

Mouthguard use and dental injury in sport: a questionnaire study of national school children in the west of Ireland

Précis

A survey of parents of 505 national school children (aged nine to 13) found that 22% wore mouthguards during sport. A mouthguard policy may increase mouthguard use.

Abstract

Statement of the problem: The risk of children getting dental injuries during sport can be minimised by using a mouthguard. Within Ireland, information on mouthguard use and policy is limited. The extent of dental trauma experienced by children during sport is also unclear.

Purpose of the study: To determine the extent of mouthguard use, dental trauma and barriers to use among children. The survey also investigated school and sports club policy on mouthguard use in sport.

Materials and methods: A questionnaire was sent to parents of 1,111 children aged nine to 13 years attending 25 randomly selected schools in the Health Service Executive West region of Ireland. It sought information about children's sporting activities, mouthguard policy and use, barriers to use, and dental accidents.

Results: A total of 505 questionnaires were returned (46%). More than nine out of ten children were involved in sport. Mouthguards were worn by 22% of children during sport. Less than one-third of schools and sports clubs that children attended had a mouthguard policy. Significantly more children used mouthguards where there was a mouthguard policy. Reasons for not wearing mouthguards included cost, lack of knowledge and information, and lack of a mouthguard policy. One in ten children had suffered a sports accident in the previous year, of which 51% injured teeth. Of these, 72% visited a dentist within two hours.

Conclusions: The dental profession and individual practitioners should promote mouthguard use for children during sport and be advocates for the development of policies in schools and sporting organisations.

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TABLE 1: Summary of key questions included in the survey.

| QUESTION | RESPONSE CHOICES |
|---|--|
| What age is your child? | _____years |
| Gender of child | Male, female |
| What sports does your child play? | Gaelic football, soccer, camogie, hurling, rugby, basketball, other |
| Does your school have a policy about the wearing of mouthguards? | Yes, no, don't know |
| Does the sports club/clubs your child attends have a policy about the wearing of mouthguards? | All of the clubs, most of the clubs, some of the clubs, none of the clubs |
| Does your child wear a mouthguard while playing any sport? | Yes, no |
| Why doesn't your child wear a mouthguard while playing sport? | Open-ended question |
| For which of the following sports does your child wear a mouthguard? | Gaelic football, soccer, camogie, hurling, rugby, basketball, other |
| What type of mouthguard do they wear? | Sports shop brand (Ozone, Shockdoctor, Rugbymate, Rival), dentist (impression of child's mouth), other, don't know |
| Did your child have any accidents in the past year, while playing sport? | Yes, no |
| Did any of the accidents involve your child's teeth? | Yes, no |
| In any of the accidents in the past year were the teeth involved permanent or baby teeth? | Permanent teeth, deciduous/baby teeth |
| Following the last accident, did your child visit the dentist? | Yes, no |
| Was the dentist that you attended a private or a public dentist? | Private, public (HSE) |
| Following the accident, approximately how much was the overall cost of the dental treatment from the private dentist? | €_____ |
| How long after the accident did you visit the dentist with your child? | Immediately, the day of the accident – within two hours, the day of the accident – more than two hours, within a week, within a month, longer than a month |

Introduction

Sport plays a key role in the promotion of children's health and well being.¹ However, children are susceptible to sports injuries. Injuries to teeth in particular can be very distressing both to children and to parents,² and can have a significant social, psychological and economic impact.^{3,4} The US Surgeon General's report on oral health⁵ found that sporting activities are linked to nearly one-third of all dental injuries. Castaldi⁶ has shown that dental and facial injuries contribute up to 39% of total injuries experienced in youth sport. In Ireland, Stewart *et al.*⁷ found that sports injuries accounted for 23% of children attending Cork emergency services for dental trauma treatment. Injuries involving teeth require extensive aesthetic and functional rehabilitation involving long-term multi-disciplinary dental treatment.⁸ Dental injury represents a significant economic cost, not alone to individual affected families, but to public health services in general. The lifelong financial cost for a lone avulsed tooth is estimated to be €18,000.⁹

