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Introduction

Every year, more than five million teeth are lost due to sports injuries (FRONTERA ET AL. 2011). A number of studies showed that facial injuries are six times more likely to occur in sports accidents than in work accidents and three times more likely than through exposure to violence or following traffic accidents (MUHTAROGULLARI ET AL. 2004).

Rule changes caused handball to develop into a much faster and high-impact sport over the past few years (RECKLING ET AL. 2003). Fast sports with close body contact are especially prone to orofacial trauma (CETINBAS ET AL. 2008). According to the Fédération Dentaire Internationale (FDI), handball belongs to the medium risk group, with 8.3 dental traumata/1,000 playing hours (FDI 1990).

Dental and General Trauma in Team Handball

A Survey of Professional Players and Coaches in Switzerland

KEYWORDS

dental trauma;
trauma;
handball;
orofacial injuries;
mouthguard

SUMMARY

Handball has developed into a much faster and high-impact sport over the past few years because of rule changes. Fast sports with close body contact are especially prone to orofacial trauma. Handball belongs to a category of sports with medium risk for dental trauma. Even so, there is only little literature on this subject. The aim of this study was to examine the prevalence and the type of injuries, especially the occurrence of orofacial trauma, habits of wearing mouthguards, as well as degree of familiarity with the tooth rescue box.

For this purpose, 77.1% (n=542/703) of all top athletes and coaches from the two highest Swiss leagues (National League A and National

League B), namely 507 professional players and 35 coaches, were personally interviewed using a standardized questionnaire.

19.7% (n=100/507) of the players experienced dental trauma in their handball careers, with 40.8% (n=51/125) crown fractures being the most frequent by far. In spite of the relatively high risk of lip or dental trauma, only 5.7% (n=29/507) of the players wear mouthguards.

The results of this study show that dental trauma is common among Swiss handball players. In spite of the high risk of dental trauma, the mouthguard as prevention is not adequately known, and correct procedure following dental trauma is rarely known at all.

Data on prevalence of dental trauma in Swiss handball has been collected in only one study so far (LANG ET AL. 2002). In this study, seven handball teams (total of 112 individuals) from two countries (Switzerland/Germany) belonging either to amateur or semiprofessional leagues were surveyed using interviews (LANG ET AL. 2002). 10 of 56 (17.9%) surveyed Swiss players had experienced dental trauma (LANG ET AL. 2002).

Tooth injuries may lead to esthetic, functional, and psychological problems, which often result in high costs (DUARTE-PEREIRA ET AL. 2008, YESIL DUYMUS ET AL. 2009). Due to their prominent position within the jaw, upper incisors are injured most often (ALTUN ET AL. 2009). The most common dental injury in sports is crown fracture (CETINBAS ET AL. 2008).

Tab. I Number of players and coaches

Playing position	Male		Female		Total
	National League A	National League B	National League A	National League B	
Wing	40	39	27	28	134
Back	45	44	31	27	147
Center	16	27	19	13	75
Pivot	20	30	16	12	78
Goalkeeper	19	24	15	15	73
Coach	10	10	8	7	35
Total	150	174	116	102	542

Tab. II Questionnaire

Question	Evaluated Responders
1. What type of injury have you sustained while playing handball? (concussion, contusion, pulled muscle, injuries to the eyes, fractures: which part of the body, ligaments: which part of the body) *	All players and coaches
2. Have you ever seen a dental injury in handball?	All players and coaches
3. If yes, what kind of dental injury? (avulsion, crown fracture, dislocation, lip injury) *	All players and coaches
4. Have you ever experienced a dental injury yourself in handball?	All players
5. If yes, what kind of dental injury? (avulsion, crown fracture, dislocation, lip injury) *	All players
6. In which league did you sustain dental trauma? (Junior League, National League A, National League B, National Team)	All players
7. Where would you store an avulsed tooth on the way to the dentist?	All players and coaches
8. Are you familiar with a tooth rescue box?	All players and coaches
9. Do you wear a mouthguard?	All players
10. If not, why? (communication, breathing, esthetic, others) *	Only field players, not goalkeepers
* several answers are possible	

A number of authors were able to show that use of a mouthguard reduces risk of orofacial injuries significantly (LANG ET AL. 2002, TULUNOGLU & OZBEK 2006). In spite of the high risk of dental trauma in handball, wearing of a mouthguard is neither mandatory nor popular among players (LANG ET AL. 2002).

