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Prevalence and prevention of dental injuries in young taekwondo athletes in Croatia

ABSTRACT

Aim *The aim of this study was to evaluate the occurrence of dental and facial injuries, the habit of wearing mouthguard and the awareness regarding injury prevention and first aid after tooth avulsion among young taekwondo athletes in Croatia.*

Materials and methods *A survey on a sample of 484 taekwondo athletes was conducted, which included 271 male (56%) and 213 female (44%) athletes aged between 8 and 28 years. The questionnaire submitted to the athletes contained 15 questions about dental trauma, use of mouthguard, dental trauma prevention, level of awareness about tooth avulsion and replantation and disturbances associated with mouthguard use. Collected data were evaluated according to gender, age groups and duration of actively engagement in taekwondo. Descriptive statistics and Chi-square tests were used for comparisons between groups.*

Results *From the survey 300 (62%) of 484 athletes had sustained one serious injury and 103 (21%) had sustained an orofacial injury, while 194 (40%) had observed another player sustaining a dental injury. Higher number of orofacial injuries was observed in males (24%) than in females (18%). Furthermore, 98 (20%) athletes have experienced one or more dental injuries, and out of these 98 suffering dental injury 60 were male (61%) and 38 were female (39%). The frequency of orofacial injuries in the older group (42%) is higher than in three younger groups (younger cadets 25%; cadets 13%; juniors 20%) ($p<0.05$). Mouthguard wearing was recorded in 465 athletes (96%), 47.1% of them wear stock mouthguard, 47.6% wear boil and bite mouthguard, but only 5.3% were custom-made mouthguards. Most of them (96%) consider that mouthguards are useful for injury prevention in taekwondo.*

Conclusion *The results of this survey show that dental and orofacial injuries occur in taekwondo in all age groups but mostly in the senior group. Taekwondo players know the importance of mouthguard use, but only 5% use custom made mouthguards. This is not adequate for dental injury prevention and highlights the important role of dental professional in education of athletes for advocating the use of custom made mouthguards.*

Keywords *Dental injury, Mouthguard, Prevention, Taekwondo.*

Introduction

From the review of literature on dental trauma due to sport activities it emerges that the incidence of orofacial injuries is variable between 12 to 33%, and it is in relation to the type of sport and age of athletes [Perunski et al., 2005; Biagi et al., 2010; Onyeaso and Adegbesan, 2003; Lee et al., 2013]. Taekwondo, as one of many martial art sports, belongs to group of contact sports with high risk of dental trauma. Recently the World Taekwondo Federation (WTF) revised competition rules and introduced a variable scoring system that grants higher scores for head attack [WTF, online data], with a higher risk of orofacial injuries [Lee et al., 2013]. The incidence of orofacial injuries in taekwondo is respectively high, varying from 20% to 34.2% [Pieter at al., 2012; Pieter, 2005]. In other contact sports such as judo and karate the rate of orofacial injuries varies from 4.0% to 87.9% [Pieter, 2005]. To date no information is available about Croatian taekwondo players.

Dental and orofacial injuries associated with sport remain a risk for children and adolescents. The use of mouthguard has been advocated for over almost 40 years to prevent dental and orofacial injuries, and sport communities of various countries have started to appreciate their usefulness [Levin and Zadik, 2012]. For the Croatian Taekwondo Federation the use of protective gears is mandatory for all competitors, including the use of mouthguards on competitions. Dental trauma may vary from minor enamel fracture to combined orofacial injuries. The intensity and frequency of the match between competitors can be the main determinants of dental injury. Treatment of dental trauma is very complex and expensive. In addition to the immediate costs, there are expenses with follow-up medical visits that may be necessary for many years after the traumatic event. Dental trauma can often be prevented or reduced by wearing a properly fitted mouthguard [Levin

and Zadik, 2012]. Several studies have shown that the use of mouthguard decrease the risk of dental and craniofacial injuries to athletes. There are three types of mouthguard available for athletes: 1) stock mouthguards, prefabricated in few sizes, 2) boil-and-bite mouthguards, made from thermoplastic material, immersed in hot water and formed by athlete in mouth, 3) custom made mouthguards, made individually for each athlete by the dentist on the athletes' dental casts [Biagi et al., 2010; Dhillon at al., 2014]. The first two types of mouthguard are easily available in sport stores for low prices, they provide a lower dental protection and have poorer performances. Custom made mouthguard entail dental visit and higher costs. Nowadays stock and boil and bite mouthguards are the most commonly used ones by Croatian taekwondo athletes.

