

## Lay knowledge and attitudes on the management of traumatically avulsed teeth and the use of mouthguards

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**Abstract** The outcome of replantation of traumatically avulsed teeth depends largely on the immediate and appropriate management. However most dental injuries happen in the home or at school, where immediate treatment is not usually available. The objective of this study was to assess the knowledge and attitudes among guardians and children in Japan about tooth injuries, the management of avulsed teeth, and mouthguards. An 18-item questionnaire (3 general items about tooth injuries, 8 about the management of avulsed teeth and 7 about mouthguards) was distributed to 256 guardians and 92 children at the Pediatric Dental Clinic of Niigata University Dental Hospital. One-third of the respondents reported having had a tooth injury, but most had never been advised about the importance of emergency management in dental injuries. On the other hand, 185 guardians (72%) but only 21 children (23%) indicated an interest in taking an educational course about dental injuries. Approximately 75% of the respondents did not know that avulsed teeth could be replanted. Moreover, less than 20% knew that the best way to store avulsed teeth at home was to soak them in milk. Forty-five percent of those with this knowledge had obtained the information from TV programs, whereas only 10% received it from their dentist. As to mouthguards, while nearly 70% of the respondents knew what mouthguards are, only 13% of the children planned to use a mouthguard while playing sports, whereas 30% of the guardians reported that they would require their children to wear one during sports. This study revealed the need for educational campaigns to increase lay people's knowledge of emergency treatment for avulsed teeth and to encourage children to use mouthguards while playing baseball and basketball.

### Key words

Lay people,  
Mouthguard,  
Replantation,  
Tooth avulsion,  
Tooth injuries

### Introduction

Immediate replantation of avulsed teeth lessens the damage to fibroblasts in the periodontal ligament and greatly influences the outcome of replantation<sup>1-3</sup>. When tooth avulsion occurs, guardians or teachers are usually the first people to provide emergency management. If guardians have adequate knowledge of how to handle and replant an avulsed tooth, a favorable outcome could be expected. Therefore, it is essential to provide guardians and teachers with

information about emergency dental management. In this regard, several studies have investigated parental knowledge about emergency care for dental injuries and/or children's tooth avulsion<sup>4-7</sup>. In an Australian study, more than 90% of 2,000 respondents had little knowledge of the correct procedures for replanting or transporting avulsed teeth<sup>4</sup>. The apparent lack of knowledge among lay people led several countries to conduct educational campaigns on how to manage tooth injuries<sup>5,8-10</sup>. To evaluate the effectiveness of educational campaign, a study in England examined lay knowledge on this issue<sup>5</sup>.

Sports are one of the most well-known causes of dental and oral injuries. These sports-related

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dental injuries can be effectively prevented by mouthguards. Several surveys have been conducted around the world to assess their usage<sup>11-15</sup>. Most of these studies suggest that parents do not perceive a need for mouthguards in sports such as basketball, baseball, and soccer, although they were in favor of mandatory mouthguard use in football, boxing, ice hockey, wrestling, and karate.

The purpose of this study was to investigate Japanese lay knowledge of the initial emergency management of traumatized teeth and, through a questionnaire, to acquaint children and their guardians with information necessary to manage avulsed teeth. Moreover, we investigated lay knowledge and attitudes toward mouthguards in order to conceive a strategy to promote mouthguard use even in popular sports that do not mandate the use of mouthguards.

## Materials and Methods

We designed a questionnaire about tooth injuries, avulsions, and mouthguards such that the respondents, by answering simple questions, learn how to handle an avulsed tooth and what the most effective mouthguard is. The 18-item questionnaire was given to those who visited the Pediatric Dental Clinic of Niigata University Medical and Dental Hospital for periodic oral examination and/or dental treatment during summer vacation, after the object of the present research was sufficiently explained. Each respondent was informed that the survey was voluntary and that strict confidentiality was assured, as names were not required. As a result, 348 subjects (256 guardians and 92 children aged 12 years or over) consented to the study and completed the questionnaire.

In the first section of the questionnaire, the subject was asked to indicate gender and age, and whether he or she had a history of tooth injury. Guardians were asked for the dental injury histories of their children. Each subject was also asked whether he or she had ever been advised about the emergency management of injured teeth. In the next section, on the supposition that the child and the child's guardian had ever had an avulsed incisor, we asked questions related to tooth avulsion. The final section contained general questions about mouthguards.

