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**Educational initiative for school nurses and physical education
teachers on the emergency management of traumatic dental
injuries in Dubai, United Arab Emirates.**

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ABSTRACT

Educational initiative for school nurses and physical education teachers on the emergency management of traumatic dental injuries in Dubai, United Arab Emirates.

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Introduction

Emergency management of traumatic dental injuries (TDIs) is an urgent matter crucial for long term prognosis, especially in cases of tooth avulsion. School playgrounds and physical education (PE) classes are common sites for TDIs. School nurses and PE teachers find themselves the first respondents to TDIs occurring on school premises. Proper knowledge of the emergency management of the TDIs on the part of school nurses and PE teachers will inevitably lead to better outcomes.

Aim

The aim of the study was to assess the knowledge of school nurses and PE teachers in Dubai, United Arab Emirates (UAE) about the management of emergency dental trauma at school and to measure the educational impact of the specially designed educational session on school nurses' and PE teachers' knowledge regarding TDIs both immediately after the session and three months later.

Materials and methods

The design of this study was a longitudinal (cohort) prospective pre- and post *t*- test design involving a questionnaire survey distributed to the school nurses and PE teachers during an educational session, t-test and Analysis of Variance (ANOVA) with repeated measures were used to compare the three group means for the same participants, a P-value of less than 0.05 was considered significant in all statistical analysis.

Results

Results of the repeated *ANOVA* test revealed a significant improvement in the knowledge score among participants from the initial survey to immediately after the educational session, and sustainability of knowledge from immediately after the educational session to three months after the first session.

Conclusion

The study demonstrated an initial lack of knowledge about the emergency management of the TDIs among school nurses and PE teachers in Dubai. A significant improvement in the

overall knowledge score was observed between the time before the educational session and both immediately after and three months later. Recommendations for more training programs are essential for school nurses and PE teachers to improve their knowledge and awareness for better future handling of dental emergencies.

DEDICATION

This thesis is dedicated to my parents, my husband Omar, my three little angels Aaesha, Abdalla and my little baby girl Hoor and my lovely family

For their endless love, support, and encouragement

DECLARATION

I declare that all the content of the thesis is my own work. There is no conflict of interest with any other entity or organization.

Name: Shahad Alsari

Signature:

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ABBREVIATIONS

A (Before the educational session).

B (Immediately after the educational session).

(BSPD) British Society of Paediatric Dentistry.

C (three months after the educational session).

(DHCC) Dubai Health Care City.

(HBMCDM) Hamdan Bin Mohammad College of Dental Medicine.

(IADT) International Association of Dental Traumatology.

(KHDA) Knowledge and Human Development Authority.

(MBRAMC) Mohammed Bin Rashid Academic Medical Center.

(MBRU) Mohammad Bin Rashid University of Medicine and Health Sciences.

(MOE) Ministry of Education.

(MOH) Ministry of Health.

(NSCaOH) Non Setting Calcium Hydroxide.

(PDL) Periodontal Ligament.

(PE) Physical Education.

(RCSE) Royal College of Surgeons of England.

(TDIs) Traumatic Dental Injuries.

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APPENDICES

Appendix I: Ethical approval from HBMCDM Research Ethics Committee.

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1.0 INTRODUCTION

Traumatic dental injuries (TDIs) occur more in children and young adults than adults and account for 5% of all traumatic injuries.¹ Among all school children, twenty-five percent will experience dental trauma, and 33% of adults have experienced trauma to the permanent dentition, especially before age 19.¹ In the primary dentition, luxation injuries are the most common TDIs. Luxation injuries refer to disruption of the tooth and its surrounding tissues secondarily to trauma, which may occur with or without visible tooth displacement. Luxation injuries may be accompanied by damage to the periodontal ligament or cementum and pulpal neurovascular supply. In permanent teeth, crown fractures which involve any part of the crown, enamel, dentine or pulp, or all of them together, are more common. For a favorable outcome, proper diagnosis, treatment planning, and follow-up are essential.¹

Avulsion (when the tooth is totally displaced from its socket) of permanent teeth is seen in 0.5–3% of all dental injuries.^{2,3} This injury is one of the most serious dental injuries, and the prognosis for it is highly dependent on action taken immediately at the scene of the accident. The best treatment is immediate replantation in most situations. This is not always possible at the same time of injury. Therefore, appropriate emergency management and treatment planning are essential for a good prognosis. Replantation may successfully save the tooth, although some of the replanted teeth have lower chances of long-term survival and may eventually be lost or extracted.⁴

Trauma to the oral region occurs more frequently and comprises approximately 5% of all injuries to people seeking treatment.^{2,5,6} In preschool children, where locomotion is not fully stable, head and facial non-oral injuries constitute approximately 40% of all somatic injuries. Moreover, in the age group 0–6 years, oral injuries are the second most common injury involving 18% of all somatic injuries.^{2,5,6} Regarding oral injuries, dental injuries are the most

frequent, followed by oral soft-tissue injuries. Luxation injuries affecting both multiple teeth and surrounding soft tissues are common mainly in children 1–3 years of age and generally occur as the result of falls.

Paediatric emergency situations present a challenge to clinicians everywhere. The resulting injuries are a major threat to children's health and the issue is a neglected public health problem⁷. Therefore, an appropriate response from healthcare professionals regarding treatment of injured teeth combined with both parental consent and patient cooperation⁸ is the desirable reaction when dealing with paediatric emergencies.^{9,10}

The role of the school nurses and PE teachers is crucial in cases of TDIs. School nurses and PE teachers should have the proper knowledge of the emergency early management of traumatic dental injuries to ensure the best possible prognosis for the injured teeth. They are the first assistance available in trauma situations with students at school, the most frequent scene of TDIs.

Numerous studies have been conducted globally concerning TDIs in general and the role of the school nurses and PE teachers in particular. There are no published data regarding this topic in the United Arab Emirates (UAE) as a whole or in Dubai in particular.¹¹ Thus it would be appropriate to assess the school nurses and PE teachers' knowledge regarding the management of emergency dental traumatic injuries and their needs for training courses to help them in managing the outcomes of traumas occurring in schools.

2.0 LITERATURE REVIEW

This chapter consists of eight sections. The *first section* includes an introduction; the *second section* discusses prevalence of TDIs; the *third section* deals with immediate management of avulsion; the *fourth section* describes the consequences of avulsed permanent teeth. The *fifth section* includes TDIs management guidelines (International Association of Dental Traumatology or IADT and British Society of Paediatric Dentistry or BSPD), objectives of avulsion treatment according to IADT, TDIs first aid advice for lay personnel according to IADT, extra oral time according to IADT, treatment guidelines for avulsed permanent teeth with closed apex according to IADT, treatment guidelines for avulsed permanent teeth with open apex according to IADT, antibiotics and TDIs according to IADT, and the outcomes after replantation according to IADT. The *sixth section* contains avulsion and BSPD guidelines, outcomes of avulsion according to BSPD, BSPD and initial management of avulsion, BSPD avulsion and endodontic treatment. The *seventh section* covers the knowledge of the public and school staff, teachers and nurses; a global perspective and finally the *eighth section* comprises an overall summary.

2.1 Introduction

Dental trauma is an “irreversible pathology which is characterized by lifelong debilitating effects”.¹² According to Andreasen *et al* (2009)¹³, dental injuries are a frequent experience during childhood and adolescence, and statistics showed that two out of three children suffer a traumatic dental injury before adulthood. Dental trauma incidence is 1–3% while the prevalence is approximately 20–30%.¹⁴ One in 14 students in school will experience dental trauma.¹⁵ Approximately 19% of dental related injuries will occur at schools.¹⁶ 80% of elementary school students will seek help from school nurses when they face a trauma situation.¹⁷

TDIs comprise a variety of injuries such as luxation injuries and fractures of teeth and alveolar bone and can involve either primary or permanent dentition. *Luxation injuries* are of various kinds; such as concussion where the tooth is tender to touch, has normal mobility and no sulcular bleeding, while *subluxation* is when the tooth has increased mobility but has not been displaced, and bleeding from gingival crevice may be noted. More serious is *extrusive luxation* where partial displacement of the tooth from its socket is involved, the tooth appears elongated and can be excessively mobile, while *lateral luxation* is when the tooth is displaced, usually in a palatal/lingual, or labial direction, is immobile and displaced through the labial bone plate, or it can impinge upon the succedaneous tooth bud if a primary tooth injury is involved. In addition, *avulsion* is when the tooth is completely displaced from the socket. On the other hand, *fractures* of teeth and alveolar bone include several different types, such as *enamel fracture*, involving enamel, uncomplicated *crown fracture* which involves both enamel and dentine, while *complicated crown fracture* is a fracture involving both enamel and dentin, and which leaves the pulp exposed. *Crown-root fracture* is where the fracture involves enamel, dentin, and root structure; the pulp may or may not be exposed it's either complicated or uncomplicated. Other findings may include loose, but still attached, fragments of the tooth, and minimal to moderate tooth displacement. In *root fractures*, the coronal fragment either mobile or displaced. In addition, an *alveolar fracture* is where the fracture involves the alveolar bone and may extend to adjacent bone. In this type of fracture segment mobility and dislocation are common findings, as well as occlusal interference is often noted.¹⁰

2.2 Prevalence of TDIs

The prevalence of TDIs is greater in children and young adults and accounts for 5% of all traumatic injuries. Twenty-five percent worldwide of all school children experience dental

trauma in the permanent dentition compared to (33%) of adults. Proper diagnosis, treatment planning, and follow-up are essential to achieve a favorable outcome.¹ Specifically, in the UAE, in (2010)¹⁸ the prevalence of dental injuries was greatest amongst 18-22-year-olds.

The latest United Kingdom (UK) Child Dental Health national survey¹⁹ showed a prevalence of 1.2% among fifteen-year-old children with missing anterior teeth due to trauma. Over three-quarters of all traumatic injuries happened in childhood⁶ and for this age group, the fourth most common site of injury was the mouth which only accounts for 1% of the body surface.²⁰

In the primary dentition, luxation injuries are the most common TDIs, whereas in the permanent dentition crown fractures are more common,¹ with crown fractures representing 26–76% of injuries to the permanent dentition.²¹ Luxation injuries form 30–44% of all dental injuries to primary and permanent teeth.²²

According to Glendor (2008)²³, TDIs are prevalent on a worldwide basis in both primary and permanent teeth. The statistics from several countries show that one in four schoolchildren and one in three adults had, at least once, suffered from trauma to permanent dentition. As an example, 21.3% of Italian children had experience of dental trauma.²⁴ In addition, in 1985, reporting on a Scandinavian study, Andreassen²⁵ stated that more than half of the children there would sustain traumatic dental injuries before the end of their school days.

Regarding the UAE, little published data on the prevalence of TDIs exists, although one of the few studies reported a prevalence of 25.9% for TDIs.¹⁸ Concerning the injuries reported, 46.9% led to tooth restorations and 42.3% remained as minor injuries, including untreated enamel fracture, mostly in one upper central incisor (53%).¹⁸ The mean age of TDI occurrence in females was 10.5 years and the range 8-13 years, while the mean age in males was older, at 14 years, and the range, 12-16 years.¹⁸ The scene of the occurrence of Dental

Trauma for most males was a public place such as on the street (27%), with (19%) due to motorbike/micro scooters accidents followed by bicycles (17%) as well as unspecified traffic accidents (9%).¹⁸

Dental trauma can cause dental morbidity and mortality (tooth loss). Children are most active and involved in physical activities at school where a significant number of injuries can occur to the face involving both primary and permanent dentition during *Physical Education* (PE) classes.²⁶ Therefore, prevention and management of these injuries through educating School Nurses and (PE) teachers is essential.²⁷ Coaches and teachers of PE should be able to deal with such emergencies.²⁵ Studies from different countries, reviewed in the course of the present research, demonstrated a lack of the proper knowledge of dental injury management and the pressing need for training and education.²⁸

One of the most severe dentoalveolar injuries is avulsion, where the tooth or teeth are completely knocked out of the mouth. The periodontal ligament is severed and a fracture of the alveolus may occur.²⁹ Tooth avulsion occurs more frequently in children aged 7 to 9 years, especially boys.^{3,30,31} Upper central incisors are the most commonly affected teeth.^{3,30} Tooth avulsion constitutes 1-16% of all traumatic dental injuries.

Avulsion can be caused by a variety of events such as accidental falls, sporting activities, fights, or health-related situations.^{30,31,32,33,16} The incidence of occurrence of this injury is 75% higher in children under the age of 15.²² In all cases of dental injuries, immediate management is crucial, especially in cases of avulsion.^{3,34,35,36} The best treatment, in avulsion, is the immediate replantation of the permanent tooth, with success rates of around 85–97%. An additional factor is that the healing of the periodontal ligament is highly dependent on the stage of root development. Many surveys have highlighted that parents,

teachers, children, and even emergency unit staff lack sufficient knowledge to deal with such injuries effectively.^{37,38, 39, 40,41, 42 , 43}

2.3 Immediate management

2.3.1 Avulsion

The specific circumstances are an essential consideration in the proper management of avulsion cases of primary teeth such as the age of the patient; young children are difficult to treat in general due to cooperation issues. Moreover, it is important to consider the distance between the apex of the root of the injured primary tooth, and the underlying permanent tooth germ. Specific consequences resulting from severe injuries to primary teeth and/or alveolar bone are tooth malformation, impacted teeth, and eruption disturbances in the developing permanent dentition. Consideration should be given to other significant factors which influence the treatment outcome including repeated trauma, the child's maturity and ability to cope with the emergency situation, also the time for the shedding of the injured tooth, and the implications for the occlusion.¹

According to the Royal College of Surgeons of England (RCSE)²⁰ 2012 in most cases, reimplantation of an avulsed permanent tooth is the best treatment. However, in a few cases, reimplantation is not appropriate. These cases include: an avulsed primary tooth or where other injuries are severe, as well as a medical history indicating that the patient could be at risk by the reimplantation of a tooth. In the case of an immature permanent tooth with a short root and wide open apex, and where the extra-oral time is extremely prolonged, the prognosis is very poor. Replanted permanent teeth should be followed for a minimum of 2 - 3 years to determine the outcomes such as inflammatory resorption, replacement resorption, ankylosis, infra-occlusion, and discoloration. If progressive resorption occurs prosthetic assessment, and/or orthodontic assessment should be considered.

In cases where the period of extra oral time is prolonged for permanent teeth with closed apices, where the storage medium employed was not appropriate (i.e. tap water or dry storage) a different strategy for treatment has been suggested. This consists of the complete removal of the periodontal membrane and the immersion of the tooth in fluoride solution. Some authors suggest completing endodontic treatment extra-orally before reimplantation.

On the other hand, the soaking of avulsed teeth in a pH balanced solution prior to reimplantation to encourage the reconstitution of periodontal ligament cells has also been recommended. While other authorities have proposed that soaking avulsed teeth in an antibiotic solution prior to replantation where the apex is open, and the dry time less than 60 min is more effective than systemic antibiotics and lead to good prognosis. All these suggestions remain controversial.²⁰

2.4 Consequences of avulsed permanent teeth

The prognosis for avulsed permanent teeth is highly dependent on the immediate actions taken at the scene of the accident. As a result, increasing public awareness of the emergency management of the avulsed tooth is strongly encouraged. Treatment choices, as well as the prognosis for the avulsed tooth, are highly dependent on the vitality of the periodontal ligament (PDL), and the maturity of the root. Furthermore, proper healing following any TDIs requires both patients' and parents' compliance with follow-up visits together with home care and hygiene. Both the patients and the parents should take three steps to care for the injured tooth/teeth to ensure proper healing and to prevent any further injury by avoiding contact sports, implementing proper oral hygiene, and rinsing with an antibacterial such as Chlorhexidine Gluconate 0.1% alcohol-free for 1-2 weeks. For a young child, Chlorhexidine Gluconate should be applied to the affected area with a cotton swab.¹

Treatment time, costs, and the life-long consequences of TDIs have been well documented by Wong and Kolokosta (2004)⁴⁴. The resulting complications can be costly as well as time-consuming^{45, 46, 47, 48} and many teeth are at risk of eventual loss⁴⁸.

One-third of dental injuries have been shown to cause permanent effects to teeth and their surrounding tissues.⁴⁶ TDIs have a negative effect on children's school attendance and parents' loss of work time.⁴⁸ In addition to the high cost associated with TDIs, the effect of these types of injuries is exacerbated in lower income, minority and non-insured children.^{46,49} For example, crown fractures may require as many as 16 dental visits⁴⁷ and replacement of a tooth may cost several thousands of U.S. dollars.⁵⁰ Moreover, early tooth loss, especially in the anterior region, can have a negative psychosocial impact on children.⁵¹

2.5 TDIs management guidelines (IADT and BSPD)

The IADT published management guidelines in 2012.⁴ “These were based on a consensus statement developed by the IADT after a review of the dental literature and group discussions. Experienced researchers and clinicians from various specialties were included in the task group. The guidelines represented the current best evidence and practice based on literature research and professional opinion. In cases where the data did not appear conclusive, the recommendations were based on the consensus opinion or majority decision of the task group”.⁴ The guidelines summarize the initial management of TDIs and are available online (Dental Trauma Website-www.dentaltraumaguide.com).⁴

It is important to carry out a clinical radiographic assessment of a TDI to determine its type and severity and subsequently decide on its management. Clinical and radiographic findings will show if the tooth is not present in the socket or the tooth has already been replanted.

