

# Cognition and Implementation of Protective Measures for Oral and Maxillofacial Injuries of Ice Hockey Players in Primary and Secondary Schools in Beijing(10-12)

Bing Li (✉ [crystallibing@126.com](mailto:crystallibing@126.com))

PLA General Hospital, 28 Fuxing Road, Haidian District, Beijing, China. <https://orcid.org/0000-0003-4774-4587>

**Xue Bai**

China PLA General Hospital

**Hui Sun**

Chinese PLA General Hospital

**Chunyan Cui**

Chinese PLA General Hospital

**Weihong Liu**

Chinese PLA General Hospital

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## Research

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# Abstract

**Objective:** Through a cross-sectional investigation on the cognition and implementation of sports related oral and maxillofacial injury prevention measures of ice hockey players in primary and secondary schools in Beijing, this paper discusses the effective methods to improve the safety of juvenile ice hockey sports and reduce the incidence of oral and maxillofacial injuries such as tooth avulsion, tooth fracture and jaw fracture.

**Methods:** using convenient sampling method, obtain the consent of young ice hockey players from 5 primary and secondary schools and 6 special sports training institutions in Beijing, and issue questionnaires. 280 valid questionnaires were collected.

**Results:** only 12.50% of the young people often wear the mouth guard in ice hockey. 62.50% of the juvenile ice hockey players never wear the mouth guard. 43.58% of the respondents did not know the risk of sports related oral injury. The necessity of not removing teeth protection is the important reason why the athletes did not wear the protective gear (89.64%). The inconsistent behaviour with other teammates (67.14%) was the psychological factor of young athletes' refusal to wear the mouth guard. Wearing discomfort (34.33%) and communication influence (33.14%) should not be ignored. Therefore, the most effective way to promote the young athletes to wear the mouth guard is to establish and enforce the standards of the relevant management organizations (77.14%).

**Conclusion:** young ice hockey players in our city are lack of knowledge about sports related oral injury and effective protective measures, and there is a high risk of sports. It is the most effective way to improve the compliance of athletes to wear the protective gear to draw up and supervise the relevant standards of Ice Hockey Association and coach's guidance. There is a great space for the dental staff to improve the denture bracket, improve the wearing comfort, expand the health guidance efficiency of the dental staff, and promote the oral health of the whole people.

## Introduction

With the enrichment of youth sports and the extension of training time, the incidence of sports injury is gradually increasing. The incidence of sports injury is higher in antagonistic sports due to the close even indirect physical contact between the athletes on both sides of the confrontation. The National Federation of High Schools (NFHS) and the University Sports Association (NCAA) require the wearing of mouth guard in hockey, rugby, ice hockey, lacrosse and other sports<sup>[1-2]</sup>. According to the statistics of soccer sports injuries by the national electronic injury monitoring system of the United States in 2001, 175000 people in the United States are injured by football every year, of which 43% are aged from 8 to 14 years old. Among the wounded, 30% of the injuries are oral and maxillofacial injuries, including tooth avulsion, tooth fracture and jaw fracture<sup>[3-6]</sup>. A number of studies have shown that the use of dental protectors in sports can significantly reduce oral and maxillofacial injuries<sup>[7-9]</sup>. The American Dental Association (ADA) and the American Society of Pediatric Dentistry (AAPD) also recommend the use of

dental protectors in competitive sports. At present, China's youth participate in more confrontational sports, including football, basketball, ice hockey, rugby, baseball, hockey and so on<sup>[10]</sup>. However, there is no large sample statistical data of the injury caused by the above-mentioned antagonistic sports, and there is little mention on the wearing of the tooth guard in sports.

Through self-designed questionnaire, this study investigated the primary and secondary school students who participated in ice hockey, rugby, hockey, football, basketball and baseball, to understand the current situation of oral sports protection of primary and secondary school students in our city, and analyze the causes and countermeasures, so as to reduce the occurrence of sports injuries of Chinese teenagers and promote their healthy growth.

## Research Methods

By using convenience sampling, questionnaire was distributed to the players from 10 primary and secondary schools in Beijing and 13 special sports training institutions.

### 2.1 Design questionnaire

Through literature review, learn from foreign sports injury prevention experience and problems, combined with China's national conditions, design 10 problems related to the implementation of tooth protection measures in primary and secondary school students in sports.