We statistically analyzed the differences in the responses to each question between the guardians and the children. The guardians were further catego-

Table 1 Characteristics of the respondents

Guardians	Age	
	Mean $\pm$ SD	41.5 $\pm$ 5.7 years
	Range	27-67 years
	Relation	Number (%)
	Mother	234 (91.4)
	Father	16 ( 6.2)
Children	Grandmother	5 ( 1.9)
	Grandfather	1 ( 0.4)
	Age	
	Mean $\pm$ SD	15.0 $\pm$ 1.93 years
	Range	12-21 years
	Gender	Number (%)
Male	46 (50.0)	
Female	46 (50.0)	

rized into two groups: those whose children had ever injured a tooth (experienced group,  $n=97$ ) and those whose children had never experienced tooth injury (non-experienced group,  $n=155$ ). Chi-square test was used to compare between groups; multiple logistic regression analyses were employed to evaluate attitudes and knowledge. The level of statistical significance was set at  $P<0.05$ .

## Results

The details and distributions of 256 accompanying guardians and 92 child patients are given in Table 1.

### Tooth injuries

Almost 40% of the guardians reported that their children had experienced a dental injury, and about 20% of the children reported that they had suffered from a dental injury (Table 2, Q1). Eight guardians reported that their children had experienced dental injury at least twice.

Most of the subjects (90% of guardians and 95% of children) had never received any instruction on the emergency management of dental injuries (Table 2, Q2). As to Q2, however, there was a statistically significant difference between the two groups of guardians (Table 3, Q2): the percentage of guardians who received instruction on the emergency management of dental injuries was higher in the experienced group than in the non-experienced group ( $P<0.05$ ). Whereas 185 guardians (72%) were interested in taking an educational course for dental injuries, only 21 children (23%) expressed interest (Table 2, Q3).

Table 2 Tooth injuries

	Guardians	Children
	Number (%)	Number (%)
Q1 Have you (or have your children) ever experienced dental injuries?		
Yes	97 (37.9)	20 (21.7)
No	155 (60.5)	71 (77.2)
No reply	4 ( 1.6)	1 ( 1.1)
Q2 Have you ever received any advice on the emergency management of dental injuries?		
Yes	18 ( 7.0)	4 ( 4.3)
No	231 (90.3)	87 (94.6)
No reply	7 ( 2.7)	1 ( 1.1)
Q3* Are you interested in taking an educational course on dental injuries?		
Yes	185 (72.3)	21 (22.8)
No	65 (25.4)	70 (76.1)
No reply	6 ( 2.3)	1 ( 1.1)

\*: Significant difference between guardians and children;  $P < 0.05$ .

Table 3 The questionnaires showing a significant difference between the experienced group and the non-experienced group

	Experienced group	Non-experienced group
	Number (%)	Number (%)
Q2* Have you ever received any advice on the emergency management of dental injuries?		
Yes	12 (12.4)	5 ( 3.2)
No	83 (85.6)	146 (94.2)
No reply	2 ( 2.0)	4 ( 2.6)
Q3* Are you interested in taking an educational course on dental injuries?		
Yes	77 (79.4)	104 (67.1)
No	18 (18.6)	47 (30.3)
No reply	2 ( 2.0)	4 ( 2.6)
Q8* Do you know that the best way to take an avulsed tooth to a dental clinic is by soaking it in milk?		
Yes	23 (23.7)	20 (12.9)
No	70 (72.2)	134 (86.5)
No reply	4 ( 4.1)	1 ( 0.6)

\*: Significant difference between the two groups;  $P < 0.05$ .

The subjects in the experienced group had significantly more interest in receiving further instruction ( $P < 0.05$ ) than those in the non-experienced group (Table 3, Q3).

### Management of avulsed teeth

Seventy-three percent of the guardians and 78% of the children did not know that an avulsed tooth could be replanted (Table 4-1, Q4). Fewer than 15% of the respondents knew that an avulsed tooth can

be immediately replanted into the alveolar socket provided that the tooth root is carefully washed without scrubbing. (Table 4-1, Q5-7). Among the small percentage of respondents who answered Q5 correctly, the guardians understood self-replantation significantly better than the children.

Fewer than 20% of the children and guardians knew that the best way to store avulsed teeth at home was to soak them in milk (Table 4-2, Q8). In an additional questionnaire not shown in the tables,

Table 4-1 Management of avulsed teeth

	Guardians	Children
	Number (%)	Number (%)
Q4 Do you know that an avulsed tooth can be replanted?		
Yes	62 (24.2)	20 (21.7)
No	187 (73.0)	72 (78.3)
No reply	7 ( 2.7)	0 ( 0.0)
Q5* Do you know that you can attempt to replant an avulsed tooth if it is a permanent tooth that has been cleaned?		
Yes	14 ( 5.5)	1 ( 1.1)
No	237 (92.6)	91 (98.9)
No reply	5 ( 2.0)	0 ( 0.0)
Q6 Do you know that you should try not to touch the root of an avulsed tooth?		
Yes	37 (14.4)	10 (10.9)
No	214 (83.6)	82 (89.1)
No reply	5 ( 2.0)	0 ( 0.0)
Q7 Do you know that a dirty, avulsed tooth can be replanted only after gently washing it with water and without scrubbing it?"		
Yes	12 ( 4.7)	5 ( 5.4)
No	239 (93.3)	86 (93.5)
No reply	5 ( 2.0)	1 ( 1.1)

\*: Significant difference between guardians and children;  $P < 0.05$ .