There will always be a risk of children getting dental injuries during play and sporting activities (particularly in unsupervised activities where protective equipment may not be worn). However, this risk can be reduced by using a mouthguard (gumshield).⁴ Mouthguards distribute the impact of a 'blow' evenly throughout the mouth, lessening the chances of injury.¹⁰ They are generally made from ethylene vinyl acetate (EVA) because of its non-toxicity, minimal

moisture absorption, elasticity, and ease of manufacture.¹¹ Several reviews of studies on mouthguards have shown that they are effective in reducing hard and soft oral tissue injuries, jaw fractures and neck injuries.^{4,10,12,13} As a result, a number of sporting organisations in several different countries promote their use or have made them compulsory (e.g., rugby union,¹⁴ American football,¹² ice hockey^{12,15}). Studies have shown that this has had a significant impact on reducing the incidence of dental trauma, dental injury costs, and the number of dental insurance claims.^{14,16} Individualised well-fitting mouthguards (provided by a dentist) have been shown to deliver the best protection.^{4,17} These require a dental impression, dentist models, and a forming process based on vacuum or pressure.¹¹ This involves one to two visits to a dentist.¹⁸ The cost of an individualised mouthguard varies significantly by dental practice. On reviewing the available prices of 50 dental clinics in Ireland,¹⁹ the average cost was €109 (minimum = €50; maximum = €250). A stock mouthguard is a preformed thermoplastic tray that loosely fits over the teeth.²⁰ These are available in stores (approximately costing between €2.50 and €12) and are worn without modification. However, these offer limited protection.²¹ Mouth-formed 'boil and bite' mouthguards are also available in stores. These are moulded by the user after softening the mouthguard in hot water and forming it in the mouth with pressure from fingers, tongue and cheeks.¹¹ 'Boil and bite' mouthguards provide better protection and comfort than stock mouthguards. They

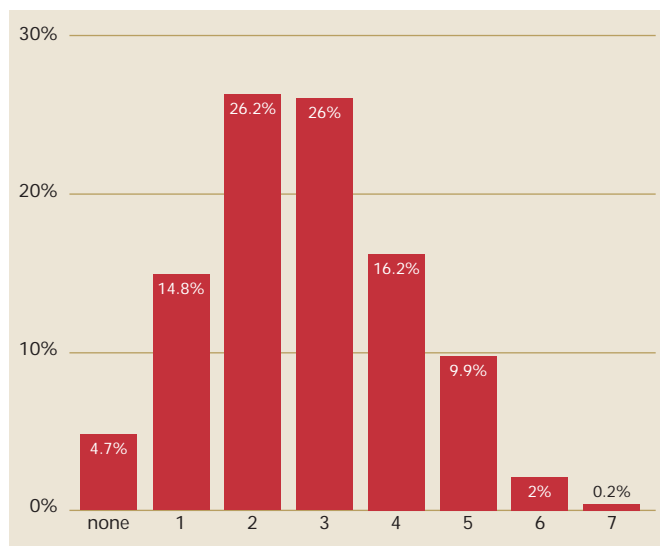


FIGURE 1: Number of sports played.

are lower in cost than individualised mouthguards (costing approximately between €3 and €30) and are the most common type of mouthguard used.⁴

Within Ireland, the extent of dental trauma experienced by children during sport is unclear. There is also limited information on the use of mouthguards by children and whether there are any measures in place to promote their use. This study aimed to determine the extent of mouthguard use, dental trauma, and barriers to use among children. It also investigated the policies of schools and sports clubs in relation to the prevention and management of dental injuries in sport.

