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Knowledge of firefighters with special paramedic training of the emergency management of avulsed teeth

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Abstract – Immediate replantation into the socket is the ideal procedure in cases of accidental avulsion of permanent teeth. In Brazil, firefighters with special paramedic training are in charge of providing first-aid care to victims of road accidents and might have to deal with tooth avulsions. This study assessed the knowledge of firefighters regarding the emergency management of avulsed teeth. Information was collected from a questionnaire submitted to 110 volunteer firefighters in seven cities in the São Paulo State (Brazil). The results revealed that 70.9% of the respondents did not know what tooth avulsion was; 53.6% did not know what tooth replantation was or defined it incorrectly; 60% would not act properly in tooth avulsion cases; 20.9% did not consider replantation of the avulsed tooth into the socket as a treatment option; the ideal time interval for tooth replantation was unknown to 40% of the interviewees; 90% of the participants answered that they would not be able to perform tooth replantation. Among those who considered themselves unable to perform tooth replantation, 47.3% chose saline as the best storage medium for an avulsed tooth, 21.8% chose milk, 3.6% chose the patient's mouth and 20% reported not knowing where to store the tooth; 81.8% of the firefighters reported not to have ever received any specific directions on tooth replantation and 100% of them considered this knowledge a requirement for first-aid care to accident victims. In conclusion, the knowledge of the surveyed firefighters regarding emergency management after tooth avulsion was unsatisfactory in several aspects that are important for the success of replantation procedures. Firefighters with special paramedic training should be educated on how to proceed in cases of dentoalveolar traumas and tooth avulsions in order to improve treatment prognosis and increase the survival rate of replanted teeth.

The primary goal of dentistry is to preserve the dental structures. A major challenge to this purpose is the management of trauma to the teeth and their supporting tissues (1). Maxillofacial trauma often results in tooth loss, causing esthetic, functional, and psychological problems to the patients (2). In most situations, accidental avulsions cause the loss of healthy teeth and immediate replantation should be the treatment of choice (3).

The survival rate of a replanted tooth is associated with the preservation of the vitality of its periodontal ligament (4–7), which in turn is directly related to damage or inadequate handling of the root (by the victim or the person giving first aid), length of extra-alveolar time, storage medium in which the tooth is maintained until replantation (in case of delayed replantation) and type of resorption developed during the healing process (4, 8–10). The chance of a favorable prognosis increases if the tooth is replanted into the socket within the shortest time possible, preferably by the person present at the scene of the accident. Usually this person is a layman (11, 12). Several classes of people, including teachers (13, 14), physical health instructors and physical education teachers (12, 15), undergraduate students of Pedagogy (10, 16), parents (17) and physicians (18) have had their knowledge of immediate conduct after a dental trauma evaluated. The outcomes of these studies agree with the fact that the general population and even health professionals need to be better instructed with respect to postdental trauma care.

Victims of maxillofacial trauma involving tooth avulsion usually receive first aid from non-dental trained personnel. Therefore, in most situations, important factors for the success of replantation cannot be controlled. Studies have shown that this scenario can be significantly improved with educational campaigns to the general population and non-dental health professionals, especially those working in emergency assistance services (3, 11).

In Brazil, unlike in other countries such as the USA, the profession of a paramedic is neither regulated nor recognized by law. Firefighters with special paramedic

training are in charge of providing first aid to victims of road accidents and referring these trauma patients to emergency rooms. Therefore, they might have to deal with cases of tooth avulsion. However, there are no surveys evaluating how much information these professionals have about tooth avulsion and tooth replantation. The purpose of this study was to assess the knowledge of firefighters regarding the emergency management of avulsed teeth.

Material and methods

Data for this study were gathered from a questionnaire containing objective and subjective questions referring to issues such as definitions of tooth avulsion/replantation, postavulsion conducts, possibility of performing replantation, extra-alveolar time and storage media, ideal care of avulsed teeth, first-aid dental/medical facilities, previous instructions on replantation procedures and importance of tooth replantation (appendix). In order to avoid interpersonal exchange, the questionnaire was explained and submitted to the participants by the principal investigator. The study population comprised of 110 effective firefighters with special paramedical training from Fire Brigades of seven cities in the State of São Paulo (Araçatuba, Birigui, Penápolis, Andradina, Jales, Votuporanga and Fernandópolis) in Brazil. Following the recommendations of previously published protocols (19, 20), the reported postavulsion conducts (question no. 3) were classified as adequate or inadequate.

