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Use of mouth guard in basketball: observational study of a group of teenagers with and without motivational reinforcement

ABSTRACT

Aim This study aims at ascertaining the capacity of 2 groups of young athletes to be faithful to the initial oral prevention project, with the difference that the study group received motivational reminders by either researchers and technical staff members of the team during the observation period, while the control group did not receive any motivational reminders.

Materials and methods This observational study was based on two groups selected from a wide group of 150 adolescent basketball players who accepted to use a custom-made mouth guard during their sport sessions. None of the selected athletes (60 adolescents aged between 12 and 15 years) had ever worn a mouth guard during their sports activity. A customised mouth guard was supplied, and subjects were requested to wear it for 12 months during training sessions and competitions. The study group was composed of 30 athletes, 15 males and 15 females, who received a constant motivational reinforcement to the use of the mouth guard by their coach and during checkups. Similarly, the control group was composed of 30 athletes (15 males and 15 females) who did not receive any motivational reinforcement.

Results Twelve months after the beginning of the study, 24 subjects belonging to the control group were

not using the mouth guard, while only 7 subjects of the study group were not using it. It was also noticed, six months after the beginning of the observation period, a rapid decline in the participants' interest in the use of the mouth guard.

Conclusion No traumatic event was registered among those adolescents who had used the mouth guard for the whole period of the study. Female athletes showed greater compliance to this prevention project. It is important that all technical staff members, and particularly the leading coach, encourage the regular use of oral protection devices for prevention among teenagers practicing sports.

Keywords Dental Trauma; Mouthguard; Sports dentistry.

Introduction

Dental traumas have an incidence between 25 and 30% in the teen population practising sports activities [Glendor, 2009]. The age range between 11 and 15 years is the time when many people start practicing agonistic sports, many of which are contact sports with a high traumatic risk for the oral cavity and teeth. In this age range a tooth trauma can lead to injuries which can be serious and often cannot be rehabilitated in a satisfactory way (avulsion, coronal-root fracture). For this reason it would be always desirable to apply adequate methods to prevent dental traumas so that such events can be limited or avoided [Bauss et al., 2004; Shulman and Peterson, 2004]. In fact, literature evidence shows that all prevention methods should be implemented on those who practice sports activities that imply a traumatic risk, with the aim of diminishing the number of dental traumatic events. In performing any sports activity, it is generally accepted that the use of correct oral protection devices (such as mouth guards) can dramatically reduce or even eliminate the consequences of a trauma on one's teeth and support tissues [Yeşil and Gungor, 2009; Stenger et al., 1964].

Among the various types of mouth guards, it would be advisable to use those devices with specific characteristics of adequate quality of production and adaptability, based on the age and the features of the mouth of the young athlete (custom-made mouth guard). However, the number of athletes wearing an oral protection device during risky sports activities is very low, except in those sports or competitions where their use is compulsory (boxing, martial arts, field and ice hockey, football) [Çetinbaş and Sönmez, 2006; Scott et al., 1994]. The regularity in the use of these devices is a rare occurrence: it is difficult to make an athlete, especially a young one, use them, and the literature informs us of the quick loss of interest in the use of these devices over time [Yamada et al., 2006; Miller and Truhe, 1991].

This study aims to ascertain the capacity of a group of adolescents, informed about the possible risk of facial and dental trauma during sports activity, to use a custom-made mouth guard, during their sport sessions with and without a continuous motivational reinforcement, and then value the regularity in the use and the eventually abandoned timing of these devices during the 12-month observational period. The possible different behavioural responses of the two groups could lead to interesting considerations on the possibilities to use preventive devices during adolescent age.

Material and methods

Our study was based on two groups of adolescent basketball players who accepted to use a custom-made mouth guard which we provided for free, during their sport sessions (Fig. 1).

Subjects were randomly selected from a group of 150 young athletes (80 girls and 70 boys) aged between 11 and 15 years, who played basketball in six major sports groups in the city of Cagliari (Italy), who took part in a series of informative meetings organised by our research group aimed at informing about the risk of facial and dental traumas during sports activity, and motivate coaches to promote the use of protective devices like mouth guards.