Materials and methods

The study focused on national school children in the Health Service Executive (HSE) West region of Ireland. HSE-West includes counties Donegal, Sligo, Leitrim, Cavan, Mayo, Roscommon, Galway, Clare, North Tipperary and Limerick. It has 1,287 national schools and 159 special schools, comprising 35% of the total number of such schools in Ireland.²² Children aged nine to 13 years (fourth, fifth and sixth class) were selected, as at this age the mouth and teeth are in a key stage of development, which increases the potential of an injury having long-term effects.²³ There is also an increased risk of injury as school and club team sports in Ireland actively focus on this age group.²⁴ A random sample of 25 schools in HSE-West, stratified by county, was selected. The principals of each school then sent the parents of children in fourth, fifth and sixth class a confidential self-completion questionnaire for each child they had attending these classes. The questionnaire (which is summarised in Table 1) sought information about the parent's child (or children), including sporting activities, policies on mouthguards, mouthguard use, barriers to mouthguard use, and history of dental trauma and treatment. Quantitative data was analysed using PASW Statistics V19 (SPSS Ireland Ltd). Pearson's Chi-square test, Fisher's Exact test, and independent T tests were undertaken to assess the significance of any differences between key variables. The reason

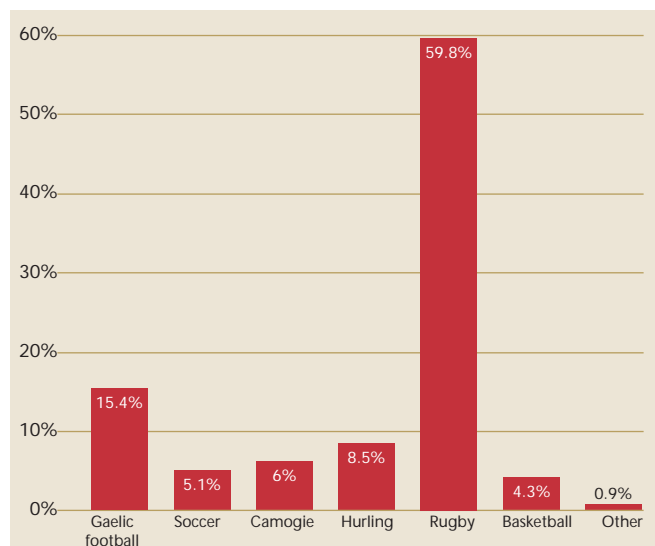


FIGURE 2: Sports played by children wearing mouthguards.

for not wearing a mouthguard was asked as an open-ended question. Responses were grouped into the main reasons following a grounded theory approach.²⁵

Results

Background profile

Of the 1,111 questionnaires that were posted, 505 were returned, giving a 46% response rate. A total of 53% of children were male, with 47% female. The mean age of children was 10.91 years (minimum = 9; maximum = 13) with no significant differences in mean age by gender (independent T test, $t = 1.532$, $df = 496$, $p = 0.126$). The majority of children (95%) were of Irish nationality.

Involvement in sport

From Figure 1 it can be seen that 95% of parents report that their children are engaged in sport and over two-thirds of children (67%) play between one and three sports. The average number of sports played is 2.73 (male = 2.99, female = 2.47). Boys play a significantly greater number of sports than girls (independent T test, $p < 0.001$). The main sports that children played included gaelic football (65%), soccer (62%), basketball (40%), other sports (39%), hurling (27%), rugby (27%), and camogie (12%).

Policy on mouthguards

Over two-thirds of parents (68%) stated that none of the sports clubs that their child (children) attended had a policy on mouthguards. A total of 2% reported that the national school that their child (children) attended had a policy on the wearing of mouthguards, while 70% stated that it did not have a policy, with 28% not knowing if it had a policy.

Mouthguard use

A total of 22% of children were reported as wearing mouthguards while playing sport. Figure 2 shows that the main sports played for

TABLE 2: Mouthguard use by gender and school/club policy on mouthguards.

