

Mouthguard use in Korean Taekwondo athletes – awareness and attitude

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PURPOSE. A survey was performed to identify the level of mouthguard use, awareness, wearability issues and attitude toward mouthguard among elite Korean Taekwondo athletes. **MATERIALS AND METHODS.** Survey questionnaires were given to 152 athletes participating in the Korea National Taekwondo team selection event for the 2010 Guangzhou Asian Games. Questionnaires consisted of three sections, mouthguard awareness, reasons for not wearing mouthguard and the last section to test the level of acceptance on current mouthguard and when the identified problems were resolved. For analyzing difference among response, χ^2 test was used and significant level (α) was set up as 0.05. **RESULTS.** Responses in each of items showed significant difference ($P < .001$). Majority of response regarding each question: Majority of respondents believed that mouthguard were effective in preventing injuries (36.4%) but the result suggested that the provision of information on mouthguard to athletes was inadequate (44.0%) and the result showed that respondents were not greatly interested or concerned in relation to the mandatory mouthguard rule (31.6%). Although the responses on the level of comfort and wearability of mouthguard were negative (34.8%), athletes were positively willing to wear mouthguard if the problems rectified (51.2%). **CONCLUSION.** Considering the high level of willingness to wear mouthguard if the problems rectified, it is thought that together with efforts in providing more mouthguard information, the work of sports dentistry to research and improve mouthguard will be invaluable in promoting mouthguard to more athletes. [*J Adv Prosthodont 2013;5:147-52*]

KEY WORDS: Mouth protectors; Awareness; Attitude; Martial arts; Athletes

INTRODUCTION

Taekwondo is an international sport practiced by over 70 million people in 188 countries around the world. However,

it is reported that participating in a contact sports (24%) such as Taekwondo poses 3 times higher risk of orofacial injuries than sports in non-contact category (8%) such as Volleyball where the risk of suffering sports related orofacial injuries in general is 6 times higher than undertaking average daily activities. The results of the report also indicated that sport accidents were responsible for six times as many facial injuries as work accidents and accounted for three times more injuries than violence or traffic accidents.^{1,2} Some of sports related oral and maxillofacial injuries include facial laceration, facial bone and tooth fracture, temporomandibular disorders and these injuries can lead to dental aesthetic and functional problems as well as irreversible nerve damages such as brain damage.^{1,3-6}

Modern Taekwondo competitions demand the athletes to undertake carefully designed systematic training programs to produce maximum physical strength during events. In 2001, as part of an effort to design a more inter-

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esting competition format, the World Taekwondo Federation (WTF) revised competition rules and introduced variable scoring system that grants higher scores for head attack. Kim *et al.*⁷ reported that the revised rules resulted in reduced hand and foot injuries but increased orofacial injuries. Thus the modern techniques and rules provided the sport with not only superior sporting qualities but also the higher risk of facial injury.

It is a scientifically proven fact that wearing mouthguard can prevent sports related orofacial injuries and the World Taekwondo Federation introduced a mouthguard rule in 2003 that enforced mandatory use of mouthguards during competitions, and Korea Taekwondo Association followed the change in 2010.⁸ However, many athletes believe that mouthguard are uncomfortable and cause speech, breathing impairments and degrades performance.⁹ In Turkey, it is reported that 24% of Taekwondo athletes experience orofacial injuries yet only 10% of athletes wear mouthguard.¹

There are a number of detailed studies of mouthguard awareness in sports such as Rugby and American Football but such studies in Taekwondo are rare. Thus, this study was conducted on Taekwondo athletes from the Korea Taekwondo National Team final selection event for the 2010 Guangzhou Asian Games. A questionnaire based survey was conducted to investigate the extent of mouthguard awareness, attitude (Reasons for not wearing mouthguard) and “Level of Acceptance” for improved version of mouthguard, i.e. when the existing problems are rectified.

MATERIALS AND METHODS

Survey questionnaires were given to 152 athletes participating in the Korea National Taekwondo team selection event for the 2010 Guangzhou Asian Games. Table 1 shows general information on Taekwondo athletes participated in the survey.