With a standardized questionnaire, prevalence and type of injuries, especially orofacial injuries, habits of wearing mouthguards, as well as familiarity with the tooth rescue box were investigated in a population of professional players and coaches in Switzerland.

Materials and Methods

During the season of 2010/2011, the two highest Swiss leagues had 666 players and 37 coaches. Of those, 507 players and 35 coaches (77.1%) were interviewed individually for this study using a standardized questionnaire (Tab. I, Tab. II).

The interviews were conducted at the beginning or end of a training session. All attending players were interviewed. Besides the ten questions of the standardized questionnaire, data such as players' age, playing position (wing, center, back, pivot, and goalkeeper) and number of training sessions per week were collected. Similar questionnaires were used in other studies (LANG ET AL. 2002, PERUNSKI ET AL. 2005, PERSIC ET AL. 2006).

For some questions, only the players' answers were analyzed, not those of the coaches (Tab. II). Therefore, the rule changes

of the past few years have had no effect on the results. When asked about reasons for not wearing a mouthguard, only answers given by field players, and not by goalkeepers, were analyzed, because their style of play differs significantly.

The statistical evaluation differentiated between gender (male/female), league (National League A, National League B), and playing position (wing, center, back, pivot, and goalkeeper). For categorical parameters, a cross-classified table with the number of cases and their percentages was used. The corresponding P-Values were calculated using the Fisher's Exact Test, i.e. the Chi-squared Test. In terms of injuries, both sexes were compared using the Wilcoxon Rank Sum test.

The level of significance was $p < 0.05$. All analyses were done using "Statistical package R" (The R Foundation for Statistical Computing, version 2.12.2).

Results

507 players, 304 males and 203 females, with an average age of 22.79 years (15–42 years, SD 4.69) were interviewed. Average age of the 35 coaches was 41.17 years (22–62 years, SD 9.68).

Of the interviewed players, 100 (19.7%) experienced dental or oral injuries at one point while playing handball. Oral injuries were categorized as follows: a) lip injuries and b) dental and periodontal injuries, such as crown fracture, dislocation and avulsion.

Crown fracture was the most common injury (40.8%, n=51/125) (Fig. 1). The percentage of injuries was higher in males (21.7%) than in females (16.7%) during their handball career. Most injuries were experienced in junior league (40.2%). Pivots experienced the most injuries (24.4%, n=19/78), wing players (16.4%, n=22/134) and goalkeepers (16.4%, n=12/73) were the least injured (Fig. 2).

302 of the interviewed players and coaches witnessed dental trauma at one point during their handball career, with more males (60.1%, n=200/333) being affected than females (48.8%, n=102/209, p=0.013). Figure 1 shows the prevalence for each type of injury.

16.2% (n=88/542) stored an avulsed tooth in milk, and 15.3% (n=82/542) in a dry container.

Only 30 players (5.54%) were familiar with tooth rescue boxes, such as SOS Zahnbox (Miradent, Duisburg, Germany), Dento-safe® (Medice, Iserlohn, Germany), EMT Toothsaver (Gering, Nebraska, USA), and three interviewees (0.55%) actually used one.

29 (5.7%) players wore a mouthguard while playing handball, slightly more males (6.2%) than females (4.9%).

Reasons for not wearing a mouthguard are shown in Figure 3. Most players (70.0%, n=304/434) do not deem wearing of a mouthguard necessary. A noteworthy difference was shown in respect to esthetics as reason for not wearing a mouthguard. 19.1% (n=33/173) of females and only 12.3% (n=32/261) of males

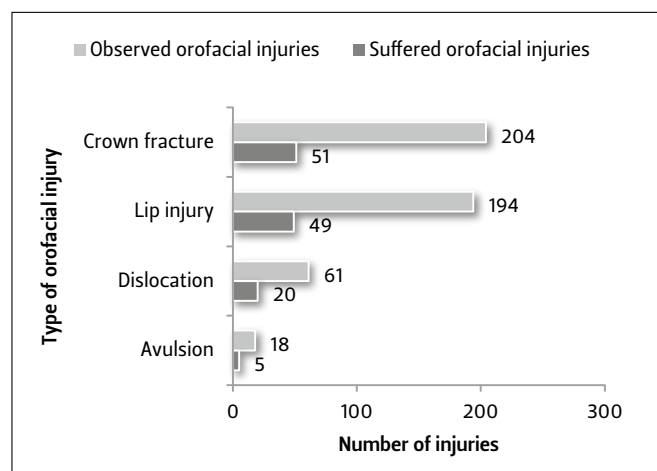


Fig. 1 Observed and suffered orofacial injuries.

