# Oral trauma, mouthguard awareness, and use in two contact sports in Turkey

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Abstract – The purpose of the present study was to evaluate the occurrence of dental hard and soft tissue injuries during participation in contact sports, and the awareness and use of mouthguards in a young adult sample of semi-professional or amateur boxers and tae kwon do participants in Turkey. The samples consisted of 274 young adults [174 male (63.5%) and 100 female (36.5%)] aged between 17 and 27 years of which 185 (67.5%) were tae kwon do practitioners, and 89 (32.5%) were boxers. The participants answered a standard questionnaire. All answers were evaluated and then statistical analyses were performed. Of the total sample, 61 of the subjects (22.3%) suffered dental trauma. Of these sufferers, 32 (17.3%) were boxers and 29 (32.6%) were tae kwon do practitioners. It was found that 19 (6.9%) athletes lost their teeth post-trauma. Of the 54 subjects (19.7%) suffering soft tissue injuries, 44 were female (81.5%), while only 10 were male (18.5%), of which 40 (74.1%) were tae kwon do practitioners and 14 (25.9%) were boxers. Of the total sample of 274 subjects, 228 (83.2%) were well informed about mouthguard usage. Of the total sample, 153 (55.8%) of the subjects used mouthguards, all of which were boil-and-bite type. The results of our study indicate that dentists and sports authorities in Turkey should promote the use of mouthguards in contact sports such as tae kwon do and boxing, which have a serious risk for dental and oral soft tissue trauma and tooth loss.

Sport activities often increase the risk of traumatic injuries to dental and oral tissues. These injuries are reported to be most prominent in soccer, basketball, hockey, and boxing (1-3). In contrast to some sports, rotational torque as well as repeated direct impact forces to the head are hypothesized mechanisms of head injury in boxing. Boxing poses a high risk for severe focal and diffuse neurologic injuries, intracranial hemorrhage, cerebral edema, and diffuse axonal injury (4).

Recent reports mentioned that participation in a number of sports does carry a considerable risk of dental injury, not only in contact sports such as rugby and hockey, but also in less dangerous sports such as basketball. There have also been attempts to extend the use of mouthguards in many other sports (3, 5).

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The importance of using mouth protectors has been widely accepted. Injuries, including dental and orofacial soft tissue injuries, as well as jaw fractures have been dramatically reduced by the use of these devices (6).

The purpose of the present study was to evaluate the occurrence of oral and dental injuries during the practice of contact sports, and to determine the awareness and use of mouthguards in a young adult sample of semi-professional or amateur boxers and tae kwon do participants in Turkey.

# **Material and methods**

The sample consisted of 274 boxers and tae kwon do participants in Turkey between 17 and 27 years of age. All participants were using boil-and-bite mouthguards. The study sample was of a random convenience sample from different parts of the country. The sample had no common background regarding place of birth, education, hobbies, or sport activities in the past. The survey was based on a previously described standard questionnaire (3). The names of the participants who answered the questionnaire were not recorded on the questionnaire to ensure anonymity. All answers were evaluated and statistical analysis was performed using a standard statistical software package (SPSS for Windows, version 10.0; SPSS Inc., Chicago, IL, USA).

### Results

The study sample of 274 young adults [174 male (63.5%) and 100 female (36.5%)] aged 17–27 years consisted of amateur martial artists and boxers. Of the subjects, 185 (67.5%) were tae kwon do practitioners, while 89 (32.5%) were boxers. Of the 274 participants, 29 (10.6%) were professional and 245 (89.4%) were amateur athletes and 200 of these athletes (73.0%) were affiliated with various sports organizations.

Of the 274 subjects, 61 (22.3%) reported having sustained dental trauma. Of these 61 subjects, 32 (17.3%) were boxers and 29 (32.6%) were tae kwon do practitioners. Further, 19 (6.9%) athletes lost teeth post-trauma, of which 16 (84.2%) were tae kwon do practitioners and 3 (15.8%) were boxers.

The average age for exposure to dental trauma was 16.65 years (16.77 in males, 16.16 in females). These athletes were most prone to dental trauma at 16 and 18 years of age (Fig. 1).

Of the 54 subjects (19.7%) suffering soft tissue laceration and injury 44 were female (81.5%), while only 10 were male (18.5%). Of these, 40 (74.1%) participated in tae kwon do practitioners, and 14 (25.9%) were boxers (Tables 1 and 2).



*Fig. 1.* The frequencies of dental and soft tissue trauma by age groups.