| Mouthguard use | YES | | NO | |
|---|-----|----|-----|----|
| | No. | % | No. | % |
| Gender | | | | |
| Male | 82 | 32 | 173 | 68 |
| Female | 24 | 11 | 201 | 89 |
| Age | | | | |
| 9-10 | 37 | 21 | 140 | 79 |
| 11-13 | 69 | 23 | 234 | 77 |
| School policy on mouthguards | | | | |
| Yes | 8 | 80 | 2 | 20 |
| No | 69 | 21 | 265 | 79 |
| Don't know | 27 | 20 | 106 | 80 |
| Sports club policy on mouthguards that child (children) attend | | | | |
| All of the clubs | 16 | 94 | 1 | 6 |
| Most of the clubs | 19 | 66 | 10 | 35 |
| Some of the clubs | 59 | 62 | 37 | 39 |
| None of the clubs | 9 | 3 | 297 | 97 |

those that wore mouthguards were rugby (60%), gaelic football (15%), and hurling (9%). Table 2 shows mouthguard use by age, gender, and the existence of a mouthguard policy. It can be seen that significantly more boys wore mouthguards compared to girls ($\chi^2 = 31.40$, $df = 1$, $p < 0.001$), with no significant differences in use by age ($p > 0.05$). In addition, significantly more children wore mouthguards if at least some of the sports clubs they attended had a policy on mouthguards (66% compared to 34% if none of the clubs attended had a policy, $\chi^2 = 219.92$, $df = 1$, $p < 0.001$). Where there was a school policy on mouthguards, significantly more children were reported as wearing mouthguards in schools (80% compared to 20% if the school did not have a policy, $\chi^2 = 20.30$, $df = 2$, $p < 0.001$). The main type of mouthguard used for those wearing mouthguards was 'boil and bite' (64%), other types of mouthguard (12%), and a mouthguard from a dentist (4%). Almost one-fifth of parents (19%) did not know the type of mouthguard used by their children.

In terms of reasons for not wearing mouthguards, content analysis of this open-ended question revealed that the main reasons given by parents of children that did not use mouthguards was the cost of mouthguards, lack of knowledge and information about the benefits of wearing mouthguards, and the lack of a policy on mouthguards in schools or clubs.

Sports-related dental injuries

A total of 10% of parents reported that their child (children) had suffered a sports-related accident in the past year, with 52% of these sustaining injuries to teeth. The majority of injuries to teeth were to permanent incisors (87%). Of the parents whose children had injured their teeth, treatment from a dentist was sought for all those that had injured permanent teeth and for 50% of those that had injured deciduous teeth. Almost three-quarters (72%) visited a dentist immediately or within two hours of the injury. The average cost of emergency dental treatment was €214.23.

Discussion

In Ireland, sport and exercise have been identified as key factors contributing to children's well being.²⁶ The importance of sport in children's lives is evident in the current study, with 95% involved in at least one sports activity. This is promising and has implications in terms of the prevention of obesity. However, it is worth noting that boys play significantly more sports than girls. A number of other studies have shown that boys are more physically active than girls.^{1,27,28} This highlights the importance of making sports more accessible and attractive to girls. It suggests the need for gender-based initiatives to encourage girls' ongoing participation in sport.

The most popular sports played by children in the study are all sports that involve a degree of bodily contact with other participants (e.g., gaelic football, basketball, soccer). This increases the potential for dental injury and highlights the importance of dental protection. For example, although basketball is not a full contact sport, it does have a considerable risk of dental injury.¹³ The close contact between athletes and speed of the game are predisposing factors, with injuries caused by hand or elbow contact in the facial area.²⁹ Similarly, soccer and gaelic football have a risk of contact with other players, the ground, the ball, and the goalposts. Pribble *et al.*³⁰ state that up to 30% of all injuries in soccer are to the orofacial region. However, the results suggest that there is a lack of awareness among parents of the risks of dental injury to children during sport. Indeed, a number of parents also stated that they lacked knowledge and awareness in terms of the benefits of wearing mouthguards. Only 22% of parents stated that their children wore a mouthguard while playing sports. The findings suggest that there was a 52% chance that if a child had a sports injury, it would be a dental injury. Parents need to be made aware of the risks of dental trauma and of the benefits of wearing mouthguards so that they can make an informed decision about the need for dental protection. This is particularly the case for parents of girls. Girls are involved in sports where there is the potential for injury, yet were reported as being significantly less likely to wear mouthguards. Nowjack-Rayner and Gift³¹ suggest that gender differences in headgear and mouthguard use in the United States may be due to perceptual and cultural differences, peer pressure, and the nature of the sports played. Such issues would require further investigation in an Irish context.