Furthermore, radiographic assessment will reveal if the tooth had intruded (forced inside the socket) when the tooth appeared lost at the time of trauma.⁴

Another set of guidelines have been provided by the BSPD. These guidelines have been updated, and one of the authors not only contributing to the IADT guidelines but having a minor role in reviewing the previously mentioned dental trauma website. These guidelines largely complement the other sources of advice available. There are some areas, however, where they differ from the IADT approach, including: the process of the development of the guidelines is clearly described; including specifics of the search strategy used, a narrative description of the review process, and a discussion of the literature supporting each treatment intervention, and its strength. The treatment and care described are designed for a UK audience, allowing the guidelines to concentrate on national issues particularly relevant to the UK population and healthcare system.²⁰

2.6 Avulsion and International Association of Dental Traumatology (IADT) guidelines

2.6.1 Objectives of avulsion treatment according to IADT

Primary teeth treatment objectives focus on the prevention of further injury to the developing successor (permanent tooth germ). For example, an avulsed primary teeth should not be replanted back into the socket due to the potential for damage to subsequently developing permanent tooth germs.

While permanent teeth treatment objectives are early reimplantation and the stabilization of the replanted tooth in its socket to assist in maximising the healing of the periodontal ligament and neurovascular supply while maintaining esthetic and functional integrity. Replanting is contra-indicated in situations such as a compromising medical condition or compromised integrity of the avulsed tooth or supporting tissues.²⁹

2.6.2 TDIs first aid advice for lay personnel according to IADT

The first aid management for avulsed teeth at the place of the accident by a lay person should be as follows:

- If a tooth is avulsed, make sure it is a permanent tooth (primary teeth should not be replanted).
- Keep the patient calm.
- Find the tooth and pick it up by the crown (the white part).
- Avoid touching the root.
- If the tooth is dirty, wash it briefly (max 10 seconds) under cold running water and reposition it.
- Try to encourage the patient/guardian to replant the tooth.
- Once the tooth is back in place, get the patient to bite on a handkerchief to hold it in position. If this is not possible (e.g., an unconscious patient), place the tooth in a glass of milk or another suitable storage medium and bring the patient to the emergency clinic.
- The tooth can also be transported in the mouth, keeping it inside the lip or cheek if the patient is conscious. If the patient is very young, they could inhale or swallow the tooth, therefore, it is advisable to get the patient to spit into a suitable container and place the tooth in this.
- Avoid storage in water.
- If there is access at the place of accident to special storage or transport media (e.g., tissue culture/transport medium, Hanks Balanced Storage Medium (HBSS or saline) such media can preferably be used.

- Seek emergency dental treatment immediately.⁴

2.6.3 Extra oral time according to IADT

The choice of treatment depends on the maturity of the root of the permanent tooth (open or closed apex) together with the condition of the periodontal ligament cells. This is dependent on the storage medium that has been used and the period of time out of the mouth, particularly the dry time, something critical to the survival of the cells. If the dry time exceeds 60 minutes, all PDL cells become non-viable. For this reason, the dry time of the tooth, before it was replanted or placed in a storage medium, is very important. This emphasizes the need for a careful assessment of the accident history. If the dry time was longer than 60 min or there are other factors suggesting non-viable cells, replantation of the tooth has a poor long-term prognosis. In these situations, the periodontal ligament will be most likely to be necrotic and unlikely to heal.⁴

Although the goal in delayed replantation is to restore the tooth for several reasons such as esthetic, functional, and psychological reasons and to maintain alveolar contour, unfortunately the eventual outcome will be ankylosis and resorption of the root specially if the extraoral dry time is longer than 60 minutes.⁴

2.6.4 Treatment guidelines for avulsed permanent teeth with closed apex according to IADT

Three situations are discussed here for closed apex; *the first situation* is when the tooth has been replanted before the patient's arrival at the clinic. The dentist should leave it in place

and check it clinically, as well as cleaning the area and suture gingival lacerations, if present. An x-ray should be taken and flexible splint can be used for up to 2 weeks. Systemic antibiotics are recommended, the dentist should check tetanus protection status and patients should be instructed accordingly. Initiate root canal treatment 7–10 days after replantation and before splint removal, then schedule follow-up.⁴

In the second situation, when the tooth has been kept in a physiologic storage medium or osmolality balanced medium and/or stored dry, and the extra-oral dry time has been less than 60 minutes, then the root surface and apical foramen should be cleaned with a stream of saline and the tooth soaked in saline. Local anesthesia should be given, the socket irrigated with saline, then, the alveolar socket should be examined for any fractures and repositioned with a suitable instrument. Replantation of the tooth should be gentle with slight digital pressure. This should be followed by suturing gingival lacerations, if present, and then verifying the normal position of the replanted tooth both clinically and radiographically. A flexible splint should be applied for up to 2 weeks, systemic antibiotics are recommended and dentist should check tetanus protection status and give the patient instructions. Root canal treatment should be initiated 7–10 days after replantation and before splint removal and follow-ups scheduled.⁴

In the third situation, when the tooth has been out of the mouth in a dry environment for longer than 60 minutes, since the periodontal ligament will be necrotic and unlikely to heal there is a very poor prognosis for a delayed replantation. The goal in delayed replantation is to maintain alveolar bone contour, in addition to restoring the tooth for esthetic, functional and psychological reasons. However, the outcome is almost certain to be ankylosis and resorption of the root, followed by the eventual loss of the tooth.⁴ The procedure for treatment is as follows: careful removal of any attached non-viable soft tissue using gauze. Root canal treatment can be performed on the tooth before replantation, or delayed until 7–10

days later, as in other replantation situations. It is recommended to stabilize the tooth for 4 weeks using a flexible splint in children and adolescents as ankylosis is often associated with infra-position. A careful follow-up is essential with communication with the patient and the parents to make sure they fully understand the likely outcomes. Decoronation of the tooth is done when infraposition (>1 mm) is observed. In order to slow down osseous replacement of the tooth, the treatment of the root surface with fluoride before replantation has been suggested (2% sodium fluoride solution for 20 min).⁴

2.6.5 Treatment guidelines for avulsed permanent teeth with open apex according to IADT

Treatment guidelines for permanent tooth with open apex also cover three possible situations; the *first situation* when the tooth has been replanted before the patient's arrival at the clinic, the dentist should leave the tooth in place and clean the area with water spray, saline, or chlorhexidine, followed by the suturing of any gingival lacerations present before verifying the normal position of the replanted tooth both clinically and radiographically and positioning a flexible splint for up to 2 weeks. Covering with systemic antibiotics is recommended and checking tetanus protection status before giving the patient instructions. The goal for replanting permanent (immature) teeth in children is to allow for possible revascularization of the pulp space. If that does not occur, then root canal treatment may be recommended. Follow-up is highly recommended.⁴

The *second situation* concerns when the tooth has been stored in a physiologic medium, or an osmolality balanced medium and/or dry stored, if the extra-oral dry time has been less than 60 min, suitable physiologic storage media include tissue culture medium and cell transport media. Suitable forms of osmolality balanced media are HBSS, saline, and milk and saliva can also be used. If the tooth has been contaminated, the root surface and apical foramen

must be cleaned with saline. The topical application of antibiotics has been used to enhance the potential for revascularization of the pulp. Local anesthesia is then administered before an examination of the alveolar socket. If there the socket wall is fractured, it should be repositioned with a suitable instrument before removing any coagulum in the socket and gently replanting the tooth. In addition, suturing of any gingival lacerations, especially in the cervical area should be performed, beside the normal position of the replanted tooth should be verified clinically and radiographically. Finally a flexible splint should be applied for 2 weeks. As in the previous situation, administering systemic antibiotics is recommended plus checking tetanus protection status and giving the patient instructions. The goal here, in replanting permanent (immature) teeth in children is to allow for possible revascularization of the pulp space but the risk of infection related root resorption should be weighed up against the chance of revascularization; unfortunately, such resorption, when it occurs, is very rapid in children's teeth. If revascularization does not occur, root canal treatment may be initiated, after which follow up is essential.⁴

The *third situation* is when dry time lasts longer than 60 min or other reasons suggesting non-viable cells; here in this situation delayed replantation has a poor long-term prognosis. The periodontal ligament will be necrotic and not expected to heal so the goal here is to restore the tooth to the dentition for esthetic, functional, and psychological reasons and to maintain alveolar contour. The ultimate outcome will be ankylosis and resorption of the root.⁴

The technique for delayed replantation is as follows: removal of any attached non-viable soft tissue carefully with gauze. Then root canal treatment to the tooth can be carried out prior to replantation or later. Local anesthesia is administered followed by removal of the coagulum from the socket with a stream of saline. It is important to examine the alveolar socket if there is a fracture of the socket wall, repositioning it with a suitable instrument should be performed, followed by gentle replantation of the tooth and suturing any gingival laceration.

When all this has been completed the normal position of the replanted tooth must be verified clinically and radiographically. In addition, the tooth should be stabilized for 4 weeks using a flexible splint. Administering systemic antibiotics and checking tetanus protection, together with giving the patient instructions are all highly recommended. To slow down osseous replacement of the tooth, treating the root surface with fluoride before replantation with (2% sodium fluoride solution for 20 min) has been suggested to delay osseous replacement; however, ankylosis is unavoidable after delayed replantation and this should be considered.⁴

In children and adolescents, ankylosis is frequently associated with infraposition. Careful follow-up is essential and good communication is necessary to ensure the patient and parents are aware of this likely outcome. Decoronation is necessary when infraposition (>1 mm) is seen.⁴

2.6.6 Antibiotics and TDIs according to IADT

The value of the systemic administration of antibiotics in humans after replantation is still questionable in terms of clinical studies, although experimental studies have usually shown positive effects upon both periodontal and pulpal healing, especially when administered topically. As a result, antibiotics are recommended in most situations after the replantation of teeth. In addition, the patient's more general medical status or concomitant injuries may need antibiotic coverage. For systemic administration, tetracycline is the first choice in the appropriate dose for the patient's age and weight in the first week after replantation. The risk of discoloration of permanent teeth is the only issue here. In many countries, tetracycline is not recommended for patients under 12 years of age. A penicillin, phenoxymethyl penicillin (Pen-V) or amoxicillin, in an appropriate dose for age and weight, for the first week, can be given as an alternative to tetracycline. Moreover, topical antibiotics (minocycline or doxycycline, 1 mg per 20 ml of saline for 5 min soak) appear to have a beneficial effect

experimentally in increasing the chance of pulpal space revascularization and periodontal healing, and may be considered in immature teeth.⁴

2.6.7 Outcomes after replantation according to IADT

Favorable outcomes for closed apex permanent teeth are: tooth asymptomatic, normal mobility, normal percussion sound. No radiographic evidence of resorption or peri-radicular osteitis; the lamina dura should appear normal. On the other hand, favourable outcomes for open apex permanent teeth are: tooth asymptomatic, normal mobility, normal percussion sound; radiographic evidence of arrested or continued root formation and eruption, as pulp canal obliteration is to be expected. However, unfavorable outcomes for closed apex teeth are: symptomatic, excessive mobility or no mobility (ankylosis) with high-pitched percussion sound and radiographic evidence of resorption (inflammatory, infection-related resorption, or ankylosis-related replacement resorption). When ankylosis occurs in a growing patient, infraposition of the tooth is highly likely leading to disturbance in alveolar and facial growth over the short, medium, and longterms.⁴

2.7 Avulsion and British Society of Paediatric Dentistry (BSPD) guidelines

2.7.1 Outcomes of avulsion according to BSPD

According to Day and Gregg, of the BSPD avulsion Guidelines (2012)²⁰ several outcomes for the avulsed tooth should be considered which affect the prognosis: Initially periodontal healing; The aim of this treatment is to facilitate cemental/PDL healing. Unfortunately, for many teeth that suffer avulsion and replantation, the optimal outcome is ankylosis. Second is pulpal healing; although pulpal regeneration is the best outcome, especially in immature

teeth, in general this is not realistic. This means that the optimal outcome is the disinfection of the root canal space. Third is tooth survival; tooth survival is related to periodontal healing, where cemental/PDL healing occurs the survival of the tooth could be expected to be similar to an uninjured adjacent tooth. On the other hand, when ankylosis is the repair process, the replacement of the root by bone will slowly happen and the speed of ankylosis is age dependent, in adults this replacement of the root by bone is slow (5-20 years) while in children, it is more rapid, especially if the ankylosis occurs prior to puberty, and the consequences of ankylosis are further complicated by the lack of vertical growth in children; as a result the tooth will appear infra-occluded.²⁰

Four is discoloration; it is an important outcome concerning both children and their parents, especially if the color differs significantly from the adjacent teeth. Both non-setting calcium hydroxide and Ledermix™ (a steroid and antibiotic paste recommended by the guidelines), were found to cause yellow and gray discolouration and should only be placed in the root canal. Five is the quality of life, and health economics; traumatic injuries affect the anterior maxillary teeth with central incisors being most frequently involved, the injuries may affect dental health, appearance, facial aesthetics and in some cases, have a negative psychological impact, especially in adolescence, and affect the child's social interaction with other children. Therefore, care should be child centered and emphasis put on achieving the best aesthetic appearance.²⁰

2.7.2 BSPD and initial management of avulsion

Initial management by the dentist involves first taking a careful medical, dental and accident history from the patient and /or parent. Additionally an overall intraoral bony and soft tissue injuries and extra oral examination, including the head and neck, is important, to rule out accompanying injury including head injury, facial fracture or lacerations. Then the dentist

should assess the likely prognosis (assuming the tooth has yet to be replanted). If extra-alveolar dry time is less than 30 minutes and the total extra-alveolar time less than 90 minutes when an appropriate storage medium has been used (e.g. milk, physiological saline, or saliva in the absence of the others) then the chance of cemental/PDL healing is greater, the chance is above 10%. On the other hand, if the extra-alveolar dry time exceeds 30 minutes or the total extra-alveolar time exceeds 90 minutes, or storage has been in an inappropriate storage medium (e.g. water) then healing after replantation probably going to be by ankylosis; the probability being in excess of 90%. This implies that for very immature permanent teeth with short roots and wide open apices, ankylosis is the only likely outcome. In this situation, the dentist should still replant the tooth and leave the further management to the interdisciplinary team.²⁰

Treatment for avulsed teeth can happen in two situations:²⁰

2.7.2.A: First scenario

Avulsion with a chance of cemental/PDL healing e.g. Teeth with an extra-oral time of less than 30 minutes' dry time and less than 90 minutes' total extra-alveolar time when stored in an appropriate storage medium for (mature and immature) teeth:

Management including informed consent is difficult before replantation, therefore, the best action is to replant the tooth as soon as possible. Regarding topical tetracycline application prior to replantation, this is not currently recommended. Local anaesthesia should include both buccal and palatal tissue anesthesia to allow proper replantation, and this also assists in the reduction of any associated alveolar fractures and in the manipulation of the socket. Replantation is possible without local anesthesia in the case of minimal disruption to the socket. If a clot is present, simple irrigation is enough, while commencing root canal treatment prior to replantation is not recommended. Splinting an avulsed tooth is

recommended by splinting to one adjacent un-injured tooth on either side using a physiological splint for 7-14 days. The recommended splint is an acid etch/composite and flexible wire splint. Other splints such as orthodontic brackets and wire can be used as long as the wire is passive. Oral hygiene plays an important role in achieving the desired outcome.²⁰

The evidence for using systemic antibiotics for avulsion injuries with respect to improved pulp or periodontal outcomes is far from conclusive. Antibiotic coverage is an option over the first few days of healing (5-7-day course) in specific situations, for example, when additional contamination of the tooth or soft tissues have occurred. If the case involves injuries to multiple teeth, soft tissues or other parts of the body, antibiotic cover may be required to facilitate the safe performance of the subsequent surgery, especially where the medical status of the child is susceptible to infection. Prescribing systemic antibiotics can involve doxycycline (if over the age of 12, or a penicillin based antibiotic (if under the age of 12)).²⁰

A tetanus booster may be required if environmental contamination of the tooth has occurred. If in doubt, referral is needed to a medical practitioner within 48 hours.