The first selection criterion was complete eruption of the permanent teeth: this is the reason why many young athletes could not be included in our sample group. This limit was due to the production of a double-laminated custom-made mouth guard for each athlete, whose production requires the complete eruption of the teeth for a correct molding of the dental arch. The athletes wearing multi-bracket braces on the upper dental arch were also excluded from the study (Fig. 2). The reason for such second limits was based on the consideration that, with participants of very young age, the sample group could include athletes whose permanent teeth had not yet completed the eruption stage, thus creating problems at the time of producing and wearing a custom-made mouth guard, in terms of the need to continually adapt the device during the observational period [Spinas and Savasta, 2007]. The patients undergoing orthodontic therapy aimed at modifying the position of the dental arches could also represent a problem in terms of complications to the whole process [Bauss et al., 2004]. It is well known that in young boys and girls in mixed dentition the use of boil-and-bite type mouth guard can be more suitable, because it offers the chance to be modified several times, with a consistent reduction of costs compared to the individual device [Spinas and Savasta, 2007; Spinas, 2009].

Parents and managers of sports teams were also informed of the aim of the study and all its stages. After the first informative phase, the athletes and their parents (due to their being underage) were asked to sign an informed consent in order to proceed with the fabrication



FIG. 1 Type of mouthguard used in the project. Oral view.



FIG. 2 Oral view of a patient with a multi-bracket orthodontic appliance in the inferior dental arch.

and use of the device. None of the selected athletes had ever worn a mouth guard during their sports activity.

All 60 athletes included in the study were asked to wear the mouth guards during their weekly training sessions (twice a week) and during games (once a week) for 12 months; 30 athletes were randomly assigned to the study group and 30 to the control group, both comparable for age (12-15) and sex (15 F and 15 M). The study group received continuous motivational reinforcements to use the mouth guard, both by their coaches and our research group, during the whole observation period. The control group followed the initial oral prevention project, but without any motivational reminder. For this reason the coaches of the control group were informed of the modalities, characteristics and aims of the study, but were not asked any particular form of commitment in terms of pressing the athletes about the use of the mouth guard both during the training sessions and the competitions.

In the study group two subjects had already suffered dental traumas (crown fractures), but not in a sport-related accident. In the control group, 3 subjects had already suffered dental traumas (crown fractures), and only one of them in a sport-related accident.

Timing

The timings of the study consisted in the start of the use of the protective device (T0) followed by clinical checkups at 3, 6 and 12 months (Steps 1, 2 and 3). The observational period started after a week, which was needed to verify the correct adaptation of the devices and their wearability by the young participants. The follow-up started on September 2010 and ended on September 2011.

Check-ups of the control group were not designed to convince or motivate the athletes to the use of the mouth guard, but only to check the fitting of the device for efficacy and reliability for the study. At T0 the 60 athletes were accurately visited, their impression taken,

and 60 individual mouth guard were fabricated with the Druformat technique (Drevo Dentamid, Unna, Germany); these devices were double laminated and they respected the characteristics indicated by the producer for the realization of the "Junior" model.

Statistical analysis

Data were analysed with the Stata-12 package (Stata Corp LP, Texas - USA). We assessed the statistical significance of the difference in the ratio of athletes who stopped the use of mouth guard in the two groups after one-year and the proportion of males and females who stopped using the mouth guard.

Results

No traumatic event was registered among those adolescents who had used the mouth guard for the whole period of the study, while one of the subjects (a boy belonging to the control group), who had abandoned the use of the mouth guard after only three months, had an accident during a game which caused the dislocation of teeth 1.1 and 2.1 (the latter also needed a root canal treatment). None of the mouth guards provided showed any structural damage, and their structural conditions at the end of the observation period were satisfactory.

Control group

Three months (Step 1) after T0 participants were interviewed and the devices were checked for fitting. In this first check 15 subjects (11 boys and 4 girls) reported that they had not used the device constantly (10 used it only during games), while 15 used it regularly.

In the following Step 2 (i.e. 6 months after T0) 21 subjects (13 boys and 8 girls) were not using the mouth guard on a regular basis, leaving only 9 participants who used it regularly.

At the third check up, at 12 months, 24 subjects (14 boys and 10 girls) stated that they were not using the device any more (Fig. 3).

Study group

As said, the athletes in the study group had a continuous motivational reinforcement by their coaches and by the researchers at the 3-steps follow-ups.

At Step 1 six athletes (4 males and 2 females) out of 30 complained major discomforts during the use of the mouth guard and, in spite of the constant encouragement of their coach, they were not able to wear it regularly.

At Step 2, after 6 months, all the athletes were wearing the device regularly except the 6 above mentioned, while another male athlete had already completely abandoned the use of the device.

At Step 3, after 12 months, out of the initial 30 athletes 23 were still wearing the mouth guard regularly and 7 (5 males and 2 female) had definitely abandoned it (Fig. 4).