A number of other studies have also reported low levels of mouthguard use among school children. Onyeaso's study of 1,127

secondary school athletes (aged 12-19) in Nigeria found that 20% reported using mouthguards.³² Rodd and Chesham,³³ in a study of 770 14- to 15-year-old children in England, reported that 14% had worn a mouthguard at some stage, with fewer than 6% currently using one. Fakhruddin *et al.*³⁴ in a Canadian study of 270 12- to 14-year-old children found that 6% of children wore mouthguards for school sports, with 20% wearing them for league sports. As with the current study, gender differences were also found in all these studies, with significantly more boys reporting that they wore mouthguards compared to girls. These studies demonstrate that the west of Ireland is not unique in its low level of mouthguard use. It also highlights the scope for countries to work together to develop policies and initiatives to increase mouthguard use.

The study found that rugby is the main sport where mouthguards are used. The International Rugby Board (IRB) has recommended that mouthguards are worn in training and games.³⁵ In addition, many local rugby clubs have made the wearing of mouthguards mandatory. An unpublished survey of rugby clubs by the Irish Rugby Football Union (IRFU) found that 85% of clubs have made the wearing of mouthguards mandatory (IRFU Medical Department, personal communication, December 15, 2011). These policies appear to have been effective in promoting mouthguard use in children who play rugby. Another contributing factor could be the influence of professional rugby players (often seen wearing mouthguards), who can act as role models for young players.¹⁸ For other sports, only a minority of children were reported as wearing mouthguards. With the exception of rugby, none of the main sports played by children have a policy on the mandatory wearing of mouthguards. For hurling and camogie, it must be acknowledged that mandatory helmet use^{36,37} reduces the risk of orofacial injury. However, only 0.7% of children solely played these sports, with most children who played hurling or camogie also playing other sports that do warrant the use of mouthguards. Clearly there is a need for policies such as that employed in rugby to also be developed for other sports.

The need for policies on mouthguard use is also reinforced by the fact that significantly more parents reported that their child (children) wore mouthguards if the school or the sports clubs that their children attended had a policy on mouthguard use. However, less than one-third reported that sports clubs currently had policies, and only 2% stated that schools currently had policies. Interestingly, when school principals were contacted about participating in the study, they were asked about existing policies. None reported that there was a specific policy on mouthguards, which supports the survey findings. The 2% of parents reporting the existence of a school policy may have been referring to informal policies or other generic policies that addressed mouthguard use. This highlights a need for mouthguard policies to be developed and promoted within schools and sports clubs. This is reinforced by comments from parents of children who did not wear mouthguards, who stated that this was due to the lack of school and club policy on mouthguard use. Both the HSE and the Irish Dental Association (IDA) could have a role in promoting and developing policies. A promising development in 2010 was the call by the IDA to

address the lack of mouthguard use in gaelic football at both adult and juvenile levels.³⁸ Subsequently, the Gaelic Athletic Association (GAA) and the Gaelic Players Association (GPA) provided custom-made mouthguards to every inter-county senior football squad.³⁹ The mandatory wearing of mouthguards is also being considered by the GAA and was a proposed motion at their 2011 Congress.⁴⁰ The issue was referred to the 2012 Annual Congress, and in April 2012, Congress passed a motion making it mandatory for juvenile football players up to minor grade to wear mouthguards from the start of 2013. The rule will come into effect for senior football players from the start of 2014.

It is suggested that the GAA and other organisations considering making mouthguard use mandatory should liaise with organisations that have successfully developed such policies (e.g., rugby union clubs). In this way any concerns can be addressed and lessons can be learnt in terms of implementation and adherence to the policy at all levels.

The lack of awareness of the risks of dental injury to children during sport is in complete contrast to awareness levels in terms of what to do if an accident occurs. Almost three-quarters of parents of children that had a dental accident visited a dentist immediately or within two hours. Immediate care after a dental injury has been shown to increase the chance of survival of a damaged tooth and reduce the risk of post-injury complications.^{41,42} It is encouraging that appropriate action is being taken when an accident occurs.