Table 1. General information on respondents

Index	Gender			Career of the prize winner		
Category	Man	Woman	None	National competition	National team selection events	International competition
Frequency (%)	109 (71.7)	43 (28.3)	25 (16.4)	85 (55.9)	19 (12.5)	23 (15.1)
Total (Missing value)	152 (0)			152 (0)		

Index	Team type			Experience of using mouthguard	
Category	High school team	University team	Professional team	Yes	No
Frequency (%)	3 (2)	115 (75.7)	34 (22.4)	67 (44.1)	85 (55.9)
Total (Missing value)	152 (0)			152 (0)	

Index	Received mouthguard information?		Mouthguard type		
Category	Yes	No	Stock	Boil and Bite	Customized
Frequency (%)	79 (52.3)	72 (47.7)	0 (0)	148 (97.4)	4 (2.6)
Total (Missing value)	151 (1)		152 (0)		

Index	Weight										
Category	Fin	Fly	Bantam	Feather	Light	L-Welter	Welter	L-Middle	Middle	L-Heavy	Heavy
Frequency (%)	20 (13.2)	18 (11.8)	22 (14.5)	23 (15.1)	17 (11.2)	5 (3.3)	10 (6.6)	0 (0)	14 (9.2)	1 (.7)	18 (11.8)
Total (Missing value)	148 (4)										

L-Welter: Light Welter, L-Middle: Light Middle, L-Heavy: Light Heavy.

Table 2. Survey questionnaire: questions per section

Awareness	Reasons for not wearing mouthguard	Level of acceptance
Have you received any information on mouthguard?	Breathing impairment Performance degradation	Level of comfort and wearability of current mouthguard
Do you believe mandatory use of mouthguard is appropriate?	Speech impairment Difficult mouth closure: Disclusion	Level of acceptance with improvements
Do you believe in mouthguard as effective protection?	Swallowing difficulty Causes nausea Causes mouth dryness Poor retention Poor occlusion Fatigue of muscle	

Frequency analysis & χ^2 test were performed to figure out difference among response at each of questions. And significant level (α) set up .05 for χ^2 test. All analyses were performed using IBM SPSS 20.0.

The survey questionnaire consisted of three sections, mouthguard awareness (3 questions), reasons for not wearing mouthguard (10 questions) and the last section to test the level of acceptance on current mouthguard and when the identified problems rectified (2 questions). All questions were subjected to evaluation for their validity by an expert panel of two dental specialists, one member of Korea National Taekwondo team and two experts in physical education PhD. All questions that were found to pose possible validity issue were removed from the questionnaire. The questionnaire used a 5 point Likert scale to measure responses and details are as in Table 2.

RESULTS

Statistically significant difference in response was found in all questions. The most common response to the question “Have you received any information on mouthguard?” was ‘Neutral’ from 55 athletes (36.2%) followed by 44 athletes (28.9%) responding with ‘disagree’. Overall figure shows that 122 (80.3%) out of 152 Taekwondo athletes have responded with ‘Neutral’ or below for this question. The most common response in relation to appropriateness of mandatory mouthguard usage was ‘Neutral’, 63 respondents (41.44%), followed by ‘Agree’ and ‘Disagree’, both responses were provided by 29 respondents (19.1%) each. Of the 151 respondents, 61 (40.4%) responded ‘Neutral’ whilst 45 (29.8%) agreed that mouthguard were effective in protecting the teeth (Table 3). On breathing impairment, majority of respondents responded that wearing a mouthguard causes breathing impairment. 66 (43.4%) respondents responded “Strongly Agree” and 45 (29.6%) responded “Agree”. Majority of the respondents responded that mouthguard present performance issues. 57 (37.5%) answered “Strongly Agree” and 54 (35.5%) answered “Agree” to degradation of performance caused by wearing

mouthguard. On the question of speech impairment caused by wearing a mouthguard, majority of the respondents responded that wearing a mouthguard causes speech impairment. From 152 respondents, 52 (39.5%) responded “Agree” and 58 (38.2%) responded “Strongly agree”. Majority of the respondents agreed that mouthguard causes difficulty in closing mouth (Disclusion), 49 (32.2%) responded ‘Neutral’ and 47 (30.9%) responded “Agree”. Majority of respondents also claimed that wearing a mouthguard causes swallowing difficulty. Of the 152 respondents, 52 (34.2%) responded with “Strongly agree” and 44 (28.9%) responded with “Agree”. In relation to mouthguard causing nausea the responses were polarized into “Disagree”, 54 (35.5%), and “Strongly agree”, 39 (25.7%). It is observed that respondents who complained of nausea chose extreme response and this is thought to be due to the level of individual gag reflex.