Table 4-2 Management of avulsed teeth

	Guardians	Children
	Number (%)	Number (%)
Q8 Do you know that the best way to take an avulsed tooth to a dental clinic is by soaking it in milk?		
Yes	45 (17.6)	18 (19.6)
No	205 (80.1)	74 (80.4)
No reply	6 ( 2.3)	0 ( 0.0)
Q9 Do you know that an avulsed tooth should never be stored dry, such as in plastic wrap or paper?"		
Yes	29 (11.3)	6 ( 6.5)
No	222 (86.7)	86 (93.5)
No reply	5 ( 2.0)	0 ( 0.0)
Q10 Do you know that an avulsed tooth should be replanted within 30 minutes?		
Yes	23 ( 9.0)	5 ( 5.4)
No	228 (89.1)	87 (94.6)
No reply	5 ( 2.0)	0 ( 0.0)
Q11* Do you know that a dentist should replant an avulsed milk tooth?		
Yes	63 (24.6)	13 (14.1)
No	187 (73.0)	79 (85.9)
No reply	6 ( 2.3)	0 ( 0.0)

\*: Significant difference between guardians and children;  $P < 0.05$ .

Table 5 Mouthguards

	Guardians	Children
	Number (%)	Number (%)
Q14* Do you know the purpose of mouthguards?		
Yes	190 (74.2)	61 (66.3)
No	60 (23.4)	30 (32.6)
No reply	6 ( 2.3)	1 ( 1.1)
<u>The following questions were answered only by the respondents checking "Yes" in Q14.</u>		
Q15 Do you know mouthguards can be bought in a store?		
Yes	37 (19.5)	15 (24.6)
No	151 (79.5)	45 (73.8)
No reply	2 ( 1.1)	1 ( 1.6)
Q16 Do you know that custom-made mouthguards are available at dental clinics?		
Yes	42 (22.1)	16 (26.2)
No	147 (77.4)	45 (73.8)
No reply	1 ( 0.5)	0 ( 0.0)
Q17 Do you know that custom-made mouthguards feel and fit better and prevent dental injuries more than store-bought ones?		
Yes	35 (18.5)	8 (13.1)
No	150 (78.9)	53 (86.9)
No reply	5 ( 2.6)	0 ( 0.0)
Q18* Do you want to try to use mouthguards or have your children use mouthguards while playing sports?		
Yes	57 (30.0)	8 (13.1)
No	114 (60.0)	53 (86.9)
No reply	19 (10.0)	0 ( 0.0)

\*: Significant difference between guardians and children;  $P < 0.05$ .

45% of those who knew about soaking avulsed teeth in milk had obtained this knowledge from TV programs, while only 10% had received the knowledge from a dental health professional. Guardians in the experienced group were significantly more likely ( $P < 0.05$ ) to know about milk transport than guardians in the non-experienced group (24% vs. 13%, respectively) (Table 3, Q8). Few respondents knew that an avulsed tooth must be kept wet and that it is optimal to replant the tooth within 30 minutes (Table 4-2, Q9, 10). As to the handling of an avulsed primary tooth, approximately 75% of the guardians gave incorrect answers, but the percentage of guardians with the correct answer was significantly higher than that of the children (Table 4-2, Q11).

### Mouthguards

The subjects were asked in Q12 what sports their children played and, in Q13, in what sport they

thought a dental injury was most likely to occur. About 60% of the children were active in at least one sport. Of those, 22% played soccer, 15% baseball, and 15% basketball. Twenty-seven percent of the respondents believed that the sport causing the most dental injuries was boxing, followed by rugby (19%), ice hockey (11%), and soccer (11%). They answered that basketball (6%) and baseball (5%) were less likely to lead to dental injuries.

The guardians (74%) were more familiar with mouthguards than the children (66%) (Table 5, Q14). Among respondents who were familiar with mouthguards, 82% answered an additional question that they had seen mouthguards in use on TV broadcasts of rugby, American football, and/or boxing. Meanwhile, only four of those who knew about mouthguards (1.5%), attributed their knowledge from dental health care professionals.

Of those who knew about mouthguards, fewer than 30% understood the difference in the material,

feel, and fit of a custom-made mouthguard vs. a store-bought one (Table 5, Q15–17). The children were less concerned than the guardians about the need to use mouthguards in the future (Table 5, Q18).