In order to contribute to establish effective strategies of education regarding dental trauma, the aim of this study was to evaluate the occurrence of dental and facial injuries, the habit of wearing mouthguard and the awareness regarding injury prevention and emergency measures after dental trauma.

Materials and Methods

We conducted a survey on a 484 Croatian taekwondo athletes from Croatian clubs registered by the Croatian Taekwondo Federation. The study was approved by the University of Zagreb, School of Dental Medicine Ethics Committee. A questionnaire was developed, similar to questionnaires used in previous studies [Biagi et al., 2010; Perunski et al., 2005; Ferrari and Medeiros, 2002], which contained 15 questions (Table 1)about dental trauma, its prevention, use of mouthguard and disturbances associated with it, level of awareness about tooth avulsion and replantation, knowledge of the tooth rescue kit (SOS Zahnbox, Miradent; Dentosafe, Medice).

The questionnaires were self-administered and collected during national championships or tournaments. Informed consent was collected from all subjects involved in the survey, which included 271 male (56%) and 213 female (44%) athletes aged between 8 and 28 years. The mean age of athletes was 15 (±3.7) years. Collected data were evaluated according to gender, age groups and duration of activity (≤3 years, >3 years). Athletes were divided into 4 age groups: (younger cadets 8-11 years; cadets 12-14 years; juniors 15-17, seniors 18-28 years). Descriptive statistics and Chi-square tests were used for comparisons between groups.

Results

From the analysis of results it emerges that in this survey sample of 484 athletes, 300 subjects (62%) had sustained at least one serious injury. Orofacial injury occurred in 103 athletes (21%), while 193 athletes (40%) had observed another player sustaining dental injury, while 98 (20%) athletes experienced one or more dental injuries. Dental injuries with jaw fracture were recorded in 5 (1%) subjects.

Table 1 shows the frequencies of orofacial injuries (tooth injury, tooth and soft tissue injury and jaw fracture) by gender. Higher number of orofacial injuries was observed in males (24%) than in females (18%), but this was not

How long do you practice tae kwon do?
Have you ever had teeth or mouth injuries outside sports?
Have you ever had other injuriesy (hand or leg fracture, twist, laceration-slash) beyond sport?
Have you ever seen a dental injury during your sport activity?
If yes, what kind of injury? (avulsion, crown fracture, dislocation)
Have you ever experienced a dental injury?
If yes, what kind of injury? (tooth injury, tooth and soft tissue, jaw fracture)
If yes, what kind of dental injury? (avulsion, crown fracture, dislocation)
Do you know that it is possible to replant an avulsed tooth?
Do you know the tooth rescue kit?
Do you know what is a mouthguard?
Do you use a mouthguard?
If yes, which kind of mouthguard do you use?
If not, why? (not available, uncomfortable, esthetics, not useful)
Do you think that wearing a mouthguard could be effective in your sport activity?

TABLE 1 Questionnaire.

Group of athletes			Type of injury				
			Tooth injury	Tooth and soft tissue injury	Jaw fracture	Total	Chi-square test
		N	N (%)	N (%)	N (%)	N (%)	
Age group	Young cadets (8-10 y)	36	1 (2.8)	8 (22.2)	0 (0)	9 (25.0)	p=0.669
	Cadets (12-14 y)	240	5 (2.1)	24 (10.0)	2 (0.8)	31 (12.9)	
	Juniors (15-17 y)	109	6 (5.5)	15 (13.8)	1 (1)	22 (20.2)	
	Seniors (18-28 y)	98	13 (13.3)	26 (26.5)	2 (2)	41 (41.8)	
Sex	Female	213	8 (3.7)	30 (14.1)	1 (0.5)	39 (18.3)	p=0.505
	Male	271	17 (6.3)	43 (15.9)	4 (1.5)	64 (23.6)	
Duration of sport activity	≤3	80	2 (2.5)	7 (8.8)	1 (1.3)	10 (12.5)	p=0.708
	>3	402	23 (5.7)	66 (16.4)	4 (1)	93 (23.1)	

TABLE 2 Distribution of orofacial injuries (tooth injury, tooth and soft injury, jaw fracture) overall and by sex, age group and duration of sport activity.

