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Dental injuries in water polo, a survey of players in Switzerland

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Abstract – Water polo is a sporting activity which has a medium risk of causing dental trauma. Owing to the high speed, close body contact, and the combination of throwing and swimming that is inherent to the sport, the general injury potential is high. Using a standardized questionnaire for a total of 415 water polo players from Switzerland, this study examines the frequency of dental and facial injuries in water polo, athletes' habits regarding the wearing of mouthguards, and the general level of knowledge about emergency procedures following dental trauma. The participating players came from 6 divisions: Swiss national leagues A and B, first and second leagues, as well as the women's, and junior's league. The data were evaluated according to division and gender. Of the 415 interviewees, 185 (44.6%) had witnessed a dental injury in water polo. Eighty-seven (21.0%) players reported having suffered a tooth injury when playing water polo. Tooth fracture was the most stated dental injury [86 (16.4%)]. A similar number of tooth injuries were experienced by both male [355 (21.1%)] and female [60 (20.0%)] players. The interviewees over the age of 50 showed a higher incidence of tooth injuries than younger players (>50 years $=$ 41.7%). Slightly more than half of the interviewed players [228 (54.9%)] were aware of the possibility of replanting avulsed teeth. As few as 43 (10.4%) players were familiar with tooth rescue boxes. Only 32 (7.7%) water polo players wore a mouthguard; the most common reason for not wearing a mouthguard was that it was seen to be unnecessary [169 (40.7%)]. This survey highlights the potential for improvement in the level of knowledge about dental injury prevention in water polo. In addition to information and guidelines from the relevant sports' associations, and coaches, dentists could also play a role in the provision of this education.

Dental injuries occur frequently in sporting accidents. Those taking part in fast sports with close body contact are especially prone to orofacial injuries (1). Owing to the increasing popularity of high-risk sports, such as skate-boarding, inline-skating and mountain-biking, the risk of suffering orofacial injuries has increased over the past few years (2). Up to 35% of children and adolescents suffer from accidents involving permanent teeth (3). Owing to their exposed position (4), the upper front teeth and the upper jaw are most often affected. The most common dental sports injuries are crown fractures (5). Severe dental trauma requires expensive therapy and incurs substantial treatment costs (6).

Another study has shown that wearing a mouthguard leads to a significant reduction of tooth injuries (7); yet they are not widely accepted in many sports which involve close body contact. Mouthguards are criticized by athletes for causing breathing problems, impairing communication and creating irritating aesthetics (8). However, it has been shown that airway resistance is not significantly increased by a custom-made mouthguard (9). Consequently, increasing the awareness of custom-made mouthguards and improving their availability may result in increased acceptance amongst athletes. Custom-made mouthguards fit well and offer the best overall protection (10).

In numerous contact sports such as ice hockey, rugby, boxing and American football, mouthguards are part of the standard protective gear, whilst they are only occasionally worn in water polo.

According to the International Dental Federation, there are two risk categories for dental trauma: high-risk sports, such as American football, ice hockey, inline-skating, skate-boarding, lacrosse, rugby and mountain-biking; and medium-risk sports, such as basketball, soccer, team handball, squash, gymnastics and water polo (11). There is an injury risk in water polo because of the close body contact, high speed, and the combination of throwing and swimming (12, 13). Data about the risk of injury in water polo in Switzerland are presently not available.

Using a questionnaire as a component of interviews with water polo players from different divisions, the objective of this survey was to establish a representative set of data on the frequency of injuries, the habit of wearing a mouthguard and the general level of awareness about both emergency procedures following dental trauma and the consequences.

