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Does a free-of-charge distribution of boil-andbite mouthguards to young adult amateur sportsmen affect oral and facial trauma?

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Correspondence to: Dr Liran Levin, Department of Oral Rehabilitation, The Maurice and Gabriela Goldschleger, School of Dental Medicine, Tel-Aviv University, Tel-Aviv, Israel Tel.: +972 3 6409112 Fax: +972 3 6409250 e-mail: liranl@post.tau.ac.il Accepted 22 March, 2008 Abstract - The purpose of this retrospective study was to evaluate the compliance effectiveness of free-of-charge distribution of boil-and-bite mouthguards to amateur sportsmen who exercise and play without a formal team, a coach, or regulations. Several infantry units in the Israel Defense Forces distributed maxillary boil-and-bite mouthguards to their recruits. Target companies from these battalions and from similar battalions (comparison group -mouthguards not supplied), were selected. Soldiers were interviewed using a structured questionnaire. Of the 630 male participants, 272 received a mouthguard and 358 served as the comparison group. No differences were found between groups regarding demographic parameters or overall trauma cases. When compliance to a free-of-charge distributed boil-and-bite mouthguard was assessed, 93 (34.2%) participants reported using the mouthguard during sport activities. Compliance was high for martial arts, but low for other sports. Although the number of self-reported sport-related oral/dental trauma cases was similar between mouthguard users and non-users, the users group showed less severe injuries. However, free distribution to young amateur sportsmen does not affect oral and dental trauma unless accompanied by education and motivation.

Accidents are common causes of oral and dental trauma, as well as other maxillofacial injuries as a result of sport activities, especially between the second and fifth decades of life (1–4). Mouthguards were first invented by Krause in the 1890s to prevent lip lacerations in boxers (5), but is currently used to prevent dental and brain injuries. According to the time/area principles of elasticity, the mouthguard reduces the impact force in a direct blow to the jaw. Moreover, by creating a gap between the condyle and the skull, the mouthguard reduces the impact transference to the brain (6).

Currently, mouthguard usage is a proven method to reduce the prevalence and severity of injuries to the teeth, jaws, and intra-oral and peri-oral soft tissues, as well as jaw fractures, concussions, and neck injuries (7, 8). However, in one study, football officials only partial complied to mouthguard regulations (7). Moreover, when a mouthguard is compulsory, there is still general unawareness of the need for mouth protection (9). In young adults, awareness and compliance are low. In a study that evaluated the occurrence of oral and dental injuries in young Israelis, only 27% of the participants (amateur sportsmen in diverse sport activities), were aware of protective devices (e.g., mouthguards) and only 3% actually used them (4). These results show the high risk of potential dental and oral injury during sport activities and the little knowledge regarding the benefits of mouthguards and their limited use. Nevertheless, most researchers study the effect of mouthguard usage in professional or semiprofessional (e.g., high-school teams) sportsmen (10), and not the usage in amateur sports activities (4, 11, 12). The purpose of this retrospective study was to evaluate the compliance effectiveness of free-of-charge distribution of boil-and-bite mouthguards to amateur sportsmen who exercise and play without a formal team, a coach, or regulations.

Methods

Several infantry units in the Israel Defense Forces distributed maxillary boil-and-bite mouthguards to their recruits. Target companies were selected from these battalions, as well as from similar battalions (comparison group – no mouthguards). Both groups were similar in age, socio-economic and education status, recruitment methods, training program, and military activities.

A structured questionnaire was used to collect demographic personal details and sports-related oral and dental trauma during military service: occurrence, location and type of sport, extent of injuries, whether the injury caused disturbance, and number of days of disturbance. Participation was voluntary.

Non-sports-related trauma events, non-sport active soldiers or those active in a professional sports team were excluded, as well as soldiers who had a mouthguard prior to recruitment. No clinical examinations or evaluation of dental/medical records were performed in this study setting. This retrospective study included 630 male participants in which 272 received a mouthguard upon recruitment. The remaining 358 served as a comparison group.

Data were collected and analyzed by spss 12.0 (SPSS Inc., Chicago, IL, USA). The comparison between the dichotomous variables was examined using McNemar test. A value of P < 0.05 was considered statistically significant.

Results

Table 1 shows the demographic details, sport activities, awareness, and sport-related dental trauma events. There were no differences between groups regarding demographic parameters or overall trauma cases. There were no reports of sport-related injury in other sports than the main sport activity. A significant difference was found in the awareness of the protective role of the mouthguard.