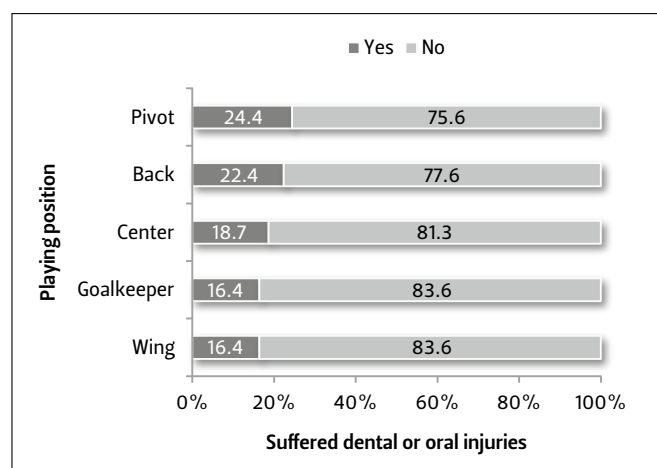


Fig. 2 Percentage of players having suffered dental or oral injuries according to playing position.

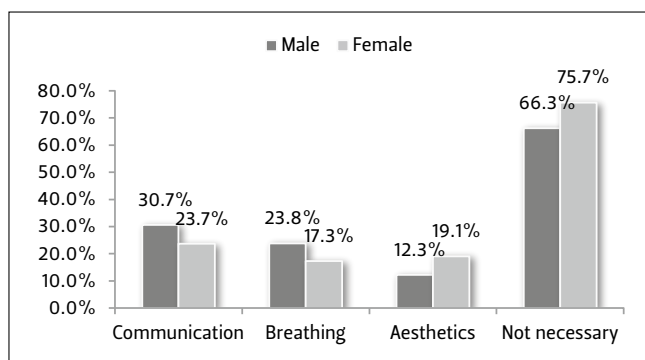


Fig. 3 Reasons for not wearing a mouthguard according to gender.

named esthetics as main reason for not wearing a mouthguard (p=0.055).

The answers to the question “What type of injury did you sustain while playing handball?” of all 542 players and coaches were analyzed. 52.4% of all injuries affected the lower extremities, 30.7% the upper extremities. Head injuries made up the remaining 16.9%.

146 (26.9%) interviewees had sustained a concussion, which makes this the most common head injury, and the third most common injury altogether. There was a significant difference between genders. Significantly more females (33.5%, n=70/209) sustained a concussion than males (22.8%, n=76/333, p=0.007).

On the contrary, significantly more males (7.8%, n=26/333) experienced injuries to the eyes than females (3.3%, n=7/209, p=0.042).

69.2% (n=375/542) of the interviewed professional players reported injuries to ankle ligaments, which makes this the most common injury in handball. Back players and wings (25.4%, n=59/232) are the positions most susceptible to this type of injury.

Knee ligaments are the second most commonly injured body part (27.1%, n=147/542), affecting more females (31.6%, n=66/209) than males (24.3%, n=81/333, p=0.074).

The most common injury to the upper extremities is hand fracture. 20.7% (n=112/542) of the interviewees did sustain such an injury.

3.7% (n=20/542) of interviewees sustained a leg fracture, whereas more males (5.7%, n=19/333) were affected than females (0.5%, n=1/209, p=0.001).

Discussion

The present study examined prevalence and type of injuries, especially orofacial injuries, in professional Swiss handball. Knowledge of first aid measures following tooth avulsion as well as of the tooth rescue box and prevention (use of mouthguard) were examined as well.

Although clinical trials are known to provide the best level of evidence, it is neither appropriate nor possible in this setting. Any trauma and especially a dental trauma is a dramatic experience that would be hard to forget. Our aim was therefore to investigate the prevalence using a standardized questionnaire with a large population of professional handballers. According to literature, between 2.5 (WEDDERKOPP ET AL. 1999) and 4.1 (YDE & NIELSEN 1990) injuries occur in handball per 1,000 playing hours. As stated in literature, injuries to the lower extremities (52.44%) (RECKLING ET AL. 2003) and injuries to ankle ligaments (69.2%) are the most common (HABELT ET AL. 2011). Similar injury

patterns are found in basketball players (HARMER 2005). This report shows that injuries to ankle ligaments, concussion, and hand fracture are most common in back players (25%, n=94/375) and wings (28.1%, n=103/275). During offensive plays, back players move boldly towards the opposing defense in order to create gaps for their teammates. One of the most important tasks of wings is a fast counterblast – one of the fastest situations in handball. For this, the player must pay attention to his travel path, the ball, as well as his opponent, in order to prevent a collision with the goalkeeper (LINDNER ET AL. 2012). In higher leagues, exceptionally quick and bouncy players are found in these positions. Players on both positions often perform jump-throws. Jump-throws are throwing techniques in which ankles are injured very often (LINDNER ET AL. 2012).

