Dental Traumatology 2005; 21: 76–79

DENTAL TRAUMATOLOGY

Dental trauma incidence and mouthguard use in elite athletes in Turkey

Keçeci AD, Eroğlu E, Baydar ML. Dental trauma incidence and mouthguard use in elite athletes in Turkey. Dent Traumatology 2005; 21: 76–79. © Blackwell Munksgaard, 2005.

Abstract – Contact sports may lead to dental trauma, which often can be reduced with appropriate preventive measures. While numerous studies exist on this topic for several countries throughout the world, there is a lack of comprehensive descriptive studies in Turkey. The purpose of this study was to investigate the incidence and type of dental injuries associated with three different sports among Turkish elite athletes, who do not contact (volleyball), contact directly (taekwondo) or indirectly (handball) with competition rivals. Additionally, awareness and use of mouthguards were also compared. Thus, during the 2003 and 2004 Turkish National Championships in three sports, 50 taekwondo, 62 handball and 50 volleyball male athletes were interviewed by questionnaire. Results showed that taekwondo and handball athletes experienced significantly more dental trauma than volleyball athletes ($P < 0.05$). Twelve of the taekwondo (24%), 16 of the handball (26%) and four of the volleyball athletes (8%) experienced at least one type of dental injury. Awareness of mouthguards as a preventive measure against dental trauma was significantly higher among taekwondo and handball athletes ($P < 0.05$), although a very small percentage in either of these sports actually wore a mouthguard (10 and 0%, respectively). Trauma incidence between direct contact with rival competitors and indirect contact with rival competitors was not significantly different. The incidence of dental trauma in contact sports shows that the awareness and use of mouthguards must be intensified. Mouthguard use should be made compulsory, especially in those sports with high risk for dental trauma.

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Key words: sports trauma; dental injury; elite athletes; taekwondo; handball; volleyball

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Accepted 26 May, 2004

Dental trauma especially in children and young adults, has been reported from several countries as well as Turkey with high rates between 11 and 60% (1–4). A large number of these injuries can cause irreparable dental loss or even if treated, root resorption or ankylosis could occur (5).

Epidemiological studies have reported sports activities as one of the main etiological factors for the dental trauma (6–8). A blow or kick from another player most often causes injury to one tooth, while a fall or blow from a hard object often results in injuring more than one tooth (9). The incidence varies according to the type of sport, being even higher compared with the global population (6, 10). Furthermore, the highest risk of dental trauma appears to occur to professional athletes (11, 12). An almost universal finding is that the majority of injuries affect the upper jaw, with the maxillary incisors being most prone to injury, often accounting for as many as 80% of all cases (13, 14). Maxillofacial injuries do not occur only during competition. Up to 25–30% of these accidents occur during training sessions (15).

Contact sports are defined as those sports in which players physically interact with each other, trying to prevent the opposing team or person from winning (16). In most of the studies, types of the contact were not categorized and the frequency of activity was not standardized (4, 17, 18). The intensity and frequency of the contact during competitions can be the main determinants of dental injury. Consequently, the type of contact can be classified as direct contact with rival competitors (taekwondo, jui-jitsu, kickbox, boxing etc), indirect contact with rival competitors (handball, basketball, football, soccer, ice-hockey etc) and no contact with rival competitors (volleyball, badmington, etc) during the activity. Therefore, handball, taekwondo and volleyball were the sports selected in this study.

Mouthguards have been determined to be the most effective way of preventing dental injuries (19, 20). Three types of mouthguards are available: (i) stock mouthguards, which are prefabricated in different sizes; (ii) boil and bite mouthguards made from a thermoplastic material, and immersed in hot water and formed in the mouth of the athlete; (iii) custom made mouthguards made by dentists on a model of the patient's mouth (21, 22).

The purpose of this study was to investigate and compare the incidence and type of dental injuries in three sports among Turkish elite athletes. Additionally, awareness and use of mouthguard were also compared.