## Discussion

### Dental injuries

The percentages of guardians' children and children themselves who had experienced dental injuries were 38% and 22%, respectively. Since the data were collected at a major government pediatric dental facility, the percentage of respondents who had experienced dental injuries was slightly higher than the rates reported in general population (4–33%)<sup>16</sup>. Few subjects (less than 10%) had previously received advice about the emergency management of dental injuries even in this clinical setting. These subjects who have prior knowledge of management of tooth avulsion were four times more likely to be in the experienced group. Their knowledge may have been acquired during treatment of a tooth injury.

Because approximately 90% have not received instruction on the management of tooth avulsion, aggressive educational campaign by dental health professionals must be done. Fortunately, since almost 70% of the guardians are willing to learn about emergency treatment success of educational courses designed for lay people can be predicted. And, because children showed less interest, dental health professionals should encourage school teachers and school nurses to incorporate the emergency management of dental injury in their health education classes.

### Management of avulsed teeth

In the present study, more than 70% of the subjects did not know that an avulsed tooth could be replanted. A report in the United Kingdom, where mass media and public organizations waged a massive campaign about tooth trauma, showed that approximately 40% of lay people did not know that an avulsed tooth could be replanted<sup>5</sup>. We should realize that the Japanese public needs to be informed about replantation as a matter of course.

According to the answers for Q5–10, fewer than 20% of respondents knew about the appropriate management of avulsed teeth, and very few (1–6%) knew it was better to replant avulsed teeth by themselves rather than wait for a healthcare personnel. Established guidelines recommend that patients

should try first to replant the avulsed teeth<sup>2,17</sup>, and this was also emphasized in educational campaigns in Europe and the United States<sup>8–10</sup>. Meanwhile, 20% of the respondents knew that, in case of avulsion at home, it was best to soak the avulsed tooth in milk. This was a higher percentage than in other questions related to the handling of an avulsed tooth. While 45% of respondents who knew this had learned it from TV programs, only 10% had learned it from dentists. Since this means TV programs are the more effective means to impart knowledge to lay people, it is advantageous to use the mass media to inform the public that avulsed teeth can be self-replanted or transported in milk to a clinic.

As for the handling of avulsed primary teeth, nearly 75% of the guardians answered, incorrectly, that self-replantation should be attempted rather than going to a dentist. If a dentist can select cases carefully, replantation of avulsed primary teeth can achieve fairly good results<sup>18,19</sup>. However, it is not generally recommended even for dentists to replant avulsed primary teeth<sup>20,21</sup>. It is also necessary to emphasize that lay people should not self-replant an avulsed primary tooth, so as to avoid secondary infection and damage to the successor tooth.

### Mouthguards

In this survey, the majority of the Japanese children played soccer (22%), baseball (15%), and/or basketball (15%). Previous research on dental injuries in various sports played by children aged 7–18 years and their guardians showed that accidents often occurred in these same three sports<sup>15</sup>. Very few of the present children and guardians, however, recognized the dangerous aspects of these sports for dental injuries. Moreover, while 74% of the guardians had some knowledge of mouthguards, 60% of those who were aware did not feel the need for their children to wear them. It was previously reported that 75% of sports injuries occurred while the players were not wearing mouthguards and, of these, 40% were in baseball and basketball<sup>11</sup>. This study supports the recommendation of mandatory mouthguard use in baseball and basketball. In the United States, football is the second most popular sport but there are relatively few dental and/or oral traumas in football because children are required to wear mouthguards during the games, as well as during boxing, ice hockey, wrestling, and karate events<sup>15</sup>. We should endeavor to inform guardians about differences in

injury rates with and without mouthguards in various sports, and to help them appreciate that mouthguards help prevent dental injuries. Parents and guardians have tremendous influence not only on their children's attitudes toward wearing a mouthguard, but also on the selection of an optimal mouthguard. Even among the guardians who know mouthguards, only 19% know that the custom-made ones are more comfortable to wear, fit better, and better protect the wearer compared with store-bought ones. It was reported that most children who do not want to wear mouthguards cite discomfort, poor retention, and/or gagging as reasons. These reasons may be associated with stock or mouth-formed mouthguards<sup>22</sup>. Since parents are generally likely to waver due to these valid complaints, guardians should be encouraged to select custom-made mouthguards to ensure proper fit and comfort to the children.

The results of this study indicate that the public can be educated about dental trauma and mouthguards via mass media such as television, radio, and newspapers, as well as at school and related organizations. As mentioned in the responses to Q3, approximately 70% of the guardians answered that they wanted an opportunity to learn emergency treatment. Hence, as the first step toward this, we handed all respondents some color brochures about emergency treatment of dental trauma and mouthguards after they completed the questionnaire. Since then, we have also put up posters about athletic injuries and displayed actual mouthguards in patient waiting areas to educate children and guardians about their use. It is important for us to gauge the effectiveness of our activities in spreading fundamental knowledge of dental injuries to the public. Further research is under way to assess the effectiveness of our activities.

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