In the receivers group, 93 (34.2%) participants reported using the mouthguard during sport activities, but most (65.8%) did not. Table 2 presents the demographic details, sport activities, awareness, and dental trauma events among the 272 mouthguard receivers and

Table 1. Demographic details, sport activities, awareness and dental trauma events of receivers vs non-receivers (comparison group)

Characteristics	Mouthguard receivers	Comparison group (non-receivers)
No.	272	358
Mean age, years (± SD)	21.79 (± 3.0)	21.23 (± 3.5)
Time from recruitment/receiving of mouthguard, months (± SD)	31.83 (± 14.2)	28.47 (± 16.4)
Main sport activity		
Athletics	109 (40.1%)	196 (54.7%)
Ball games	94 (34.6%)	119 (33.2%)
Martial arts	39 (14.3%)	18 (5%)
Others	30 (11%)	25 (7%)
Awareness to the protective role of mouthguard*	171 (62.9%)	45 (12.6%)
No. of sport-related oro-facial trauma cases**	38 (14.0%)	31 (8.7%)
Incidences per 1000 person-months	4.39	3.04
Dental fractures*	25 (9.2%)	17 (4.7%)
Dental luxations/subluxations	4 (1.5%)	4 (1.1%)
Lip laceration*	16 (5.9%)	7 (2.0%)
Chin laceration**	8 (2.9%)	5 (1.4%)
Dislocation and/or pain of TMJ*	6 (2.2%)	1 (0.3%)
Fracture of mandibule*	0	1 (0.3%)
* <i>P</i> ≤ 0.001. ** <i>P</i> < 0.05.		

Table .	2. Demo	ographi	c d	etails, sport	activities,	awarer	ness	and
dental	trauma	events	of	mouthguard	receivers:	users	VS	non-
users								

Characteristics	Users	Non-users			
No. (%)	93 (34.2)	179 (65.8)			
Mean age, years (± SD)	21.78 (± 3.3)	21.80 (± 2.8)			
Time from receiving of mouthguard, months (± SD)	29.92 (± 16.6)	32.82 (± 13.0)			
Main sport activity (% of all sportsmen)					
Athletics	27 (24.8)	82 (75.2)			
Ball games	32 (34)	62 (66)			
Martial arts	27 (69.2)	12 (30.8)			
Others	7 (23.3)	23 (76.7)			
Awareness to the protective role of mouthguard*	93 (100)	78 (43.6)			
No. of sport-related oro-facial trauma cases	13 (14)	25 (14)			
Incidences per 1000 person-months	4.67	4.26			
Dental fractures	8 (8.6)	17 (9.5)			
Dental luxations/subluxations*	0	4 (2.2)			
Lip laceration	7 (7.5)	9 (5)			
Chin laceration	4 (4.3)	4 (2.2)			
Dislocation and/or pain of TMJ	1 (1.1)	5 (2.8)			
Fracture of mandibule	0	0			
* <i>P</i> < 0.001.					

Table 3. Demographic details, awareness and dental trauma events of *martial art* sportsmen among mouthguards receivers: users vs non-users

Characteristics	Users	Non-users
No. (% of martial art sportsmen)	27 (69.2)	12 (30.7)
Mean age, years (± SD)	21.69 (± 3.8)	21.36 (± 2.0)
Time from receiving of mouthguard, months (± SD)	35.17 (± 26.7)	29.36 (± 20.7)
Awareness to the protective role of mouthguard*	27 (100)	5 (41.7)
No. of martial arts-related oro-facial trauma cases*	3 (11.1)	6 (50)
Incidences per 1000 person-months*	3.16	17.03
Dental fractures*	2 (7.4)	0
Dental luxations/subluxations*	0	1 (8.3)
Lip laceration*	1 (3.7)	4 (33.3)
Chin laceration*	0	2 (16.7)
Dislocation and/or pain of TMJ*	0	3 (25)
Fracture of mandibule	0	0
* <i>P</i> < 0.001.		

compares actual users with non-users. Compliance was high for martial arts but low for other sports. All users were aware of the mouthguard's protective role compared with less than one-half of the non-users. Although the number of self-reported sport-related oral/dental trauma cases was similar between groups, users showed less severe injuries (i.e. TMJ injuries, dental luxations and sub-luxations, and dental fractures) but a higher incidence of peri-oral soft tissue lacerations. This same trend was observed more significantly when separating participants who practiced martial arts (Table 3) and, also, those who practiced ball sports, but to a lesser extent (Table 4).

Table 4. Demographic details, awareness and dental trauma events of *ball sports* players among mouthguards receivers: users vs non-users

Characteristics	Users	Non-users
No. (% of ball-sports players)	32 (34)	62 (66)
Mean age, years (± SD)	22.39 (± 5.4)	21.37 (± 2.7)
Time from receiving of mouthguard, months (± SD)	33.18 (± 22.5)	29.14 (± 18.1)
Awareness to the protective role of mouthguard*	32 (100)	31 (50)
No. of ball games-related oro-facial trauma cases	3 (9.4)	9 (14.5)
Incidences per 1000 person-months	2.83	6.64
Dental fractures	2 (6.3)	7 (11.3)
Dental luxations/subluxations*	0	2 (3.2)
Lip laceration	3 (9.4)	5 (8.1)
Chin laceration	2 (6.3)	1 (1.6)
Dislocation and/or pain of TMJ	1 (3.2)	2 (3.2)
Fracture of mandibule	0	0
* <i>P</i> < 0.001.		