The research project was submitted to Ethics in Research Committee of the School of Dentistry of Araçatuba (UNESP, Brazil) and the study design was approved. The participation of the firefighters was voluntary. The answers were maintained confidential and the identity of the interviewees was protected. Data were entered to Microsoft Excel 2003 and subjected to statistical analysis by using Kruskal–Wallis test at 5% significance level.

Results

Regarding the knowledge of the definitions of tooth avulsion and tooth replantation, 70.9% ($n = 78$) of the firefighters answered that they did not know and 53.7% ($n = 59$) of them gave incorrect definitions. When asked whether they had any idea of how they should react in case of tooth avulsion, 40.9% ($n = 45$) of the firefighters answered that they had no idea of what to do; 19.1% ($n = 21$) would have an incorrect conduct and 40% ($n = 44$) would have an adequate conduct, namely replantation or storage of the tooth in a wet medium, such as milk, saline or saliva (Table 1). When asked whether the avulsed tooth could be repositioned in its socket, 79.1% ($n = 87$) answered, yes.

As for the ideal extra-alveolar time for tooth replantation, 40% ($n = 44$) answered that they did not know, 21.8% ($n = 24$) answered that replantation should be performed immediately, 16.4% ($n = 18$) answered that it should be performed within 30 min, 9.1% ($n = 10$) answered it should be within 1 h, 10% ($n = 11$) answered it should be performed between 2 and 6 h and 2.7% ($n = 3$) thought that replantation could be performed within 24 h after avulsion (Table 2).

Ninety percent ($n = 99$) of the firefighters considered themselves unable to reposition an avulsed tooth in its socket. When asked where would they store an avulsed tooth in case of being unable to replant it immediately, 72.7% ($n = 80$) of the respondents chose an adequate medium [47.3% ($n = 52$) answered saline, 21.8% ($n = 24$) milk, 4.5% ($n = 5$) water or the patient's mouth], 4.5% ($n = 5$) chose an inadequate medium (wrapping the tooth in paper or cotton) and 20% ($n = 22$) answered not knowing where to store the tooth (Table 3).

When asked how they should proceed with a dirty avulsed tooth, 51.8% ($n = 57$) would wash it with saline, 8.2% ($n = 9$) would wash it with milk, 0.9% ($n = 1$) would wash it in water, 10% ($n = 11$) would not wash it and 29.1% ($n = 32$) did not know what to do (Table 4). Finally, when asked which would be the ideal first-aid facility to send a patient with this kind of trauma, 49% ($n = 54$) of the firefighters answered that the victims should be taken to an emergency room or hospital, 29.1% ($n = 32$) believed that a specialized dentist would be the best choice, 20% ($n = 22$) chose the nearest dental office (either public or private) and 1.8% ($n = 2$) the dental school (Table 5). Ninety of the 110 firefighters interviewed in this survey never had any specific instructions on the first-aid care after a dental

Table 1. Which should be your conduct in cases of tooth avulsion?

Adequate conduct	44 (40%)
Inadequate conduct	19 (19.1%)
Do not know	47 (40.9)%
Total	110 (100%)
Significant ($P = 0.003$).	

Table 2. Which is the ideal time for tooth replantation?

Immediately	24 (21.8%)
Up to 30 min	18 (16.4%)
Up to 1 h	10 (9.1%)
Up to 2 h	4 (3.6%)
Up to 6 h	7 (6.4%)
Up to 24 h	3 (2.7%)
Do not know	44 (40%)
Total	110 (100%)
Non-significant ($P = 0.249$).	

Table 3. Which is the ideal storage medium for an avulsed tooth?

Paper or cotton wrapping	5 (4.5%)
Water	1 (0.9%)
Saline	52 (47.3%)
Milk	24 (21.8%)
Patient's mouth	4 (3.6%)
Other	2 (1.8%)
Do not know	22 (20%)
Total	110 (100%)
Non-significant ($P = 0.098$).	

Table 4. Which is the procedure with 'a fallen and soiled tooth'?

Brush it vigorously	0 (0%)
Wash in water	1 (0.9%)
Wash with milk	9 (8.2%)
Wash with saline	57 (51.8%)
Do not wash	11 (10%)
Do not know	32 (29.1%)
Total	110 (100%)

Non-significant ($P = 0.129$).

Table 5. Which is the ideal first-aid facility for dental trauma patients?