Majority of respondents claimed that mouthguard cause mouth dryness, 57 (37.5%) responded “Strongly agree” and 54 (35.5%) responded “Agree”. For mouthguard retention, there were more negative responses than positive responses implying that respondents were generally satisfied with retention. 45 (29.6%) responded “Neutral” and 37 (24.3%) responded “Disagree”. Similarly, respondents were generally satisfied with occlusion, 57 (37.5%) responded ‘Neutral’ and 35 (23.0%) responded ‘Disagree’. Most of the respondents agreed that mouthguard causes jaw muscle fatigues. 40 (26.5%) athletes responded ‘Neutral’ and 39 (25.8%) athletes agreed that wearing a mouthguard causes jaw muscle fatigues (Table 4). When the respondents were asked of comfort and wearability of mouthguard the most common response was “Neutral”, 51 (33.6%), followed by “Disagree” 37 (24.3%) and overall figure shows that slightly more respondents gave negative responses. However, most of the respondents were willing to wear mouthguard if existing problems with mouthguard rectified (Table 5).

Table 3. Responses on mouthguard awareness

Item	Response	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total	χ^2
Have you received any information on mouthguard?	f	3	27	55	44	23	152	52.868***
	%	2	17.8	36.2	28.9	15.1	100	
Appropriateness of mandatory mouthguard rule	f	12	29	63	29	19	152	50.500***
	%	7.9	19.1	41.4	19.1	12.5	100	
Mouthguard as effective protection	f	10	45	61	22	13	151(1)	64.199***
	%	6.6	29.8	40.4	14.6	8.6	100	

(***: $P < .001$)

Table 4. Responses on reasons for not wearing mouthguard

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total	χ^2
Breathing impairment	f	66	45	31	7	3	152	91.421***
	%	43.4	29.6	20.4	4.6	2	100	
Performance degradation	f	57	54	35	4	2	152	91.750***
	%	37.5	35.5	23	2.6	1.3	100	
Speech impairment	f	58	60	29	3	2	152	105.171***
	%	38.2	39.5	19.1	2	1.3	100	
Disclusion	f	42	47	49	10	4	152	61.487***
	%	27.6	30.9	32.2	6.6	2.6	100	
Swallowing difficulty	f	52	44	43	10	3	152	65.039***
	%	34.2	28.9	28.3	6.6	2	100	
Causes nausea	f	39	18	31	54	10	152	39.513***
	%	25.7	11.8	20.4	35.5	6.6	100	
Mouth dryness	f	43	47	36	19	7	152	37.605***
	%	28.3	30.9	23.7	12.5	4.6	100	
Poor retention	f	11	30	45	37	29	152	20.895***
	%	7.2	19.7	29.6	24.3	19.1	100	
Poor occlusion	f	12	24	57	35	24	152	37.803***
	%	7.9	15.8	37.5	23	15.8	100	
Causes jaw muscle fatigue	f	38	39	40	26	8	151	24.662***
	%	25.2	25.8	26.5	17.2	5.3	100	

(***: $P < .001$)

Table 5. Responses on the level of acceptance

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Total	χ^2
Level of comfort and wearability of current mouthguard	f	21	27	51	37	16	152	22.500***
	%	13.8	17.8	33.6	24.3	10.5	100	
Level of acceptance with Improvements	f	30	48	43	10	21	152	32.013***
	%	19.7	31.6	28.3	6.6	13.8	100	

(***: $P < .001$)

DISCUSSION

The use of mouthguard during all International Taekwondo competitions has been a mandatory rule since 2003. However, there has not been sufficient level of studies on mouthguard awareness for Taekwondo athletes around the world including Korean athletes.

Respondents of this survey were top class Taekwondo athletes, 15.1% of the athletes were prize winners at international level competitions, 12.5% in National Team Selection Events and 55.9% were National competition prize winners. However, 55.9% of the respondents had no experience of wearing mouthguard.

Keçeci *et al.* revealed that only 7 athletes out of combined 162 athletes in Taekwondo, Volleyball and Handball were wearing mouthguard in Turkey.¹ Considering the fact that the majority of respondents in this study had participated international and or domestic competition in 2010, when the use of mouthguard became mandatory for competitions at both levels, the level of mouthguard was low. Furthermore, the majority of respondents in this study believed that mouthguard are effective in preventing injuries but the survey result suggests that the provision of information on mouthguard to athletes is inadequate; it was also found that the respondents are not greatly interested or concerned in relation to the mandatory mouthguard rule. In addition, only 4 respondents were using custom-made mouthguard which was made by dentists and the rest were using boil and bite type mouthguard.

