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## Mouthguards in the American Hockey League [AHL]

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**Purpose.** *To examine the orofacial injuries and attitudes toward mouthguards reported by professional ice hockey players of the American Hockey League [AHL].*

**Methods.** *A survey was created and sent to the certified athletic trainers [ATC] of 23 AHL teams. A total of 25 questions were posed regarding age, position, orofacial injury, frequency of prophylaxis by a dental hygienist and methods to clean a mouthguard. The influence and responsibility of professional athletes as role models was also explored.*

**Results.** *A total of 344 surveys of the original 394 surveys [87.3%] were returned. Three hundred twenty-four [82.2%] were acceptable for analysis. All respondents were male, with 74% between the ages of 19 and 25. Almost all players [93.8%] had been advised to wear a mouthguard, with a parent / family member first to advise on their use. Approximately 67.3% of players reported wearing a mouthguard in some capacity. Of those who did not, 31% stopped wearing a mouthguard upon arrival into the AHL. Dental injuries were numerous, occurring within 63.3% of ice hockey players. The most frequently reported injury was chipped teeth. As professional athletes, 88.6% consider themselves role models.*

**Conclusion.** *It is recommended that mouthguards be mandated within the professional arena as the prevalence of orofacial injuries remains a concern within ice hockey. Emphasis should be placed on educating health professionals of all disciplines who interact with athletes, as well as utilizing the promotional power of professional athletes.*

**Keywords:** *AHL, attitudes, ice hockey, mouthguards, orofacial injury*

### Introduction

In light of several national publications, most notably Oral Health in America: The Surgeon General's Report, Healthy People 2010 Goals and Objectives,<sup>1,2</sup> as well as the recommendations of professional organizations<sup>3-12</sup> the wide reaching effects of dental injury have been documented.<sup>1,13</sup> Therefore, this study was conducted to gauge the attitudes, usage and outcomes of mouthguards in professional ice hockey players of the American Hockey League [AHL].

The 2000 Report of the Surgeon General attributes the leading causes of oral and craniofacial injuries to "sports, violence, falls and motor vehicle collisions," and elaborates further, stating "oral-facial injuries can bring disfigurement and dysfunction, greatly diminishing the quality of life and contributing to social and economic burdens."<sup>1</sup> Healthy People 2010 listed injury and violence prevention as one of the top ten leading health indicators, with objective 15-31 dedicated to "Increase the proportion of public and private schools that require use of appropriate head, face, eye, and mouth protection for students participating in school-sponsored physical activities."<sup>2</sup>

Ten key dental associations: the Academy of General Dentistry [AGD]<sup>3</sup> American Association of Endodontists [AAE]<sup>4</sup>, the American Association of Orthodontists [AAO]<sup>5</sup>, the American Association of Oral and Maxillofacial Surgeons [AAOMS]<sup>6</sup>, the American Academy of Pediatric Dentistry [AAPD]<sup>7</sup>, the American Dental Association [ADA]<sup>8</sup>, the American Dental Hygienists' Association [ADHA]<sup>9</sup>, the Academy for Sports Dentistry [ASD]<sup>10</sup>, the Canadian Dental Association [CDA]<sup>11</sup> and the Canadian Dental Hygienists Association [CDHA]<sup>12</sup> are comprised of experts in their respective fields who promote injury prevention through mouthguard education and mandates.

The AAOMS and the ADA have recommended mouthguard use in 30 sports. They are acrobatics, baseball, basketball, bicycling, boxing, equestrian events, extreme sports, field events, field hockey, football, gymnastics, handball, ice hockey, inline skating, judo, lacrosse, martial arts, racquetball, rugby, skateboarding, skiing & snowboarding, skydiving, soccer, softball, squash, surfing, volleyball, water polo, weightlifting, and wrestling.<sup>6,8</sup>

### ***Youth and Sports Safety***

Prevention of Sports-related Orofacial Injuries, a 2006 policy generated by the AAPD, reports that approximately 46 million youth in the United States are involved in "some form of sports," further specifying that approximately 30 million children participate in organized programs.<sup>14</sup> In children, dental injuries were reported in 10-39% of sports accidents, with the most common injury [50-80%] involving the maxillary incisors.<sup>14</sup>

Since 1993, the National Youth Sports Safety Foundation [NYSSF] has raised awareness on issues such as eating disorders, emotional injuries, coaching education, and safety equipment through its campaign, "April is National Youth Sports Safety Month."<sup>15</sup> Beginning in the year 2000, the AAO, the AAOMS, and the AAPD collaborated to promote the use of helmets and mouthguards in their annual campaign, "April is National Facial Protection Month."<sup>16</sup>

### ***High School Sports and Mouthguards***

The governing body of high school activities, the National Federation of State High School Associations [NFHS], mandates the use of mouthguards within football, ice hockey, and lacrosse.<sup>17,18,19</sup> In 2006, NFHS provided more explicit guidelines regarding the visibility of mouthguards within football and ice hockey. The Official Rule Book states that "All tooth and mouth protectors shall be a color other than completely clear or white. The officials should, through normal observations, attempt to verify that each player is legally equipped prior to the ball becoming alive and if illegal equipment is detected, that player must fix the problem or leave the game."<sup>17,18</sup> In addition, ice hockey players must keep their mouthguard attached to their facemask at all times.<sup>18</sup>

Individual leagues, conferences, or states have the option to mandate athletic teams to wear mouthguards. The Massachusetts Interscholastic Athletic Association [MIAA] has taken the lead by requiring mouthguards in 7 school sponsored activities: basketball, field hockey, football, ice hockey, lacrosse, soccer, and wrestling.<sup>20</sup>

### ***College Sports and Mouthguards***

The National Collegiate Athletic Association [NCAA] currently oversees 360,000 student-athletes participating at 1,200 institutions within 3 divisions. Of its 23 intercollegiate sports, mouthguards are mandatory within only 4: field hockey, football, ice hockey, and lacrosse.<sup>21</sup> In 1990, additional appliance specifications were imposed stating that the mouthguard was to be "of any readily visible color [not white or transparent] with FDA approved base materials that covers all upper teeth."<sup>21</sup>