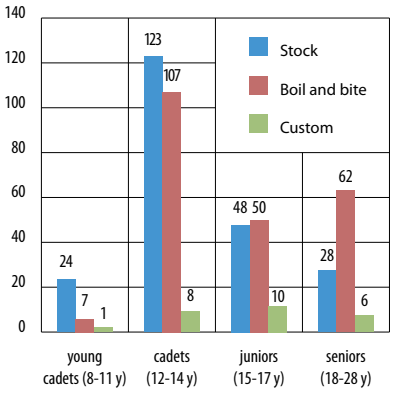

FIG. 1 Distribution of athletes according to the type of mouthguard used in different age groups.

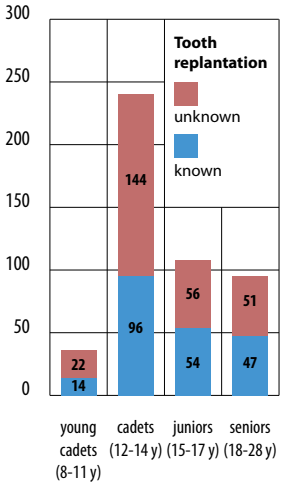

FIG. 2 Distribution of athletes according to their knowledge about tooth replantation.

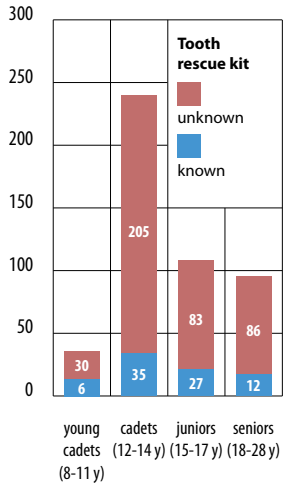

FIG. 3 Distribution of athletes according to their knowledge about tooth rescue kit.

statistically significant. Of the 98 subjects suffering dental trauma, 60 were male (61%) and 38 were female (39%). Frequencies of orofacial injury by age groups are presented in Table 2. Athletes in senior group (18-28 years) had a higher number of tooth injuries (42%), than in the younger three groups (younger cadets 25%; cadets 13%; juniors 20%) ($p<0.05$). All type of orofacial injuries are equally represented in different age groups. Frequency of injuries increases with the years of engagement in sport ($p<0.05$). Mouthguard wearing, as shown in figure 1, was recorded in 465 athletes (96%). Only 5.3% of them were custom made, 47.1% were stock-type and 47.6% were boil and bite ($p<0.05$). Most of the athletes (96%) consider that mouthguards are useful for injury prevention. Figure 2 shows the distribution of athletes according to their knowledge about tooth replantation. Awareness and knowledge of possibility of replanting avulsed tooth was recorded in 221 (44%) athletes. Level of knowledge is equally distributed in all age groups. Awareness of tooth rescue kit in all age groups (Fig. 3) is worryingly low. Of the 484 subjects, only 80 of them (16%) were informed about tooth rescue kit. There was no differences in knowledge among age groups ($p=0.069$).