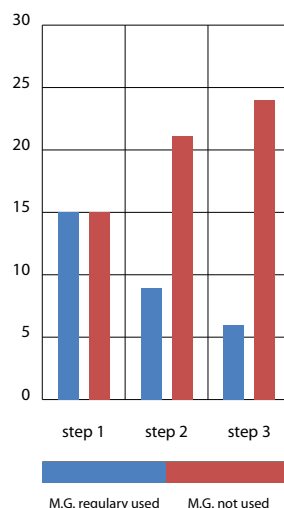


FIG. 3 The use of the mouth guard in the control group (n=30) during the observation period.

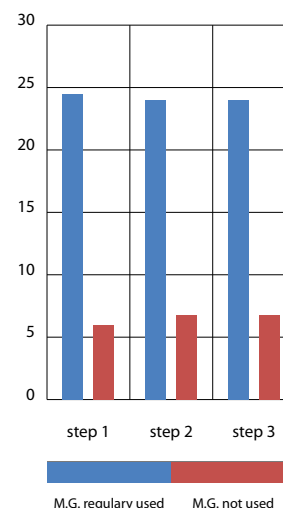


FIG. 4 The use of the mouth guard in the study group (n=30) during the observation period.

Statistical results

Data were analysed with the Stata-12 (Stata Corp LP, Texas - USA). We assessed the statistical significance of the difference in the ratio of athletes who stopped the use of mouth guard in the two groups after one-year and the proportion of males and females who stopped using it. In the control group we observed a proportion of 0.80 (30 subjects in the group) for the athletes who quit (24 out of 30). In the study group the total proportion of athletes who quit was 0.23 (7 out of 30) (Table 1). There is a statistically significant difference between the proportion of athletes who abandoned the use of the mouth guard in the two groups (the 95% C.I. for estimate of the parameter does not include 0). However, the results do not show a statistically significant differences (at 95% C.I. level) between the proportion of male and female athletes who abandoned the use of the mouth guard .

The 95% C.I. for the estimate of the parameter ranges between -0.01 and 0.43 (it included 0) (Table 2).

Discussion

This study showed two different behaviours: in the control group it was seen a rapid decline in the participants' interest in the usefulness of the prevention project; in fact, after six months 21 subjects out of 30 had abandoned the regular use of the protection device, and at the end of the observational period of 12 months, the subjects who had abandoned the project were 24.

The proportion of athletes who quit the use of mouth guard is 0.80 in the control group while it is 0.23 in the study group: the difference is significant (95% C.I.: [0.36; 0.77]) if we think that at the time of the presentation

of the study the researchers and coaches were asked to refrain from any motivational reinforcement for the use of the mouth guard. The results demonstrate a significant effect of the motivational reinforcement.

It is clear enough that without any motivational support many young athletes have quit the use of the device already after short period, though adequately informed on the usefulness of the mouth guard for the prevention of possible serious damages to their teeth; moreover they all accepted to use the mouth guard in consideration of a safe and complete protection system.

After one year since the beginning of the project, only 6 athletes were still wearing the mouth guard constantly during all their sports activities. Among those athletes who quit the mouth guard the results do not highlight a significant difference between males (0.63) and females (0.40) (95% C.I.: [-0.01;0.48]). We deem this result to be carefully considered; indeed, in percentage terms, girls seems far more compliant with the study compared to boys: 5 girls out of 15 completed the project whereas, among the boys, only 1 out of 15 did the same. The graph shows this difference (Fig. 5).

The study group received a continuous motivational reinforcement for the use of the mouth guard by coaches and researchers during the 3-steps of follow-up. Twenty-three athletes out of 30 completed the observation period fully compliant with the program of oral protection. Only 7 athletes quit the program despite the constant encouragements received.

Basketball is one of those sports activities classified by the FDI (1) as a medium-risk activity for dental trauma (in the same category of handball, soccer, squash and water polo); the regular use of a mouth guard during the games should always be encouraged. Contacts between players are very frequent, and the low level of experience, like in this young group of athletes, contributes to increase the risk of trauma. As a confirmation of this theory and of the high chance of risk existing in this sport [Perunski et al., 2005; Cetinbaş et al., 2008], one of the boys (member of the control group) who quit the use of the mouth protector too early (before the first step) had an oral injury during a game, which caused the dislocation of the central upper incisor teeth.