### ***Professional Sports and Protective Gear***

*ECHL*

The *ECHL*, formerly known as the East Coast Hockey League, serves as the developmental affiliate for the *AHL* and is comprised of 23 teams.<sup>22</sup> As defined within The Official Rule Book, "All players of both teams shall wear a helmet and visor of design, material and construction approved by the League at all times while participating in a game, either on the playing surface or the players' or penalty benches."<sup>23</sup>

#### *AHL*

The *AHL* serves as the developmental affiliate for the National Hockey League [*NHL*] and is comprised of 27 teams. The 6 month season runs from October through April.<sup>24</sup> Beginning with the 2006-2007 season the *AHL* moved to mandate visors.<sup>25</sup> The Official Rule Book states:

All players of both teams shall wear a helmet and clear protective visor of design, material and construction acceptable to the Competition Committee at all times while participating in a game, either on the playing surface or the players' or penalty benches. The helmet and visor must not be worn tilted back such that the protective capacity (integrity) of the visor is diminished... While the choice of visor model and manufacturer is left to the player; it is recommended that for optimal protection the bottom of the visor come to the tip of the nose.<sup>26</sup>

#### *NHL*

The world's elite professional hockey league, the *NHL*, is comprised of 30 teams throughout the United States and Canada.<sup>27</sup> The Official Rule Book declares helmets as the only piece of craniofacial safety equipment required and "All players of both teams shall wear a helmet of design, material and construction approved by the League at all times while participating in a game, either on the playing surface or the players' or penalty benches."<sup>28</sup> The *NHL* maintains a reactive stance on injury prevention with players given the option to wear a mask following facial injury.<sup>28</sup>

As illustrated above, The Official Rule Books of the *ECHL*, *AHL*, and *NHL* are devoid of any language pertaining to mouthguards.

#### *Hockey Canada*

Hockey Canada is the national governing body of ice hockey in Canada. The organization upholds their mission "Lead, Develop, and Promote Positive Hockey Experiences" while managing 13 regional branches of players ages 5-20.<sup>29</sup> In addition, Team Canada participates in the Deutschland Cup, International Ice Hockey Federation [IIHF] World Championships, Loto Cup, Sweden Hockey Games, Spengler Cup and the Winter Olympic Games. Beginning with the 2000-2001 season, Hockey Canada required all amateur hockey teams to implement the Hockey Canada Safety Program. Each team provided a representative who received training in topics such as abuse / bullying, first aid, protective equipment, and stretching.<sup>30</sup>

The Referee's Case Book states that all players and goaltenders must wear a "CSA [Canadian Standards Association] approved hockey helmet, to which a CSA approved facial protector, must be securely attached and not altered in any way."<sup>31</sup> For those divisions that allow the half visor, the use of a mouthguard is compulsory.<sup>31</sup> Referees have authority to issue team penalties when a player wears a mouthguard improperly or carelessly.<sup>31</sup>

#### *USA Hockey*

USA Hockey, Inc. is a national organization promoting the sport of ice hockey through relations with coaches, parents, players, and officials.<sup>32</sup> Activities include the expansion of grassroots hockey programs, the sponsorship of skill development camps / national tournaments and recommendations regarding protective equipment. The organization prepares the men's and women's teams for International World Championships and the Winter Olympic Games. USA Hockey partners include the International Ice Hockey Federation [IIHF], the National Collegiate Athletic Association [NCAA], the National Hockey League [*NHL*], and the United States Olympic Committee [USOC]. The Official Rules require all male and female players and goalkeepers under the age of 19 to wear "a colored (nonclear) internal mouthpiece covering all teeth of one jaw,

customarily the upper" with a "facemask and chinstrap certified by the Hockey Equipment Certification Council [HECC]."<sup>33</sup> USA Hockey encourages players to obtain the form-fitted mouthpiece from a dentist and strongly recommends all players continue to uphold these policies throughout their career.<sup>33</sup>

## **Review of Literature**

### ***History of Mouthguards***

The earliest mention of the mouthguard, previously referred to as a "gum shield," dates back to 1890 when Woolf Krause, a London dentist, originally fabricated the device of gutta percha. His son, dental counterpart and amateur boxer Philip Krause, primarily utilized the appliance to prevent lip lacerations.<sup>34</sup> Thomas Carlos, a Chicago dentist, manufactured the first mouthguard in the United States in 1916.<sup>34</sup> Mouthguards became mandatory in the boxing arena by the 1930s, while high school football followed suit in 1962.<sup>35</sup>

As dentistry has progressed, the materials used to fabricate custom-fitted mouthguards have improved. A number of materials have been tested alone or in combination pursuing convincing results in mouthguard attributes such as hardness, shock-absorbing capability, stiffness, tear strength, tensile strength and water absorption.<sup>35</sup> Polyvinyl chloride, latex rubber, acrylic resin, and polyurethane are examples of former mouthguard materials. Ethylene vinyl acetate is most widely used today.<sup>35</sup> Despite differing levels of protection offered by various materials, the use of any mouthguard provides orofacial protection not present otherwise.<sup>36</sup>

### ***Athletic Injuries***

The Centers for Disease Control and Prevention [CDC], Morbidity and Mortality Weekly Report [MMWR] indicates that "approximately one third of all dental injuries and approximately 19% of head and face injuries are sports-related."<sup>37</sup> Burt and Overpeck found that individuals aged 5-24 years accounted for 2.6 million of the 3.7 million emergency department visits for sports related injuries among persons of all ages.<sup>38</sup> It is estimated that for each avulsed tooth that is not able to be salvaged or properly re-implanted, approximately \$10,000-\$15,000 of cost will be amassed over a lifetime.<sup>13</sup>

A study of 282 Junior 'A' Hockey players by Stuart et al. analyzed the correlation between injuries amassed and extent of facial protection [full cage, half shield, none] present. The quantity of injuries increased as the level of facial protection decreased.<sup>39</sup> As a result, 52 injuries occurred in players wearing no facial protection, 45 injuries were documented for those wearing partial facial protection, and only 16 injuries were noted for those wearing full facial protection.<sup>39</sup> In those players wearing full facial protection, no eye or neck injuries occurred.<sup>39</sup>