Materials and methods

Elite athletes of men's national and/or first league teams in three sports in Turkey were selected for this study. They were divided into three groups as follows:

Group 1:
Taekwondo athletes (direct contact with rival, $n = 50$)

Group 2:
Handball athletes (indirect contact with rival, $n = 62$)

Group 3:
Volleyball athletes (no contact with rival $n = 50$) (n, the number of athletes per group).

A questionnaire was answered directly by each athlete that participated voluntarily in this study. The dental trauma incidence was determined in relation to the criteria of the sport type, whether the athlete experienced dental injury, type of dental injury, awareness of mouthguards, and use of mouthguards (Table 1).

The study included a total number of 162 athletes, whose average age was 24.36 years (5.34 SD), practiced related sport modality for 11.93 years (4.86 SD), and trained at least 10 h week^{-1}.

Table 1. Questionnaire form

- Age:
- What is your sports modality?
- How long have you been practicing this sport activity?
- Have you ever experienced a dental injury during trainings or competitions?
- If yes, what kind of dental injury? (crown fracture, dislocation, avulsion)
- Are you aware of mouthguards as preventive measure against dental trauma?
- Which types of mouthguard do you know [(i) stock, (ii) boil and bite and (iii) custom made)?
- Do you use mouthguard during trainings and competitions?
- If not, why?

The three groups were compared for each criterion using chi-square analyses in SPSS 10.0. (SPSS Inc., Chicago, IL, USA). The level of significance was set at $P < 0.05$.

Results

Taekwondo and handball athletes experienced significantly more trauma than volleyball athletes ($P < 0.05$). No significant difference was found between handball and taekwondo players (Table 2). In all groups, crown fracture was the most frequently seen injury type, followed by dislocation and avulsion ($P < 0.05$) (Table 3).

Awareness of mouthguards among taekwondo and handball players' were significantly higher than

Table 2. Experienced trauma incidence of three groups

Sports modality (number of athletes)	Experienced trauma [n (%)]
Taekwondo (50)	12 (24)*
Handball (62)	16 (25.81)*
Volleyball (50)	4 (8)

*Significant difference with volleyball, $P < 0.05$.

Table 3. Distribution of dental trauma according to type of injury, and to type of the sport

Type of dental injury	Sport type	n (%)
Crown fracture	Taekwondo	10 (20)
	Handball	10 (16.12)
	Volleyball	4 (8)
Dislocation	Taekwondo	1 (2)
	Handball	4 (6.45)
	Volleyball	0
Avulsion	Taekwondo	1 (2)
	Handball	2 (3.22)
	Volleyball	0
Total trauma	Taekwondo	12 (24)
	Handball	16 (25.80)
	Volleyball	4 (8)

volleyball players ($P < 0.05$) (Table 4). The athletes (44.12%) were aware of mouthguard types, but only of two types (stock and boil-and bite). None of the athletes was aware of custom mouthguards, made by the dentist for individual use. There was no statistical difference among the groups in terms of mouthguard users (Table 4). Awareness of different types of mouthguards in taekwondo athletes was significantly more than that of volleyball athletes' ($P < 0.05$) (Table 5).

Discussion

There is a lack of research on sports-related dental trauma from Turkey in the literature. Therefore, taking into consideration the goals of the International Academy for Sports Dentistry (IASD), we initially aimed to evaluate the status of elite athletes in Turkey in terms of dental trauma incidence and preventive measures (23). The reason why we chose taekwondo (direct contact with the rival), handball (indirect contact with the rival), and volleyball (no contact with the rival) was our curiosity about the effect of contact type on dental trauma. We assumed that 'direct contact' would increase the incidence of the injuries. These sports (taekwondo, handball and volleyball) are also the sports that have more licensed athletes when compared with the other contact sports in Turkey. So, they represent a large majority of the athletes. We especially studied the elite athletes that were training more than 10 h week^{-1} over the last 4 years. We thought that these athletes were 'role models' for amateur athletes, in that they would be encouraging in terms of prevention.

Lang et al. (17) reported an injury incidence of 10.71% in handball players. Their study group consisted of both women and men, who were playing in semiprofessional and amateur leagues so, the results were different from our study. However, in another study surveyed by Ferrari and Medeiros (4), the injury incidence of handball players was found to be 37.1%. There was no descriptive information about the categories of the athletes in that study. We assume that these differences can originate from the lack of standardization in such studies.

