortable than the ordinary one. However, due to its substantial thickness, it may affect normal communication in sports. There are also uncomfortable symptoms, such as foreign body sensation. The third type is the custom-made tooth guard, which doctors and technicians make based on imaging techniques. It is characterized by accurate retention and stable wearability. It can prevent oral injury while ensuring comfort and durability. However, athletes need to go to clinics often and cooperate with doctors during the customization process; this requires a long time and is expensive. Therefore, it is of great significance to develop a tooth guard characterized by strong resistance and ease of wearing.

Conclusions

Ice hockey is an intensely competitive sport, and the risk of oral injury is high. It is necessary to wear effective sports protective equipment such as tooth guards. The youth ice hockey players in Beijing lack an understanding of sports-related oral injuries and effective protection measures. The most effective way to improve compliance with ice hockey association recommendations is to draw up the relevant standards and coaches' guidance regarding wearing protective gear. Oral health care personnel should promote the oral health of all people. Currently, oral health care in the community has substantial room for improvement.

Abbreviations

USA—United States of America

Declarations

Ethical approval and consent to participate:

The ethics committee has approved this study of the Chinese PLA General Hospital, and the committee's reference number is 20180454. The survey content does not investigate the personal privacy of the interviewees. The interviewees signed the paper informed consent forms before the investigation began.

Consent for publication:

Not applicable

Availability of supporting data:

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Competing interests:

The authors declare that they have no competing interests.

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Authors' contributions:

LB designed the questionnaire and was a major contributor in writing the manuscript. BX and SH analysed and interpreted the data. CC and LW completed the ethical argumentation and informed consent. All authors read and approved the final manuscript.

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