Flik et al. analyzed the injuries of 8 NCAA Division I ice hockey teams during a season. Concussions were the most common injury, accounting for 18.6% of all injuries.<sup>40</sup>

Lahti et al. evaluated the cause and nature of dental and maxillofacial injuries of ice hockey players in Finland. Data was collected from insurance records of 479 players with a non-complicated crown fracture deemed the most common injury.<sup>41</sup> Orofacial protection was utilized in only 10% of players. The authors made recommendations to encourage mandatory facial protection and mouthguard use.<sup>41</sup>

Bemelmans and Pfeiffer created and distributed a questionnaire to top German athletes to evaluate attitudes toward mouthguards and incidence of orofacial injuries. Orofacial injuries occurred in 32% of the athletes surveyed.<sup>42</sup> Complaints were reported with boil and bite mouthguards on the inability to speak [19.9%], comfort / fit [4.8%] and breathing difficulty [3.4%].<sup>42</sup> The authors recommended athletes receive information on the benefits of a custom-made mouthguard.<sup>42</sup>

Lieger and von Arx studied the frequency of cerebral and orofacial injuries among professional athletes [basketball, handball, ice hockey, and soccer] in Switzerland. Athletes were surveyed regarding their injuries and mouthguard habits. Eighty-four percent of athletes did not wear a mouthguard.<sup>43</sup> Ice hockey accounted for the highest incidence of orofacial injuries when athletes did not wear a mouthguard at 59%, followed by soccer with 24%.<sup>43</sup> In addition, Lieger and von Arx questioned officials on their willingness to issue penalties to athletes who did not wear a mouthguard. Despite awareness of the infraction, officials revealed a reluctance to issue penalties for non-compliance. The authors encouraged students to pursue sports medicine and sports dentistry education with great emphasis placed on generating team dentists.<sup>43</sup>

### ***Attitudes / Compliance / Enforcement***

Walker et al. evaluated three soccer teams comprised of 7 and 8 year old children. The study randomly assigned each team with a stock, boil and bite, or custom-fitted mouthguard. The study found over 80% of the children wearing the boil and bite and custom-fitted mouthguards were "happy" or "enthusiastic" about its use.<sup>44</sup> The children wearing the stock mouthguard had negative feelings toward the appliance. Although 95% of parents understand that mouthguards aid in preventing injury, only 24% expressed a willingness to purchase the device for their child.<sup>44</sup> The study emphasized the need for education of parents and athletes regarding the benefits and comforts of a custom-fitted mouthguard.

Miller et al. conducted a survey of Michigan high school ice hockey players and mouthguard use. A discrepancy in compliance was found with 80.3% of players wearing a mouthguard during games, but only 25.6% of players wearing one during practice.<sup>45</sup> A lack of education was cited, suggesting that coaches, parents, and healthcare professionals take on a greater role in delivering information about mouthguards.<sup>45</sup>

Berry et al. surveyed ice hockey players of the Central Collegiate Hockey Association [CCHA] on their player position, exposure to mouthguard education and mouthguard use. A correlation was substantiated between player position and mouthguard stance with "defensive players having more negative attitudes toward mouthguard usage compared to offensive players."<sup>46</sup>

Hawn et al. investigated the rate of mouthguard use as reported by certified athletic trainers [ATCs] of NCAA Division I, II, and III ice hockey teams. A large percentage of athletic trainers [93%] thought that mouthguards held a place in injury prevention; however, only 63% of their players regularly wore mouthguards in competition.<sup>47</sup>

Maestrello et al. surveyed 2,500 Virginia dentists on their pattern of mouthguard recommendation. Of those sampled, 97% of orthodontists, 84% of pediatric dentists, and 67% of general dentists recommended mouthguards to their athletically inclined patients.<sup>48</sup> Those dentists who did not recommend a mouthguard cited their lack of formal instruction on device fabrication as well as the patient's perceived financial burden.<sup>48</sup>

## **Methodology**

### ***Subjects***

The certified athletic trainer [ATC] for each of the 27 *AHL* teams was contacted to introduce the research study and to request participation. Three teams could not be contacted and an additional team was prohibited from participating by their *NHL* parent organization. The remaining 23 teams throughout the United States and Canada agreed to participate. The sample was estimated to include 394 players based on the cumulative number of surveys requested by the ATCs.

Each participating *AHL* team received a packet, via mail, containing a cover letter, statement of intent, and surveys requested. This occurred between January and March 2007. Each packet also included a self-addressed stamped envelope to encourage participation and expedite response time. A variety of donated oral hygiene samples were offered to the ATC and participants upon receipt of the completed surveys.

### Instrumentation and Measurement

Each ATC was instructed to present the statement of intent prior to administering the surveys. The statement introduced the researcher and the rationale behind the study.

Participants were asked to complete the survey to the best of their ability, keeping in mind that dental injuries should only be listed if the injury occurred while practicing or playing ice hockey. Following the introduction, the 5-page survey was to be distributed (Figure 1a, 1b, 1c, 1d). It was estimated to take between five and ten minutes to complete.

Figure 1

**Mouthguards in the American Hockey League**

1. How old are you?

<input type="checkbox"/> ≤ 18	<input type="checkbox"/> 33 – 39
<input type="checkbox"/> 19 – 25	<input type="checkbox"/> 40 +
<input type="checkbox"/> 26 – 32	

2. I value dental health. Mark only ONE.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Strongly disagree	Disagree	No Opinion	Agree	Strongly agree

3. How would you BEST describe your dental / oral health?

- Excellent
- Good
- Fair
- Poor

4. My MOST recent dental visit was for a/an \_\_\_\_\_. Mark only ONE.

- Cleaning
- Emergency
- Screening

5. How would you BEST describe the frequency of your dental cleanings by a dental hygienist?

- Every 3 months
- Every 6 months
- Once a year
- Rarely
- Never

6. How many years have you been playing organized ice hockey such as Youth League, High School, Juniors, AHL?

<input type="checkbox"/> ≤ 5	<input type="checkbox"/> 21 – 25
<input type="checkbox"/> 6 – 10	<input type="checkbox"/> 26 – 30
<input type="checkbox"/> 11 – 15	<input type="checkbox"/> 30 +
<input type="checkbox"/> 16 – 20	

7. What position do you currently play?

- Defense
- Forward
- Goalie

8. In your opinion, is "toothless" an accurate portrayal of a hockey player?

<input type="checkbox"/> Yes	<input type="checkbox"/> No
------------------------------	-----------------------------

9. Have you EVER been advised to wear a mouthguard?  
 Yes  No

If yes, Who first advised you to wear a mouthguard? Mark only ONE.