Materials and methods

Standardized interviews with 415 male and female athletes were conducted. The participating athletes played in six different Swiss divisions: national league A, national league B, first league, second league, juniors league and the women's league. In each division, interviews with more than 60 athletes were analysed and evaluated (Table 1). The interview contained 15 questions about general, facial and dental injuries experienced, tooth replantation, tooth rescue boxes and mouthguards (Table 2). This questionnaire has previously been used in similar studies (14–17). The clubs were selected from all over the German-speaking part of Switzerland and the players were chosen as they became available in training and matches. Each athlete was categorized according to the league they were currently playing in; female players were categorized in their own division (women's league). Each player was interviewed individually to minimize the influence of other players' opinions on an individual's responses. The age and division of each interviewee was recorded at the beginning of the interview.

Table 1. Segmentation of interviewed water polo players according to division

Division	No. of players	Average age (min.–max.)
National League A	67	33 (18–61)
National League B	74	28 (15–56)
League 1	85	35 (14–55)
League 2	67	37 (16–64)
Juniors	62	18 (13–24)
Women league	60	27 (15–48)
Total	415	30

Table 2. Questionnaire

No.	Question
1.	Have you ever suffered from a general injury?
2.	If yes, what kind of general injury (lip injury, nose injury, eye injury, finger- or arm-muscle injury, other)?
3.	Have you ever experienced a dental injury?
4.	If yes, what kind of dental injury (avulsion, crown fracture, dislocation)?
5.	Have you visited a dentist?
6.	If yes, within what period of time (immediately, the same day, after there was no recovery)?
7.	Have you ever observed a dental injury?
8.	Are you aware that an avulsed tooth has to be collected and taken with you?
9.	Are you aware that an avulsed tooth can be replanted?
10.	Have you heard of the tooth rescue kit?
11.	Do you wear other protectors besides the water cap and the plastic ear protectors (jock strap, safety goggles)?
12.	Have you heard of mouthguards?
13.	If yes, what kind (stock, custom-made)?
14.	Do you wear a mouthguard?
15.	If no, why not (aesthetics, breathing, communication, price, not necessary)?

The statistical evaluation considered the league, gender and age. By means of a general linear model, a variance analysis was carried out to determine significant relationships. All analyses were performed using R version 2.7.1 (18). The level of significance was set at $P \leq 0.05$.

Results

Of the 715 players invited to take part in this study, a total of 415 athletes of both genders from different Swiss water polo clubs were interviewed; this constitutes a response rate of 58%.

The average age of the interviewees was 29.6 years (14–63 years). One hundred and eighty-three (44.1%) players had already experienced a general injury, most commonly a muscle injury to the arm and fingers ($n = 103$), or a lip injury ($n = 72$). Eighty-seven (21.0%) players reported having suffered a tooth injury when playing water polo. Of the 87 (21.0%) players with a tooth injury, 58 (14.0%) had also suffered a general injury: Only 29 (7.0%) had suffered an isolated tooth injury. A total of 6 (1.4%) athletes had suffered an avulsion, 14 (3.4%) a dislocation and 68 (16.4%) had been diagnosed with a tooth fracture. A statistically significant difference in the frequency and type of tooth injuries between the divisions was not evident ($P = 0.232$). A similar number of tooth injuries were experienced by both male [355 (21.1%)] and female [60 (20.0%)] players. However, there were differences between the frequencies of tooth injuries in each age category: The interviewees over the age of 50 showed a correspondingly higher incidence of tooth injuries than younger players (frequency of injury >50 years $=$ 41.7% vs frequency of injury <50 years $=$ 21.6%, $P = 0.021$, Fig. 1).

No differences could be discerned in the answers to the question concerning the point in time at which a dentist was visited after an injury had occurred ($P = 0.198$), although only 16 (3.9%) players consulted a dentist directly following the trauma and 26 (6.3%) the same day.

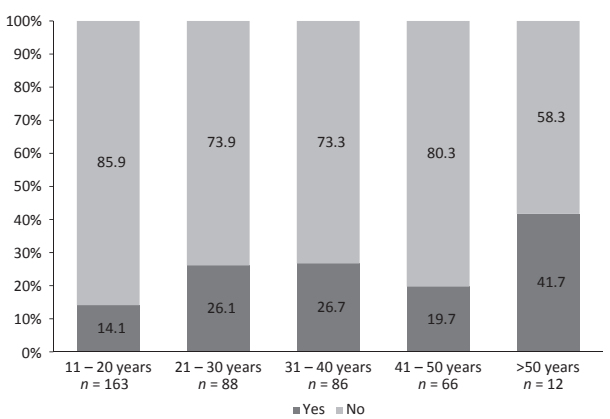

Fig. 1. Frequency of dental trauma in corresponding age category.