Regarding endodontic treatment, depending on the maturity of the avulsed tooth and the inter-visit medicament chosen, after the trauma pulp extirpations should commence between days 0 – 10. For immature teeth, no endodontic treatment is required to enhance achieving an optimum outcome for the tooth; unless infection happens, endodontic treatment will be the best choice. For a mature tooth, either ledermix is used between days 0-10 with endodontic therapy or Non Setting Calcium Hydroxide (NSCaOH) at day 7-10 with endodontic therapy.²⁰

2.7.2.B: Second scenario

Ankylosis pathway treatment for teeth with little chance of cemental/PDL healing e.g. teeth with extra oral time of greater than 30 minutes dry time or greater than 90 minutes total extra-alveolar time (for mature and immature) teeth:

Even when stored in an appropriate storage medium extra-oral endodontics is crucial here, a conventional access cavity is cut and the necrotic pulp is removed using a barbed broach. The root length is established by direct vision and thorough chemical cleaning of the canal is essential, combined with some mechanical filling. Sodium hypochlorite or chlorhexidine are the best irrigants. The canal is then dried and obturated with gutta-percha and sealer, the definitive coronal seal is essential, followed by replantation, splinting, with post-operative care. The child should be recalled at 7-10 days for reassessment, reinforcement of oral hygiene practice and splint removal. If extra oral endodontics has not been undertaken at the emergency visit, then intraoral endodontics should be undertaken at the 7-10-day visit following the use of NSCaOH for both mature and immature teeth. Ledermix is not recommended in this situation, as the steroid will have no effect on the type of periodontal healing and unnecessarily risks discoloring the crown.²⁰

2.7.3 BSPD, avulsion, and endodontic treatment

According to the BSPD guidelines, endodontic treatment depends on whether the avulsed permanent tooth is mature or immature. In the case of *immature teeth* there are several indications making it appropriate to ascertain whether pulpal healing by regeneration will occur. These include; if the tooth is immature (where the tooth has yet to develop a complete root length with half or more apical closure) and where pulpal extirpation will leave a weakened root at increased risk of a late-stage coronal fracture, and there is a chance of

cemental/PDL healing of the periodontal membrane (extra-oral time of less than 30 minutes dry time and less than 90 minutes total extra-alveolar time when stored in an appropriate storage medium). Even with a longer extra-alveolar dry time or total time, this may be acceptable and the tooth is given the opportunity to see if pulpal regeneration occurs. As a result, no endodontic treatment is required, and monitoring the tooth for pulpal regeneration or pulpal necrosis would be recommended. If pulpal regeneration fails and pulp necrosis occurs, endodontic treatment should be initiated.²⁰

In the case of *mature teeth*, root canal treatment is indicated. There are two potential root canal medicaments that can be used. The first material is Ledermix. The dentist should remove the pulp as soon as possible, ideally at the emergency appointment, day 0. The tooth should be replanted and splinted prior to endodontic treatment. If it is not possible to extirpate on the same day, pulp extirpation should be commenced by day ten at the latest. Obturation with gutta percha is dependent on the tooth displaying no signs of infection or infection related resorption, e.g. no radiolucency can be seen in the bone adjacent to the tooth. The second option as a material is NSCaOH; if this is chosen as the inter-visit intracanal medicament, extirpation and application of NSCaOH should not be undertaken before day seven, but preferably performed before day eleven. The duration of dressing is for four weeks prior to obturation with gutta percha followed by removal of the splint between days 7 and 14. Patient and parents should inform that upon splint removal, the injured tooth will still be mobile. If loss of buccal alveolar bone is observed, the duration of splinting required must be longer. At follow-up visits, adjacent teeth should also be monitored in case they have become traumatized.²⁰

2.8 Knowledge of public and school staff, teachers, and nurses

2.8.1 A global perspective

A review of the literature reveals many studies conducted around the world that assessed nurses' as well as school teachers' knowledge of the management of dental trauma. The majority of these worldwide studies indicated the lack of knowledge by school teachers and nurses regarding the emergency management of dental trauma.^{52, 39,53,54, 55, 56,57, 58} In addition to these findings, studies conducted in several countries regarding the knowledge of parents about the management of avulsed permanent teeth revealed that the level of knowledge of parents is low.^{56, 59, 60,61, 62, 63}

Glendor (2009)²⁸ reviewed published epidemiological studies and concluded that a large part of the educational process about dental trauma care for caregivers and lay people had failed because lay people could not handle difficult cases such as tooth avulsion. He suggested additional educational programs to increase their knowledge. In England, Newman and Crowford (1991)⁵³ reported that teachers of PE lacked the appropriate knowledge about the management of TDIs and concluded that they should be given more training regarding dental injury management.

Furthermore, Chan *et al* (2001)⁵⁸ investigated the extent of knowledge PE teachers had about the emergency management of dental trauma in Hong Kong. The study revealed a lack of knowledge among school PE teachers about the management of dental injuries and suggested that educational campaigns are crucial for improving their knowledge.

In addition, a randomized controlled trial conducted in Hong Kong investigated the effectiveness of educational posters in increasing the level of knowledge of primary and

secondary school teachers in relation to dental trauma management. The intervention group showed a much greater degree of knowledge after poster education, leading to the conclusion that educational posters are a very effective way of educating teachers.⁶⁴ In addition, it was shown that primary and secondary school teachers in Hong Kong lacked sufficient knowledge on how to manage dental trauma, especially avulsed teeth, and the proper medium for transporting these teeth.⁶⁵ The participants in this study had little knowledge regarding management of TDIs in general. However, it was revealed in a different study that nurses' knowledge about TDIs was much better than teachers or the teachers' assistants. Both nurses and teachers thought that this topic was important and were interested in more information and training.⁶⁶

A study by Choi *et al* (2012)⁶⁷ investigating dental trauma management by New York City school nurses through a survey questionnaire concluded that nurses lacked the appropriate knowledge and information about managing such cases. On the other hand, 62% of the nurses knew that the right solution was to replace the tooth after avulsion. However, almost half of them did not know whether to replant the tooth back in the socket or not, and practically all the nurses needed more training on how to manage dental trauma cases.⁶⁷

A survey was distributed to all public high and middle schools in the Milwaukee area, Wisconsin, United States of America (USA). The aim of this survey was to evaluate the knowledge of athletic coaches and teachers in dental trauma management. The knowledge related to the replantation of avulsed teeth was very low in the group surveyed. Furthermore, most of the surveyed groups were ignorant about the preferred solutions to store the avulsed teeth in. In conclusion, the study recommended educational awareness courses on dental trauma for all teachers and coaches to improve their knowledge.⁶⁸

Another study was conducted in the USA to evaluate the knowledge, practice, and experience of dental trauma among elementary school staff through a questionnaire. The results showed that the dental trauma knowledge among the staff was poor. However, following the study, the staff showed an increased interest in receiving more education and training in the management of dental trauma.⁶⁶

In Rio de Janeiro (Brazil), a study was conducted regarding dental avulsion management among elementary school teachers. A survey questionnaire was distributed consisting of seven simple questions, and answered by 60 teachers from five different elementary schools; the aim was to evaluate their knowledge on the management of a dental emergency situation, especially regarding dental avulsion. The study concluded there was a lack of knowledge among of school teachers. More effective communication between dental professionals and school teachers was recommended for better handling of future trauma accidents.⁶⁹

Additionally, the nurses at schools in Bialystok, Poland were found to be lacking in the proper knowledge for the management of dental trauma although there was a strong correlation between their knowledge level and participation in the lecture on the management of dental trauma conducted two years earlier.⁷⁰

A study performed in Bergen in Norway to identify guidelines for managing traumatic dental injuries in schools concluded that none of the schools had clear guidelines for dealing with dental traumatic cases. The study emphasized the importance of these guidelines for improving the diagnosis of traumatized teeth.⁷¹

A study conducted in India by Pujita *et al* (2013)⁷² investigated school teachers' knowledge on the management of traumatized teeth. Assessment of teachers' knowledge was carried out by means of a questionnaire that had been used prior to an educational program and three months after. The results of this study showed that teachers lacked the sufficient knowledge

on the management of dental trauma cases prior to the program and their knowledge had significantly increased after the educational lectures. Most of the urban teachers showed a good response to educational programs for tetanus prophylaxis during traumatic injuries. The authors suggested that this type of education should be included in the teacher training curriculum as basic knowledge.⁷²

A cross-sectional study testing the knowledge of school teachers in Coorg, rural India on the management of avulsed teeth showed that teachers had a poor knowledge of the management of dental trauma.⁷³ In agreement with similar studies, this study suggested an increasing need in the level of education of all school teachers regarding the management of dental trauma.^{74,75,66,76} Furthermore, there was an increased interest by Coorg teachers, along with teachers in Bangalore urban schools, towards receiving more education on teeth avulsion management.^{73, 52}

Another study showed that the lack of knowledge about the immediate management of traumatized teeth in Iranian teachers' and suggested educational campaigns to improve their knowledge.⁷⁷

A study done in Ankara, Turkey, investigated the knowledge of primary school teachers about dental trauma management. The teachers were asked to complete a questionnaire and were then given an educational leaflet. The knowledge of the teachers was re-examined one month after the distribution of the leaflets and it had improved.⁷⁸

In Jordan, almost 19% of 10-12-year-old children were found to suffer from dental trauma.⁷⁹ Furthermore, in the same country, about one-third of dental injuries were found to occur in schools.⁸⁰ Additionally, a study in Jordan reported the lack of knowledge among school teachers on the management of emergency dental injuries and suggested educational programs to improve their knowledge.⁵⁷

A study conducted in the Tel -Aviv area, Israel, used a questionnaire to explore the knowledge of elementary school teachers about traumatic dental injury management regarding permanent teeth. The teachers who were also parents knew how to handle the situation better than those who were not. Teachers aged between 35-49, or who had previous familiarity with trauma cases also demonstrated better knowledge of the topic. The results showed that the knowledge of traumatic dental injuries management in the Tel-Aviv teachers is inadequate; therefore, educational programs were recommended to be added to the curriculum to improve ways of managing trauma cases.⁸¹

Additionally, in Egypt (2010) Abdellatif and Hegazy ⁸² showed that school staff lack adequate knowledge about managing avulsed teeth. They recommended training programs to enable nurses to know how to manage an emergency situation.

According to Al-Majed *et al* (2001)⁸³ in Saudi Arabia, dental trauma prevalence in children from 12- 14 and 5- 6 years was found to be 34% and 33% respectively. Additionally, this study demonstrated that teachers in Riyadh city did not know the proper storage solution for avulsed permanent teeth. Another study conducted by Al-Obaida (2010)⁸⁴ showed that most Saudi teachers in Riyadh city did not know how to manage children suffering from dental injuries.

Several studies conducted in Kuwait tested the knowledge of school children, school teachers, and parents on the management of avulsed teeth and showed that leaflets and lectures are the best way to educate people.^{37,38, 63} In most of the areas, the investigators observed that teachers that attended 30 minute lectures on how to manage avulsed teeth showed an improvement in their knowledge.³⁸ Moreover, teachers in the urban and rural areas who were lacking the knowledge on how to manage dental trauma demanded more

extended educational programs on dental trauma. It has been suggested that continuing education through posters on dental trauma should be carried out periodically.^{58,56, 85,66}

2.8.2 A UAE perspective

With regards to the prevalence of TDI, and the level of knowledge among school staff, teachers and nurses in the UAE, a study by Fakhruddin and Kawas (2010)¹⁸ assessed the prevalence and etiological factors related to dental injuries amongst 18-22-year-olds; it suggested interventions such as educating parents, caretakers, and older siblings on how to reduce and prevent dental injuries.¹⁸ Another study conducted to test the level of knowledge of dental trauma management about avulsed teeth among mothers in Ajman, UAE, revealed that their knowledge is inadequate and educational campaigns were recommended about the management of emergency dental injuries. Therefore, there exists a general consensus on the importance of educating the public on dental injury management.⁸⁶ Additionally, a study in Ajman showed that the level of knowledge of management of dental trauma, especially tooth avulsion, among school teachers was inadequate, and educational campaigns were recommended to improve the management of emergency dental injuries.¹¹

2.9 Summary

In summary, the time, cost and life-long consequences of TDIs can be significant.⁴⁴ The permanent anterior teeth are essential for aesthetics, speech, and mastication, the health of the supporting tissues and the psychological and mental health of children. Therefore, the immediate management of avulsed permanent incisors results in better prospects for maintaining good self-esteem and enhanced self-image in children.⁸⁷

The role of school nurses in such situations should be first to assess the child to detect any head injuries resulting from the trauma and to refer the patient immediately to a hospital if

such injuries are suspected. Once, and if, any head injury has to be ruled out, the nurse should assess the pain levels, and whether the avulsed tooth is a primary or permanent tooth before replanting the tooth back into its socket. In addition to, the tooth, all the surrounding soft tissues should be checked as well. Furthermore, the proper storage solution for the avulsed teeth should be something known to all nurses so that they can take the right action at the right time.⁸⁸ School nurses should have a proper knowledge of emergency early management of traumatic dental injuries in order to ensure the best prognosis possible for the injured teeth.

Based on this literature review, while numerous studies have been conducted in this field globally, very few have involved the UAE, and specifically Dubai. Properly conducted education for school nurses and PE teachers will improve knowledge and outcomes of traumas that occur in schools.

2.10 Aim of the study

The purpose of this longitudinal study, utilizing a pre-test and post-test design, is to test the effectiveness of a training session to teach school nurses and PE teachers about the emergency management of traumatic dental injuries in children and adolescents

2.10.1 General objective

To assess the knowledge of school nurses and PE teachers on the management of emergency child dental trauma at school.

2.10.2 Specific objectives

- To identify the level and quality of knowledge of school nurses and PE teachers regarding the emergency management of child TDIs.

- To design an educational session to improve the knowledge of school nurses and PE teachers regarding the emergency management of child TDIs.
- To measure the educational impact of the specially designed educational session on the school nurses' and the PE teachers' knowledge regarding child TDIs, both immediately after the session and three months later.
- To suggest guidelines about the emergency management of TDIs for school nurses and PE teachers.

2.11 Research question

How, if at all, does a school nurses' and PE teachers' knowledge of TDIs differ before and after participating in an educational session about the subject?

2.12 Null hypothesis

There is no difference in the knowledge of school staff, teachers and nurses about TDIs, before and after an education session.

3.0 MATERIALS AND METHODS

This methodology section (chapter 3) is presented under the following headings: study design, ethical approval, eligibility criteria, questionnaire and data collection, sample size, and statistical analysis.

3.1 Study design, location and population

- Study Design: longitudinal pre and post T Test design study.
- Location: in Dubai, one of the seven Emirates of the UAE, and its most populated city. It is located on the southern coast of the Arabian Gulf on the Arabian Peninsula.
- Population under study: nurses and PE teachers in Dubai private and state schools.

3.2 Ethical considerations

All participants were informed about the objectives and confidential nature of the study and that there would be no negative consequences for declining to participate, even if they agreed initially. Ethical approval was obtained from the Research and Ethics Committee at Hamdan Bin Mohammad College of Dental Medicine (HBMCDM), Mohammad bin Rashid University of Medicine and Health Sciences (MBRU). Approval, from the event organizer of the activities, the Knowledge and Human Development Authority (KHDA) and the Ministry of Education (MoE) were also obtained (See Appendix I).

3.3 Eligibility criteria

3.3.1 Inclusion criteria

All Dubai school nurses and PE teachers accepting our invitation were included in the study.

3.3.2 Exclusion criteria

School nurses and PE teachers who declined to participate.

3.4 Questionnaire and data collection

Data were collected by means of a questionnaire, which was designed using modified versions of the questionnaires from several studies.^{38,66,70,72,75,76,78,89} A pilot study was conducted to validate the questionnaire among pediatric dentistry residents and supervisors at MBRU and minor modifications were made to improve wording and clarity. School nurses and PE teachers were invited to one of two educational workshops, the participants were different in each workshop, and the workshop was in the form of one-hour presentation including videos on the emergency management of TDIs. The workshop discussed in details all the questions of the questionnaire. In addition, the steps of TDIs management poster, which was given to the participants at the end of the workshop.

The demographic information in the questionnaire (demographic questions) (from Q1 to Q15). (Appendix II, III) included the following: gender, age, name of school, primary position including: the grades that they are responsible for, type of school, the level of education, years of service in this position, years of experience, if they had children of their own, their own personal experience regarding traumatic dental injuries (TDIs) with children, previous advice or information regarding TDIs, source of previous advice if any, if they feel adequately informed about TDIs and finally, if their first aid course covered the management of TDIs. The questionnaire also included a total of 16 questions about the knowledge and management of TDIs (from Q16-Q31), the knowledge questions were divided into two parts: part 1 tested the participants' knowledge about types of dental injuries and whether they could differentiate between primary and permanent tooth injuries and their management,

while part 2 tested the knowledge about knocked out primary and permanent tooth management. (Appendix II, III).

The questionnaire was paper-based and was completed by all the school nurses and PE teachers before an educational awareness presentation about how to manage trauma situations in children at school; and then was distributed and completed again immediately after the educational presentation. The response rate was 100% because all the 68 participants were instructed to complete the paper-based questionnaire before the workshop and immediately after and each participant returned his/her completed questionnaire to receive the poster and certificate of attendance. After three months, the participants were all interviewed by telephone call by the primary investigator to answer the full questionnaire again to test their knowledge retention from our educational program.

3.5 Sample size

Sampling technique: The Knowledge and Human Development Authority (KHDA) provided us with the list of all private schools while the Ministry of Health (MOH) listed the state schools. The principals of the schools were contacted and invited to participate and to request their nurses and PE teachers to attend our educational session held at Mohammed Bin Rashid Academic Medical Center (MBRAMC) in Dubai Health Care City (DHCC) about TDIs emergency management. A total number of 200 school nurses and PE teachers were invited by an email and a telephone follow up. The final sample size was 68 (54) school nurses and (13) PE teachers. One of the participants did not specify their position in the school.

3.6 Statistical analysis

Data were entered into the computer using SPSS for Windows version 20.0 (SPSS Inc., Chicago, IL). Statistical analysis was performed using χ^2 -square for a test of association and Fisher's exact test, as appropriate. Where two or more continuous independent variables were examined, the t-test and Analysis of Variance were used (ANOVA) with repeated measures was used to compare the three group means for the same participants, a P-value of less than 0.05 was considered significant in all statistical analyses.

