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Compliance of children and youngsters in the use of mouthguards

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Abstract – The purpose of the study was to examine the compliance of children wearing their mouthguards, and to evaluate socio-environmental factors that impact upon the usage of the device. Eighty children attending the student clinic of the Hadassah School of Dental Medicine received mouthguards free of charge. One year later, 69 participants and their parents answered a survey aimed at gaining information regarding compliance and comfort when wearing the mouthguard correlated with gender, ages of parents and child, number of siblings, position of child in the family, socio-economic status, education of parents and past dental injuries of siblings or parents. Twenty-nine percent of the children never wore the mouthguard, 32% wore it sometimes, 15.9% wore it when necessary at the beginning but stopped after one month and 23.2% wore the mouthguard whenever needed. About 68% of the participants still possessed the mouthguard one year after receiving it, 44.9% reported that they did not wear the mouthguard because they forgot and 42% reported that the reason for not wearing the appliance was because it was not comfortable. Seventy-seven percent of the parents were not aware of the existence of this appliance prior to this study. In addition, 47.9% stated that dentists had not offered such treatment to them in the past, 20.8% indicated that their child had never possessed a mouthguard before due to its significant expense and 39.6% stated that they would not invest in this treatment in the future because their child would not wear the appliance. Boys were more comfortable wearing the mouthguard than girls. The younger the child and the later s/he was in the sibling order of the family, the more likely s/he was to lose the mouthguard.

Individuals worldwide participate in a wide range of vigorous physical activities as well as competitive sports at all levels. As a result, in many cases, such activities are associated with injury risks that include orofacial trauma (1).

The mouthguard is a resilient appliance placed inside the mouth to protect against injuries to the teeth, lacerations to the mouth, fractures and dislocations of the jaw. Epidemiologic and laboratory studies have shown that mouthguards reduce the incidence and extent of dental injuries in sports (2). Moreover, there is evidence that mouthguards are effective in protecting against brain concussion and injuries to the cervical spine (2). The importance of using mouth protectors has been widely recognized. Despite the growing evidence for the importance of mouthguards, however, there is a gap between recognizing their value and actually wearing them (3). The lack of compliance among Japanese soccer athletes, for instance, resulted from insufficient knowledge about mouthguards and the fact that the athletes were not concerned about preventing oral injury, although it is in fact a common problem in their sport (4). In Scotland, there also does not appear to be much awareness or much interest in the need for mouth protection among athletes; however, greater interest in mouth protection was found among players of rugby and hockey, sports in which mouthguards are worn by professional players who may be seen as role models (5). Ferrari and Ferreria indicate, however, that increased awareness does not necessarily increase compliance. They showed that the majority of athletes demonstrated little utilization of mouthguards, in spite of their awareness of the importance of mouthguards during sports practice and their general knowledge of the use of the device (6).

In the 1960s, it was estimated that participants in contact sports had a 10% chance of oral injury each season, with a 33–56% chance of oral injury at some point in their playing lifetime. A more recent study of 14- to 15-year-old school children showed that 26% of oral injuries were a result of participation in sports (5). In Israel, Levin et al. found a general dental trauma during sport activities to be 27%. Their study concluded that the level of usage, knowledge and awareness of the benefits of using a mouthguard was found to be minimal; only 27% of athletes were found to be aware of the mouthguard as a protective device and only 3% reported that they actually used them (7). In a study among fifth and sixth graders in Jerusalem, a general dental trauma prevalence of 29.6% was found, which included 16.1% of mild trauma limited to the enamel and 13.5% severe trauma involving at least the dentin (8).

The aim of our study was to examine the compliance of children wearing their mouthguards and to assess the socio-environmental factors that impact upon the usage of the device.

Materials and methods

The Hadassah Institutional Review Board (IRB) approved this prospective study, and consent was obtained from each participant's parent or guardian.