The information gathered through the interviews of our researchers regarding the comments of the young participants to the study on the early abandonment of the device, are also very interesting. With regard to the control group, those adolescents who abandoned the project (Step one and two) stated that the main reason for quitting was that the device was bulky (14 subjects); other reasons were dryness of the mouth (2 subjects), but above all the sensation of feeling different and inadequate with respect to the opponent athletes (10 subjects) (Fig. 6), as no one ever wore a mouth guard during the games, a fact that very often led to ironic comments by fellow teenagers and that made the study subjects abandon the use of the device.

GROUP	Proportion	Std. Err.	[95% Conf. Interval]	
Control	0.80000	0.07303	0.65686	0.94313
Study	0.23000	0.07722	0.08198	0.38468
diff	0.56667	0.10628	0.35835	0.77498
Control: Number of obs = 30 Study: Number of obs = 30				

TABLE 1 Two-sample test of proportions for the athletes who abandoned the use of the mouth guard in the study and control group.

GROUP	Proportion	Std. Err.	[95% Conf. Interval]	
Control	0.63333	0.08798	0.46089	0.80577
Study	0.40000	0.08944	0.22470	0.57530
diff	0.23333	0.12546	-0.01257	0.47923
Control: Number of obs = 30 Study: Number of obs = 30				

TABLE 2 Two-sample test of proportions for female and male athletes who abandoned the use of the mouth guard.

Conversely, in the study group 3 young athletes withdrew due to the feeling of bulkiness caused by the mouth guard, 3 for the sensation of being different and inadequate with respect to the opponent athletes and 1 due to dryness of the mouth.

Therefore, it appears plain and clear that in order to favour and motivate the use of oral protectors among teenagers, it is necessary to have a constant reiteration of a motivational message, especially by someone that the young athletes trust such as those who are closer (parents), healthcare professionals, and particularly the sport group technical staff.

Our results seem comparable to what found in the literature about the key role that the coaches could play in

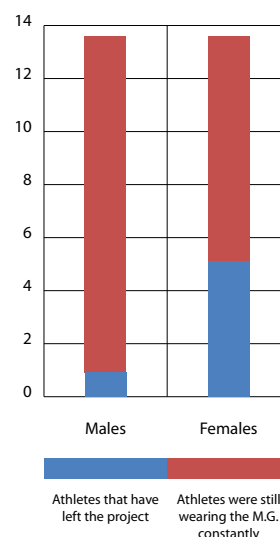


FIG. 5 Control group: The graph shows the different of compliance of males and females to the prevention project at Step 3.

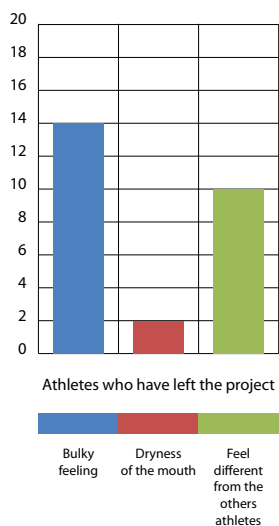


FIG. 6 Example of reasons for quitting the use of the mouth guard.

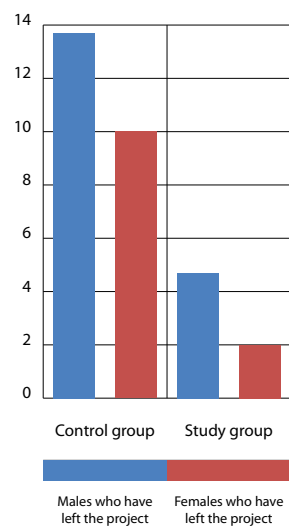


FIG. 7 Control group and study group. The graph shows the different of compliance of males and females to the prevention project at Step 3.

being constantly on the subject, informing and motivating the athletes; their support has proven to be even more fruitful than that of a family member [Spinas and Savasta, 2007; Gardiner and Ranalli, 2000; Boffano et al., 2012].

It is also useful to underline the need of a stronger promotional campaign in favour of mouth guards among teenagers: as this study shows, almost none of the opponent team members wore a mouth guard. In general, there is a need also for dentists (particularly paediatric dentists and orthodontists) to promote the use of these devices at least among parent of athletes with predisposing anatomical factors of risk of sports accidents the use of mouth guard as a primary preventive measure, according to the subjects interviewed for the study, was never mentioned to them, and they had never before used such devices.