According to the FDI (Fédération Dentaire Internationale), handball has a medium risk of dental trauma (FDI 1990). Lang et al. found that 17.9% (n=10/56) of interviewed amateur and semi-professional Swiss handball players experienced dental trauma (LANG ET AL. 2002). 19.7% (n=100/507) of the players in the present study sustained orofacial trauma, and 55.7% (n=302/542) were witness to trauma injuries during a handball game. This high prevalence may be explained by the inclusion of dental and periodontal tissues as well as lips, when evaluating dental trauma.

As mentioned, recent rule changes have led to handball becoming a much faster sport. One such change is the “quick center”. The purpose of this rule change in 2001 was to make handball faster and more attractive. This rule change allows a direct counterattack after a goal is scored, even if all opposition players haven't reached their half (IHF, Rules of the game, 2010, rule 10:3). In the study by Lang et al. (LANG ET AL. 2002), it can be assumed that the players were interviewed in the season 2001/2002 when the new rule was introduced, therefore the prevalence of dental trauma was similar to this study.

The result is comparable to similar studies on dental trauma in other sports, such as waterball (21.0%), basketball (16.6%), inline skating (9.2%), mountain biking (5.7%), and squash (4.5%) (LANG ET AL. 2002, RECKLING ET AL. 2003, FASCIGLIONE ET AL. 2007, MÜLLER ET AL. 2008).

Most players (40.2%) sustained dental trauma in Junior League. Possibly, younger players lack one-on-one experience and have less coordination skills. Therefore, prevention of dental trauma and knowledge of correct first aid procedure is very important for Junior League players and their coaches in order to prevent lifelong consequences.

Pivots sustained the most dental trauma (24.4%). Players in this position stand in an offensive play with their backs to the opposing goalkeeper, keeping intense body contact with the opposing players in order to create gaps for their teammates. Most dental injuries were crown fractures (40.8%, n=51/125). The high prevalence can be explained by the specific injury pattern. In handball, tooth injuries are caused by blows to the face by hands or elbows, or by collisions with other players, due to the fast and physical type of play (SANE & YLIPAVALNIEMI 1988, SANE 1988). This type of injury also occurs when the ball hits the face. The force of an impact of such intensity can lead directly to trauma and crown fracture (BENNETT 1964, ANDREASEN 1970).

It has been shown that wear of a mouthguard decreases orofacial injuries significantly (YDE & NIELSEN 1990, LANG ET AL. 2002). Despite the high risk of dental trauma, only 5.7% (n=29/507) wear a mouthguard. Most players deem mouthguards unnecessary (70.0%, n=304/434). Other reasons for not wearing a mouthguard were esthetics (19.1%, n=65/434), communication

(27.9%, n=121/434), and interference with breathing (21.2%, n=92/434). Whilst the first two reasons are solely subjective perceptions, it has been shown that wearing a customized, dentist-fitted mouthguard does not affect performance and interferes only slightly with breathing (AMIS ET AL. 2000). Similar reasons for not wearing a mouthguard were stated in other studies (AMIS ET AL. 2000, LANG ET AL. 2002, RECKLING ET AL. 2003). Although wearing of a mouthguard is not mandatory in handball, the latter belongs to one of 29 types of sports for which the “American Dental Association” does recommend it (AMERICAN DENTAL ASSOCIATION 2004).

Only 30 (5.54%) of the 542 interviewees are familiar with tooth rescue boxes. Similar results were found in a study of field hockey players in Switzerland (6.5%) (MAXÉN ET AL. 2011).

Upon avulsion of a permanent tooth, the best therapy is immediate replantation. The tooth should only be handled by touching the crown, and, if contaminated, should only be rinsed quickly. Then the tooth is replanted and held in place by the patient by biting on a tissue (ANDRESON ET AL. 2012). It has been shown that more than 80% of interviewed laypersons would not replant an avulsed tooth (HAMILTON ET AL. 1997). In such cases, a tooth rescue box is needed in order to secure survival for the cells of an avulsed tooth up to 48 hours (POHL ET AL. 2005). These boxes are available in most pharmacies without prescription (MERZ ET AL. 2011).