- Athletic Trainer  
 Coach  
 Dental Professional [Dentist, Dental Hygienist, Orthodontist]  
 Parent / Family Member  
 Teammate  
 Other: \_\_\_\_\_

10. Do you currently own a mouthguard?

- Yes  No

If yes, What type of mouthguard?

- "One Size Fits All"  
 Boil & Bite  
 Custom Made

If no, Have you EVER owned a mouthguard?

- Yes  
 No

11. When did you first obtain a mouthguard? Mark only ONE.

- After Injury  
 Before Injury  
 Mandatory requirement from Coach, League, School  
 Do not own a mouthguard

12. Do you wear a mouthguard?

- Yes



- No

If no, When did you STOP wearing one?

- Upon arrival into the AHL

- Other: \_\_\_\_\_ [Skip to # 16]

If yes, When?

- Games and practice  
 Games only  
 Practice only

13. How would you BEST describe your mouthguard use?

- Always  
 Most times  
 Sometimes  
 Rarely

14. Why do you wear a mouth guard? Mark ALL that apply.

- Mandatory  Protect previous dental work  
 Protect teeth  Recommendation  
 Prevent concussions  Other: \_\_\_\_\_  
 Previous injury

15. Do you clean your mouthguard?

- Yes  No

If yes, What method / products do you use? Mark ALL that apply.

- |  |  |
|--|--|
| <input type="checkbox"/> Rinse with cold water | <input type="checkbox"/> Toothbrush and toothpaste |
| <input type="checkbox"/> Rinse with hot water  | <input type="checkbox"/> Toothbrush only           |
| <input type="checkbox"/> Soak in mouthwash     | <input type="checkbox"/> Other: _____              |
| <input type="checkbox"/> Soak in water         |  |

16. Have you EVER experienced a dental injury as a result of playing ice hockey?

- Yes  No

If yes, Mark ALL that apply.

- |  |   |
|--|---|
| <input type="checkbox"/> Avulsed [knocked-out] teeth | <input type="checkbox"/> TMJ problems [joint that allows you to open / close mouth] |
| <input type="checkbox"/> Chipped teeth               | <input type="checkbox"/> Other: _____   |
| <input type="checkbox"/> Fractured teeth             |   |
| <input type="checkbox"/> Jaw fractures               |   |

17. To the best of your knowledge, how was your dental injury treated? Mark ALL that apply.

- |   |                                       |
|---|---------------------------------------|
| <input type="checkbox"/> Bonding                    | <input type="checkbox"/> Implant      |
| <input type="checkbox"/> Crowns / "Caps" / Veneers  | <input type="checkbox"/> Oral Surgery |
| <input type="checkbox"/> Fixed Bridge               | <input type="checkbox"/> Root Canal   |
| <input type="checkbox"/> Flipper / Removable Bridge | <input type="checkbox"/> Other: _____ |

18. Have you EVER had a concussion as a result of playing ice hockey?

- Yes  No

If yes, Were you wearing a mouthguard at the time of injury?

- Yes  No



19. In your opinion, how often should a mouthguard be replaced?
- After injury       At the start of every season  
 1 – 6 months       7 – 11 months  
 Once every year       When damaged
20. Rank the following safety equipment [1–6] in the order of importance to you.  
 1 = MOST important, 6 = LEAST important
- \_\_\_\_ Athletic Supporter  
 \_\_\_\_ Gloves  
 \_\_\_\_ Helmet  
 \_\_\_\_ Mouthguard  
 \_\_\_\_ Pads [Shoulders, Elbows, Shin]  
 \_\_\_\_ Visor
21. Who would you prefer to provide education about mouthguards? Mark only ONE.
- Athletic Trainer  
 Coach  
 Dental Professional [Dentist, Dental Hygienist, Orthodontist]  
 Other: \_\_\_\_\_
22. Do you believe that promotion / advertising should be done to encourage mouthguard use in ice hockey?  
 Yes       No  
 If yes, Rank the following methods [1 - 7] in the format the information should be delivered.  
 1 = MOST effective, 7 = LEAST effective
- \_\_\_\_ Billboard  
 \_\_\_\_ Health Fairs  
 \_\_\_\_ Internet / E-mail / Website  
 \_\_\_\_ Magazines [Advertisements or Articles]  
 \_\_\_\_ Public Service Announcements  
 \_\_\_\_ Tournament Booths  
 \_\_\_\_ TV Commercials
- Other suggestions? \_\_\_\_\_
23. Do you, as a professional athlete, consider YOURSELF to be a role model?  
 Yes       No
24. Children and teens are influenced by viewing professional athletes wearing mouthguards.
- Strongly disagree       Disagree       No Opinion       Agree       Strongly agree
25. Professional athletes have a responsibility to set the example for today's youth.
- Strongly disagree       Disagree       No Opinion       Agree       Strongly agree

Thank you!

The survey was comprised of 25 questions. The first section addressed demographics and the value placed on dental health. Questions were posed regarding age, current position, and number of years playing organized ice hockey. Participants were asked to provide the reason for their most recent dental visit and the frequency of their professional dental cleanings. A Likert scale question allowed the participants to evaluate their own dental / oral health status.

The second section addressed the ownership, use and habits regarding mouthguards. It gathered specifics on who initially recommended their use, when [practice / games] they were worn, how often, and why they were being used. Participants were also asked how and when they clean and replace their mouthguard, respectively.

The third section investigated dental injuries, concussions, and safety equipment. Participants were asked to report to the best of their ability the orofacial injuries they had suffered and the treatment they had received. In addition, the survey asked participants to rank standard ice hockey safety equipment [athletic supporter, gloves, helmet, mouthguard, pads, and visor] in the order of importance to them.

The final 5 questions examined education and promotion of mouthguards. The influence of professional athletes as role models and their responsibility to set a positive example to children and teens was also explored.