Table 1. Crosstabulation between experience of dental trauma, type of sports activity, and mouthguard awareness

Dental trauma	Mouthguard awareness		
	Yes	No	Total
Yes			
Type of sport			
Tae kwon do			
Count	29	3	32
% within type of sport	90.6	9.4	100.0
% within mouthguard awareness	50.0	100.0	52.5
Boxing			
Count	29	0	29
% within type of sport	100.0	0	100.0
% within mouthguard awareness	50.0	0	47.5
Total			
Count	58	3	61
% within type of sport	95.1	4.9	100.0
% within mouthguard awareness	100.0	100.0	100.0
No			
Type of sport			
Tae kwon do			
Count	110	43	153
% within type of sport	71.9	28.1	100.0
% within mouthguard awareness	64.7	100.0	71.8
Boxing		•	
Count	60	0	60
% within type of sport	100.0	0	100.0
% within mouthguard awareness	35.3	0	28.2
lotal	170	40	010
Count	1/0	43	213
% within type of sport	/9.8	20.2	100.0
% within mouthguard awareness	100.0	100.0	100.0

Of the 274 subjects, 228 (83.2%) were well informed about mouthguard usage, out of which 139 were tae kwon do participants, while 89 (100%) were boxers.

Of the 153 (55.8%) subjects who used mouthguards, 104 were male (68.0%) and 49 were female (32.0%); 66 (35.7%) tae kwon do practitioners and 87 (97.8%) boxers used mouthguards (Tables 3 and 4).

Statistical evaluation with Fisher's exact test and chi-squared test revealed that the difference between patients with and without a dental trauma experience was statistically significant for mouthguard awareness (P = 0.002), and for mouthguard use (P = 0.000). The difference between patients with and without a facial trauma experience was statistically significant for mouthguard awareness (P = 0.007) and for mouthguard use (P = 0.025) (Tables 1–4).

## Discussion

The aim of the present survey was to evaluate the awareness and use of mouthguard in tae kwon do and boxing, and to identify the occurrence of dental trauma, tooth loss and soft tissue injuries among young boxers and tae kwon do participants in

# Tulunoglu & Özbek

Table 2. Crosstabulation between experience of soft tissue trauma, type of sports activity, and mouthguard awareness

Table 3. Crosstabulation between experience of dental trauma, type of sports activity, and mouthguard use

Soft tissue trauma	Mouthguard awareness		
	Yes	No	Total
Yes			<u> </u>
Type of sport			
Tae kwon do			
Count	37	3	40
% within type of sport	92.5	7.5	100.0
% within mouthguard awareness	72.5	100.0	74.1
Boxing			
Count	14	0	14
% within type of sport	100.0	0	100.0
% within mouthguard awareness	27.5	0	25.9
Total			
Count	51	3	54
% within type of sport	94.4	5.6	100.0
% within mouthguard awareness	100.0	100.0	100.0
No			
Type of sport			
Tae kwon do			
Count	102	43	145
% within type of sport	70.3	29.7	100.0
% within mouthguard awareness	57.6	100.0	65.9
Boxing			
Count	75	0	75
% within type of sport	100.0	0	100.0
% within mouthguard awareness	42.4	0	34.1
Total			
Count	177	43	220
% within type of sport	80.5	19.5	100.0
% within mouthguard awareness	100.0	100.0	100.0

Turkey. The general rate of occurrence of oral and dental trauma in the present survey was 22.3%. This is in accordance with the study of Ferrari & Ferreria de Medeiros (2), who showed rates of 28.8%, and with Levin et al. (3) who showed rates of 27% for dental trauma during sport participation, and with Holmes (7) who reported the risk of injury during sport activity in Scotland. Similarly, Rodd & Chesham (8) reported that in 14–15 year olds, 26% of the oral injuries were as a result of participation in sports.

The number of injuries increased with age, probably as a result of the increased frequency of sports participation at advanced ages. A higher rate of soft tissue laceration than dental injury was found at all ages. The risk of trauma to the lower or middle part of the face increased for the oldest participants. It also increased with the number of yearly competitions and number of hours of weekly training (9).

In our study most of the participants (n = 228, 83.2%) knew the importance of using mouthguards. Ranalli (10, 11) suggested that the only professional sport that requires a mouthguard is boxing. In this study, especially, all boxers (n = 89, 100%) were aware and were giving importance to using mouthguard, but tae kwon do practitioners' awareness of