In case of crown fracture, the fragment can be reattached without treating the pulp, as long as the pulp is not exposed (DIANGELIS ET AL. 2012). The fragment should be stored in a humid environment until reattachment by a dentist. If the fracture involves exposure of the pulp, the choice is pulp capping or partial pulpotomy for young patients with completely formed or immature teeth (DIANGELIS ET AL. 2012). In case of patients with mature apical development, the alternative is usually root canal treatment (DIANGELIS ET AL. 2012).

The results of the present study show that although most injuries in handball occur to the lower extremities, the risk of orofacial trauma is also high. Despite these results, mouthguards are not considered important, and the degree of familiarity with the tooth rescue box is low. Education of players, coaches, and medical attendants in Swiss handball seems important and necessary, especially in Junior League, in order to reduce lifelong consequences and costs of dental trauma. Dentists play an important role: they should ask young patients about their hobbies and sport activities and counsel them about the importance of a mouthguard.

Résumé

Le handball est devenu un sport encore plus rapide et plus puissant au cours de ces dernières années en raison de quelques changements de règles. Les sports rapides avec des contacts corporels étroits sont particulièrement exposés aux blessures orofaciales. Le handball fait partie des sports présentant un risque d'accident dentaire moyen. Néanmoins, il n'y a pas beaucoup de littérature à ce sujet. L'objectif de cette étude était d'examiner le type et la fréquence des blessures, en particulier des blessures orofaciales, les habitudes au niveau de l'utilisation des protège-dents et la notoriété de la boîte de sauvetage pour les dents.

Pour cela, 77,1% (n=542/703) de tous les sportifs d'élite des deux plus hautes ligues nationales suisses (Ligue nationale A et Ligue nationale B), à savoir 507 joueurs professionnels et 35 entraîneurs, ont été interrogés à l'aide d'un questionnaire standardisé.

Pendant leur carrière de handball, 19,7% (n=100/507) des joueurs ont subi un traumatisme dentaire. Avec 40,8% (n=51/125), les fractures coronaires étaient de loin les plus fréquentes. Bien que le risque de se blesser les lèvres et les dents soit relativement élevé, seuls 5,7% (n=29/507) des joueurs portent un protège-dents.

Les résultats de cette étude montrent que les accidents dentaires sont assez fréquents chez les handballeurs suisses. Malgré un grand risque de subir un accident, le protège-dents n'est pas suffisamment reconnu comme un moyen de prévention important et les mesures à prendre après un traumatisme ne sont que peu connues aussi.

Zusammenfassung

Handball hat sich aufgrund einiger Regeländerungen in den letzten Jahren zu einem noch schnelleren und kraftvolleren Spiel entwickelt. Schnelle Sportarten mit engem Körperkontakt bergen ein besonders hohes Risiko für orofaziale Verletzungen. Handball gehört zu den Sportarten mit mittlerem Risiko, einen Zahnunfall zu erleiden. Dennoch gibt es nur wenig Literatur zu dieser Thematik.

Das Ziel dieser Studie war es, die Art und Häufigkeit der Verletzungen, insbesondere der orofazialen Verletzungen, die Gewohnheiten betreffend Zahnschutzverwendung sowie den Bekanntheitsgrad der Zahnrettungsbox zu untersuchen.

Dazu wurden 77,1% (n=542/703) aller Spitzensportler und Trainer aus den zwei höchsten Schweizer Nationalligen (Nationalliga A und Nationalliga B), nämlich 507 Profispieler und 35 Trainer, persönlich mithilfe eines standardisierten Fragebogens befragt.

19,7% (n=100/507) der Spieler haben während ihrer Handballkarriere eine Zahnverletzung erlitten. Dabei kam es in 40,8% (n=51/125), und damit mit Abstand am häufigsten, zu einer Kronenfraktur. Trotz dieses relativ hohen Risikos, sich Lippen und Zähne zu verletzen, tragen nur 5,7% (n=29/507) der Spieler einen Zahnschutz.

Die Resultate dieser Studie haben gezeigt, dass Zahnunfälle bei den Schweizer Handballspielern weit verbreitet sind. Trotz des hohen Risikos, einen Zahnunfall zu erleiden, ist der Zahnschutz als wichtiges Präventionsmittel nicht genügend anerkannt und sind die korrekten Massnahmen nach einem Unfall nur wenig bekannt.

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