Survey data was entered into an Excel spreadsheet and a statistical analysis was performed. Results of this study were anonymous; no player or team was named.

## **Results**

Of the 394 surveys mailed to 23 *AHL* teams, 344 surveys from 18 teams were returned. A total of 324 surveys were deemed acceptable for analysis with a final response rate of 82.2% [324/394]. The sample was comprised of professional male ice hockey players with 74% of players between the ages of 19 and 25. The sample included 191 forwards, 110 defenders and 23 goalies.

Ninety percent [n=292] of respondents agreed or strongly agreed with the statement "I value dental health." Participants were also asked to evaluate their own dental / oral health status. The majority of players [69.4%] felt that the best description of their dental / oral health was "good." Less than one percent [n=2] responded "poor." A total of 240 participants responded that a cleaning was the reason for their most recent dental visit. Additional responses included "a week ago," "jaw check," "February 28," "filling," "summer 2006" and "wisdom teeth."

Thirty-one percent [n=102] of ice hockey players reported their frequency of a dental prophylaxis by a dental hygienist to be every six months, while 58.3% [n=189] responded once a year.

When participants were asked whether or not they believed that "toothless" was an accurate portrayal of a hockey player, 39.1% [n=127] of respondents agreed with this stereotype while 60.8% [n=197] did not.

Almost all players [93.8%] had been advised to wear a mouthguard, with a parent / family member [n=110] first to advise on their use. Other individuals responsible for advising on mouthguard use were reported as "girlfriend," "league," "organization," and "self." The most common reason [n=144] for first obtaining a mouthguard was a mandatory requirement by a coach, league, school, or team.

A total of 245 ice hockey players [75.6%] reported owning a mouthguard. Of these, 238 were custom-made mouthguards, 5 were boil and bite mouthguards and 2 were stock mouthguards. While 79 participants did not currently own a mouthguard, 64 stated they had previously owned one. Approximately 67.3% of ice hockey players wore a mouthguard in some capacity. Forwards had the highest percentage of wear at 74.8% [n=143/191] while the percentage of wear for defenders was slightly less at 66.4% [n=73/110]. Only two goalies reported wearing a mouthguard, accounting for the lowest rate of compliance at 8.7% [n=2/23].

Of the 241 players between the ages of 19 and 25, 68.4% [n=165] reported wearing a mouthguard; this was the highest rate of mouthguard use among all age groups. Only 28 players reported wearing the appliance during both games and practice, as the majority of mouthguards were worn only in games [86.2%].

Of those individuals who received a dental prophylaxis every 6 months, 71.5% [n=73/102] wore a mouthguard. Of those ice hockey players who reported a cleaning every year, 67.1% [n=127/189] reported wearing a mouthguard. Of the individuals who admitted to "rarely" getting their teeth cleaned, 51.8% [n=14/27] admitted to wearing a mouthguard. Lastly, of the four ice hockey players who had never had their teeth cleaned, two reported wearing a mouthguard.

Of those who did not wear a mouthguard, 33 [31%] ceased wearing one upon arrival into the *AHL*. Seventy-three participants reported when they stopped wearing a mouthguard: "3rd year pro," "15 years ago," "college," "*ECHL*," "forgot it after trade," "I am goalie," "juniors," "never wore one," and "OHL-Ontario Hockey League."

"Protecting the teeth" topped the list of reasons why ice hockey players wear a mouthguard, followed closely by "preventing concussions." Additional reasons to wear a mouthguard were reported as "just do" and "braces gave me a great smile."

One hundred seventy-five ice hockey players reported cleaning their mouthguard with differing methods and products, while 43 [19.7%] admitted they did not. "Soaking in mouthwash" was totaled as the most common cleaning technique [n=86], while rinsing the mouthguard with hot and cold water was also done. Only *one* individual reported using a toothbrush and toothpaste to clean their mouthguard. Written responses included the use of "cleaning soap" and "soaking in Gatorade."

Dental injuries were numerous, occurring within 63.3% [n=205] of ice hockey players. Forwards reported the highest incidence of injury at 68% [n=130/191] while 61% [n=67/110] of defenders accrued injuries. Injury was reported within 34.7% [n=8/23] of goaltenders.

The most frequently reported injury was chipped teeth [n=160], followed by avulsed teeth [n=65], fractured teeth [n=61], TMJ problems [n=20] and jaw fractures [n=16]. Injuries were most commonly repaired with crowns [n=86], followed by bonding [n=78], root canals [n=62], flippers [n=30], fixed bridges [n=21], oral surgery [n=20], and implants [n=18]. Additional written responses regarding treatment included, "filled in," "minor, nothing been done," "sealant," "splint," "too small to fix," and "surgery on TMJ." One hundred eighty-five ice hockey players reported experiencing a concussion, with 61% [n=113] wearing a mouthguard at the time of injury.

Approximately 30% [n=98] of ice hockey players believed that a mouthguard should be replaced at the start of every season, and 22% [n=72] alleged once every year was sufficient. Six individuals felt that a mouthguard should be replaced at the start of every season and when damaged.

Participants were asked to rank standard safety equipment with the number "1" assigned to the most important item and the number "6" assigned to the least important item. The helmet was found to be the most important receiving 66.8% [n=189] of "1" votes. This was followed by the athletic supporter with 17.3% [n=49], pads at 11% [n=31], visor with 2.5% [n=7], and gloves with 1.8% [n=5]. Mouthguards received only two "1" votes representing the least important piece of safety equipment [ $< 1\%$ ].

Forty-nine percent of professional ice hockey players would prefer ATCs to provide education about mouthguards while 43% chose a dental professional [dentist / dental hygienist / orthodontist]. Approximately 8.6% [n=28] of players thought coaches or others would be appropriate including "medical doctor," "nobody," "no one, personal decision," and "yourself."

Approximately 58.6% [n=190] of participants believe advertising / promotion should be done to encourage mouthguard use within the sport. Overall, ice hockey players believe TV commercials constitute the most effective means of promoting mouthguards. Other suggested methods of advertising were, in order, magazines, internet, public service announcements, tournament booths, and lastly, health fairs and billboards. Five additional suggestions were offered including "come around and talk to teams," "discounts for players," "dressing room advertisements," "explaining benefits," and "representative talk to minor league hockey - kids." One player commented further, "I think everybody understands the benefits of wearing protection but many who opt not to, do so out of preference. It's easier to breathe and communicate, which are very important for hockey players."