Eventually, it was noticed that female teenagers are very interested in prevention [Queiröz et al., 2013] as demonstrated by the limited number of withdrawals in the control group (10 out of 15 females quit the program, compared to 14 out of 15 males) and this is even better confirmed in the study group where the withdrawals were only 2 out of 15 females, while the withdrawals in the male group were 5 out of 15 (Fig. 7).

Conclusion

Our study highlighted that most of the young athletes abandoned the regular use of the mouth protector already six months after the beginning of the observation period, despite all the most qualified methods for prevention of dental traumas in sports were implemented, an accurate selection of the technical materials had been done and the

observation time was not excessively long (12 months).

We think that such behaviour is due in particular to the lack of a constant motivational support by the technical staff of the teams, especially coaches of the control group, as expected. This is confirmed by the results obtained in the study group, where a continuous motivational reinforcement by coaches led to a lower number of athletes who quit the use of the mouth guard.

Therefore, it is important that all sports technical staff members encourage the regular use of the mouth guards among teenagers practicing risk contact sports.

Finally, from the study it emerges that female athletes showed greater compliance to this project of prevention of oral trauma. Further studies with a larger number of participants will be needed to confirm the data shown in the present study, so as to further confirm both the present data and the large amount of evidence already shown in literature.

References

- › Bauss O, Rohling J, Schwestka-Polly R. Prevalence of traumatic injuries to the permanent incisors in candidates for orthodontic treatment. *Dent traumatol* 2004; 20:61-66
- › Boffano P, Boffano M, Gallesio C, Roccia F, Cignetti R, Piana R. Rugby athletes' awareness and compliance in the use of mouthguards in the North West of Italy. *Dent Traumatol*. 2012 Jun;28(3):210-3.
- › Çetinbaş T, Sönmez H. Mouthguard utilization rates during sport activities in Ankara, Turkey. *Dental Traumatology* 2006;22:127-129.
- › Cetinbaş T, Yildirim G, Sönmez H. The relationship between sports activities and permanent incisor crown fractures in a group of school children aged 7-9 and 11-13 in Ankara, Turkey. *Dent Traumatol*. 2008 Oct;24(5):532-6.
- › Duhaime CF, Whitmyer CC, Butler RS, Kuban B. Comparison of forces transmitted through different EVA mouthguards. *Dent Traumatol*. 2006 Aug;22(4):186-92.
- › Gardiner DM, Ranalli DN. Attitudinal factors influencing mouthguard utilization. *Dent Clin North Am*. 2000 Jan;44(1):53-65.
- › Glendor U. Aetiology and risk factors related to traumatic dental injuries--a review of the literature. *Dent Traumatol*. 2009 Feb;25(1):19-31.
- › Miller M, Truhe TF. Mouthguard use should be encouraged for many sports. *Dentistry*. 1991 Feb;11(1):21-2.
- › Perunski S, Lang B, Pohl Y, Filippi A. Level of information concerning dental injuries and their prevention in Swiss basket ball - a survey among players and coaches. *Dent Traumatol* 2005; 21: 195- 200.
- › Queiröz AFVR., Barbosa de Brito R., Cama Ramacciato J., Lopes Motta RH, Martao Florio F., Influence of mouth guard on the physical performance of soccer players. *Dent Traumatol* 2013 Dec; 29(6): 450-454.
- › Scott J, Burke FJ, Watts DC. A review of dental injuries and the use of mouthguards in contact team sports. *Br Dent J*. 1994 Apr 23;176(8):310-4.
- › Shulman JD, Peterson J. The association between incisor trauma and occlusal characteristics in individuals 8-50 years of age. *Dent Traumatol*. 2004 Apr;20(2):67-74.
- › Spinass E. *Odontoiatria e Sport*. Edi Ermes Edizioni, Milano -2009
- › Spinass E, Savasta A. Prevention of traumatic dental lesions: cognitive research on the role of mouthguards during sport activities in paediatric age. *Eur J Paediatr Dent*. 2007 Dec;8(4):193-8.
- › Stenger JM, Lawson EA, Wright JM, Ricketts J. Mouthguards: protection against shock to head, neck and teeth. *J Am Dent Assoc*. 1964 Sep;69:273-81.
- › Yamada J., Maeda Y, Satol H., Miura J. Anterior palatal mouthguard margin location and its effect on shock-absorbing capability. *Dent Traumatol* 2006;22:139-144.
- › Yeşil Duymuş Z, Gungor H. Use of mouthguard rates among university athletes during sport activities in Erzurum, Turkey. *Dent Traumatol*. 2009 Jun;25(3):318-22.