Emergency room	38 (34.5%)
Public hospital	16 (14.5%)
The nearest dentist	20 (18.2%)
Private dentist	2 (1.8%)
Dental school	2 (1.8%)
A specialized dentist	32 (29.1%)
Total	110 (100%)

Non-significant ($P = 0.64$).

trauma with tooth avulsion and all of them (100%; $n = 110$) considered this kind of information of paramount importance.

Discussion

The successful treatment of tooth avulsions relies basically on how the emergency assistance is provided. Among the goals of the educational programs on dentoalveolar traumas, one of the most important refers to the improvement of case prognosis. Treatment outcomes may be remarkably improved by educating the general population, especially opinion-forming classes, and people who are more likely to be at accident sites, such as primary and secondary school teachers, physical education teachers, physical health instructors, team coaches and first-aid professionals including physicians, nurses, and firefighters. The Fire Brigades play a fundamental role in the assistance to accident victims by means of its mobile emergency care service (SAMU), which counts on firefighters with special paramedical training. They provide a highly efficient first-aid care that may improve the prognosis of trauma cases directed to the hospitals and emergency rooms.

The findings of previous studies (10, 16) have shown that the indirect action of dentists by means of educational campaigns promoted a positive change in the behavior of the studied populations regarding the basic care of tooth avulsion cases, which might contribute to increasing the prognosis of replantation.

In the present investigation, the knowledge of the studied population of basic procedural terms was assessed and 'tooth avulsion' received the largest number of incorrect definitions. Many definitions referred to tooth loss because of extractions motivated by carious lesions or fractures. Nevertheless, knowing the exact technical terms for dental procedures is not a prerequisite for determining the survival rate of replanted teeth. Correct definitions of 'tooth replantation' were more frequent compared with 'tooth avulsion' definitions. Most firefighters defined replantation incorrectly as, for example, 'the insertion of an implant in the site of the lost tooth', which confirms the disinformation about tooth replantation among the lay population.

Among the questions posed to the participants, those related to the possibility of replantation, ideal extra-alveolar time, storage medium and handling of the avulsed tooth are the most important, and present the closest relation to replantation prognosis.

Regarding firefighters' attitudes with respect to emergency management of avulsed teeth, only 40% of their procedures would have a positive impact on replantation success. This means that less than half of the respondents would replant the tooth immediately, or would store it in the adequate medium and direct the patient to a dentist. These findings are consistent with the outcomes of previous studies undertaken with diverse populations, including physicians in hospital emergency rooms (10, 15, 18) and dental surgeons (21), which demonstrates the lack of information on this subject. On the other hand, the findings of an investigation of lay knowledge of the management of avulsed permanent teeth in the Netherlands (12) showed that over 60% of the respondents (people with no dental training) and most of the general practitioner dentists in the Curitiba, Brazil (22) would treat avulsions correctly.

Almost 40% of the firefighters indicated a correct time for performing tooth replantation, namely immediately or up to 30 min. Similar results were obtained by other authors (10, 13, 14). On the other hand, 40% of the interviewees did not know what to answer. This is a cause for concern because the awareness of this time is of paramount importance to determine the survival rate (success) of a replanted tooth. Ninety percent of the firefighters considered themselves unable to perform tooth replantation, which is agreement with the findings of other studies (10, 12, 13). The rationale for feeling insecure or unskilled is probably due to the lack of instructions and appropriate training, as this is not a complex procedure compared with the primary activity of these professionals.

In case that for any reason immediate tooth replantation could not be done, most firefighters (72.7%) answered that they would maintain the tooth in the wet storage media such as saline, milk or the patient's mouth. This percentage is significantly higher than that reported in previous studies (10, 13–15) and is very representative for replantation success. This result may be explained by the firefighters' paramedical training and by the fact that saline is readily available during of first-aid care.

Handling of the avulsed tooth has also an important role for replantation success. In the present study, 29.1% of the participants did not know what to do. Most of them (60%) gave correct answers, like washing with saline or milk, while 10% chose wrong options such as vigorous scrubbing, or not washing the avulsed tooth.