A total of 287 [88.6%] ice hockey players consider themselves role models, with 69.1% agreeing or strongly agreeing that children and teens are influenced by viewing professional athletes wearing mouthguards. Furthermore, 85.8% [n=278] of the ice hockey players felt professional athletes have a responsibility to set an example for today's youth.

## **Discussion**

The findings of this study concur with the findings of other studies which have highlighted the deficiency of mouthguard education and high rate of injuries within the sport of ice hockey.<sup>13,15,30,34,39,40-48</sup> These claims were substantiated within the *AHL* with numerous orofacial injuries and concussions coupled with irregular use of mouthguards. Almost all players [93.8%] had been advised to wear a mouthguard, but consistent use and care of the appliance was not stressed. Players should be encouraged to wear the mouthguard during both practice and games for ultimate protection. Additional education should be focused on the maintenance and cleansing of the device. Players must be advised to avoid hot water, sunlight and alterations that can lead to distortion, thus decreasing the effectiveness of the mouthguard.<sup>3,12,49,50</sup>

Many participants remarked that their first exposure to mouthguards was through a parent / family member or ATC. A lack of continuity and regularity in receiving dental care may play a role in the lack of recommendations by dental professionals. The percentage of individuals wearing a mouthguard was directly proportional to the frequency of professional dental cleanings. Forwards and defenders averaged a similar rate of mouthguard use, while goalies' rate of compliance was poor. This finding was aligned with attitudes of ATCs who believed goalies would be exempt from participating in

the survey. It appears that the presence of a face mask persuades many ice hockey goalies to view the use of a mouthguard as excessive and redundant protection.

A number of participants confessed that they did not wear a mouthguard in youth leagues, high school and college where supposedly strict rules currently exist.<sup>17,18,19,20,21</sup> This dilemma is due in part to the fact that coaches and officials fail to hold players accountable for non-compliance.

Upon entering the ranks of professional ice hockey, another decline in mouthguard use was noted. At a time when the risk of injury is highest, the amount of required safety equipment is lowest. The overwhelming choice of helmets as the most important piece of safety equipment is not surprising considering their requirement in every ice hockey league.<sup>23,26,28,31,33</sup> Therefore, to aid in reducing the incidence and severity of orofacial injuries, it is recommended that mouthguards be elevated to mandatory status in the *AHL* and all professional affiliates.

Since *AHL* ice hockey players deemed TV commercials as the most effective means to promote mouthguards, it is only appropriate that they headline this advertisement. The presence of a recognizable professional athlete may elevate the weight of the recommendation due to their esteem and visibility in the public arena. Most notably, this commercial has the potential to reach a diverse demographic [age, ethnicity, socioeconomic status] targeting those who do not have access to a healthcare provider.

It is recommended that this study be replicated among male and female ice hockey players within various levels of competition. Future research should target the function of mouthguards in concussion prevention as no substantial evidence exists on this topic.

### ***Limitations***

The ebb and flow of players defines the partnership between the *ECHL*, *AHL*, and *NHL*. This quality allows players to be "called up" or "sent down" to replace others resolving injury, illness, performance, or personal matters. In addition, the *NHL* trade deadline [February 27, 2007] may have reduced those available to complete the survey, decreasing the purposive sample size. In the future, surveys should be distributed at the start of the season [October] to minimize the interruption of "call ups," injuries and playoff scheduling.

Due to time constraints and financial resources, all data was self-reported and clinical examinations were not conducted. Therefore, restorative materials and prosthetic appliances may have been incorrectly identified by survey participants. Digital photographs, radiographs, Current Dental Terminology [CDT] coding and dental records would have provided the most accurate documentation of injury and treatment.

### **Conclusion**

Despite mouthguard use, the prevalence of dental injury remains a concern within the sport of ice hockey. Although restoration is possible, it is time consuming and less desirable than initial efforts of prevention.

In an attempt to preserve the endurance of the *AHL* and its players, it is recommended that mouthguards become mandatory safety equipment. Emphasis should also be placed on educating health professionals of all disciplines who interact with athletes of all ages [ATCs, coaches, dentists / dental hygienists, health / physical education teachers, pediatricians, physical therapists and school nurses] so they can become an integral safety advocate to those individuals the "6 month recall" fails to reach. Moreover, advertisements utilizing professional role models should be implemented to encourage athletes to keep playing... *safely*.

### **Update**

2007-2008: The American Hockey League expanded to 29 teams.