The study population consisted of a random population sample of 80 youngsters aged 9–17 who arrived for treatment at the student clinic of the Hadassah School of Dental Medicine. The population had no common background regarding education, socio-economic level (as defined by parents' occupation), number of siblings in the family or involvement in specific sport activities. The children received custom-made mouthguards free of charge as well as a full oral and written explanation concerning the usage, cleaning and maintenance of the device. The designed mouthguard had margins extended labially to within 2 mm of the vestibular reflection, adjusted to allow even occlusal contact, rounded at the buccal peripheries and tapered at the palatal edges. One year later, 69 participants and their parents completed a telephonic survey aimed at gaining information regarding compliance and the child's comfort with using the device correlated with gender, ages of parents and child, number of siblings, position of child in the family, socio-economic status, education of parents and past dental injuries of siblings or parents. The survey also addressed the following issues: frequency of use, loss of the device, parent's opinion about aesthetic dentistry, the importance of wearing a mouthguard, the awareness of its existence and parent's personal feeling as to whether mouthguards prevent dental injuries. The survey (translated into English) is shown in the appendix. All children chosen for this study had at least two fully erupted incisors. Twenty-one children were siblings and therefore 48 families made up the study population. Statistical evaluation was performed on the group of 69 children and/or the group of 48 parents as appropriate for each question.

Descriptive statistics such as mean age and SD were calculated. Chi-squared test was used to test the significance of association between two related categorical variables, and significance was set at $P \leq 0.05$.

Results

Out of the 80 patients who received free mouthguards during the years 2004–2005, 69 children, 42 boys and 27 girls with a mean age of 12.7 ± 1.95 years, answered the survey 1 year later (10 patients could not be contacted and one refused to answer the survey). The response rate to our telephonic follow-up survey (86%) is appropriate for studies of this sort. The majority of children (63.8%) belong to the ultra-Orthodox community. Twenty-one of the children were siblings; as a result, 48 parents answered the survey. Of these parents, 42.7% were under the age of 40 and 57.3% were 41 years old or older. Regarding parents' education, 68.8% of the fathers and 47.9% of the mothers had only a high-school education, while 31.3% and 52.1%, respectively, had further education and degrees. Size of family was categorized into two groups: 35.4% of families had up to four children while 64.6% had five children or more. About a quarter of the children were the oldest in their family or second in line, and 72.5% of the children were the third child in the family or younger. No statistically significant associations were seen between frequency of usage of the mouthguard and parental age or parental level of education. Similarly, no correlation was found between frequency of usage and size of family or sibling sequence.

Frequency of usage is shown in Fig. 1. Twenty-nine percent of the children never wore the mouthguard, 31.9% wore it occasionally, 15.9% used the mouthguard frequently during the first month after receiving it and later stopped using the device and 23.2% wore their mouthguard when needed, i.e. during sport activity. Of the children who used the mouthguard 'when needed' or 'occasionally', 34% reported being comfortable, while 21% wore the mouthguard even though they felt discomfort.

Sixty-eight percent of the participants still possessed the mouthguard 1 year after receiving it. Thirty-two percent of the children lost their device, with no difference found between boys and girls. Figure 2

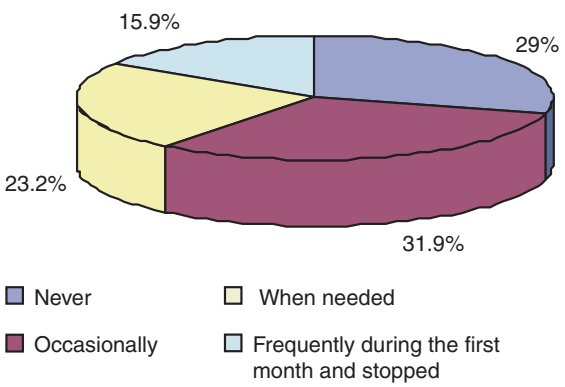

Fig. 1. Frequency of mouthguard usage.

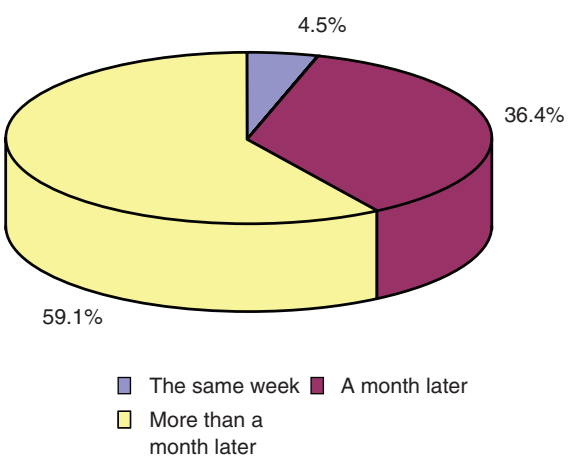

Fig. 2. Time range of losing the mouthguard.

illustrates the time range of losing the mouthguard. Four-and-a-half percent ($n = 1$) lost the mouthguard within a week of receiving it, and 36.4% ($n = 8$) lost it 1 month after receipt. Correlation was found between young-age participants and loss of the device. The mean age of the group of children who indicated that they did not wear their appliance because they lost it (11.43 ± 1.65) was lower than that of the children who did not lose their appliances and gave different excuses for not using the device ($P = 0.005$). In addition to young age, position in the sequence of siblings was a contributing factor towards losing the mouthguard within a year, with children third in line and younger losing their mouthguards significantly more often than first and second children in a family ($P = 0.048$).