### 2.2 Questionnaire distribution

By using convenient sampling method, through network query, friend recommendation and other ways, contact with relevant principals of 10 primary and secondary schools and 13 special sports training institutions in Beijing to explain the purpose, method and significance of the research. Finally, with the consent of 5 primary and secondary schools and 6 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 experience.

### 2.3 Quality control

Two researchers explained the content of the questionnaire on the spot, assisted the parents to complete the questionnaire, and ensured that the meaning of the question was understood accurately and the answer was complete.

### 2.4 Data analysis

Excel was used for data entry, and Stata 8.0 statistical software was used to conduct descriptive analysis of the data through chi square test.

# Results

## 3.1 Object of studies

280 athletes participated in the survey, with a participation rate of 54%, including 213 males and 63 females. The average age of the participating athletes was  $11.47 \pm 3.54$  years old. (table 1)

Table 1 Analysis of General Situation of the Investigated Young Athletes

Items		Distribution Percentage	
Age		11.47±3.54	
Gender	male	213	76.07%
	female	67	23.93%
Time for ice hockey	<1year	53	18.93%
	1-2year	68	24.29%
	2-5year	74	26.43%
	>5year	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 were 1 case of orthodontic fixator loosening, 1 case of lip swelling and 1 case of gingival bleeding.

## 3.2 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. 62.50% of the young ice hockey players have never worn a mouthguard.

Table 2 Analysis of Implementation Situation of Tooth Guard for Young Athletes

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%)
<b>total</b>	280	0	35(12.50%)	27(9.64%)	54(18.93%)	175(62.50%)

### 3.3 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 believed sports injury risk would not happen.

47.86% of the respondents knew that they needed to wear tooth protectors in ice hockey matches through the relevant 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 of them had a history of oral injury, and two parents reported that they were dentists. There are still 8.57% of the respondents who have never obtained any relevant information. If more relevant information is needed, the most popular way for parents to get information is through the coach's guidance (41.78%) or the ice hockey association publicity (33.92%). Some parents think that social publicity (12.14%) and dentist's guidance (10.36%) are the most effective ways to spread information. Only 4 parents (1.43%) think that the mutual influence between athletes and parents' recommendation are the best way to spread information.

Table 2 Cognition of young athletes' parents on 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 propaganda	34	12.14%
	Communication between team members and parents	4	1.43%

### 3.4 Influencing factors and Countermeasures of wearing rate of tooth guard

89.64% of the parents thought that *Don't understand the necessary* was the important reason why the athletes didn't wear the tooth protector. *Inconsistent behavior with other teammates* (67.14%), *discomfort* (34.33%), *image change caused by wearing* (17.50%), and *affects language communication* (33.21%) are also important reasons for athletes not to wear tooth fixers. Only 2.85% of the athletes showed obvious discomfort such as suffocation and nausea.

77.14% of the parents thought that the formulation and enforcement of the standards of the relevant regulatory agencies were the important measures to promote young athletes to wear protective gear, and the coach's supervision was also an effective method (54.64%). >30% of parents think that parents' supervision and the influence of team-mates can play a better role in promoting.

Table 3 Influencing factors and Countermeasures of wearing rate of tooth guard

Questions	Options	Numbers	Percentage
The reasons of hindering young athletes from wearing mouth guard	Don't understand the necessary 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 mouth, troublesome to wear	97	34.33%
	Wearing affects language communication		
	Affect appearance after wearing	93	33.21%
	High price of tooth guard	49	17.50%
	Obvious discomfort when wearing, such as suffocation, nausea and other symptoms	15	5.36%
How to improve the wearing rate of tooth guard	Sports associations set standards and enforce them	216	77.14%
	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%

## Discuss

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

With the 2022 Beijing Winter Olympic Games approaching, the implementation outline of "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 more and more popular among sports lovers. As one of the sports promotion programs for young people, the General Administration of the people's Republic of China issued the "ice hockey program" jointly with the Ministry of education of the people's Republic of China. However, it is not directly proportional to the increase of ice hockey participation enthusiasm that the participants' awareness of sports injury. Ice hockey is one of the fierce antagonistic sports, the incidence of sports injury is high. Oral injury, especially dental injury, has a long-term effect on the function of the wounded, as well as on the external and psychological aspects of the wounded. In recent years, the athletes of antagonistic sports pay more and more attention to the oral protection in sports. According to the statistics of soccer sports injuries by the national electronic injury monitoring system of

the United States in 2001, 175000 people in the United States are injured by football every year, of which 43% are aged from 8 to 14 years. Among the wounded, 30% of the injuries are oral and maxillofacial injuries, including tooth avulsion, tooth fracture and jaw fracture [11,12]. Because ice hockey allows a certain degree of reasonable collision, the risk of sports related injury is higher. In this survey, 20 people had periodontal injury (7.14%), 8 people had tooth injury (2.86%).