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## **Notes**

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## **References**

1. U.S. Department of Health and Human Services. Oral Health in America: A Report of the Surgeon General [homepage on the Internet]. Rockville (MD): U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health; 2000. [cited 2006 Oct 31]. Available from: <http://www.surgeongeneral.gov/library/oralhealth/>.
2. U.S. Department of Health and Human Services. Healthy People 2010: Injury and Violence Prevention [homepage on the Internet]. Rockville (MD): U.S. Department of Health and Human Services; 2000. [cited 2007 Jan 28]. Available from: [http://www.healthypeople.gov/Document/html/volume2/15injury.htm#\\_Toc490549391](http://www.healthypeople.gov/Document/html/volume2/15injury.htm#_Toc490549391).
3. What is a Mouthguard? [homepage on the Internet]. Chicago (IL): Academy of General Dentistry; 2006. [cited 2008 Aug 31]. Available from: <http://www.agd.org/public/oralhealth/Default.asp?IssID=331Topic=SArtID=1328#body>.
4. Root Canal Awareness Week Urges Kids to Watch Their Mouth [homepage on the Internet]. Chicago (IL): American Association of Endodontists; 2008. [cited 2008 Aug 26]. Available from: <http://www.aae.org/patients/pressroom/RootCanalAwarenessWeek.htm>.
5. When to Wear a Mouthguard [homepage on the Internet]. St. Louis (MO): American Association of Orthodontists; 2008. [cited 2008 Aug 26]. Available from: [http://www.braces.org/nfpm/when\\_to\\_wear.htm](http://www.braces.org/nfpm/when_to_wear.htm).
6. Treating and Preventing Facial Injury [homepage on the Internet]. Rosemont (IL): American Association of Oral and Maxillofacial Surgeons; 2005. [cited 2007 Feb 27]. Available from: [http://www.aaoms.org/facial\\_injury.php](http://www.aaoms.org/facial_injury.php).
7. Mouth Protectors [homepage on the Internet]. Chicago (IL): American Academy of Pediatric Dentistry; 2002-2008. [cited 2008 Aug 26]. Available from: <http://www.aapd.org/publications/brochures/mouthpro.asp>.
8. American Dental Association. The importance of using mouthguards. *J Am Dent Assoc.* 2004. Jul;135: 1061.
9. Ask Your Dental Hygienist About Proper Oral Health Care for Adolescents [homepage on the Internet]. Chicago (IL): American Dental Hygienists' Association; 2007. [cited 2008 Aug 26]. Available from: [http://www.adha.org/downloads/adolescents\\_factsheet.pdf](http://www.adha.org/downloads/adolescents_factsheet.pdf).
10. Position Statements [homepage on the Internet]. Farmersville (IL): Academy for Sports Dentistry; 2006. [cited 2008 Aug 26]. Available from: [http://www.sportsdentistry-asd.org/position\\_statement.asp](http://www.sportsdentistry-asd.org/position_statement.asp).
11. CDA Position on Prevention of Traumatic Oral Facial Injuries [homepage on the Internet]. Ottawa (ON): Canadian Dental Association; 2005. [cited 2008 Aug 31]. Available from: [http://www.cda-adc.ca/\\_files/position\\_statements/injury\\_prevention.pdf](http://www.cda-adc.ca/_files/position_statements/injury_prevention.pdf).
12. Information Sheet for Dental Hygiene Clients: Mouthguard Use & Care [homepage on the Internet]. Ottawa (ON): Canadian Dental Association; 2005. [cited 2008 Aug 31]. Available from: <http://www.cdha.ca/pdf/Mouthguard%20info%20sheet%20for%20clients.pdf>.
13. Echlin PS, Upshur REG, Peck DM, Skopelja EN. Craniomaxillofacial injury in sport: a review of prevention research. *Br J Sports Med.* 2005;39: 254-263.

14. Policy on Prevention of Sports-related Orofacial Injuries [homepage on the Internet]. Chicago (IL): American Academy of Pediatric Dentistry; c2002-2007. [cited 2007 Feb 2]. Available from: [http://www.aapd.org/media/Policies\\_Guidelines/P\\_Sports.pdf](http://www.aapd.org/media/Policies_Guidelines/P_Sports.pdf).
15. National Campaign [homepage on the Internet]. Boston (MA): National Youth Sports Safety Foundation; 1993. [cited 2007 Feb 25]. Available from: <http://www.nyssf.org/wframeset.html>.
16. Association of Orthodontists. Get Involved in National Facial Protection Month. *The Bulletin*. 2007. Jan/Feb;25(1): 8.
17. 2006 Football Rules Interpretations [homepage on the Internet]. Indianapolis (IN): The National Federation of State High School Associations; 2006. [cited 2007 Apr 1]. Available from: [http://www.nfhs.org/web/2006/09/2006\\_football\\_rules\\_interpretations.aspx](http://www.nfhs.org/web/2006/09/2006_football_rules_interpretations.aspx).
18. Ice Hockey Rules Differences [homepage on the Internet]. Colorado Springs (CO): The National Federation of State High School Associations; 2005. [cited 2007 Apr 1]. Available from: [http://www.nfhs.org/core/contentmanager/uploads/PDFs/IceHockey/Ice\\_Hockey\\_Rules\\_Differences.pdf](http://www.nfhs.org/core/contentmanager/uploads/PDFs/IceHockey/Ice_Hockey_Rules_Differences.pdf).
19. NFHS / NCAA Boys Lacrosse Rules Differences [homepage on the Internet]. Indianapolis (IN): The National Federation of State High School Associations; 2005. [cited 2007 Apr 1]. Available from: [http://www.nfhs.org/web/2005/01/nfhsncaa\\_boys\\_lacrosse\\_rules\\_di.aspx](http://www.nfhs.org/web/2005/01/nfhsncaa_boys_lacrosse_rules_di.aspx).
20. Massachusetts Dental Society. Mouthguards Help Athletes Avoid the School of Hard Knocks. *Word of Mouth*. 2006. Fall: 4.
21. Sports Medicine: 2006-2007 NCAA® Sports Medicine Handbook. (18thed). Klossner G. , editor. Indianapolis (IL): Publishername; 2006. 79-81- 86-87.
22. Frequently Asked Questions [homepage on the Internet]. Princeton (NJ): ECHL; 2008. [cited 2008 Aug 24]. Available from: <http://www.echl.com/faq.shtml>.
23. Section 3 - Protective Equipment, 9.5. ECHL Official Rules 2007-2008 [homepage on the Internet]. 12. Princeton (NJ): ECHL; 2007. [cited 2008 Aug 28]. Available from: [http://www.echl.com/upload\\_images/ECHLRuleBook.pdf](http://www.echl.com/upload_images/ECHLRuleBook.pdf).
24. Frequently Asked Questions [homepage on the Internet]. Springfield, MA: American Hockey League; 2007. [cited 2007 Jan 27]. Available from: <http://www.theahl.com/theahl/faqs/>.
25. AHL to mandate visors in 06-07 [homepage on the Internet]. Springfield (MA): American Hockey League; 2007. [cited 2007 Jan 28]. Available from: [http://theahl.com/news/league/index.html?article\\_id=6692](http://theahl.com/news/league/index.html?article_id=6692).
26. Section 3 - Protective Equipment, 9.5. American Hockey League Official Rules 2008-2009 [homepage on the Internet]. 16-19. Springfield (MA): American Hockey League; 2007. [cited 2008 Oct 30]. Available from: [http://theahl.com.ismmmedia.com/ISM3/std-content/repos/Top/Text%20Blocks/08-09\\_rules.pdf](http://theahl.com.ismmmedia.com/ISM3/std-content/repos/Top/Text%20Blocks/08-09_rules.pdf).
27. McGourty John J. NHL celebrates 90th anniversary today [homepage on the Internet]. 16. National Hockey League; 2007. [cited 2008 Aug 25]. Available from: <http://www.nhl.com/ice/news.htm?id=369827>.
28. 3 - Protective Equipment, 9.5. National Hockey League Official Rules 2007-2008 [homepage on the Internet]. 12. Chicago (IL): National Hockey League; 2007-2008. [cited 2008 Aug 24]. Available from: <http://www.nhl.com/ext/0708rules.pdf>.
29. Mandate and Mission [homepage on the Internet]. Ottawa (ON): Hockey Canada; 2008. [cited 2008 Aug 31]. Available from: <http://www.hockeycanada.ca/6/8/3/6/index1.shtml>.
30. Safety & Risk Management Overview [homepage on the Internet]. Ottawa (ON): Hockey Canada; 2008. [cited 2008 Aug 31]. Available from: <http://www.hockeycanada.ca/2/3/7/1/2/index1.shtml>.
31. Rule 3.6 - Protective Equipment [homepage on the Internet]. Ottawa (ON): Hockey Canada; pp.34-39. [cited 2008 Aug 31]. Available from: [http://www.hockeycanada.ca/index.cfm/ci\\_id/25542/la\\_id/1/document/1/re\\_id/0/file/rulebook.pdf](http://www.hockeycanada.ca/index.cfm/ci_id/25542/la_id/1/document/1/re_id/0/file/rulebook.pdf).
32. This is USA Hockey [homepage on the Internet]. Colorado Springs (CO): USA Hockey; 2001-2008. [cited 2008 Aug 26]. Available from: [http://www.usahockey.com/Template\\_Usahockey.aspx?NAV=AU&id=184132](http://www.usahockey.com/Template_Usahockey.aspx?NAV=AU&id=184132).
33. Equipment 304-c. USA Hockey: Official Rules of Hockey 2007-2009 [homepage on the Internet]. Colorado Springs (CO): USA Hockey; pp.22-23. 2007-2009. [cited 2008 Aug 24]. Available from: [http://www.usahockey.com/uploadedFiles/USAHockey/Menu\\_Officials/Menu\\_RulesEquipment/Rulebook%200709.pdf](http://www.usahockey.com/uploadedFiles/USAHockey/Menu_Officials/Menu_RulesEquipment/Rulebook%200709.pdf).
34. McCrory P. Do mouthguards prevent concussion?. *Br J Sports Med*. 2001. >;35: 81-82.
35. Knapik JJ, Marshall SW, Lee RB, Darakjy SS, Jones SB, Mitchener TA, delaCruz GG, Jones BH. Mouthguards in sport activities: history, physical properties and injury prevention effectiveness. *Sports Med*. 2007;37(2): 117-44.
36. de Wet FA, Heyns M, Pretorius J. Shock absorption potential of different mouth guard materials. *J Prosthet Dent*. 1999. Sep;82(3): 301-6.
37. Centers for Disease Control and Prevention. Promoting Oral Health: Interventions for Preventing Dental Caries, Oral and Pharyngeal Cancers, and Sports-Related Craniofacial Injuries. A Report on Recommendations of the Task Force on Community Preventive Services. *MMWR*. 2001. Nov30;50(RR21): 1-13.
38. Burt CW, Overpeck MD. Emergency visits for sports-related injuries. *Ann Emerg Med*. 2001. Mar;37(3): 301-8.
39. Stuart MJ, Smith AM, Malo-Ortiguera SA, Fischer TL, Larson DR. A Comparison of Facial Protection and the Incidence of Head, Neck and Facial Injuries in Junior 'A' Hockey Players: A Function of Individual Playing Time. *Am J Sports Med*. 2002. Jan;30: 39-44.
40. Flik K, Lyman S, Marx RG. American Collegiate Men's Ice Hockey: An Analysis of Injuries. *Am J Sports Med*. 2005. Feb;33: 183-7.