One hundred and eighty-five (44.6%) participants had witnessed a tooth injury to another water polo player in the course of their sporting activities. Two hundred and fifty-one participants (60.5%) knew that avulsed teeth should be collected, yet only 228 (54.9%) knew that replantation of avulsed teeth was possible. Only 43 (10.4%) interviewees knew about tooth rescue boxes such as Dentosafe® (Medice, Iserlohn, Germany), Curasafe® (Curaden International AG, Kriens, Switzerland) or SOS Zahnbox® (Miradent, Hager & Werker, GmbH & Co., Duisburg, Germany).

There was a statistically significant correlation between people who had suffered a tooth injury and an awareness of any of the tooth rescue boxes ($P = 0.027$). Of the 328 interviewees who had not experienced tooth trauma, only 28 (8.5%) were aware of tooth boxes compared to a higher level of awareness [15 (17.2%)] amongst the 87 athletes who had experienced tooth injury.

In addition to the obligatory protective measures, such as bathing caps and plastic ear protectors, 71 of those surveyed (17.1%) wore further protective material including jock straps ($n = 67$) and protective glasses ($n = 4$). Overall, 173 (41.7%) participants were aware of mouthguards, eighty-three (20.0%) were aware of standardized mouthguards and 106 (25.5%) were aware of custom-made mouthguards. However, only 32 (7.7%) of the interviewed players wore mouthguards. No statistically significant difference regarding the wearing of a mouthguard could be discerned between the different leagues ($P = 0.394$) or between the different age groups ($P = 0.156$).

The reasons given for not wearing a mouthguard are summarized in Fig. 2, with the most common being that they were seen to be unnecessary [169 (40.7%)]. No statistically significant difference could be discerned regarding: (i) tooth injury experienced and the justification for not wearing a mouthguard (aesthetics: $P = 0.588$, breathing: $P = 0.076$, speaking: $P = 0.183$, price: $P = 0.698$); or, (ii) the number of players who considered wearing a mouthguard to be unnecessary between those who had experienced a tooth injury and those who had not experienced tooth injury (5.2% and 38.9%, respectively, $P < 0.001$). Correspondingly, the level of mouthguard usage was not significantly different in these groups ($P = 0.172$).

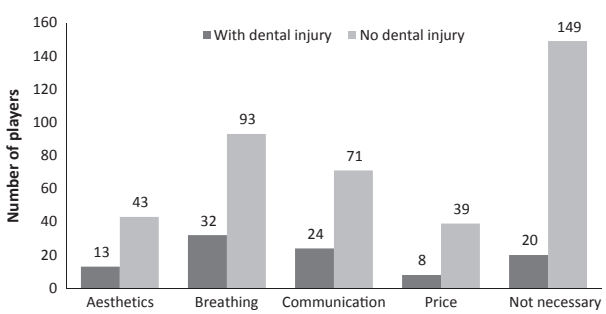

Fig. 2. Reasons for not wearing a mouthguard with or without self-experienced dental injury.