Children cited more than one reason for not wearing their mouthguard. The three most common reasons were: 'I forget to put it in my mouth' (45%), 'the appliance was not comfortable' (42%) and 'I'm embarrassed because none of my friends wear a mouthguard' (23%). Girls were found to be bothered by the discomfort significantly more than boys, and often did not wear the mouthguard for this reason ($P = 0.02$). No correlation, however, was noted between embarrassment and gender or age, or between forgetfulness and gender or age, or discomfort and age.

The recognition of the protective value of mouthguards against dental injury varied among parents. Forty-six percent of the parents stated that using a mouthguard during sport activities is essential, while 40% did not know the extent to which a mouthguard protects against dental trauma and 6.3% thought that using a mouthguard during sport activities is unnecessary. In addition, 37.5% of parents thought expecting a child to use it when needed is an unrealistic demand. No relationship was found between parents' education or occupation and their opinion regarding the use of a mouthguard during sports activities.

When asked why it is that the child had not been given a mouthguard in the past, parents provided more than one explanation or reason, as presented in Fig. 3, which add up to a total percentage exceeding 100%. Seventy-seven percent explained that they were not aware of the existence of this appliance prior to this study. In addition, 47.9% stated that dentists had not offered such treatment to them in the past, 20.8% claim this was the first time their child possessed a mouthguard since it is a big expense and 39.6% conclude they would not invest in this treatment because their child would not wear the appliance.

Dental trauma had been experienced in the past by 37.5% of the parents (16.7% of mothers and 20.8% of fathers) and by 43.8% of participants' siblings. An overwhelming majority of the parents (91.7%) stated that an injury to the front teeth is an aesthetic disturbance to one's smile and they would make the effort to fix the damage. In cases in which parents or siblings had sustained dental trauma in the past, 43.8% of parents said that using a mouthguard during sport activities is essential for avoiding dental trauma; however, only 55.3% of children of these parents wore the mouthguard during sport activities and 25.5% lost their device.

Discussion

The main objectives of the present study were to examine the compliance of children wearing their mouthguard, and to evaluate the socio-environmental factors that impact upon the usage of the device.

The mean age of 12.7 ± 1.95 years old calculated for the participants in the study reflects the physiology of dental development necessary to meet the inclusion criteria. Participants in the study had to meet the criteria of having at least two fully erupted incisors. After the emergence of the crown into the oral cavity, two or three more years are required before the root formation of permanent teeth is completed, and a substantial amount of time is generally required before the crown reaches its final occlusal position. The lower central incisors are the earliest to erupt at the age of 6–7, and the top central incisors erupt at the age of 7–8. Consequently, it is only several years later that fully erupted teeth would be seen in the mouth. Until such time as all the permanent teeth have fully erupted and aligned, children may have an

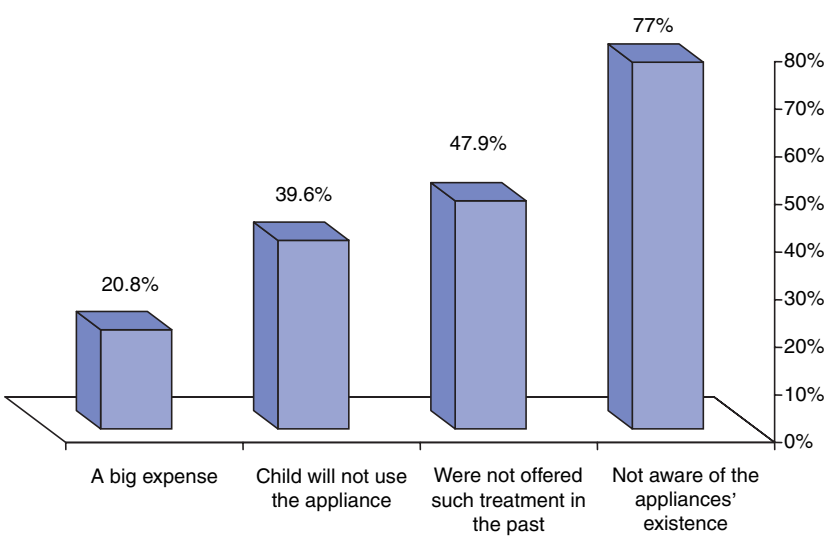

Fig. 3. Reasons cited by parents for no previous mouthguard use.