No report of dental injury incidence in taekwondo athletes was found in the literature. Only one study reported dental injury incidence of martial arts as 32.1% (4). Results from the present study of experienced dental injuries in volleyball players are statistically less than taekwondo and handball ($P < 0.05$). As expected, this result nearly made volleyball a control group compared with handball and taekwondo. Number of injuries experienced by elite taekwondo and handball athletes showed no statistical difference.

In volleyball, the net that separates the game field into two, also may prevent the rival players from contacting each other. But in handball, the game rules enable the players to contact and interfere each other to gain the ball, to score goal or to defend. So it can be assumed that the interaction between the rival players in the 'direct contact sports' may result in more dental trauma and injuries similar to those in the 'indirect contact' sports. Our expectations were not borne out. However, contact type can determine the intensity of trauma, which needs further investigation. Consequently, while the Olympic committee classified the martial arts among high-risk sports, handball and volleyball were among moderate risk group (24). This can be modified in terms of dental trauma risk, because our results showed that taekwondo and handball had similarly a high risk of dental trauma.

The majority of the athletes (74.69%) were aware of mouthguards as a protective device (90% Taekwondo, 77.42% Handball, 56% Volleyball). Ferrari and Medeiros (4) reported awareness rates of 71.9% for martial arts and 51% for handball respectively. The significant difference between volleyball and the other two groups can be explained by the low risk of overall trauma.

The athletes (44.12%) were aware of mouthguard types, but this awareness was limited to stock and boil-and bite types. None of the athletes was aware of custom mouthguards, made by the dentist for individual use.

Only seven of 162 players were using mouthguards (4.32%). Limited studies reported the mouthguard use of handball players as 18.69% in Switzerland, 4.25% in Germany, 4% in Brazil and

Table 4. Distribution of awareness and use of mouthguards

Sports modality (number of athletes)	Awareness of mouthguards [*n* (%)]	Use of mouthguards [*n* (%)]			
		Type I	Type II	Type III	Total
Taekwondo (50)	45 (90)*	0	5 (10)	0	5 (10)
Handball (62)	48 (77.42)*	0	0	0	0
Volleyball (50)	28 (56)	0	2 (4)	0	2 (4)

*Significant difference with volleyball, $P < 0.05$.

Table 5. Awareness of types of mouthguards

Sports modality (number of athletes)	Awareness of types of mouthguards [*n* (%)]			
	Type I	Type II	Type III	Total
Taekwondo (50)	3 (6)	7 (14)	0	10 (20)
Handball (62)	4 (6.45)	6 (9.67)	0	10 (16.12)
Volleyball (50)	2 (4)	2 (4)	0	4 (8)

1.6% in Israel (4, 17, 18). Interestingly, none of the handball players was a mouthguard user although 77.42% of them stated their awareness. This implies that there is much to do in Turkey to overcome this problem. Mouthguard users were unsatisfied with their improper retention of the type II. Previous studies support this experience, in which the types I and II are called as 'poor' or 'ill fitting' mouthguards. It is reported that they increase the chance of injuries, such as concussion, may be life-threatening and life-debilitating injury (25, 26). It is clear that custom-made mouthguards prove to offer better protection than the 'boil-and-bite' type (21).

The importance of public health education to increase the awareness of protective measures is an important matter in sports dentistry (17, 18, 22).

Conclusion

1 All types of the contacts with rival led to dental trauma. Taekwondo and handball athletes experienced significantly more injuries than volleyball athletes.

2 The incidence of dental injuries in contact sports points out the importance of the problem. Mouthguard use should be encouraged and/or mandated to prevent injuries.

3 Results show that elite Turkish athletes are aware of mouth protective devices. In spite of this fact, they do not use them. So, awareness of mouthguards does not mean that they will be used.

4 It should be a combined mission of parents, dentists, sports physicians and coaches to encourage the use of mouthguards in contact sports.

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