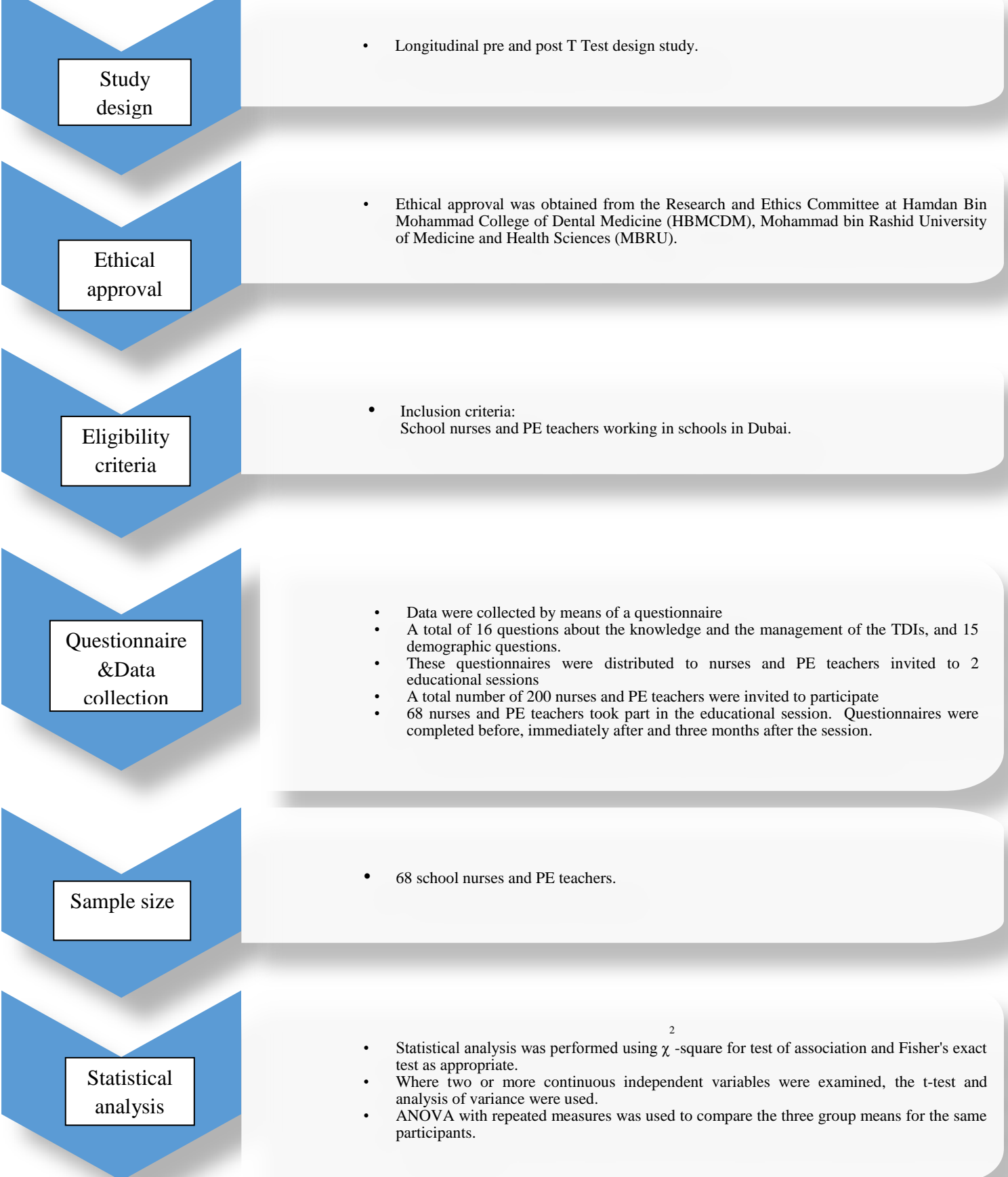


Figure 1: A flow chart of the study showing its design.

4.0 RESULTS

4.1 Demographic characteristics

Table 1 demonstrates the demographical characteristics of the study participants (Questions 1-15 excluding Q13, see Appendix II, III). The total sample size was 68, 58(85.3%) were females and 10(14.7%) males. The average age of the participants was 36.35 (SD=8.71) and the average duration in their current position was 7.88 years (SD=7.56), the average years of their experience was 11.78 years (SD=8.74). Only 13(19.4%) were physical education teachers and the majority of the participants, 54(80.6%) were school nurses, one of the participants did not specify their position. The data also reported that only 2(3.2%) participants were from preschool nurseries, 23(35.9%) were from primary schools, 7(10.9%) from middle schools, 8(12.5%) were from secondary schools and 24(37.5%) from schools of all grades. As for the education level/ qualifications of the participants, the majority 41(62.1%) had a bachelor's degree level, 11(16.7%) associate diploma level, 9 (13.6%) were at high school certificate level and only 5(7.6%) held a master's level degree. The majority 52(76.5%) of the participants reported having children of their own, only 23(33.8%) attended training about TDIs and 11(16.2%) felt adequately informed about TDIs. (See Table 1).

Table 1: Demographical data of study sample (answers from Q1 to Q15) excluding (Q13).

Variables	n (%)
Gender	
Male	10(14.7)
Female	58(85.3)
Position	
Physical education teacher	13(19.4)
Nurse	54(80.6)
Type of school	
Preschool	2(3.2)
Primary	23(35.9)
Middle	7(10.9)
Secondary	8(12.5)
School of all grades	24(37.5)
Qualification	
High school	9(13.6)
Associate Diploma	11(16.7)
Bachelor	41(62.1)
Master	5(7.6)
Having children of their own	
Yes	52(76.5)
No	16(23.5)
Ever observed children with TDIs	
Yes	40(58.8)
No	28(41.2)
Ever attending training about TDIs (Advice)	
Yes	23(33.8)
No	45(66.2)
Feeling adequately informed about TDIs	
Yes	11(16.2)
No	44(64.7)
Don't know	13(19.1)
First Aid course covering the management of TDIs	
Yes	17(25)
No	51(75)
Variables	Mean (SD)
Age	36.35(8.71)
Experience in years	11.78(8.74)
Current position duration	7.88 (7.56)

4.2 Knowledge of participants regarding differences between primary and permanent teeth over time

Figure 2 (Q17, see Appendix II, III). The answers to the question regarding the knowledge of the participants regarding distinguishing between primary and permanent teeth pre- and post-educational sessions in a set Scenario are presented in Figure 2. Before the educational session, only 44(64.7%) identified the answer as “permanent teeth” (correct answer). Following the educational session one hour later, the reported choice for “permanent teeth” increased to 65(95.6%) while three months post educational session 51(75.0%) answered correctly. For the same question, 18(26.5%) identified the teeth as “primary teeth” (wrong answer) before the educational session. While immediately after the educational session only 3(4.4%) participants answered “primary teeth” for that specific question, while three months afterwards, the figure was 17(25.0%). Prior to the educational session 6(8.8%) participants had chosen the answer “I do not know” while immediately after and three months later (0) participants chose “I do not know” for the same question. (See Figure 2).

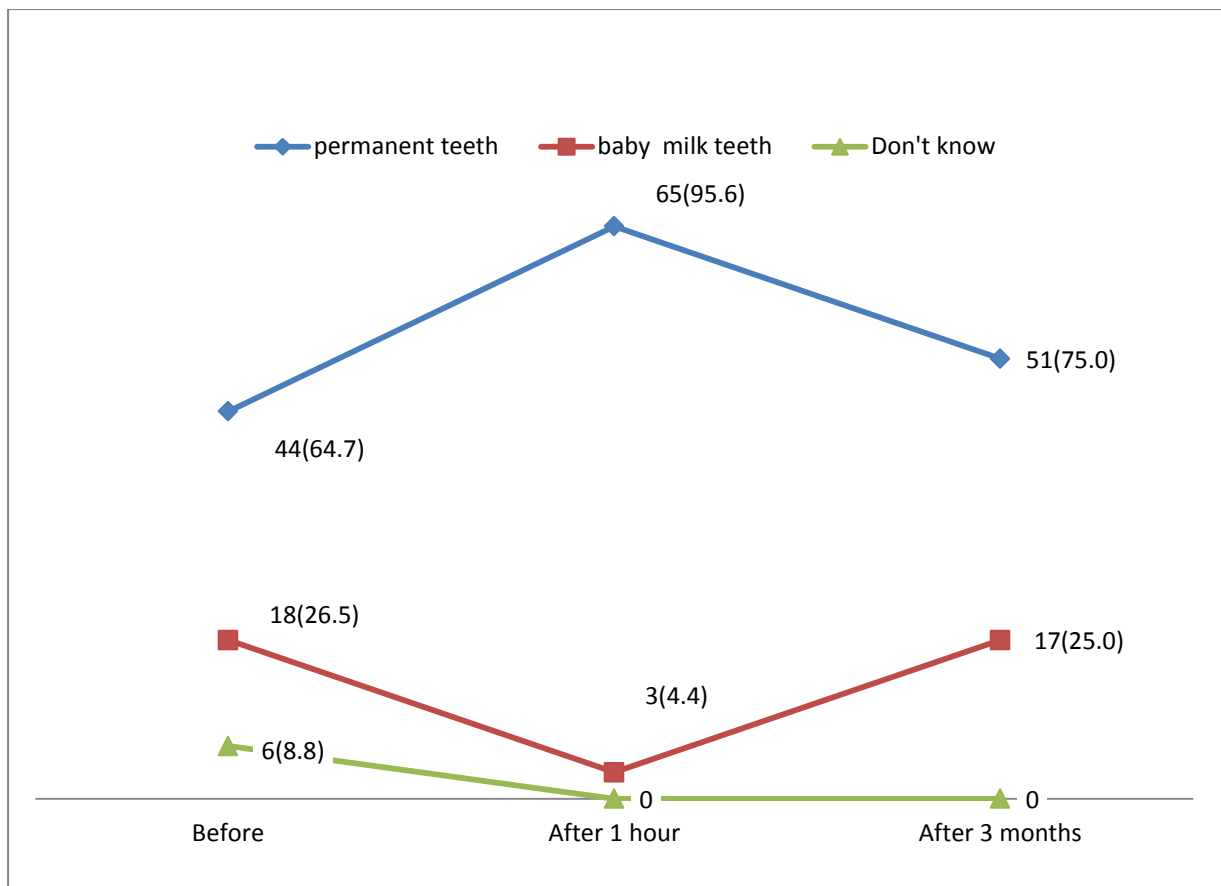


Figure 2: The response of participants to (Q17) over time (A 9-year-old was hit in the face with a soft ball during school hours but did not lose consciousness. His upper front teeth are broken, otherwise unhurt. Are the damaged front teeth primary or permanent teeth?).

4.3 TDIs past encounter experience over time

Table 2 (Q16, see Appendix II, III). Demonstrates a comparison of the replies of the participants regarding the types of TDIs they encountered in the past. There was an overall improvement in knowledge for the previously encountered experiences of different kinds of TDIs. (See Table 2).

Table2 : Comparison between TDIs past encounter experience over time (Q16).

Broken / chipped tooth	A n (%)	B n (%)	C n (%)
Yes	43(62.3)	51(73.9)	50(72.5)
No	25(37.7)	17(26.1)	18(27.5)
Tooth mobility			
Yes	41(59.4)	38(55.1)	40(58.0)
No	27(40.6)	30(44.9)	28(42.0)
Knocked out tooth			
Yes	29(42.0)	36(52.2)	32(46.4)
No	39(58.0)	32(47.8)	36(53.6)
Soft tissue(lip / chin) Injury			
Yes	45(65.2)	42(60.9)	36(52.2)
No	23(34.8)	26(39.1)	32(47.8)

A initial (before the educational session), B (immediately after the educational session), C (three months after the educational session).

4.4 The answers of the participants over the three time intervals to (Q18 through Q31 excluding Q25-Q26, Q28-Q30)

Table 3 demonstrates the answers of the participants over the three time intervals to (Q18 through Q31 excluding Q25-Q26, Q28-Q30, see Appendix II, III). The Table demonstrates an overall increase in the correct answers to these questions. The only exception to that is for Q22 regarding saving a knocked out primary tooth. There was an improvement in knowledge between the first (A) and the second surveys (B) while three months later (C), there was a decrease in knowledge. (See Table 3).

Table3 : The answers of the participants over the three time intervals to (Q18 through Q31 excluding Q25-Q26, Q28-Q30).

Questions	A n (%)	B n (%)	C n (%)
Q18. (a) Consideration of broken/chipped tooth as a dental injury over time as paired responses.			
Yes	59(86.8)	62(91.2)	68(100)
No	9(13.2)	6(8.8)	0
Q18. (b) Consideration of tooth that moved from its original position as a dental injury over time as paired responses.			
Yes	42(61.8)	57(83.8)	62(91.2)
No	26(38.2)	11(16.2)	6(8.8)
Q18. (c) Consideration of knocked out tooth as a dental injury over time as paired responses.			
Yes	53(77.9)	66(97.1)	67(98.5)
No	15(22.1)	2(2.9)	1(1.5)
Q19 Looking for broken/chipped tooth over time as paired responses.			
Yes	46 (67.6)	66 (97.1)	68 (100)
No	22 (32.4)	2 (2.9)	0
Q20 Treatment of broken/chipped tooth over time as paired responses.			
Yes	65 (95.6)	68 (100)	68 (100)
No	3 (4.4)	0	0
Q21 Informing parents about broken/chipped tooth and advising them to contact their dentist over time as paired responses.			
Yes	65 (95.6)	68 (100)	68 (100)
No	3 (4.4)	0	0
Q22 Knocked out primary tooth management over time as paired responses.			
Yes	15 (53.6)	40 (58.8)	8 (28.6)
No	13 (46.4)	28 (41.2)	20 (71.4)
Q23 Finding knocked out permanent tooth over time as paired responses.			
Yes	52 (76.5)	68 (100)	68 (100)
No	16 (23.5)	0	0
Q24 Treatment of knocked out permanent tooth over time as paired responses.			
Yes	65 (95.6)	66 (97.1)	68 (100)
No	3 (4.4)	2 (2.9)	0
Q27 Informing parents regarding knocked out permanent tooth and advising them to contact their dentist over time as paired responses.			

Yes	67(98.5)	68(100)	67(98.5)
No	1(1.5)	0	1(1.5)
Q31 Tetanus toxoid injection.			
Yes	42(61.8)	63(92.6)	66(97.1)
No	26(38.2)	5(7.4)	2(2.9)

A initial (before the educational session), B (immediately after the educational session), C (three months after the educational session).

4.5 The change in the response of participants over time on how urgently they would seek professional help if a permanent tooth was knocked out

Figure 3 (Q25, see Appendix II, III) demonstrates that there was an improvement regarding the correct response to the question of “seeking help within 30 minutes of trauma”. Immediately after the educational session, 52(76.5%) of the participants answered correctly compared to 39(57.3%) before the educational session. This improvement was increased and sustained regarding “seeking help within 30 minutes” from immediately after the educational session 52(76.5%) to three months after the educational session 64(94.1%).

Regarding the answer of “seeking help within few hours”, there was a significant decrease in the participants’ choice for this answer immediately after the educational session 16(23.5%) compared to before the educational session 25(36.8%), (p-value= 0.001). Moreover, this decrease was sustained from immediately after the educational session 16(23.5%) to three months after the educational session 4(5.9%), this decrease was also significant, (p-value= 0.038).

Regarding the answer of seeking treatment “before next day”, there was a decrease from 4(5.9%) before the educational session to (0%) immediately after the educational session and this was sustained from immediately after the educational session (0%) to three months after the educational session (0%). (See Figure 3).

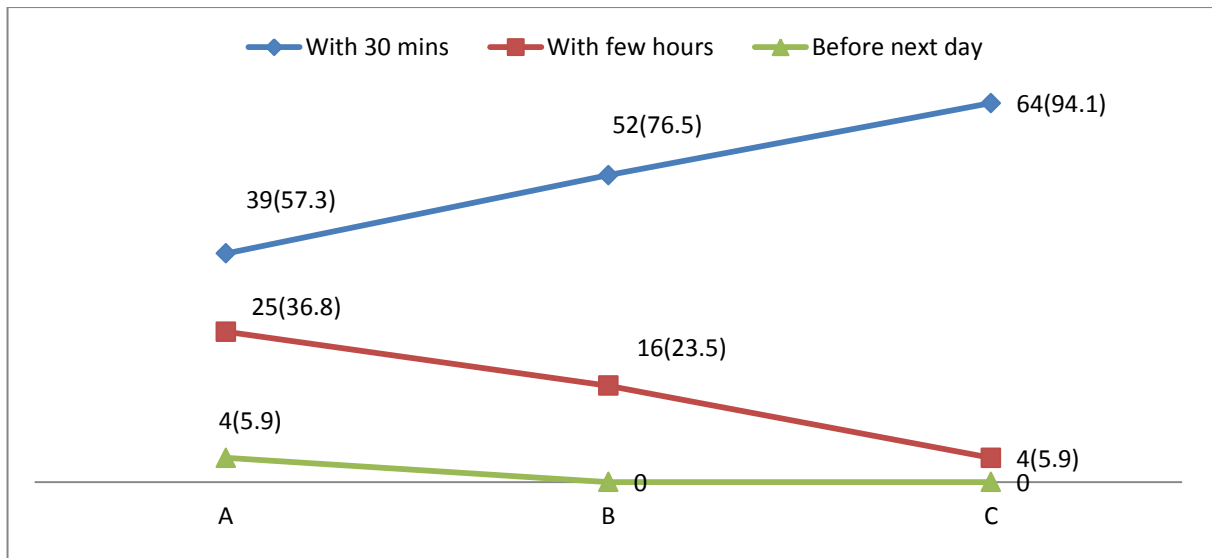


Figure 3: The change in the response of participants to (Q25) over time (How urgent do you think to seek professional help if a permanent tooth has been knocked out?).