"Tooth guard" is generally considered to be an effective oral protective device, which can reduce the impact force in sports through significant buffering effect, and reduce the incidence of tooth fracture, tooth avulsion, jaw fracture and other injuries [13]. The National Federation of high schools (NFHS) and the University Sports Association (NCAA) both require the use of mouthguards in four sports, including hockey, rugby, ice hockey and lacrosse [14-15]. The American Dental Association (ADA) and the American Society of Pediatric Dentistry (AAPD) also recommend the use of dental protectors for athletes participating in competitive sports [2]. It is clearly pointed out in the competition requirements of China's 2018 Haidian District Youth Ice Hockey League that participants must wear dental protectors. But in the survey, only 22.17% of the athletes have the habit of wearing tooth guard, and 62.5% of the athletes have never worn it. The investigation in the United States is not optimistic. Collins et al. [16] in 2017, they conducted a survey on young athletes who participated in basketball, football and other confrontational sports in 21 middle schools. 22.6% of the athletes never knew that they needed to wear tooth protectors, and only 12.3% of them often or used to wear them in sports. Chukwudi et al. [17] in the survey of Nigeria, 19.16% of young athletes reported wearing tooth guard. It can be seen that although tooth protectors are widely considered to have good protection for teeth, it is still difficult to promote and use them among young athletes. In order to improve the safety of young people participating in antagonistic sports, we should further understand the difficulties and resistance they encounter in self-protection, so as to provide targeted help and guidance.

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

Although the wearing rate of mouthguard is not high in this survey, more than half of the respondents know that athletes have the risk of oral injury in sports, but they don't know much about it. 43.58% of the respondents did not know that the risk would occur, and even believed that oral injury would not occur. Our survey results show that 48.10% of the respondents know that they need to wear tooth protectors in ice hockey matches through the notices issued by the ice hockey association. Most of these notices come from the statement of the requirements of the Ice Hockey Association for the athletes' protective gear in the competition requirements, and do not mention the necessity and correct method of wearing tooth protectors. Only 18.31% of the respondents' information came from the coach's guidance. It can be seen that the ice hockey coach's own understanding of the mouthguard is not profound. Although modern medicine pays more and more attention to oral health care, oral health professionals and social health propaganda still lack health guidance for athletes. Among the respondents who reported to be guided by stomatologists, 8 had oral injury history and learned relevant information during oral treatment. Two parents of athletes reported that their occupation was stomatologist. In addition, 8.31% of the respondents had never obtained any relevant information.



In the survey, most of the respondents expressed their hope to know the relevant information through the publicity and requirements of ice hockey coaches or sports associations. Because the respondents think that they should understand the risk of ice hockey, athletes contact them most, it is easier to obtain information, and the athletes have higher compliance to the coach's guidance. Only 10.23% of the respondents chose oral health care personnel as the best way of information dissemination, even lower than the social publicity of ordinary media. This may indicate that at present, China's medical resources are still not rich enough, and the service focus of dental specialist medical staff is still focused on the treatment of oral diseases that have occurred, lack of community service, unable to provide oral routine examination, prevention and treatment of potential oral diseases and other health care services, and there is still a long way to go from the ideal "national oral health". Respondents generally believed that it took a lot of time to wait in line to listen to the professional guidance of stomatologists or nurses, and doctors often did not have time to do detailed health guidance for patients. Without oral diseases, there is no opportunity to meet dental professionals, so it is difficult to get health guidance on exercise through them. In order to achieve the goal of national oral health, dental specialist medical staff must go deep into community hospitals to ensure that the community can get convenient oral health guidance, regular examination and other basic services.