Concerns for Breathing and Speech impairment found in this study are consistent with the findings of Gardiner and Ranalli⁹ which identified the cause of such impairments as the bulkiness of the mouthguard.

Studies conducted by Keçeci *et al.*¹⁰ and von Arx *et al.*¹¹ concluded that custom-made mouthguard have no negative effects on aerobic performance capacity of athletes and Maeda *et al.*¹² also concluded that expert built mouthguard with good fitting and right shaping do not affect breathing. Thus, it is thought that the survey result in relation to breathing and speech impairment is closely related to the fact that the most of the respondents in this study were using boil and bite type mouthguard.

There have been researches on mandibular orthopedic repositioning appliance (MORA) in relation to athletic performance since the 1970. Considering the definition of MORA, mouthguard can be classified as one type of MORA that fit over maxillary dentition and changes occlusion and mandibular position.

According to these researches, although controversial, appropriate jaw repositioning can lead to positive effects on body posture as well as athletic performance and no negative effects were reported.¹³⁻¹⁵ Similarly, Cetin *et al.*¹⁶ conducted a study using custom-made mouthguard and concluded that athletes can use custom-made mouthguard without any negative effects on their physical strength and anaerobic performance. This result is linked to the advantages of custom mouthguard that allow the thickness to be

adjusted as required and enable dentists to fabricate mouthguard to achieve desired occlusion and mandibular position. Maeda *et al.*¹⁷ concluded that adjusting palatal design of custom made mouthguard can suppress gag reflex.

In the study, respondents were generally satisfied with retention and occlusion of mouthguard but majority of respondents responded that mouthguard cause jaw muscle fatigue. This is thought to be a result of athletes biting down the mouthguard too hard during the molding process of Boil-and-Bite type mouthguard for better retention. However, this may result in undesirable mandibular deviation which can cause masticatory muscle fatigue. In addition, biting down on the mouthguard too hard can compromise the thickness and this will in turn compromise the level of protection.

CONCLUSION

The survey has shown that Korean Taekwondo athletes believed that mouthguard can prevent dental and orofacial injuries, yet a large number of them were not wearing mouthguard. This may be due to the lack of information available to athletes and discomforts they experienced wearing one. Considering the high level of willingness to wear mouthguard, it would be more widely distributed if more information and professional mouthguard provided.

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Noteworthy Abstracts of the Current Literature

The effect of surface treatment conditioning on shear bond strength between zirconia and dental resin cements

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Purpose: The purpose of this study was to evaluate the effect of surface treatment on the shear bond strength of zirconia ceramic to 3 resin cements. **Materials and methods:** A total of 143 disk-shaped Zirconia blocks (HASS Co., Gangneung, Korea) were randomly divided into three treatment groups: (1) only 50 μm Al_2O_3 sandblasting, (2) 50 μm Al_2O_3 sandblast and zirconia liner, (3) 50 μm Al_2O_3 sandblasting and Rocatec (3M ESPE, Seefeld, Germany). Bistite II (Tokuyama Dental Co., Japan), Panavia F (Kuraray Medical, Japan), and Superbond C&B (Sun Medical, Japan) were used to cement onto the zirconia. After 24h of storage in distilled water, shear bond strength was evaluated. High value group was re-tested after thermocycling at 5,000 cycles(5-55°C). Shear bond strength data were analyzed with one-way ANOVA, two-way ANOVA test and Post Hoc Test ($\alpha=.05$). Shear bond strength data before and after thermocycling were analyzed with Independent sample T test ($\alpha=.05$). **Results:** Super-bond C&B treated with Rocatec showed the most high shear bond strength. Super-bond C&B groups resulted in significantly higher than other cement groups ($P<.05$). Rocatec groups resulted in significantly higher than other surface treatment groups ($P<.05$). Shear bond strength has increased in Panavia F treated with Zirconia liner ($P<.05$). After thermocycling, shear bond strength was increased in Super-bond C&B treated with Rocatec but decreased in other groups ($P<.05$). **Conclusion:** Super-bond C&B cement resulted the highest shear bond strength and Rocatec system enhanced the shear bond strength. After thermocycling, shear bond strength has decreased in most resin cements except Super-bond C&B treated with Rocatec. (*J Korean Acad Prosthodont* 2013;51:73-81)

Key words: Zirconia; Shear bond strength; Sandblasting; Zirconia liner; Rocatec