Discussion

This present study is the first to examine orofacial injury incidence in young taekwondo athletes in Croatia. Data on orofacial injuries incurred by the Croatian taekwondo athletes are similar to those reported in other studies. There are 1,553 taekwondo athletes recorded by the Croatian Taekwondo Federation and 484 of them were included in the survey. The general rate of occurrence of oral and dental trauma in this study was 21%. This is in accordance to Ferrari et al. [2002] (28%), Levin et al. [2003] (27%) and Tulunoglu et al. [2006] (22.3%). The assessment of frequency of trauma in terms of gender showed higher number of orofacial injuries in males (24%) than in females (18%). These results are in agreement with previous studies [Dhillon et al., 2014; Aren et al., 2013; Azodo et al., 2011]. Lower limb and head are the most common location of injuries in taekwondo athletes [Kazemi et al., 2005]. Modification of the competition rules, assigns the highest score for full contact kicks to the body and head as primary target [WTF], therefore it is not surprising that 300 of 484 athletes in the survey had sustained at least one serious injury and 103 (21%) had sustained an orofacial injury, while 193 (40%) athletes had observed another athlete sustaining a dental injury. Promoting blocking skills to prevent head blows could decrease orofacial injuries in taekwondo. Athletes in senior group had a higher number of tooth injuries (42%). The number of injuries is significantly higher in groups which were practicing taekwondo for more than 3 years ($p<0.05$). Taekwondo beginner starts at a rank of white belt and when athletes achieve enough proficiency of taekwondo skills they are moved through several higher ranks, respectively to the colour belts (in increasing rank: yellow, green, blue, red) and black belts (with increasing rank based on DAN level, from 1st to 9th). This process may take few years. Taekwondo athletes practice between two to four times per week and all must demonstrate certain level of proficiency to advance in rank. Improvement of technical skills in a competition should decrease the athletes risk for injury during a match. However, more skilled athletes are likely to use dangerous techniques or perform basic ones with greater speed and strength. Therefore the possibility for injury increases. Orofacial injuries in younger groups are associated with young age and lack of blocking skills. Protective gear in taekwondo includes along with other a mouthguard. In this survey mouthguard use was recorded in 96% of athletes, 47.1% wear stock mouthguards, 47.6% wear boil and bite, and only 5.3% wear custom made mouthguards. To date no information in other studies is available about the types of mouthguard used by taekwondo athletes. When comparing the use of different types of mouthguard in other contact sports, this finding are in line with the results of few studies done by Biagi [2010], Emerich [2013], and Andrade [2010]. Previous studies reported data for boxing, karate, basketball and wrestling. In the present study,

most of the participants (93%) knew the importance of using mouthguard. Despite the majority of athletes use some kind of mouthguard, very few of them had received recommendations on what kind of mouthguard to use, and most of them were willing to learn more about the advantages of custom made mouthguards. The major complaints received from athletes regarding stock and boil-and-bite mouthguards are difficulty in talking, breathing, concerns about mouthguard fit and influence on vomiting [Biagi et al., 2010; Correa et al., 2010; Lee et al., 2013]. Custom made mouthguards, fabricated by dentist from the cast of the athlete's teeth, are likely to result in a better fit and are more comfortable to wear. The high percentage of the use of the stock and boil-and-bite mouthguards is due to their easy availability at affordable prices in sport stores and lack of knowledge about custom made mouthguards of coaches and parents [Biagi et al., 2010; Levin and Zadik, 2012]. Different studies have shown that trainers and coaches have a great influence on the players' willingness to wear mouthguards [Vidovic et al., 2014; Azodo et al., 2011]. Here the role of dental professionals is important for spreading information about custom made mouthguards. Knowledge about effectiveness of properly fitted mouthguard for injury prevention can lead to the development of more positive attitudes and increased use of custom made mouthguards. The successful prevention of dental trauma can be accomplished with the use of a proper custom mouthguard.

Knowledge about the tooth rescue kit represents an important link to increase the success rate for avulsed and replanted permanent teeth. Awareness of possibility of replanting avulsed tooth in this survey in all groups is very low; it was recorded in only 44% of athletes, and only a small percentage of athletes in this survey (16%) were familiar with the tooth rescue kit. Inexpensive, commercially available tooth storage devices containing an isotonic transport medium are the best means to maintain viability of an avulsed tooth. Other storage media such as milk, saline or even saliva are widely available, but knowledge of this information is rare among athletes as well as in this survey as in many others [Fakhruddin et al., 2007; Correa et al., 2010; Perunski et al., 2005].

Conclusion

Despite all efforts in reducing the high prevalence of orofacial injuries, the most current surveys indicate that the incidence of dental trauma remains unchanged and it is at a relatively high level among taekwondo and other marital art athletes. The results of this survey show that general injuries frequently occur in taekwondo in all age groups, but most frequently in the senior group. Dental injuries in the senior group were significantly higher than in younger age groups of taekwondo athletes. This survey highlights that dentists could play an important role in the education of athletes advocating the use of custom made mouthguards. In consideration of all findings, coaches and athletes should have appropriate information on traumatic injuries. More emphasis should be placed on which is the best and most constructive way to educate coaches and their athletes on how to prevent dental trauma. Such training should be provided by paediatric dentists in a simple, visual manner through lectures, educational posters (how to properly react when trauma occurs) and by using contemporary means like Internet and apps.