In the non-users group, only four (16%) of the 25 participants who were injured during their sport activity, stated that they increased their frequency of mouth-guards usage following dental (3) or facial (1) injuries.

Discussion

Sport-related injuries are dependent on geography and culture. The most common sport-related activities to maxillofacial injuries were skiing, cycling, and soccer (3). Basketball and football have the highest incidence of dental trauma among American military personnel and male college students, respectively (1, 13). The present study showed that among Israeli military personnel, the highest incidence of oral and dental trauma was reported in ball games and martial arts.

Only 171 (62.9%) of the 272 mouthguard receivers were familiar with their protective role. This is higher than that found by Levin et al. (4) who surveyed young adult amateur sportsmen (no free mouthguard) and found awareness of 27%. In the present study, only 45 (12.6%) of the non-receivers (comparison group) were familiar with the mouthguard's protective role.

Although 93 of the participants used a mouthguard regularly during their daily sports activities, 78 (28.7%) did not, even with the knowledge of its protective role. The present percentage (34.2%) of mouthguard users is higher than previously found among participants who did not receive a free mouthguard (3%) (4).

It is noteworthy, that in the present study, a professional dental or healthcare provider did not distribute the mouthguards. Thus, the lower than expected compliance and knowledge in the distributed group could be attributed to the lack of sufficient guidance and instructions. In our opinion, the potential of the free-of-charge mouthguard distribution was not fulfilled in this cohort. In addition to mouthguard distribution, a special educational program is required to promote awareness, knowledge, and motivation. The protective role of mouthguard usage should be presented with pictured examples and statistical findings. It is hoped that this will result in better compliance during sport activities, even among amateur sportsmen, who exercise and play without a formal team, a coach, and/or regulations.

As could be seen from the results of present study, although the mouthguard receivers group reported on higher occurrence of dental trauma, when comparing actual users with non-users, users showed less severe injuries (i.e. TMJ injuries, dental luxations and subluxations, and dental fractures). This might further emphasize the protective role of the mouthguard.

Despite its limitations, the present study is one of the first to evaluate the effect of mouthguard usage on oral and dental trauma of amateur sportsmen. The results stress the importance of a protective device during nonprofessional sport activities. Currently, in the USA, only boxing, football, ice hockey, men's lacrosse, and women's field hockey, require a mouthguard at the amateur level, and only boxing at the professional level (8). In Israel, usually non-professional sportsmen are not required to use a mouthguard (12). Moreover, in the present study, most of the nonusers were unaware of the crucial effect of mouthguards as a protective method during sport activities, although they received one. This is in agreement with the report of Levin et al.(4) regarding an extremely low level of awareness and mouthguard usage among young adult sportsmen, including contact sports, in Israel, and with Persson and Kiliaridis (14), who report that out of 26 young adults male wrestlers, not one had worn a mouth protector regularly.

Comfort, the ability to speak and breathe, esthetics, and the athlete's perception of how the mouthguard affects their image as a player, all influence whether a mouthguard will be worn. However, the key factor is inadequate information regarding the risk of injury and the long-term benefits of using a mouthguard (15). Players and coaches should be educated regarding this important issue (15).

In previous reports (10), although the number of selfreported sport-related oral and dental trauma cases were similar between mouthguard users and non-users, there was a shift toward less severe injuries (i.e. less TMJ injuries, luxations and sub-luxations, and dental fractures) and a higher incidence of lip and chin lacerations among mouthguard users. This could be the beneficial effect of the mouthguard – reducing the severity of oral and dental injuries.

In this retrospective self-reported study, luxation and sub-luxation injuries as well as treatment were counted together due to the inability to distinguish between them. Splinting is the treatment for luxation and sub-luxation injuries. Lip and chin lacerations were counted separately, as the etiologies are different. Lips can lacerate from teeth cutting, but the chin cannot. A mouthguard may reduce the possibility of laceration and bruising of intra-oral soft tissues and lips by separating them from the teeth (10).

In laboratory tests, ethylene vinyl acetate custom mouthguards offer superior protection than a boil-andbite design. Nevertheless, most players use over the counter boil-and-bite mouthguards (16), which are

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rather poorly fitted and thin over prominent teeth. Thus, protection is reduced and teeth are prone to damage (17). However, this mouthguard is inexpensive and requires only a short and easy initial adjustment at delivery, making it appropriate for large massive distribution.

Conclusions

Users of the free-of-charge distributed boil-and-bite mouthguards suffer from less severe dental trauma, especially those in amateur martial arts and ball players. However, awareness, education, and motivation must also accompany the free distribution of mouthguards.

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