4.6 The response of the participants regarding how to hold the knocked out permanent tooth over time

Figure 4 (Q26, see Appendix II, III) displays this. Before the educational session 33(48.5%) responded “by the crown” which is the correct answer and immediately after the educational session, there was an increase to 59(86.7 %) for the same answer, and three months after the educational session there was an increase 60(88.2%). As for the second answer regarding “holding the tooth by the root part”, before the educational session 18(26.5%) participants chose this answer and immediately after the educational session 8(11.8%) answered the same, (p-value=0.307). When comparing answers to the same question between immediately after the educational session and three months after the educational session, there was sustained decrease from 8(11.8%) to 5(7.4%) (p-value=0.847). As for the last answer of “don’t know”, 17(25.0%) before the educational session decreased to 1(1.5%) immediately after the educational session. Comparing the responses from immediately after the educational session

1(1.5%) to three months after the educational session 3(4.4%) there was a small increase.
(See Figure 4).

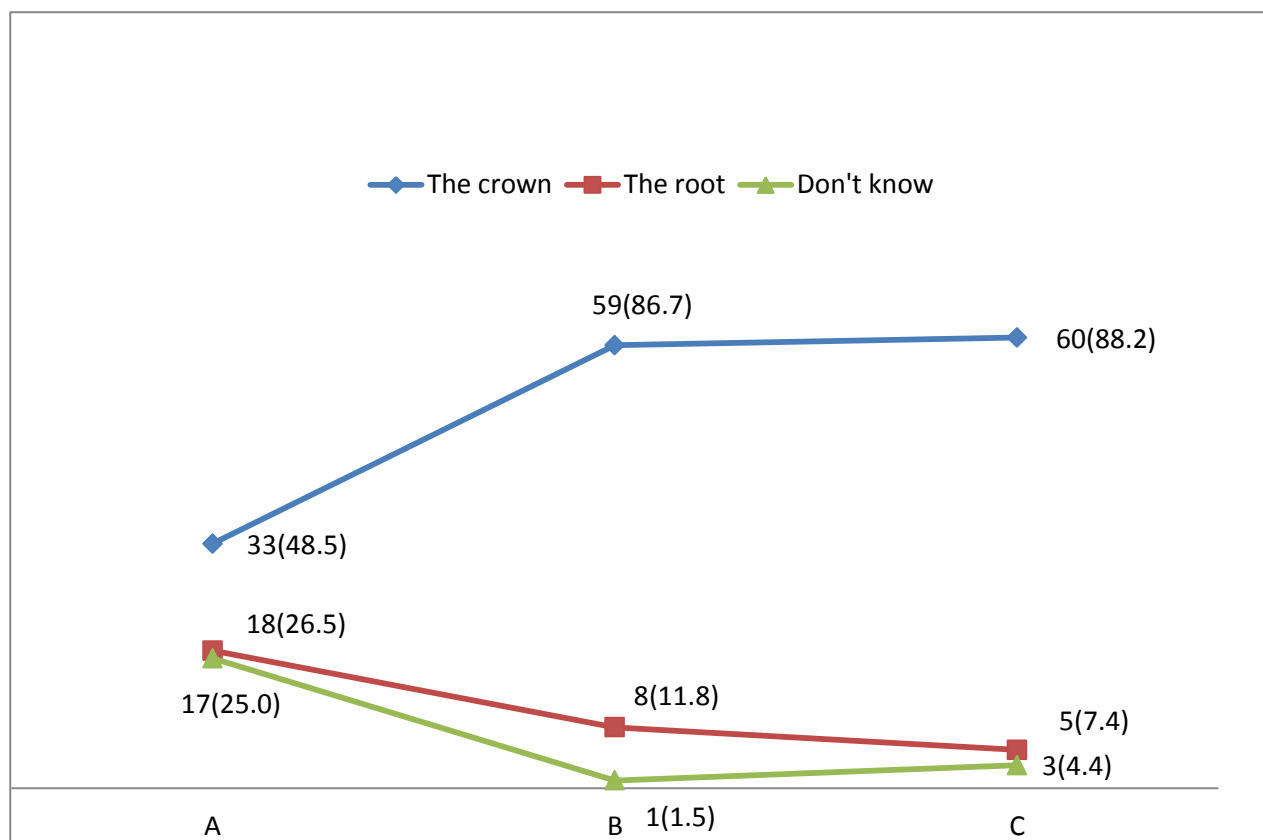


Figure 4: The response of participants to (Q26) over time (A knocked out permanent tooth should be held by?).

4.7 The response of the participants to what the first action is for a knocked out permanent tooth over time

Figure 5 (Q28, see Appendix II, III) shows the response of the participants to what would be the first action to be taken for a knocked out permanent tooth. Before the educational session the response with the highest score was 31(45.6%) which was “calling the patients parents and advising them to take the child to the dentist” followed by 14(20.6%) for “transporting the patient to the nearest dentist” then 13(19.1%) “calling a dentist and following their

instructions” then 9(13.2 %) “putting the tooth back in its place”. The lowest score was “keeping the child under observation” 1(1.5%). Immediately after the educational session, the correct answer which was “putting the tooth back in its place” scored the highest 58(85.3%) followed by 4(5.9%) for “calling patient’s parents and advising them to take the child to the dentist”. Only 3(4.4%) answered for both “keeping the child under observation” and for “transporting the patient to the nearest dentist” and (0%) answered for “calling a dentist and following their instructions”. Moreover, three months after the educational session, the correct answer of “putting the tooth back in its place” had the highest score 55(80.9 %) followed by 7(10.3%) “calling a dentist and following their instructions” then 4(5.9%) “calling patients parents and advising them to take the child to the dentist” then 2(2.9%) “transporting the patient to the nearest dentist”. The lowest score was (0%) for “keeping the child under observation”. (See Figure 5).

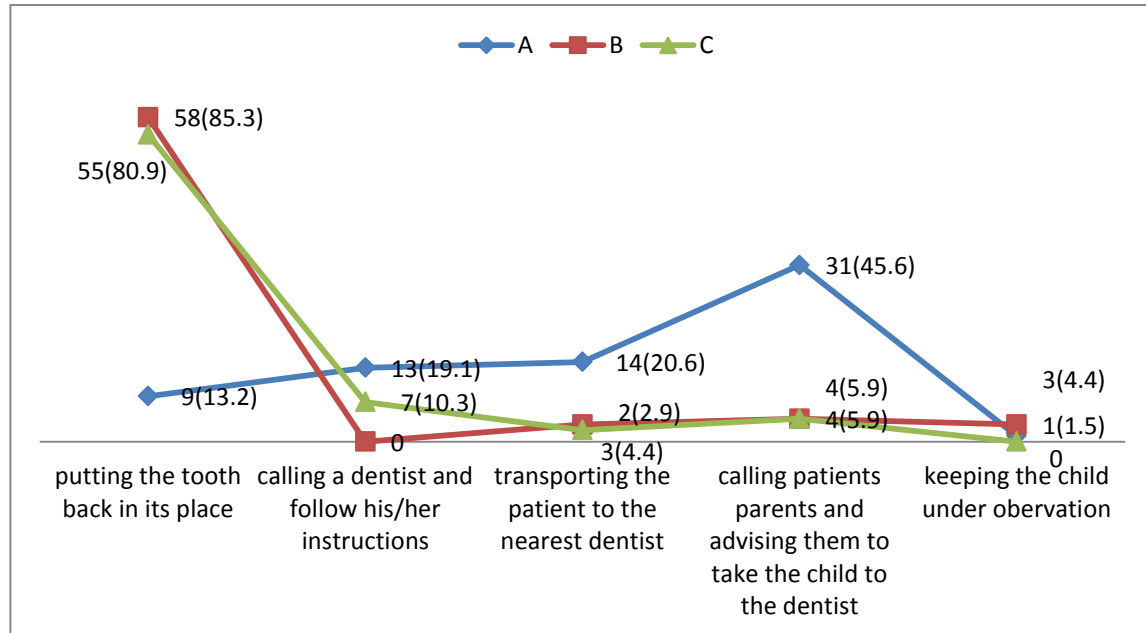


Figure 5: The response of participants to (Q28) over time (What is your first action when a permanent tooth gets knocked out?).

4.8 The response of participants to the action regarding a knocked out permanent tooth falling to the ground and being covered in dirt, over time

Figure 6 (Q30, see Appendix II, III) shows the response of participants to the action regarding a knocked out permanent tooth that fell on the ground and was covered with dirt. Before the educational session the response with the highest score was 36(52.9%) which was “rinses the tooth with normal saline” followed by 18(26.5%) “rinse the tooth under tap water” then 8(11.8%) “don’t know”, 3(4.4%) “rinse the tooth with antiseptic or alcohol solution”, 2(2.9%) answered by “putting the tooth straight back into its socket without doing anything else”, finally 1(1.5%) answer was to “scrub the tooth gently with a tooth brush”. Immediately after the educational session 50(73.5%) answered to “rinse the tooth under tap water” (correct answer), 17(25.0%) “rinse the tooth with normal saline”, 1(1.5%) “rinse the tooth with antiseptic or alcohol solution” and all other answers were (0%). Three months after the educational session the results were 36(52.9%) “rinse the tooth under tap water” , (correct answer), 27(39.7%) “rinse the tooth with normal saline”, and 4(5.9%) “put the tooth straight back into socket without doing anything else”, 1(1.5%) “don’t know” and (0%) for the other answers. (See Figure 6).

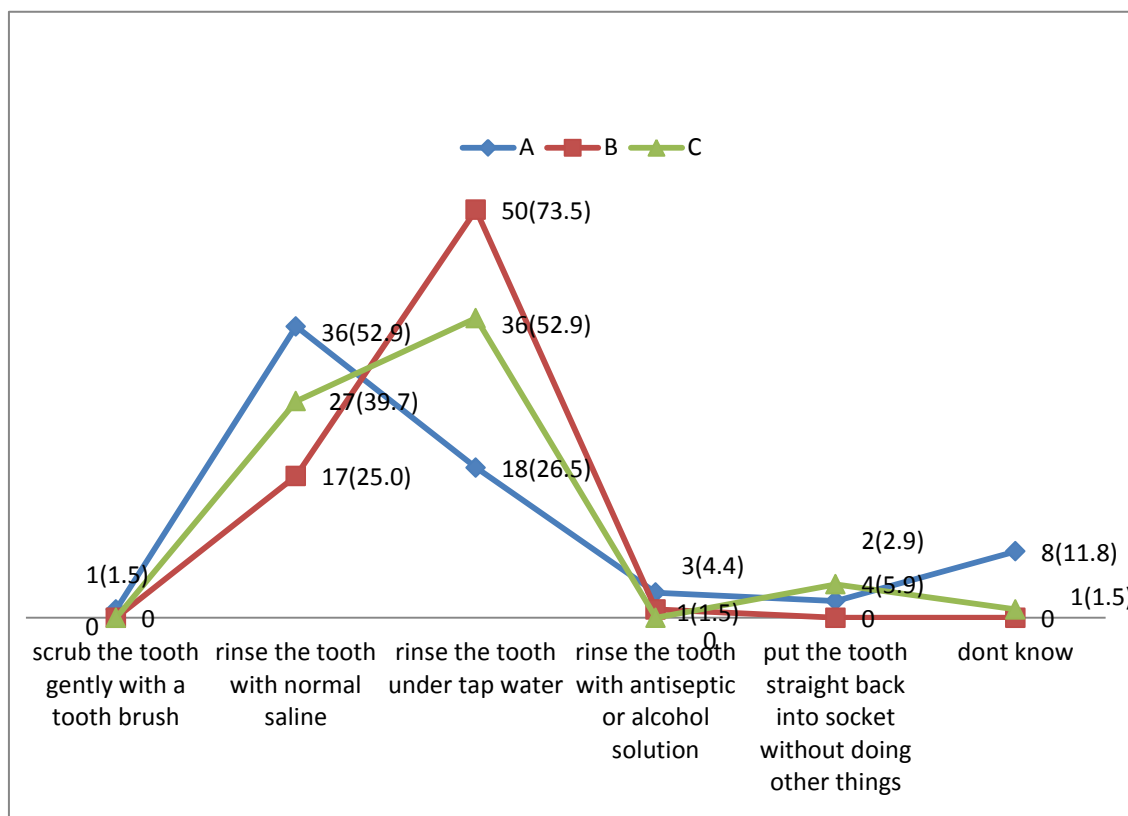


Figure 6: The response of participants to (Q30) over time (If you decided to replant the permanent tooth back into its socket but it has fallen onto the ground and is covered in dirt; what would you do?).

4.9 The ranking of actions by participants for avulsed permanent tooth from best to worst over time

Figure 7 (Q29, see Appendix II, III) shows the ranking of actions by participants for an avulsed permanent tooth, from best to worst.

Before the educational session, placing a knocked out tooth back in its socket and placing a knocked out tooth in water both had the first ranking with 16(23.9%) of participants. Placing a knocked out tooth in a milk, followed by placing a knocked out tooth in saliva both ranked in second place by 18(26.9%) of the participants and leaving a knocked out tooth dry ranked the third place with 24(35.8%) of the participants. Immediately after the educational session, the response of placing a knocked out tooth in milk, and placing a knocked out tooth in water both ranked first equal with 51(76.1%) of the participants, followed by placing a knocked out tooth in saliva, ranked the second by 52(77.6%) of the participants, then placing a knocked out tooth back in its socket, was in third place with 55(82.1%) of the participants; finally

leaving a knocked tooth dry was ranked fourth by 60(98.6%) of the participants. Three months later, after educational session, the ranking of the procedure reported as follows: first, placing a knocked out tooth in saliva with 46(68.7%) of the participants, second, placing a knocked out tooth in a milk, with 48(76.6%) of the participants, third, placing a knocked out tooth in water with 56(83.6%) of the participants, fourth placing a knocked out tooth back in its socket by 57(85.1%) of the participants and fifth leaving a knocked out tooth to dry by 66(98.5%) of the participants. (See Figure 7).

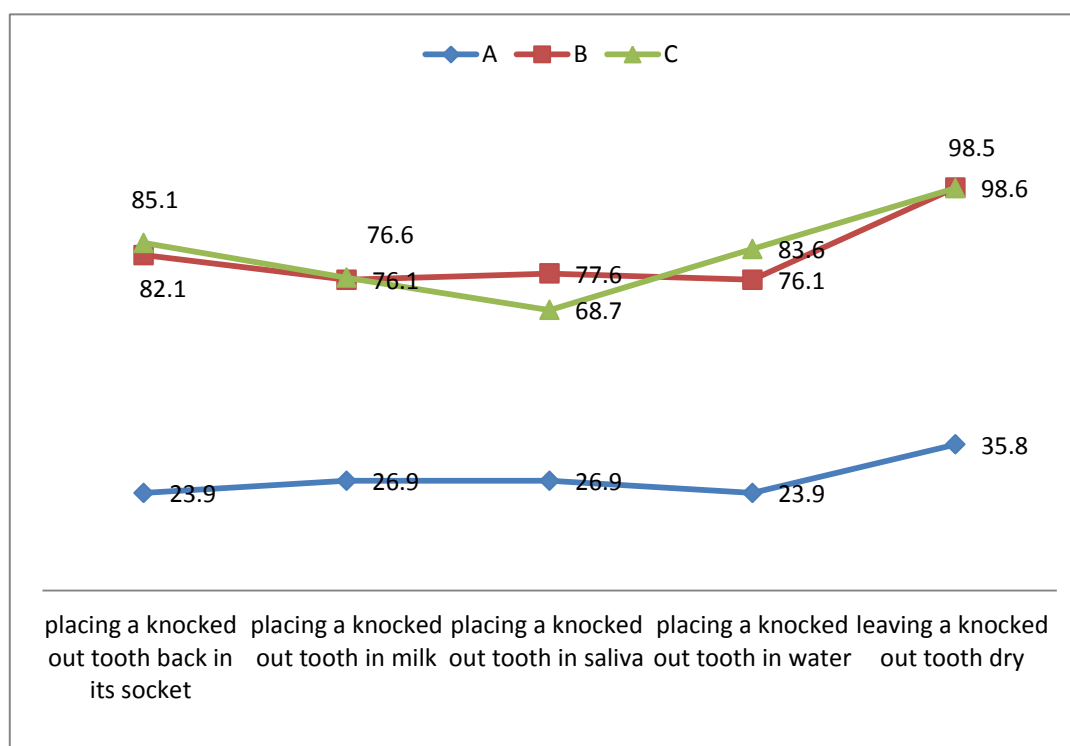


Figure 7: Answers of participants to (Q29) (the action for an avulsed permanent tooth ranked from best to worst).

4.10 The overall knowledge scores

Table 4 and Figure 8 demonstrate the repeated ANOVA results. An overall score of knowledge is important in assessing the participants' knowledge. In our study, we calculated the average score of knowledge for each participant in the three surveys that were collected.