#### 4.3 How to improve the wearing rate of Chinese teenagers' tooth guard

In order to improve the wearing rate of teenagers in China, we further investigated the main factors that affect the wearing of dental protectors. In accordance with our previous analysis, 89.64% of the parents thought that it was the important reason why the athletes didn't wear tooth protectors. This is consistent with the survey results of chukwudi et al. <sup>[17]</sup>, and it is believed that there is a significant correlation between the wearing compliance of oral protective equipment and the athletes' cognition of the risk and consequences of oral injury. It is suggested that our athletes lack the channels to obtain the information of "oral protective equipment", and the oral health education related to sports is very important.

67.14% of the respondents did not want to be excessively concerned by others because of wearing the mouthguard. Another 17.50% of the respondents were hard to accept the change of the image after wearing the mouthguard. In addition, the discomfort and communication difficulties after wearing the mouthguard also reduce the compliance of the athletes wearing the mouthguard to a certain extent. But in ice hockey, helmet, armor and other protective equipment are very common, there is no movement resistance. Therefore, the perfect and implementation of the relevant regulations of competition requirements and sports safety is the best measure to promote the use of tooth guard. 77.14% of the parents thought that the formulation and enforcement of the standards of the relevant regulatory agencies were the important measures to promote the young athletes to wear the mouthguard. Under the influence of standard and system, coach supervision is more important (54.64%). At present, many countries require the coaches of antagonistic sports to receive the safety education of oral sports related losses before working, and master the emergency treatment measures of tooth avulsion, tooth fracture and other accidents. The coach must pass the strict examination before he can obtain the qualification.

This has a good role in reducing the incidence of sports related losses and the adverse consequences of injury, which is worthy of our learning and reference.

To improve the comfort of tooth guard and reduce the cost of wearing is the next direction of oral medical professionals. There are three main types of tooth guard sleeves available. The first type is ordinary tooth guard. It is preformed, ready to buy and wear. It is cheap, but its comfort is very low. It is prone to pain, nausea, dyspnea and other obvious discomfort symptoms. The second type is the heated and occlusive type of tooth guard, which is worn for the first time after being heated in water, so as to make it suitable for different people to wear. This kind of tooth guard is the most popular one at present, and it is more comfortable than the ordinary one. However, due to its large thickness, it may affect the normal communication in sports, and there are also uncomfortable symptoms such as foreign body sensation. The third type is custom-made tooth guard, which is made by professional doctors and technicians after taking film. It has accurate retention and stable wearing. It can prevent oral injury and ensure comfort and durability at the same time. However, athletes need to go to the hospital many times to cooperate with doctors to customize, which takes a long time and costs a lot. Therefore, it is of great significance to develop a kind of tooth guard with strong resistance and easy to wear.

## Conclusions

Ice hockey is an intense competitive sport, and the risk of sports oral injury is high. It is necessary to wear effective sports protective equipment such as tooth guard. At present, the youth ice hockey players in our city are lack of understanding of sports related oral injury and effective protection measures, and there is a high sports risk. The most effective way to improve the compliance of ice hockey association is to draw up relevant standards of Ice Hockey Association and coach's guidance on wearing protective gear. Oral health care personnel in promoting the oral health of the whole people, improve the ability of oral health care in the community has greater room for improvement.

## Declarations

### **Ethical Approval and Consent to participate**

This study has been approved by the ethics committee of Chinese PLA General Hospital, and the committee's reference number is 20180454. The survey content does not involve the personal privacy of the interviewees. The interviewees have signed informed consent before the investigation.

**Consent for publication:** Not applicable

**Availability of supporting data:** All data generated or analysed during this study are included in this published article.

**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 Sun Hui analysed and interpreted the data. CC and LW completed the ethical argumentation and informed consent. All authors read and approved the final manuscript.

### **Authors' information:**

LB, PhD, CNS, RN, Oral & Maxillofacial Surgery, PLA General Hospital, Beijing, China.

BX, RN, Oral & Maxillofacial Surgery, PLA General Hospital, Beijing, China.

SH, RN, Oral & Maxillofacial Surgery, PLA General Hospital, Beijing, China.

CC, RN, Oral & Maxillofacial Surgery, PLA General Hospital, Beijing, China.

LW, RN, Oral & Maxillofacial Surgery, PLA General Hospital, Beijing, China.

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