Discussion

This study involved water polo players who were active in the 2009/2010 season in Switzerland. The 58% response rate demonstrates that, at this time, the subject of dental trauma in water polo does not attract a large amount of attention. The study shows that 87 players (21.0%) had already experienced some form of tooth injury in water polo. A previous study, carried out with 60 players in Italy, reported a lower dental injury rate (13.3%) (13). To date, water polo has been classified as a medium-risk sport by the International Dental Federation (11). However, the incidence of dental trauma in the present study of one in five players is much higher than levels reported in high-risk sports such as inline-skating (9.2%) (14). The fact that the incidence of tooth injury in this study was highest in players over the age of 50 may reflect their increased exposure to the sport. Tooth fracture, cited by 68 athletes (16.4%), is the most common type of tooth injury. Tooth injuries were predominantly caused by hits from the hands, arms and elbows of opponents. A possible reason for the relatively high risk of tooth fracture is the combination of a high-speed ball, close body contact and the maintaining of the upper body above the water level which collectively result in large concussive forces. Tooth injuries usually have lifelong consequences. Although less frequent than tooth fracture, dislocation or avulsion can cause serious periodontal damage. More than half of those surveyed knew that avulsed teeth should be collected [251 (60.5%)] and in certain cases replanted [228 (54.9%)]. These findings are encouraging but suggest that nearly half of water polo players in Switzerland are poorly informed about emergency procedures following dental trauma. Similarly, there was a low level of awareness of the tooth rescue boxes amongst the players: Only 43 (10.4%) were aware of the existence of such a box. As reported in other studies, specialized storage media, such as those used in tooth rescue boxes, constitute an important component in the process of tooth rescue (19). These media contain mineral salts, amino acids, glucose and vitamins which can promote periodontal healing and contribute to an increased success rate of replantation. However, it is important to note that the success of periodontal healing following replantation of a tooth is dependent on the correct measures taken at the place of accident. The duration and condition of extraoral storage, the extent of damage to the periodontal ligament cells and the condition of the pulp are important factors. Furthermore, the status of the tooth apex, reflecting the age of the patient, will affect both the choice of treatment and the likelihood of subsequent problems. In adults with a closed apex, root canal treatment is indicated and the risk of an ankylosis 5 years after replantation of a tooth that was stored dry for >5 min is almost 75%, and 50% when wet physiologic storage media was used within 4 min. In contrast, the risk of these sequelae in young patients in whom an open apex tooth is replanted after 5–60 min of dry storage is $<50\%$ and around 25% when wet storage media was used within 4 min (20). By ensuring that tooth rescue boxes are available at water polo training facilities

and competitions, the prognosis for dental injuries in this sport may be improved.

Approximately two-fifths of those surveyed (41.7%) were aware of mouthguards. This compares poorly to similar surveys of squash, handball and basketball players which have shown a much higher level of awareness (~90%) (15–17).

According to the water polo safety guidelines, the wearing of a water polo cap with plastic ear protectors is obligatory. It is perhaps surprising that despite the relatively high level of dental injuries experienced by water polo players, only 32 (7.7%) participants reported wearing a mouthguard. Of the 492 reasons given for not wearing a mouthguard the most common were that it was unnecessary, and it conflicted with the tough image of the sport. Several studies show similar results with regard to the reasons given for not wearing a mouthguard (14–17). In other high-risk sports such as boxing, ice hockey, American football and rugby, wearing a mouthguard has become mandatory. Another study has reported a beneficial effect on the level of dental injury in sports such as rugby after making the wearing of mouthguards compulsory: Within 8 years, the self-reported rate of mouthguard usage increased from 67% to 93%, whilst the reported dental claims reduced by about 43% (21). As athletes report a higher level of comfort and a better fit than with standardized mouthguards, custom-made mouthguards are likely to become the tooth protector of choice (10).

Similar studies of other medium-risk sports like squash, team handball and basketball show an incidence of dental trauma ranging from 4.5% to 16.6% (15–17). Compared to these studies, this survey shows a relatively high occurrence of 21.0%. The high rate of dental trauma combined with the low level of mouthguard usage suggests that water polo players could benefit from an increased awareness of the benefits of mouthguards. Whilst this initiative should be led nationally or internationally by the water polo governing body, there is also an important role for dentists in providing this education. Based on the findings of this study and data from other sports, it is strongly recommended that the usage of a mouthguard be made compulsory for all water polo players.

Conflict of interest

There is no potential conflict of interest with any co-author taking part at this study related to the publication of this paper.

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