increased overjet, since the central incisors flare out labialy (9). This age group of children is at high risk of dental trauma (9) and therefore was picked for the study. The orthodontic literature has traditionally demonstrated an association between trauma and incisal overjet, and suggested early orthodontic treatment as a possible preventive treatment of choice (10). The rationale of this has been verified, but the costs involved are often prohibitive for most of the population (8). Mouthguards offer a cheaper and more accessible treatment option for this age group.

We were interested in investigating whether parental age might influence compliance, since it might be expected that more experienced parents would make sure their children would use a mouthguard at every opportunity. In fact, no correlation between parental age and frequency of usage was found. We also examined whether parental level of education might be associated with greater compliance, as it might be expected that better educated parents would be more aware of the need for mouthguard prophylaxis against dental injuries. About half of the mothers and a third of the fathers interviewed had obtained further education and degrees; nevertheless, we found no correlation between parental level of education and compliance with mouthguard use by children. This may be, in part, due to the lack of exposure of the ultra-Orthodox community to the news and information media.

Examining compliance is a difficult task, since it is influenced by many different socio-environmental factors. The attitude towards wearing a mouthguard is influenced, at least by part, by comfort, ability to breathe and speak, aesthetics and the perception of how the mouthguard affects the child's image as a player (11). Persic et al. aver that restriction of breathing, communicative and aesthetic problems are reduced if the mouthguards are custom-made (12). A study evaluating the effect of custom-made mouthguards on the ventilatory gas exchange among taekwondo athletes demonstrates that none of the ventilation and gas values were changed as a result of wearing a mouthguard (13). Therefore, we assumed that difficulty in breathing is not a reason for lack of compliance. As shown in the past, whether or not a mouthguard is used is determined mainly by its comfort (14). In the present study, more than half (55%) of the children did not feel comfortable with their mouthguard. McClelland et al. (15) state that comfort is likely to be increased if mouthguards are extended labially to within 2 mm of the vestibular reflection, adjusted to allow even occlusal contact, rounded at the buccal peripheries and tapered at the palatal edges. In this study, the custom-made mouthgaurds distributed were designed in the way described earlier.

We found boys tolerated mouthguards better than girls did, and that they reported using their device more often. Other studies also show that gender has a significant effect on the reported use of mouthguards, with use significantly lower among girls (11, 16, 17).

The lack of compliance in our study was most commonly attributed to either embarrassment or forgetfulness: 'I'm the only kid wearing this device among all my friends' or 'I forget to put it in my mouth'. Similarly, the most common reasons for not wearing mouthguards among participants who reported that they do not use them are: 'I don't like wearing it', and 'it is too uncomfortable' (18). Another frequent reason shown in other studies for not wearing a mouthguard is that most people think that they do not need one (12, 19).

Awareness of existence of the device does not necessarily impact upon the compliance rate. Prior to the participation of their children in our study, only 23% of the parents were aware of existence of a mouthguard as a protective device. Other studies show that although most sportsmen are well informed about mouthguard usage and aware of the benefits of mouthguards, a relatively small percentage of sportsmen in contact sports actually use them (6, 7, 11, 12, 14, 17, 19).

Concerning the dentist's job in increasing parental awareness to the existence of the mouthguard and its benefits, the second to most frequent reason that parents stated for the child not using a mouthguard in the past was that their dentist had not offered them a mouthguard before. Eighty-two percent of Nigerian dentists had never recommended mouthguard protection for athletic patients, and the major reason was no formal training in the subject (20). In contrast, in the United States, Pribble et al. (21) reported that 30% of respondents in his study were recommended mouthguards for competitive youth soccer by a dentist or physician. In Israel, the subject of sport dentistry has only recently gained more attention. However, the fact that almost half of the Israeli parents in our study were unaware of the existence of a mouthguard highlights the need for more aggressive promotion of this modality by the local dental profession.

In our study, the potential financial barrier to mouthguard compliance was neutralized by providing the mouthguards free of charge. Nevertheless, it seems that expense is not a major impediment to mouthguard use, as only 21% of the parents attributed lack of prior mouthguard use to the expense entailed. On the other end of the socio-economical class scale, the Central Collegiate Hockey Association in the United States claims that 91% of their players were not influenced by the cost of the mouthguard (22). It is also possible that in our study, the fact that the appliance was provided free of charge may have resulted in the mouthguard being undervalued by parents.