We also tried to assess the improvement in the score of knowledge over the period of the study. We found a significant improvement in the score of knowledge among participants between the three times they filled out the questionnaire; before the educational session, immediately after the session and three months from the first educational session. There was a clear improvement between the initial and immediately after the educational session in the average score of knowledge from 10.75(0.24%) to 14.34(0.19%) respectively (p-value < 0.001). There was also a significant improvement of knowledge between immediately after the educational session and three months after the educational sessions 14.34(0.19%) to 14.82(0.16%) respectively (p-value = 0.047). (See Table 4, Figure 8).

These results demonstrate the sustainability of the overall knowledge in the subject acquired during the educational session; thus highlighting the importance of education regarding this topic.

Table3 : The knowledge score over the three periods using ANOVA repeated model and *pair wise post Hoc* test.

Time of intervention	Time of intervention	Mean Difference (I-J)	P-value	95% CI	
				lower	Upper
A	B	(10.75 – 14.34) -3.597*	<0.001	-4.237	-2.957
A	C	(10.75 – 14.82) -4.075*	<0.001	-4.662	-3.487
B	C	(14.34 – 14.82) -.478*	0.047	-0.949	-0.006

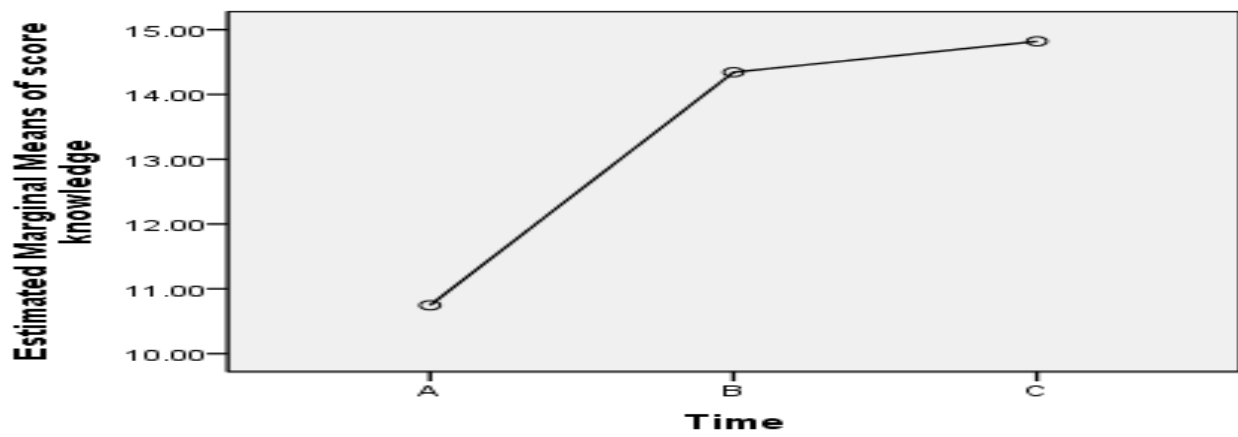


Figure 8: The repeated ANOVA result of the overall knowledge. This shows an increase in knowledge over time following the educational intervention.

5.0 DISCUSSION

A review of the literature reveals that many studies have been conducted worldwide assessing school nurses' and school teachers' knowledge about the management of dental trauma. The majority of these studies revealed inadequate knowledge on the part of school teachers and nurses regarding the emergency management of dental trauma.^{38,66,70,72,75,76,78,89}

The knowledge of school nurses and PE teachers in the UAE has yet to be adequately studied. A study by Fakhruddin and Kawas¹⁸ in Sharjah, UAE in 2010 suggested interventions such as educating parents, caretakers, and older siblings on how to reduce and prevent dental injuries.¹⁸ Another study conducted in Ajman, UAE, recommended educational campaigns about the importance of managing emergency dental injuries. This underlines the importance of educating the public in general and school nurses in particular about dental injury management.⁸⁶

5.1 Study demographics

The demographic information of our study sample was compared to those of the aforementioned eight studies.^{38,66,70,72,75,76,78,89}

5.1.1 Gender distribution

In our study the distribution of gender of participants was 10(14.7%) males and 58(85.3%) females. The higher female participation was also reported by several studies such as in McIntyre *et al* (2008)⁶⁶ study, males were 10(9%) and females were 101(91%) and in Arian and Sonmez (2012)⁷⁸ study males were 164(36.4%) and females were 286(63.6%). Additionally, in Baginska and Borawska (2012)⁷⁰, almost all the participants were female 50(96.15%). Furthermore, in Kane *et al* (2011)⁸⁹ study, males were 258(46.6%) and

292(52.7%) females with 4(0.7%) not specifying their gender. While in a Bayrak *et al* (2012)⁷⁶ study the male subjects were 241(43.8%) and the female 309(56.2%). The exception was a study by Mesgarzadeh *et al* (2009)⁷⁵ where the males subjects were in a slight majority over the females 83(52%) and 77(48%) respectively.

5.1.2 Age distribution

The mean age of participants in our study was 36.35(SD= 8.71) which is close to the McIntyre *et al* (2008)⁶⁶ study where the average age was 39.7(SD= 10.2) and also similar to a Bayrak *et al* (2012)⁷⁶ study where the majority of respondents 202(36.7%) were between 30 - 39 years of age.

In contrast, in Mesgarzadeh *et al* (2009)⁷⁵ the mean age of the participants was between 41 and 50 67(41.8%) which is slightly higher than our study. Similar results were found in Kane *et al* (2011)⁸⁹ where the age group from (20-40) years formed 50.4% of the sample, followed by the 41-60 age group, 43.5%.

5.1.3 Primary position in school

In the present study only 13(19.4%) were PE teachers, with the majority of participants 54(80.6%) being school nurses, with one participant not specifying their position.

5.1.4 Type of schools

Similar to other studies, the sample in the present study worked in schools with different levels of education. There were nurses and PE teachers working in preschool 2(3.2%), primary school 23(35.9%), middle school 7(10.9%), secondary school 8(12.5%) and school of all grades 24(37.5%). In McIntyre *et al* (2008)⁶⁶ the majority of participants were from primary school; grade 2 18(16%), grade 3 14(13%), grade 4 9(8%), grade 5 18(16%), all

grades 45(41%) which was more than those in our study. Similar results in Baginska and Borawska (2012)⁷⁰ study, primary schools were represented by 32(64%), lower secondary schools were represented by 30(60%) while upper secondary were represented by 25(50%). Furthermore, in Pujita *et al* (2013)⁷² study, 1000 participants were from both private and state primary (elementary) and secondary (high) schools.

However, in Kane *et al* (2011)⁸⁹ study, all the participants were primary school teachers and in a study by Bayrak *et al* (2012)⁷⁶ all the participants were from elementary schools, whereas in Al-Asfour *et al* (2008)³⁸ all the school teachers were from intermediate schools, and in Arikan and Sonmez (2012)⁷⁸ all the school teachers were from primary schools, which was slightly different from our study.

5.1.5 Qualifications of the participants

The level of qualifications of the participants in our study was as follows 9(13.6%) high school graduates, which was lower when compared to a McIntyre *et al* (2008)⁶⁶ study where the number of high school graduates was 17(15%) and in contrast to a Kane *et al* (2011)⁸⁹ study, where half of the teachers (50.5%) had a high school degree and a Baginska and Borawska (2012)⁷⁰ study, where the number of secondary education participants was 42(84%).

In a McIntyre *et al* (2008)⁶⁶ study, and in a Mesgarzadeh *et al* (2009)⁷⁵ study and a Baginska and Borawska (2012)⁷⁰ study, the numbers of participants with a bachelor's degree were 43(39%), 79(49.5%) and 2(4%) respectively, lower than in the present study which had 41(62.1%).

In the McIntyre *et al* (2008)⁶⁶ study the number of associates was 11(10%) which was somewhat less than our study with 11(16.7%) and much less than in the Mesgarzadeh *et al*

(2009)⁷⁵ study, where the associates were 45(28%), a figure slightly higher than ours. While Master's degree holders in the McIntyre *et al* (2008)⁶⁶ study numbered 40(36%), significantly higher than the presents study with 5(7.6%) and the Baginska and Borawska (2012)⁷⁰ study, 4(8%).

As demonstrated by this information, our study sample had a roughly similar educational background to the background of participants in similar studies in the literature.

5.1.6 Experience of the participants

In our study, the mean job experience of the participants (SD) was 11.78(\pm 8.74) years which was low compare to Baginska and Borawska (2012)⁷⁰ study were the majority 39(78%) were very experienced as they had worked equal or less than 20 years as school nurses. In an Arikan and Sonmez (2012)⁷⁸ study the majority of school teachers (82.6%) had been teaching for more than 10 years.

5.1.7 Participants length of service

In the present study the mean duration in years in current position (SD) was 7.88(\pm 7.56). In contrast, McIntyre *et al* (2008)⁶⁶ average duration in years (SD) was 13.0(9.2) which was significantly higher. Similar results were found in Mesgarzadeh *et al* (2009)⁷⁵, teaching experience varied between one to 37 years with a mean of 18.7 \pm 11.8 years. In the Kane *et al* (2011)⁸⁹ study, participants with experience of 1-5 years and 6-10 years were the most represented, with 22% and 23%, respectively. Also in the Bayrak *et al* (2012)⁷⁶ study, the majority of participants had more than 10 years length of service 462(84.0%), higher than our present study.

5.1.8 Participants own children

When participants in our study were asked if they had children of their own, 52(76.5%) responded in the affirmative, which is slightly higher than the McIntyre *et al* (2008)⁶⁶ study 76(69%). On the other hand, in both the Baginska and Borawska (2012)⁷⁰ study and the Bayrak *et al* (2012)⁷⁶ study, the equivalent figures were 47(94%) and 485(88.2%), respectively, higher proportions than our present study.

5.1.9 Participants previous encountered experience with TDIs and recognition of TDIs

Regarding previous experience with traumatic injuries; when the participants in our study were asked whether they had observed children with TDIs, the majority 40(58.8%) responded positively. While McIntyre *et al* (2008)⁶⁶ reported a lower proportion 26(24%), and Bayrak *et al* (2012)⁷⁶ reported very few participants 45(8.2%) with previous experience of, TDIs but 107(19.4%) had witnessed 1-2 cases at school. This was also the case in the Pujita *et al* (2013)⁷² study: previous experience in managing TDIs was low; 7.6% of teachers in rural areas and 10.6 % in urban areas. In Baginska and Borawska (2012)⁷⁰ dental trauma experience in family/friends was 22(44%), which is still low compared to the present study. Additionally, in an Arikan and Sonmez (2012)⁷⁸ study, 39.1% of teachers had encountered dental trauma before and, of these, more than half (53.4%) had encountered dental trauma among their students, which is similar to our study. Our study participants demonstrated a higher level of experience with TDIs than similar studies, adding emphasis to the priority of educating them and their colleagues about the emergency management of TDIs.

Regarding the recognition of different types of TDIs as a dental injury Broken/chipped tooth, tooth that moved from its normal position, knocked out tooth an overall improvement in

knowledge over the three intervals was found in our study; something essential for increasing proper initial management and referral. Moreover, there was also an overall improvement in knowledge for the previously encountered experience of different kinds of TDIs (broken/chipped tooth, tooth mobility, knocked out tooth, soft tissue (lip/chin) injury in the three intervals. The increase in the percentage of recognition or encountering different types of dental injuries showed that there was a positive effect occurring between the three times surveyed.

5.1.10 Attendance at previous training about TDIs

Regarding attendance at previous training about TDIs, only one third 23(33.8%) of our participants indicated they had previously attended any training of whom 17(25%) had first aid course covering the management of TDIs. Concerning training regarding knowledge about TDIs, 57(83.8%) of the participants reported no prior information about the management of TDIs, while in Arikan and Sonmez (2012)⁷⁸ only (7.6%) had previously received information about dental trauma which is lower than our study.

This was a sharp contrast to Baginska and Borawska (2012),⁷⁰ who reported that more than two-thirds 38(76%) of their study participants had received dental trauma education. Moreover, Pujita *et al* (2013)⁷² study found that the majority, 438(87.6%) teachers in rural and 474(94.8%) teachers in urban areas had had a first-aid component in their teacher training curriculum. While in the Bayrak *et al* (2012)⁷⁶ study, 297(54%) of the participants had received first-aid training.

This indicates that, in comparison to previous studies, participants in our study lacked the initial knowledge and sufficient educational programs regarding TDIs in children, despite the

fact mentioned previously that they had had more encounters with TDIs compared to the participants in other studies.

5.1.11 Knowledge about TDIs

Self-reported confidence in knowledge is an important indicator for proper knowledge and practice. In our study the participants were asked before the training if they felt adequately informed about TDIs and only 11(16.2%) responded by yes, which was close to the Pujita *et al* (2013)⁷² percentage of participants' who were satisfied with their level of knowledge on TDIs (12.4% in rural and 17.4% in urban areas). However, McIntyre *et al* (2008)⁶⁶ and Bayrak *et al* (2012)⁷⁶ reported proportions of 11(10%) and 18(3.3%) respectively, which were less than the present study.

The answers to this question in our survey also demonstrate the deficiency in education about the management of TDIs and hence the need for better educational programs for groups similar to the study group.

5.2 Recognition of the permanent incisor in a nine year old

In the present study, the majority of the participants reported the correct answer in recognizing what type of incisor (permanent) in a nine-year-old before the educational session 44(64.7%). These results were similar to those of the Bayrak *et al* (2012)⁷⁶ study which reported a recognition rate of 343(62.4%). Moreover, in the present study, immediately after the educational session, 65(95.6%) answered correctly while three months later 51(75.0%) were still able to make the correct identification.

5.3 Informing parents about broken/chipped tooth and advising them to contact their dentist and looking for the missing tooth fragment and treatment of the broken/chipped tooth

In our study, regarding the issue of informing parents about a traumatic incident and advising them to contact their dentist immediately in cases of a broken /chipped tooth, an overall increase in the correct answer to this issue was observed in the three times intervals; A 65(95.6%), B 68(100%) and C 68(100%). In Mesgarzadeh *et al* (2009)⁷⁵ study, when teachers were assessed about their knowledge of management of fractured teeth in school children, 66(41.2%) said they would contact the parents immediately to get them to take the child to a dentist, significantly lower than our present study.

Similar improvements to the present study were found in the Pujita *et al* (2013)⁷² study, where teachers who felt that taking fractured tooth piece to the dentist would be helpful, with the improvement being from 25.2% in rural areas and in 37.4% urban areas before the information session to 63.6% in rural areas, and 66.1% in urban areas three months of the informative session. Similarly, in a study by Arikan and Sonmez (2012)⁷⁸, school teachers intending to send the child to the dentist immediately with the broken part of the tooth increased significantly from 55.3% before the leaflet distribution to 73.6% one month after leaflet distribution (p-value<0.0001).

Regarding the issue of looking for the missing tooth fragment, an overall increase in the correct answer to this issue was observed in our study over the three time intervals; A 46(67.6%), B 66(97.1%) and C 68(100%).

Similarly, in a study by Arikan and Sonmez (2012)⁷⁸, the school teachers who would try to find the broken part of the tooth, the correct answer, increased significantly from 55.3% before the leaflet distribution to 73.6% after one month of leaflet distribution (p-value <0.0001).

Furthermore, regarding the treatment of a broken/chipped tooth over time, an overall increase in the correct answer to this issue was observed in our study in the three times intervals; A 65(95.6%), B 68(100%) and C 68(100%).

5.4 Avulsed (knocked out) permanent and primary tooth management

In the present study, regarding the issue of saving knocked out permanent tooth over time, an overall increase in the correct answer was observed in the three time intervals; A 52(76.5%), B 68(100%) and C 68(100%). Comparing this to the Pujita *et al* (2013)⁷² study, many teachers knew that knocked out (avulsed) teeth required emergency treatment, but the concept of management of avulsed teeth was not fully understood. In contrast to the Pujita *et al* (2013)⁷² study, the study by Arikan and Sonmez (2012)⁷⁸ showed that 37.1% of school teachers stated they would try to find the knocked out tooth before the leaflet distribution, while one month following the leaflet distribution, the percentage of correct answers rose significantly to 80% (p-value < 0.0001).

Additionally, in the present study, concerning the issue of the treatment of knocked out permanent tooth over time, an overall increase in the correct answer was observed in the three times intervals A 65(95.6%), B 66(97.1%) and C 68(100%).

Moreover, similarly to our study, in the study by Pujita *et al* (2013),⁷² teachers who thought that they would reimplant knocked out permanent tooth increased after three months of informative promotion in rural areas to 72.8% and in urban areas to 76.8% which is comparable to in Al-Asfour *et al* (2008)³⁸ where the general knowledge about tooth avulsion and replantation improved from before the informative lecture 39% to 30 min after the lecture 97% and the knowledge of avulsed permanent teeth improved from before the informative lecture 8% to 30 min after the lecture 71%.

Similarly to our study, the participants possessed previous knowledge of the correct procedure in the Mesgarzadeh *et al* (2009)⁷⁵ study, who reported half of the participants, 81 teachers, would replant immediately, and 14 teachers 8.7% qualified replantation depending on the type of the tooth, these results are also similar to the Baginska and Borawska (2012),⁷⁰ study where 25(50%) of the participants said they would replant.