References

- Andrade RA, Evans PL, Almeida AL, da Silva Jde J, Guedes AM, Guedes FR, Ranalli DN, Modesto A, Tinoco EM. Prevalence of dental trauma in Pan American games athletes. Dent Traumatol 2010 Jun;26(3):248-253.
- Aren G, Sepet E, Pınar Erdem A, Tolgay CG, Kuru S, Ertekin C, Güloğu R, Aren A. Predominant causes and types of orofacial injury in children seen in the emergency department. Ulus Travma Acil Cerrahi Derg 2013 May;19(3):246-250.
- Azodo CC, Odai CD, Osazuwa-Peters N, Obuekwe ON. A survey of orofacial injuries among basketball players. Int Dent J 2011 Feb;61(1):43-46.
- Biagi R, Cardarelli F, Butti A.C., Salvato A. Sports-related dental injuries: knowledge of first aid and mouthguard use in a sample of Italian children and youngsters. Eur J Pediatr Dent 2010;11(2):66-70.
- Correa MB, Schuch HS, Collares K, Torriani DD, Hallal PC, Demarco FF. Survey on the occurrence of dental trauma and preventive strategies among Brazilian professional soccer players. J Appl Oral Sci 2010 Dec;18(6):572-576.
- Dhillon BS, Sood N, Sood N, Sah N, Arora D, Mahendra A. Guarding the precious smile: incidence and prevention of injury in sports: a review. J Int Oral Health 2014 Jul;6(4):104-107.
- Emerich K, Nadolska-Gazda E. Dental trauma, prevention and knowledge concerning dental first-aid among Polish amateur boxers. J Sci Med Sport 2013 Jul;16(4):297-301.
- Fakhruddin KS, Lawrence HP, Kenny DJ, Locker D. Use of mouthguards among 12- to 14-year-old Ontario schoolchildren. J Can Dent Assoc 2007 Jul-Aug;73(6):505.
- Ferrari CH, Ferreria de Mederios JM. Dental trauma and level of information: mouthguard use in different contact sports. Dent Traumatol 2002 Jun;18(3):144-147.
- Jung-Woo Lee, Chong-Kwan Heo, Sea-Joong Kim, Gyu-Tae Kim, Deok-Won Lee. Mouthguard use in Korean Taekwondo athletes-awareness and attitude. J Adv Prosthodont 2013;5:147-152.
- Kazemi M, Shearer H, Choung YS. Pre-competition habits and injuries in Taekwondo athletes. BMC Musculoskelet Disord 2005 May; 27(6):26.
- Levin L, Friedlander LD, Geiger SB. Dental and oral trauma and mouthguard use during sport activities in Israel. Dent Traumatol 2003 Oct;19(5):237-242.
- Levin L, Zadik Y. Education on and prevention of dental trauma: it's time to act! Dent Traumatol 2012 Feb;28(1):49-54.
- Onyeaso CO, Adegbesan OA. Knowledge and attitudes of coaches of secondary school athletes in Ibandan, Nigeria regarding oro-facial injuries and mouthguard use by athletes. Dent Traumatol 2003; 19: 204-208.
- Perunski S, Lang B, Pohl Y, Filippi A. Level of information concerning dental injuries and their prevention in Swiss basketball-a survey among players and coaches; Dent Traumatol 2005; 21: 195-200.
- Pieter W. Martial arts injuries. Med Sport Sci 2005;48:59-73.
- Pieter W, Fife GP, O'Sullivan DM. Competition injuries in taekwondo: a literature review and suggestions for prevention and surveillance. Br J Sports Med 2012 Jun;46(7):485-491.
- Schildknecht S, Krastl G, Kühl S, Filippi A. Dental injury and its prevention in Swiss rugby. Dent Traumatol 2012 Dec;28(6):465-469.
- Tulunoglu I, Ozbek M. Oral trauma, mouthguard awareness, and use in two contact sports in Turkey. Dent Traumatol 2006 Oct;22(5):242-246.
- Vidovic D, Gorseta K, Bursac D, Glavina D, Skrinjaric T. Taekwondo coaches knowledge about prevention and management of dental trauma. Coll Antropol 2014 Jun;38(2):681-684.
- World Taekwondo Federation, http://www.wtf.org/wtf_eng/site/rules/competition.html