It has previously been reported that a prior history of dental trauma might increase the likelihood of a parent insisting on a child wearing a mouthguard in future, particularly during contact sports (23). Tulunoglu's et al. evaluations reveal a statistically significant difference between patients with or without a dental trauma experience and mouthguard awareness and usage (11). On the contrary, a survey among squash players and coaches in Switzerland, Germany and France indicates that no player who suffered from a dental accident wore a mouthguard after the accident (12). Studies that examined the incidence of previous dental trauma in their participants found that over a third of subjects sustained one form of orofacial injury in the past (17, 24). The impact of previous dental injury in a

parent or sibling on the compliance of a child, however, has not previously been studied. So as to evaluate the potential impact of this factor on child compliance, we interviewed the parents and siblings of the participants in our study. Although many of the parents (37.5%) and siblings (44%) had indeed experienced dental trauma in the past, we found no correlation between this factor and parental attitude or child compliance.

The present study demonstrates a marked cognitive dissonance between the attitude of parents to the aesthetic appearance of their child and their insistence on using the mouthguard. On the one hand, 91.7% of the parents declared that an injury to front teeth is an aesthetic disturbance to one's smile and indicated that they would make the effort to fix such damage. On the other hand, only half stated that using a mouthguard during sport activities is essential for avoiding dental trauma and less than a quarter of the children studied actually wore the mouthguard when needed.

Conclusions

This study assessed the compliance and usage of mouthguards a year after receiving them free of charge. Evaluation of the knowledge about the existence of a mouthguard and its benefits, the parental attitude towards sport dentistry and the practice of wearing the device by participants demonstrated:

1. Three predictor variables were statistically identified as related to mouthguard existence and usage: gender, age and position among siblings in the family. Girls were found to be bothered by the discomfort significantly more than boys and often did not wear the mouthguard for this reason. The younger the child and the later s/he was in the sibling order of the family, the more likely s/he was to lose the mouthguard.
2. Most children who did not use their mouthguards did not do so due to forgetfulness (45%) or discomfort (42%).
3. The fact that close family members had experienced dental trauma in the past did not increase parents' awareness of the option of mouthguard use as a protective device and did not increase child compliance of wearing the mouthguard.
4. Half of the parents reported that this was the first time their child used a mouthguard, since no dentist had offered them such a device in the past.
5. One year after receiving the appliance, two-thirds of the children still possessed their mouthguard, but a third of them never used it.

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Appendix

Sample of the survey (translated)

1. When did the child use the mouthguard?
   - ☐ During every sport activity, e.g: bicycle riding
   - ☐ Sometimes
   - ☐ Never
   - ☐ Consistently at the beginning and stopped after one month

2. Did the child feel comfortable with the mouthguard?
   - ☐ Yes ☐ No

3. Why didn't the child wear the mouthguard?
   - ☐ S/he is the only one among his friends with such a device
   - ☐ S/he is uncomfortable
   - ☐ S/he forgets
   - ☐ S/he lost it
   - ☐ Other _____

4. When did you lose your mouthguard?
   - ☐ The same week as receiving it
   - ☐ A month after receiving it
   - ☐ More than a month after receiving it

5. As a parent, I think using a mouthguard during sport activities is: (More than one answer is possible)
   - ☐ Necessary in order to prevent or reduce dental trauma
   - ☐ Unnecessary
   - ☐ I do not know how much it could help to prevent or reduce dental trauma
   - ☐ An unrealistic demand for a child

6. Why it is that your child had not been given a mouthguard in the past?
   - ☐ The dentist did not offer such treatment in the past
   - ☐ I did not know of the existence of such a device
   - ☐ It is expensive
   - ☐ I do not invest in things I know my child will not use

7. Did one of the parents undergo dental trauma in the past?
   - ☐ Yes- Mother
   - ☐ Yes- Father
   - ☐ No

8. Did one of the siblings undergo dental trauma in the past?
   - ☐ Yes
   - ☐ No

9. As a parent, to what extent is aninjury to front teeth an esthetic disturbance to your child's smile and what effort would you make to fix the damage?
   - ☐ Very disturbing, I do what is needed to obtain a perfect smile
   - ☐ Disturbing, but no need to fix
   - ☐ Not disturbing, no need to fix