In contrast, in the Bayrak *et al* (2012)⁷⁶ study, only 5.6% of the participants said they would replant an avulsed tooth immediately. In the McIntyre *et al* (2008)⁶⁶ study, almost half the respondents either would not replant (44%) an avulsed tooth or would be uncomfortable (28%) doing so. Furthermore, an additional 15% were undecided about what they would do, and 7% were comfortable and 5% were very comfortable. These findings further emphasized that additional TDIs education would be beneficial for elementary school staff. In addition, in the Arikan and Sonmez (2012)⁷⁸ study 92.4% of school teachers said they would not replant the knocked out tooth in its socket before the leaflet distribution and the percentage rose to 96% after one month of the leaflet distribution which showed that there is confusion here.

A controversial issue was posed by the saving of avulsed primary teeth in order to take to a professional consultation, due to the potential risk of damaging the permanent successor. This is supported by a study done in Singapore, which stated that people had poor knowledge regarding the replantation of permanent and primary teeth⁵⁶. Comparing this to the present study, saving a knocked out primary tooth over time demonstrated an improvement in the knowledge between the first A; 15(53.6%) and the second surveys B; 40(58.8%) while three months later C; 8(28.6%) there was a decrease. Similarly in the Al-Asfour *et al* (2008)³⁸ study, the knowledge of avulsed primary teeth improved from before the informative lecture 8% to 30 min after the lecture, 71%.

In the present study the results demonstrated inconsistency and confusion among the participants regarding the issue of saving a knocked out primary tooth. The participants might have confused this issue with re-planting an avulsed primary tooth. Further education is probably required to clarify this issue. The purpose of this specific question was to encourage the participants to save an avulsed primary tooth to be shown to the dentist for further verification and not to re-implant it.

In contrast to our study, the study by Pujita *et al* (2013)⁷² reported that knowledge about the management of a knocked out primary tooth had improved three months after the information promotion to 35.6% in rural areas and 26.6% in urban areas.

When questioned about the severe and often very serious infection of tetanus and the importance of tetanus prophylaxis after certain TDIs; there was an overall increase in the correct answer to this issue in the three time intervals; A 42(61.8%), B 63(92.6%) and C 66(97.1%).

These results were similar to the Pujita *et al* (2013)⁷² study, where initially the majority of the teachers (a slightly higher percentage of urban teachers) showed a positive response for tetanus prophylaxis during traumatic injuries, 50.4%, and after three months of the information session, the response showed a further increase to 76.2% .

Regarding the issue of contacting a dentist for consultation about a knocked out permanent tooth, an overall increase in the correct answer was observed in the three time intervals in our study; A 67(98.5%), B 68(100%) and C 67(98.5%).

Similarly to the present study, in the study by Kane *et al* (2011),⁸⁹ participants already had some knowledge about this, 65% of the teachers would contact the closest dental service and 20% would call the parents and 8.7% would do nothing. Only 7.2% of the teachers with

university degree would replant the tooth immediately, but more than those of secondary school level. The study by Bayrak *et al* (2012)⁷⁶ reported only 19.8% would look for the tooth and send the child to the dentist, which is lower than in Kane *et al* (2011)⁸⁹ and our study. Similarly to the Bayrak *et al* (2012)⁷⁶ study, in a study by Baginska and Borawska (2012)⁷⁰, participants who said that would call the dentist and follow their instructions were 8(16%) while calling patients parents and advising them to take the child to the dentist was reported as the answer of choice by 17(34%). Furthermore, in contrast to Baginska and Borawska (2012),⁷⁰ our study showed an overall increase in the correct answer regarding informing parents immediately about knocked out permanent tooth in the three times intervals; A 67(98.5%), B 68(100%) and C 67(98.5%).

As demonstrated by the present study and the aforementioned previous studies, there appears to be considerable variation in the knowledge of teachers and school nurses concerning the immediate management of an avulsed tooth that might be due to differences in prior knowledge and education. One certain fact demonstrated by the results of our study was the effect of education on the perception and management of avulsion by the school nurses and PE teachers. As discussed thoroughly in our literature review; the early management of avulsed permanent teeth is crucial to their long term prognosis.

Whether the improvement of the participant's knowledge would lead to improved performance in managing a case of an avulsed tooth cannot be ascertained here. It will be interesting to follow up our study group in a year time and test their knowledge retention as well as their management of any encounter with an avulsed tooth.

5.4.1 Time management in seeking help for an avulsed tooth

The improvement in our study of the correct answer regarding seeking help within 30 minutes of an avulsion happening in the three phases of the study was demonstrated. Immediately after the educational session; 52(76.5%) gave the correct answer compared to 39(57.3%) before the educational session. Comparing this to the Al-Asfour *et al* (2008),³⁸ study the knowledge level on the importance of extra-alveolar time before replantation increased from before the informative lecture from 1% before to 30 min after the lecture 74%, which is similar to the present study.

There was an improvement in our study with sustainability regarding seeking help within 30 min, from immediately after the educational session, 52(76.5%) compared to three months after the educational session, when the percentage of participants with the correct answer was 64(94.1%). Additionally, in the study by Pujita *et al* (2013)⁷², most of the teachers stated that they would take the child to a dentist within few hours, with a few teachers stating that they would consult the dentist immediately, within 30 minutes this was before the information session, while after three months 82.4% in rural areas and 88.9% in urban areas said they would replant the tooth immediately which is similar to the findings noted by a study conducted in Saudi Arabia⁸⁴ and to our study. A similar improvement was found in the Arikan and Sonmez (2012)⁷⁸ study, when asked about the ideal time to replace the knocked out tooth in its socket before the leaflet distribution, 26.2% of teachers said ‘immediately’, the ideal answer, and 14.7% said one hour later, an acceptable answer, both answers considered correct however the score given higher for the ideal answer, while after one month of the leaflet distribution, the percentage giving the ideal answer rose to 47.1% whereas the percentage of the acceptable answer decreased to 13.6%.

In contrast, in a study by Mesgarzadeh *et al* (2009)⁷⁵, the majority of teachers 54(66.5%) suggested a few hours as an appropriate upper limit. Similarly, in the Baginska and

Borawska (2012)⁷⁰ study, 46(92%) would reimplant within one hour and 4(8%) said that they did not know.

5.4.2 Holding a knocked out permanent tooth

For the question of proper handling of an avulsed tooth, our results were not so similar to Baginska and Borawska (2012),⁷⁰ that an avulsed tooth should be “held by the crown” 47(94%) which showed that most of the participants had the knowledge already. In our study, before the educational session, the participants choosing to answer that the avulsed tooth should be “held by the crown” comprised 33(48.5%) which is significantly less than for Baginska and Borawska (2012)⁷⁰. Immediately after the educational session, there was an increase to 59(86.7%) which was sustained after three months represented by 60(88.2%) choosing that answer then. Similarly, in the Arikan and Sonmez (2012)⁷⁸ study, school teachers saying that they would pick the knocked out tooth by the crown, before the leaflet distribution, amounted to 53.8% and one month following the leaflet distribution, the percentage of the correct answer rose significantly to 82.4% (p-value <0.0001).

5.4.3 The first action for a knocked out permanent tooth

In the present study, before the educational session, 9(13.2%) of the participants chose “putting the tooth back in its place” as the first action in response to a knocked out permanent tooth. Similarly, in the Kane *et al* (2011)⁸⁹ study, reimplantation was chosen by 7.2% of the participants. In comparison; there was a more positive response in the Baginska and Borawska (2012)⁷⁰ and Mesgarzadeh *et al* (2009)⁷⁵ studies where exactly half of the surveyed participants declared that they would perform tooth reimplantation immediately.

Immediately following the educational session in our study; 58(85.3%) of the participants chose to “put the avulsed tooth back in place” and three months after the educational session; 55(80.9%) chose to “put the tooth back in its place” as the first action in managing an avulsed tooth.

In our study, before the educational session, the answer chosen most frequently by participants, 31(45.6%) was “calling patients’ parents and advising them to take the child to the dentist”. These results are very similar to the Baginska and Borawska (2012)⁷⁰ study; where 34% of the respondents said they would call the parents first to inform them. This is in contrast to the Kane *et al* (2011)⁸⁹ study, where 34.1% of the participating teachers said they would get in contact with the dental services, 30.9% would send the child directly to a dentist, and only 20.2% would call the child’s parents.

Moreover, in our study, before the educational session, 14(20.6%) participants answered by choosing “transporting the patient to the nearest dentist” and 13(19.1%) chose “calling a dentist and following their instructions” the lowest scoring answer was “keeping the child under observation” 1(1.5%). Immediately after the educational session, the correct answer, which was “putting the tooth back in its place” scored the highest 58(85.3%), followed by 4 (5.9%) choosing “calling patient’s parents and advising them to take the child to the dentist”. Only 3(4.4%) participants answered for both “keeping the child under observation” and for “transporting the patient to the nearest dentist” and (0%) answered for “calling a dentist and following his/her instructions”. Moreover, three months after the educational session, the correct answer of “putting the tooth back in its place” had the highest score 55(80.9%) followed by 7(10.3%) “calling a dentist and following his/her instructions” then 4(5.9%) “calling patients parents and advising them to take the child to the dentist” then 2(2.9%) “transporting the patient to the nearest dentist” and last, (0%) for “keeping child under observation”.

Apparently, and as reported in the literature review, the best outcome for an avulsed tooth can be obtained by following immediate reimplantation. It is essential to train those who are in immediate contact with the child after avulsion to reimplant the tooth immediately. Our study sample demonstrated considerable improvement in this regard after the educational session and it is hoped that this improvement in knowledge will lead to a corresponding improvement in practice when faced by the emergency situation.

5.4.4 Cleaning a dirty knocked out permanent tooth

The IADT guidelines⁴ recommend rinsing the avulsed tooth for about 10 seconds under running water. In the Pujita et al (2013)⁷² study, knowledge of the most appropriate method to clean a dirty, knocked out tooth prior to replantation was investigated using a list of alternatives derived from the study reported by Hamilton et al (1997)⁹⁰. Considerably fewer teachers wanted to keep the teeth under running water, 3.2% in rural areas and 11.8% in urban areas. After three months of information promotion, adequate levels of improvement were achieved in terms of managing knocked out teeth under running water (63.0% in rural and 68.1% in urban areas).⁷²

Comparing these results with our study; immediately after the educational session 50(73.5%) participants and three months after education 36(52.9%) participants chose the respond to “rinse the tooth under tap water” in comparison to 18(26.5%) participants who chose the answer to “rinse the tooth under tap water” before the educational session. This demonstrates that there was improvement with sustainability regarding the preferred method to clean a dirty avulsed tooth. Similarly in the Al-Asfour *et al* (2008)³⁸ study, the knowledge about how to clean an avulsed tooth improved from before the informative lecture 5% to 30 min after the lecture 93%.

Almost all the participants in the Baginska and Borawska (2012)⁷⁰ study were able to choose the correct answer to the above issue, which showed that the participants already possessed the knowledge. While in the Mesgarzadeh *et al* (2009)⁷⁵ study; 12.5% of the participants preferred to rinse it with antiseptic solutions, and 38.1% believed that either tap water or normal saline was suitable for this purpose. In the same study; 13.1% of the participants preferred to scrub the tooth.

In the Pujita *et al* (2013)⁷² study, most of the teachers said that they would gently scrub the tooth prior to replantation (23.8% in rural and 21.0% in urban areas) before the information promotion. The study by Kane *et al* (2011)⁸⁹ demonstrated that the tooth would be systematically rinsed by 49.1% of the teachers, the solutions most often used were salted water (20.4%), antiseptics (13.9%), dentifrices (13.6%), tap water (11.7%), alcohol (1.3%), and other solutions (7.4%) such as bicarbonate, formalin, and antibiotics.

5.4.5 Ranking from best to worst regarding the immediate management for a knocked out permanent tooth

In our study, and prior to the educational session, “placing a knocked out tooth back in its socket” and “placing a knocked out tooth in water” both had the first ranking with 16(23.9%) of participants. “Placing a knocked out tooth in a milk”, followed by “placing a knocked out tooth in saliva” were both ranked in second place by 18(26.9%) of the participants, and “leaving a knocked out tooth dry” was ranked in third place, by 24(35.8%) of the participants. Immediately after the educational session, the answer of “placing a knocked out tooth in a milk” and “placing a knocked out tooth in water” were both ranked first by 51(76.1%) of the participants, followed by “placing a knocked out tooth in saliva” ranked second by 52(77.6%) of the participants; then “placing a knocked out tooth back in its socket” procedure was ranked the third place by 55(82.1%) of the participants and finally “leaving a knocked tooth

dry” was ranked the fourth by 60(98.6%) of the participants. Three months after the educational session the ranking of the procedures was reported as follows: first “placing a knocked out tooth in saliva” by 46(68.7%) of the participants, second “placing a knocked out tooth in a milk” by 48(76.6%) of the participants, third “placing a knocked out tooth in water” by 56(83.6%) of the participants, forth “placing a knocked out tooth back in its socket” by 57(85.1%) of the participants and fifth on the bottom “leaving a knocked out tooth to dry” by 66(98.5%) of the participants.

There was no separate question to investigate the appropriate storage medium for tooth transport, and this might have led to some confusion among the participants and made it hard to compare these results to other studies that looked into the issue of the appropriate transport medium in particular.

Furthermore; these results indicated confusion among participants in ranking their choices for the best immediate management for an avulsed permanent tooth. This confusion might be due to confusing question design. Another possible explanation could be that the educational session was unable to clarify this subject fully to the participants.

5.5 The score of knowledge over the three periods

An overall score of knowledge is important to assess the participants’ knowledge. In our study, we calculated the average score of knowledge for each participant in the three surveys that we collected. We also tried to assess the improvement in the score of knowledge over the period of the study. We found a significant improvement in the score of knowledge among participants between the three occasions they filled out the questionnaire; before the educational session, immediately after the session and three months from the first educational session. There was a remarkable improvement between the initial situation and immediately after the educational session in the average score of knowledge from 10.75 (0.24%) to 14.34

(0.19%) respectively, (p-value <0.001). There was also a significant improvement in knowledge between immediately after educational session and three months after educational session 14.34 (0.19%) to 14.82 (0.16%) respectively (p-value = 0.047).

These results demonstrate the sustainability of the overall knowledge in the subject acquired during the educational sessions; thus highlighting the importance of education in this topic. This is in agreement with most of the previous studies referenced here, which also demonstrated an improvement in the knowledge of TDIs management after educational sessions.

None of the previous studies published have attempted to calculate the overall score of knowledge regarding the topic of TDIs.

5.6 Study limitation

The limitations of this current study are as follow:

- An attempt to include all nurses and PE teachers in Dubai schools was undertaken, but only a small representative sample was obtained. All public and private schools were invited to participate in the educational session; a total of 200 school nurses and an unknown number of PE teachers. Out of this number; 68 participants in total attended our session. The sample we obtained is most probably representative of the school nurses in Dubai, but only a small proportion of the PE teachers attended. A higher number in the sample of the PE teachers might have resulted in a better representation of the situation regarding TDIs in this study group.
- The results revealed an overall improvement in knowledge, but still exposed deficiencies to be remedied. Repeated sessions for participants could have resulted in better outcomes regarding knowledge.

- From our experience with the data analysis, and participants' feedback, the question requesting ranking the management of an avulsed tooth from best to least may have been perceived as confusing.
- The length of the questionnaire in the survey might have led some participants to choose their answers hastily, and not take enough time to answer accurately.
- Although discussed in details during the educational session, the study questions did not include any regarding the appropriate transport medium for the avulsed tooth. This information and knowledge is crucial in the proper emergency management of avulsed teeth.
- The methods of data collection were not standardized; the method of collecting the questionnaire before and immediately after the educational sessions was paper-based format. However, for logistic and convenience purposes after three months the questionnaire was conducted through telephone calls, which might have affected the study results.
- The questionnaire might have been too long. This might have contributed to some of the participants skipping questions.
- Possible limitations to this study shared by all questionnaire survey studies might have been: variation in participants' ability to understand and interpret questions, the inability to tell how truthful a respondent is being and how much a respondent thought has put in.

6.0 RECOMMENDATIONS

- The incorporation of basic TDIs prevention and emergency management is a needed addition to the curricula of school nurses and PE teachers to ensure proper base line knowledge in the topic.
- Regular courses and updates for school nurses and PE teachers about the subject are needed to maintain an adequate level of knowledge. Some issues in the study needed more emphasis than others, as demonstrated by the results. Targeting deficient areas in future educational initiatives would probably have a significant impact on bettering the education of the concerned group.
- Availability of a dentist for advice on the immediate management of the TDIs is helpful. A telephone “hotline” could be established to provide school personnel with the needed appropriate advice.
- Follow up on the sustainability of knowledge 12 months from the educational session is recommended. This will shed further light on how much knowledge is retained and whether an annual educational session would be beneficial.
- The study participants were issued with a (IADT) TDI emergency management poster (English and Arabic) for sustaining knowledge. We recommend this poster to be distributed to all schools.
- To recommend (tooth save kit) to be distributed to all state and private schools in UAE and to train all school nurses and PE teachers on how to use it in case of TDIs.

7.0 CONCLUSIONS

In the sample of Dubai PE teachers and school nurses studied. The study demonstrated an initial lack of knowledge about the emergency management of TDIs.