	Mouthguard use		
Dental trauma	Yes	No	Total
Yes			
Type of sport			
Tae kwon do			
Count	17	15	32
% within type of sport	53.1	46.9	100.0
% within mouthguard use	37.0	100.0	52.5
Boxing			
Count	29	0	29
% within type of sport	100.0	0	100.0
% within mouthguard use	63.0	0	47.5
Total			
Count	46	15	61
% within type of sport	75.4	24.6	100.0
% within mouthquard use	100.0	100.0	100.0
No			
Type of sport			
Tae kwon do			
Count	49	104	153
% within type of sport	32.0	68.0	100.0
% within mouthquard use	45.8	98.1	71.8
Boxina			
Count	58	2	60
% within type of sport	96.7	3.3	100.0
% within mouthquard use	54.2	1.9	28.2
Total			
Count	107	106	213
% within type of sport	50.2	49.8	100.0
% within mouthquard use	100.0	100.0	100.0
	100.0	100.0	.00.0

mouthguard use was not sufficient. Also most of them (n = 119, 64.3%) reported that they do not use mouthguards in contact sports. In most martial arts, screaming during activation or attack is considered to be an important part of mental and physical concentration. They explained some difficulties while using mouthguards. When they were in attack or in activation, they screamed for concentration and the use of a mouthguard was a handicap for their screaming. In this study, all the athletes who used mouthguards, used the boil-and-bite type which is known to inhibit speech, and is inferior to custom-made mouthguards, which interfere less with speech intelligibility.

The literature suggests that those who could influence the wearing of mouthguards need more information. Numerous studies have indicated that coaches deeply influence players wearing mouthguards, thus, it would seem important that they be targeted for health promotion information. Another important point is players' attitudes toward wearing mouthguards are influenced, at least in part, by comfort, ability to speak, esthetics, and their perception of how the mouthguard affects their image as a player (10). Takeda et al. (12) suggested that the selection of different materials and mouthguard designs suitable for specific sports is important

	Mouthguard use		
Soft tissue trauma	Yes	No	Total
Yes			
Type of sport			
Tae kwon do			
Count	23	17	40
% within type of sport	57.5	42.5	100.0
% within mouthguard use	62.2	100.0	74.1
Boxing			
Count	14	0	14
% within type of sport	100.0	0	100.0
% within mouthguard use	37.8	0	25.9
Total			
Count	37	17	54
% within type of sport	68.5	31.5	100.0
% within mouthguard use	100.0	100.0	100.0
No			
Type of sport			
Tae kwon do			
Count	43	102	145
% within type of sport	29.7	70.3	100.0
% within mouthguard use	37.1	98.1	65.9
Boxing			
Count	73	2	75
% within type of sport	97.3	2.7	100.0
% within mouthguard use	62.9	1.9	34.1
Total			
Count	116	104	220
% within type of sport	52.7	47.3	100.0
% within mouthguard use	100.0	100.0	100.0

Table 4. Crosstabulation between experience of soft tissue trauma, type of sports activity, and mouthguard use

and wearing a mouthguard, which is insufficient in the occlusion, has the potential of causing a bone fracture of the mandible. Consequently, mouthguards must have proper occlusion (13).

The thicker the mouthguard material is, the greater the resulting energy absorption is. It is therefore essential that the thickness in the occlusal portion of the mouthguard remains optimal after fabrication. Park et al. (14) tested ethylene-vinyl acetate copolymer materials varying in thickness and stiffness for their mechanical, thermal, and water-absorption properties. They reported that during fabrication, thickness decreased from 25 to 50% for the custom-fabricated mouthguards and from 70 to 99% for the mouth-formed (boil-and-bite), off-the-shelf, over-the-counter mouthguards. They finally proposed a mouthguard with a stiffer insert, which softens at a higher temperature in the occlusal portion, as a more protective mouthguard.

Guevara et al. (15) compared the properties of a custom mouthguard and three commercially available mouthguards and found that all three commercially available mouthguard materials exhibited greater rebound than the custom mouthguard with the rebound related directly to the thickness of the mouthguard in the incisor region. They concluded that the thickness of a mouthguard might be a critical factor in avoiding injury to the teeth and surrounding structures.

In this study, although not included in the questionnaire, all the subjects aware of mouthguard use stated that they used boil-and-bite type mouthguards and reported that they generally used their mouthguards longer than the recommended service period and frequently they become accustomed to boil-and-bite mouthguards several times in order to restore the retentive properties of the mouthguards. It is obvious that this process can easily cause thinning at the incisal and occlusal areas and loss of the protective properties of the mouthguard.

The results of our study indicate that boxers were aware about using mouthguards, but dentists and sports authorities in Turkey should promote the use of mouthguards in contact sports, which present a considerable risk for dental hard and soft tissue trauma and tooth loss. Dentists and sports authorities should promote the use of mouthguards in martial arts and also other amateur sports, which have a risk for trauma. Education on the effectiveness of properly fitted mouthguards for injury prevention, information on the risk of injury, and availability of more comfort can lead to the development of more positive attitudes and increase its usage.

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# Tulunoglu & Özbek

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