Of the parents whose children wore mouthguards, almost two-thirds used mouth-formed 'boil and bite' mouthguards. These are the most commonly used mouthguards, and are good for growing children as they can be remoulded over time.⁴ However, this type of mouthguard can be loose fitting, which can limit their effectiveness.⁴ They are significantly less effective than individualised custom-made mouthguards.^{10,17} Customised mouthguards were only used by 4% of children. Policies on mouthguard use should emphasise the preference for customised mouthguards provided by a dentist. However, these are generally more expensive than stock and 'boil and bite' mouthguards. A number of parents stated that the cost of mouthguards was a barrier to their use. In addition, as children's dentition changes rapidly,³¹ a customised mouthguard may not always be practical. In such circumstances, a 'boil and bite' mouthguard may be more appropriate. Here, dental practitioners could have a role in helping to ensure that 'boil and bite' mouthguards are fitted properly and are not loose. Although customised mouthguards are more expensive, it is worth noting that the cost of a customised mouthguard would be significantly cheaper than dental treatment costs, which were €214 on average in the current study (excluding long-term treatment costs). This is approximately double the cost of a custom-fitted mouthguard (€109 on average). In a position paper on sports mouthguards, the Canadian Dental Hygienists Association⁴ cites a study that found that the total costs for repairing one avulsed tooth were 20 times the cost of a customised mouthguard. The costs of customised mouthguards could be significantly reduced if schools, sports clubs, and sports organisations negotiated a bulk purchase fee with manufacturers and

dental practitioners. The approximate cost of a customised mouthguard in Ireland ranges from €50 to €250. Parents/guardians could possibly reduce the cost of purchasing a mouthguard if they shopped around. There may be scope for some dental practitioners to reduce the cost of mouthguards. Dental practitioners could also consider introducing flexible methods of payment, such as spreading the cost over a given time period. In addition, the Government could also consider introducing a scheme to subsidise the cost of mouthguards. Such initiatives could help to ensure that the optimum level of protection is accessible to a greater proportion of children. It must be recognised that the study does have some limitations. Feedback was not obtained from children directly. This would have been useful in terms of determining children's attitudes towards mouthguards, barriers to their use, and attitudes towards sport and physical activity. However, it must be acknowledged that self-reports from children under 10 years of age can be inaccurate and unreliable.⁴³ While feedback was obtained from the parents of 505 children, the study is not statistically representative of children in the west of Ireland, nor of the counties within the region. This would have required a significantly larger sample. Over half the parents that were contacted (54%) did not respond to the survey, meaning that there is a possibility of sampling bias. Time and resource constraints meant that it was not possible to follow up non-responders with a reminder letter or telephone call. Such strategies have been shown to significantly increase response rates.⁴⁴ The small sample of children that had experienced dental accidents during sport limited the level of statistical analysis possible (e.g., a breakdown of dental accidents by type of sport could not be undertaken). The number of hours that children participated in sports activities was not elicited from parents. This could have provided interesting comparisons by gender and the incidence of dental injury. Despite these limitations, it is worth noting that it is (as far as the authors are aware) the largest study of mouthguard use among school children in Ireland to date, and does provide a valuable insight into the issues of mouthguard use by children during sport.

Conclusions

In this study, only 22% of parents reported that their children wore mouthguards while playing sport. This suggests that parents lack awareness in terms of the risk of dental injury during sport. Dental injuries do have significant social, psychological, and economic costs to children and their families. It is fundamental that awareness levels are raised among parents, as they are the key decision makers in terms of children's mouthguard use.¹³ The dental profession and individual practitioners have a role to play in providing information and advice to parents about using mouthguards during sport. Indeed, involvement in sports and mouthguard use should form part of a child's dental assessment. While the study found an overall lack of mouthguard policies among schools and sporting organisations, it highlighted their importance in promoting mouthguard use. Dental organisations should have an advocacy role in promoting and developing such policies in the future.

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