41. Lahti H, Sane J, Ylipaavalniemi P. Dental injuries in ice hockey games and training. *Med Sci Sports Exer.* 2002. Mar;34(3): 400-2.
42. Bemelmans P, Pfeiffer P. Incidence of dental, mouth, and jaw injuries and the efficacy of mouthguards in top ranking athletes. *Sportverletz Sportschaden.* 2000. Dec;14(4): 139-143.
43. Lieger O, von Arx T. Orofacial/cerebral injuries and the use of mouthguards by professional athletes in Switzerland. *Dent Traumatol.* 2006. Feb;22(1): 1-6.
44. Walker J, Jakobsen J, Brown S. Attitudes concerning mouthguard use in 7- to 8-year-old children. *ASDC J Dent Child.* 2002 . May-Aug;69(2): 207-11-126.
45. Miller MG, Garipey GS, Tittier JG, Berry DC. Attitudes of High School Ice Hockey Players Toward Mouthguard Usage. *The Internet Journal of Allied Health Sciences and Practice* [Internet]. 2006. [cited 2007 Jan 19]. 4 4 1-6. Available from: <http://ijahsp.nova.edu/articles/vol4num4/miller.pdf>.
46. Berry DC, Miller MG, Leow W. Attitudes of Central Collegiate Hockey Association ice hockey players toward athletic mouthguard usage. *J Public Health Dent.* year. Spring;65(2): 71-5.
47. Hawn KL, Visser MF, Sexton PJ. Enforcement of mouthguard use and athlete compliance in National Collegiate Athletic Association Men's Collegiate Ice Hockey Competition. *J Athl Train.* 2002. June;37(2): 2004-8.
48. Maestrello CL, Mourino AP, Farrington FH. Dentists' attitudes towards mouthguard protection. *Pediatr Dent.* 1999. Sep-Oct;21(6): 349-6.
49. Mouthguards protect more than your teeth [homepage on the Internet]. Ottawa (ON): Canadian Dental Hygienists Association; 2008. [cited 2008 Aug 31]. Available from: [http://www.cdha.ca/pdf/Educational\\_%20Resources\\_3.pdf](http://www.cdha.ca/pdf/Educational_%20Resources_3.pdf).
50. American Dental Association. For the Dental Patient... Protecting teeth with mouthguards. *J Am Dent Assoc.* 2006;137: 1772.