In a previous study (10), 47% of the interviewees (undergraduate students of pedagogy) chose 'the nearest

dental office' (either specialized or not) as the first-aid site of preference to send patients with accidentally avulsed teeth. This underscores the importance of the general dentists on the assistance to dental trauma patients. General dentists are available in a larger number than specialists and are more likely to receive this kind of patient in their dental offices. Different results were found in the present study. Almost 50% of the firefighters answered that the patients should receive the first care at a hospital, almost 30% chose a specialized dentist and almost 20% of the respondents chose the nearest dental office as the best option. This result was expected because all patients assisted by firefighters should invariably be refered to the hospital for medical examination.

Cardoso and Cardoso (11) reported that 82% of the interviewees (lay people in a shopping center) had no or little knowledge on the immediate management after a dental trauma. Nevertheless, disinformation or misinformation on tooth avulsion/replantation is also observed in other classes of the population and worldwide. Ninety percent of parents surveyed in an Australian study (17) had never received advice on what to do in case of an accident where a permanent tooth was avulsed. The authors emphasized the need for educational campaigns aimed at parents to increase their knowledge of the protocol for the management of this dental emergency. Another study carried out with physical education teachers in Hong Kong (15), revealed that over 90% of respondents affirmed that they had never received instructions on the emergency procedures for the management of tooth avulsions. The authors reported that the level of lay knowledge of management of dental injuries in the surveyed population was inadequate and highlighted the need for educational campaigns. A study, proposed to assess the awareness of preschool teachers concerning the management of traumatized teeth in Singapore, revealed that 63% of them admitted having no knowledge of dental trauma and 79% were unsatisfied with their level of knowledge in this area (14). Holan et al. (18) reported that most physicians in the hospital emergency rooms in Israel had never received any instruction on the first aid to patients with avulsed teeth.

Although all firefighters in this study considered that directions on the management of avulsed teeth are important and should be include in their training program, only 18.2% had actually received previous instructions. These outcomes may contribute to explaining the reasons for the generally low success rates of tooth replantations and should inform dental schools and health authorities about the importance of advising the population not only with respect to prevention and treatment of dental diseases but also with respect to postdental trauma care.

Collecting data and outlining the profile of firefighters are important actions to identify the knowledge requirements of these professionals regarding the emergency management of tooth avulsions and hence define the guidelines of an educational program on dentoalveolar traumas based on the education–prevention–treatment triad.

Conclusions

The findings of this survey with firefighters of different Fire Brigades in the State of São Paulo (Brazil) revealed that their knowledge of first-aid care after tooth avulsion was unsatisfactory in several aspects that are important for the success of replantation procedures. Firefighter training programs should include education on how to proceed in cases of dentoalveolar traumas, especially those involving tooth avulsion, in order to improve treatment prognosis and increase the survival rate of replanted teeth.

References

1. Panzarini SR, Saad-Neto M, Sonoda CK, Poi WR, Perri De Carvalho AC. Dental avulsion in young and adult patients in the region of Araçatuba. Rev Assoc Paul Cir Dent 2003;57:27–31.
2. Wolf SMR. The psychological meaning of tooth loss in adult patients. Rev Assoc Paul Cir Dent 1998;52:307–16.
3. Perri de Carvalho AC. Immediate tooth replantation: report of educational campaign. Rev Assoc Paul Cir Dent 1988;42:248–9.
4. Andreasen JO, Andreasen FM. Textbook and color atlas of traumatic injuries to the teeth. Copenhagen: Munksgaard; 1993. p. 151–77.
5. Blomlof L, Lindskog S, Hammarstrom L. Periodontal healing of exarticulated monkey teeth stored in milk or saliva. Scand J Dent Res 1981;89:251–9.
6. Loe H, Waerhaug J. Experimental replantations of teeth in dogs and monkeys. Arch Oral Biol 1961;3:176–84.
7. Okamoto T. Replantation of teeth of continuous growth after resection of dental papilla and enamel organ: histological study. Rev Assoc Paul Cir Dent 1976;30:382–95.
8. Nevins AJ, Laporta RF, Borden BG, Lonrenzo P. Replantation of enzimatically treated teeth in monkeys: part I. Oral Surg Oral Med Oral Pathol 1980;50:277–81.
9. Perri de Carvalho AC, Okamoto T. Oral surgery: experimental basis applied to clinical practice. São Paulo: Panamericana; 1987. p. 111–21.
10. Poi WR, Salineiro SL, Miziara FV, Miziara EV. Education as a means of enhancing the prognosis of tooth replantation. Rev Assoc Paul Cir Dent 1999;53:474–9.
11. Cardoso LC, Cardoso PC. The population does not know what to do. *apud* Ferreira RA. Radical impact. Rev Assoc Paul Cir Dent 1998;52:265–71.
12. Sterenborg EM, Van Hooft MJ, Frankenmolen FW, Weerheijm KL, Groen HJ. What does the non-dentistry-trained person know about avulsion? Ned Tijdschr Tandheelkd 1999;106:42–5.
13. Blakytny C, Surbuts C, Thomas A, Hunter ML. Avulsed permanent incisors: knowledge and attitudes of primary school teachers with regard to emergency management. Int J Paediatr Dent 2001;11:327–32.
14. Sae-Lim V, Lim LP. Dental trauma management awareness of Singapore pre-school teachers. Dent Traumatol 2001;17:71–6.
15. Chan AW, Wong TK, Cheung GS. Lay knowledge of physical education teachers about the emergency management of dental trauma in Hong Kong. Dent Traumatol 2001;17:77–85.
16. Stangler ML, Vanni JR, Echer R. Quantitative evaluation of the knowledge of undergraduate students of pedagogy about tooth avulsion-replantation. Rev Fac Odontol Univ Passo Fundo 2002;7:23–8.
17. Raphael SL, Gregory PJ. Parental awareness of the emergency management of avulsed teeth in children. Aust Dent J 1990;35:130–3.
18. Holan G, Shmueli Y. Knowledge of physicians in hospital emergency rooms in Israel on their role in cases of avulsion of permanent incisors. Int J Paediatr Dent 2003;13:13–29.

19. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors 4. Factors related to periodontal ligament healing. Endod Dent Traumatol 1995;11:76–89.
20. Trope M. Clinical management of the avulsed tooth: present strategies and future directions. Dent Traumatol 2002;18: 1–11.
21. Manfrin TM, Boaventura RS, Poi WR, Panzarini SR, Sonoda CK, Sundefeld ML. Analysis of procedures used in tooth avulsion by 100 dental surgeons. Dent Traumatol 2007;23:203–10.
22. Westphalen VP, Martins WD, Deonizio MD, da Silva Neto UX, da Cunha CB, Fariniuk LF. Knowledge of general practitioners dentists about the emergency management of dental avulsion in Curitiba, Brazil. Dent Traumatol 2007;23:6–8.

Appendix. Questionnaire to assess the knowledge of firefighters regarding tooth avulsion/replantation

1. Do you know what tooth avulsion means?
□ Yes □ No
If yes, please define it:_____

2. Do you know what tooth replantation means?
□ Yes □ No
If yes, please define it:_____

3. If a tooth that came completely out of its socket and fell on the ground, do you have an idea of which measures should be taken?

□ Yes □ No
If yes, please define it:_____

4. Regarding the previous question, in your opinion, is that possible to reposition (replant) that tooth back in its socket?

□ Yes □ No

5. In case your answer to the previous question was 'yes", which should be the ideal time to perform for this repositioning (replantation) in order to obtain good results?

□ immediately □ up to 30 min □ up to 1 h □ up to 2 h □ up to 6 h □ up to 24 h □ up to 72 h
□ don't know

6. In this situation, would you be able to reposition (replant) the tooth back in its socket?

□ Yes □ No
Why?:_____

7. In case you do not succeed in repositioning the tooth in its socket, where should it be stored until the patient is forward to a specialized professional?

□ Wrapped in a paper napkin
□ Wrapped in a paper towel
□ Wrapped in cotton
□ In your pocket
□ In a paper envelope
□ In a container with tap water
□ In a container with saline
□ In a container with pasteurized milk
□ In some other substance
Which?: _____
□ Don't know

Please justify your answer_____

8. If this tooth fell on the ground and became soiled, you would:

□ **Brush it vigorously, cleaning the crown and the root**
□ **Just wash it in tap water**
□ **Wash it in milk**
□ **Wash it with saline**
□ **Don't wash**
□ **Don't know**

9. Which would be the ideal first-aid facility to send a patient with this kind of trauma?

□ **Municipal emergency room**
□ **Public hospital**
□ **The nearest dentist to the accident site**
□ **Your own private dentist**
□ **The Dental School**
□ **A specialized dentist**
□ **Somewhere else**
Where?: _____

10. Have you ever received advice on what to do in situations like these?

□ **Yes** □ **No**

If yes, when? _____

11. Do you think this kind of information is important and necessary?
□ **Yes** □ **No**
Why?_____