There was a significant decrease in the participants' choice for seeking help within few hours after an avulsion, immediately after the educational session 16(23.5%) compared to before the educational session 25(36.8%), (p-value = 0.001). Also this decrease was significantly sustained from immediately after the educational session 16(23.5%) to three months after the educational session 4(5.9%), (p-value = 0.038).

There was a remarkably significant improvement in the score of overall knowledge throughout the study. Between the initial and immediately after the educational session, scores improved from 10.75 (0.24%) to 14.34 (0.19%) respectively, (p-value < 0.001). There was also a significant improvement in knowledge between immediately after educational session and three months after educational session 14.34 (0.19%) to 14.82 (0.16%) respectively, (p-value = 0.047).

8.0 BIBLIOGRAPHY

1. Dental Trauma Guidelines. International Association of Dental Traumatology. Revised 2012. Available online @ <https://www.iadt-dentaltrauma.org/1-%20iadt%20guidelines%20combined%20-%20lr%20-%2011-5-2013.pdf> .[Last accessed 9th April 2017].
2. Glendor U, Halling A, Andersson L, et al. Incidence of traumatic tooth injuries in children and adolescents in the county of Vastmanland, Sweden. *Swedish Dental Journal*. 1996; 20(1-2): 15–28.
3. Andreasen JO, Andreasen FM, Andersson L, editors. *Textbook and color atlas of traumatic injuries to the teeth*. 4th ed, Wiley- Blackwell, Copenhagen. 2007, pp 444–88.
4. Andersson L, Andreasen JO, Day P, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. *Dental Traumatology*. 2012; 28(2): 88–96.
5. Glendor U & Andersson L. *Public health aspects of oral diseases and disorders: dental trauma*. In Pine C, Harris R, Editors. *Community oral health*. Quintessence, London. 2007, pp 203–14.
6. Petersson EE, Andersson L, Sörensen S. Traumatic oral vs non-oral injuries. *Swedish Dental Journal*. 1997; 21(1-2): 55-68.
7. Margie Peden, Kayode Oyegbite, Joan Ozanne-Smith, et al. World report on child injury prevention. World Health Organization. 2008: 145–55. Available online @ http://apps.who.int/iris/bitstream/10665/43851/1/9789241563574_eng.pdf . [Last accessed 9th April 2017].
8. Harding AM. Pharmacologic considerations in pediatric dentistry. *Dental Clinics of North America*. 1994; 38(4): 733-53.
9. American Academy of Pediatrics, Committee on Pediatrics Emergency Medicine and Committee on Bioethic. Consent for emergency medical services for children and adolescents. *Pediatrics*. 2011; 128(2): 427–33.

10. Malmgren B, Jens O, Flores M T, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries :3. Injuries in the primary dentition. *Dental Traumatology*. 2012; 28(3): 174–182.
11. Hashim R. Dental trauma management awareness among primary school teachers in the Emirate of Ajman, United Arab Emirates. *European Journal of Paediatric Dentistry*. 2011; 12(2): 99–102.
12. Sgan-Cohen H D, Yassin H , Livny A. Dental trauma among 5th and 6th grade Arab schoolchildren in Eastern Jerusalem. *Dental Traumatology*.2008; 24(4): 458–461.
13. Andreasen J, Lauridsen E, Daugaard-Jensen J. Dental traumatology: an orphan in pediatric dentistry?. *Pediatric Dentistry*. 2009; 31(2): 153–156.
14. Andersson L. Epidemiology of traumatic dental injuries. *Journal of Endodontics*. 2013; 39(3), Supplement, S2–S5.
15. Sapien, R, Allen A. Emergency preparation in schools: a snapshot of a rural state. *Pediatric Emergency Care*. 2001; 17(5): 329–333.
16. Traebert J, Peres M, Blank V, et al. Prevalence of traumatic dental injury and associated factors among 12-year-old school children in Florianopolis, Brazil. *Dental Traumatology*. 2003; 19(1):15–18.
17. Di Scala, C, Gallagher S, Schneps S. Causes and outcomes of pediatric injuries occurring at school. *The Journal of School Health*.1997; 67(9): 384–389.
18. Fakhruddin K S, Kawas S A. Prevalence and etiological factors related to dental injuries amongst 18-22-year-olds in United Arab Emirates. *Dental Traumatology*. 2010; 26(5): 388–92.
19. Chadwick BL, White DA, Morris AJ, et al. Non-carious tooth conditions in children in the UK,2003. *British Dental Journal*. 2006; 200(7): 379-384.
20. Day P, Gregg T. Treatment of avulsed permanent teeth in children. *Faculty Dental Journal*. 2012; 3(3): 166–169.

21. Gassner R, Bösch R, Tuli T, et al. Prevalence of dental trauma in 6000 patients with facial injuries: implications for prevention. *Oral Surgery. Oral Medicine. Oral Pathology. Oral Radiology and Endodontology*. 1999; 87(1): 27–33.
22. Andreasen J & Andreasen F. *Textbook and color atlas of traumatic injuries to the teeth*. Munksgaard, Copenhagen. 1993, pp 315–82.
23. Glendor U. Epidemiology of traumatic dental injuries - A 12 year review of the literature. *Dental Traumatology*. 2008; 24(6): 603–611.
24. Petti S, Cairella G, Tarsitani G. Childhood obesity: a risk factor for traumatic injuries to anterior teeth. *Endodontics Dental Traumatology*. 1997; 13(6): 285–288.
25. Andreasen J. Challenges in clinical dental traumatology. *Dental Traumatology*. 1985; 1(2): 45–55.
26. Gábris K, Tarján I, Rózsa N. Dental trauma in children presenting for treatment at the Department of Dentistry for Children and Orthodontics, Budapest, 1985-1999. *Dental Traumatology*. 2001; 17(3): 103–108.
27. Levin L, Zadik Y. Education on and prevention of dental trauma: it's time to act!. *Dental Traumatology*. 2012; 28(1): 49–54.
28. Glendor U. Has the education of professional caregivers and lay people in dental trauma care failed? *Dental Traumatology*. 2009; 25(1): 12–18.
29. Council on Clinical Affairs. Guideline on Management of Acute Dental Trauma. *Dental Traumatology*. 2011; 34(6): 230–238.
30. Eyuboglu O, Yilmaz Y, Zehir C, et al. A 6 year investigation into types of dental trauma treated in a paediatric dentistry clinic in Eastern Anatolia Region, Turkey. *Dental Traumatology*. 2009; 25(1): 110–114.
31. Altun C, Ozen B, Esenlik E, et al. Traumatic injuries to permanent teeth in Turkish children, Ankara. *Dental Traumatology*. 2009; 25(3): 309–313.

32. Tzigkounakis V, Merglova V. Attitude of Pilsen primary school teachers in dental traumas. *Dental Traumatology*. 2008; 24(5): 528–531.
33. Marcenes W, Alessi O, Traebert J. Causes and prevalence of traumatic injuries to the permanent incisors of school children aged 12 years in Jaragua do Sul, Brazil. *International Dental Journal*. 2000; 50: 87–92.
34. Andreasen J, Andreasen F, Skeie A, et al. Effect of treatment delay upon pulp and periodontal healing of traumatic dental injuries: a review article. *Dental Traumatology*. 2002; 18(3): 116–128.
35. Trope M. *Endodontic considerations in dental trauma*. Ingle's Endodontic, 6th ed, BC Decker Inc, Ontario. 2008, pp 1348–52.
36. Andreasen J. Effect of extra alveolar period and storage media upon periodontal and pulpal healing after replantation of mature permanent incisors in monkeys. *International Journal of Oral Surgery*. 1981; 10(1): 43–53.
37. Andersson L, Al-Asfour A, Al-Jame Q. Knowledge of first aid measures of avulsion and replantation of teeth: an interview of 221 Kuwaiti schoolchildren. *Dental Traumatology*. 2006; 22(2): 57–65.
38. Al-Asfour A, Andersson L, Al-Jame Q. School teachers' knowledge of tooth avulsion and dental first aid before and after receiving information about avulsed teeth and replantation. *Dental Traumatology*. 2008; 24(1): 43–49.
39. Blakytyn C, Surbutis C, Thomas A, et al. Avulsed permanent incisors: Knowledge and attitudes of primary school teachers with regard to emergency management. *International Journal of Paediatric Dentistry*. 2001; 11(5): 327–332.
40. Holan G, Shmueli Y. Knowledge of physicians in hospital emergency rooms in Israel on their role in cases of avulsion of permanent incisors. *International Journal of Paediatric Dentistry*. 2003; 13(1): 13–19.
41. Traebert J, Traiano M, Armênio R, et al. Knowledge of lay people and dentists in emergency management of dental trauma. *Dental Traumatology*. 2009; 25 (3): 277–283.

42. Díaz J, Bustos L, Herrera S, et al. Knowledge of the management of paediatric dental traumas by non-dental professionals in emergency rooms in South Araucanía, Temuco, Chile. *Dental Traumatology*. 2009; 25(6): 611–619.
43. Santos M, Habecost A, Gomes F, et al. Parent and caretaker knowledge about avulsion of permanent teeth. *Dental Traumatology*. 2009; 25(2): 203–208.
44. Wong F, Kolokotsa K. The cost of treating children and adolescents with injuries to their permanent incisors at a dental hospital in the United Kingdom. *Dental Traumatology*. 2004; 20(6): 327–333.
45. Sane J, Ylipaavalniemi P, Leppänen H. Maxillofacial and dental ice hockey injuries. *Medicine and Science in Sports and Exercise*. 1988; 20(2): 202–207.
46. Sane J, Ylipaavalniemi P, Turtola L, et al. Traumatic injuries among university students in Finland. *Journal of American College Health*. 1997; 46(1): 21–24.
47. Glendor U, Halling A, Andersson L, et al. Type of treatment and estimation of time spent on dental trauma: a longitudinal and retrospective study. *Swedish Dental Journal*. 1998; 22(1-2): 47–60.
48. Nguyen P, Kenny D, Barrett E. Socio-economic burden of permanent incisor replantation on children and parents. *Dental Traumatology*. 2004; 20(3): 123–133.
49. Gift H, Reisine S, Larach D. The social impact of dental problems and visits. *American Journal of Public Health*. 1992; 82(12): 1663–1668.
50. McTigue D. Diagnosis and management of dental injuries in children. *Pediatric Clinics of North America*. 2000; 47(5): 1067–1084.
51. Walker A, Brenchley J. It's a knockout: survey of the management of avulsed teeth. *Accident and Emergency Nursing*. 2000; 8(2): 66–70.
52. Addo M, Parekh S, Moles D, et al. Knowledge of dental trauma first aid (DTFA): the example of avulsed incisors in casualty departments and schools in London. *British Dental Journal*. 2007; 202(10): E27.
53. Newman L, Crawford P. Dental injuries: 'first aid' knowledge of Southampton teachers of physical education. *Dental Traumatology*. 1991; 7(6): 255–258.

54. Hamilton F, Hill F, Mackie I. Investigation of lay knowledge of the management of avulsed permanent incisors. *Endodontics & Dental Traumatology*. 1996; 13(1): 19–23.
55. Kahabuka F. Primary school teacher's knowledge actions to be taken when a child sustains oro-dental trauma, Dares-Salaam, United Republic of Tanzania. *Citation Tanzanian Public Health Association*. 2001: 177–180.
56. Sae-Lim V, Lim L. Dental trauma management awareness of Singapore pre-school teachers. *Dental Traumatology*. 2001; 17(2): 71–76.
57. Al-Jundi S, Al-Waeili H, Khairalah K. Knowledge and attitude of Jordanian school health teachers with regards to emergency management of dental trauma. *Dental Traumatology*. 2005; 21(4): 183–187.
58. Chan A, Wong T, Cheung G. Lay knowledge of physical education teachers about the emergency management of dental trauma in Hong Kong. *Dental Traumatology*. 2001; 17(2): 77–85.
59. Raphael S, Gregory P. Parental awareness of the emergency management of avulsed teeth in children. *Australian Dental Journal*. 1990; 35(2): 130–133.
60. Oliveira TM, Sakai VT, Moretti AB, et al. Knowledge and attitude of mothers with regards to emergency management of dental avulsion. *Journal of Dentistry for Children*. 2007; 74(3): 200–202.
61. Stokes A, Anderson H, Cowan T. Lay and professional knowledge of methods for emergency management of avulsed teeth. *Endodontics & Dental Traumatology*. 1992; 8(4): 160–162.
62. Al-Jundi S. Knowledge of Jordanian mothers with regards to emergency management of dental trauma. *Dental Traumatology*. 2006; 22(6): 291–295.
63. Al-Asfour A, Andersson L. The effect of a leaflet given to parents for first aid measures after tooth avulsion. *Dental Traumatology*. 2008; 24(5): 515–521.

64. Young C, Wong K, Cheung L. Effectiveness of Educational Poster on Knowledge of Emergency Management of Dental Trauma-Part 2: Cluster Randomized Controlled Trial for Secondary School Students. *PLoS One*. 2014; 8(9): e74833.
65. Young C, Wong K, Cheung L. Emergency management of dental trauma: Knowledge of Hong Kong primary and secondary school teachers. *Hong Kong Medical Journal*. 2012; 18(5): 362–370.
66. McIntyre J, Lee J, Trope M, et al. Elementary school staff knowledge about dental injuries. *Dental Traumatology*. 2008; 24(3): 289–298.
67. Choi D, Badner V, Yeroshalmi F, et al. Dental trauma management by New York City school nurses. *Journal of Dentistry for Children*. 2012; 79(2): 74–78.
68. Vergotine R, Govoni R. Public school educator's knowledge of initial management of dental trauma. *Dental Traumatology*. 2010; 26(2): 133–136.
69. Pacheco L, Filho P, Letra A, et al. Evaluation of the knowledge of the treatment of avulsions in elementary school teachers in Rio de Janeiro, Brazil. *Dental Traumatology*. 2003; 19(2): 76–78.
70. Baginska J, Wilczynska-Borawska M. Knowledge of nurses working at schools in Bialystok, Poland, of tooth avulsion and its management. *Dental Traumatology*. 2012; 28(4): 314–9.
71. Skeie M, Evjensvold T, Hoff T, et al. Traumatic dental injuries as reported during school hours in Bergen. *Dental Traumatology*. 2014; 31(3): 228–232.
72. Pujita C, Nuvvula S, Shilpa G, et al. Informative promotional outcome on school teachers' knowledge about emergency management of dental trauma. *Journal of Conservative Dentistry*. 2013; 16(1): 21–7.
73. Shamarao S, Jain J, Ajagannanavar S, et al. Knowledge and attitude regarding management of tooth avulsion injuries among school teachers in rural India. *Journal of International Society of Preventive & Community Dentistry*. 2014; 4 (Suppl1) S44–8.

74. Mohandas U, Chandan G. Knowledge, attitude and practice in emergency management of dental injury among physical education teachers: a survey in Bangalore urban schools. *Journal of the Indian Society of Pedodontics and Preventive Dentistry*. 2009; 27(4): 242–8.
75. Mesgarzadeh A, Shahamfar M, Hefzollesan A. Evaluating knowledge and attitudes of elementary school teachers on emergency management of traumatic dental injuries: a study in an Iranian urban area. *Oral Health & Preventive Dentistry*. 2009; 7(3): 297–308.
76. Bayrak S, Tunc E, Sari E. Evaluation of elementary school teachers' knowledge and attitudes about immediate emergency management of traumatic dental injuries. *Oral Health & Preventive Dentistry*. 2012; 10(3): 253–8.
77. Raoof M, Zaherara F, Shokouhinejad N, et al. Elementary school staff knowledge and attitude with regard to first-aid management of dental trauma in Iran: A basic premise for developing future intervention. *Dental Traumatology*. 2012; 28(6): 441–447.
78. Arikan V, Sönmez H. Knowledge level of primary school teachers regarding traumatic dental injuries and their emergency management before and after receiving an informative leaflet. *Dental Traumatology*. 2012; 28(2):101–107.
79. Hamdan M, Rock W. A study comparing the prevalence and distribution of traumatic dental injuries among 10–12-year-old children in an urban and in a rural area of Jordan. *International Journal of Paediatric Dentistry*. 1995; 5(4): 237–241.
80. Al-Jundi S. Dental emergencies presenting to a dental teaching hospital due to complications from traumatic dental injuries. *Dental Traumatology*. 2002; 18(4): 181–185.
81. Fux-Noy A, Sarnat H, Amir E. Knowledge of elementary school teachers in Tel-Aviv, Israel, regarding emergency care of dental injuries. *Dental Traumatology*. 2011; 27(4): 252–256.
82. Abdellatif A, Hegazy S. School teachers' knowledge and attitude about emergency management of avulsed permanent incisors-in mansoura city. *Egyptian Dental Journal*. 2010; 56: 1419.
83. Al-Majed I, Murray J, Maguire A. Prevalence of dental trauma in 5-6-and 12-14-year-old boys in Riyadh, Saudi Arabia. *Dental Traumatology*. 2001; 17(4): 153–158.

84. Al-Obaida M. Knowledge and management of traumatic dental injuries in a group of Saudi primary school teachers. *Dental Traumatology*. 2010; 26(4): 338–341.
85. Feldens E, Feldens C, Kramer P, et al. Understanding school teacher's knowledge regarding dental trauma: A basis for future interventions. *Dental Traumatology*. 2010; 26(2): 158–163.
86. Hashim R. Investigation of mothers' knowledge of dental trauma management in United Arab Emirates. *European Archives of Paediatric Dentistry*. 2012; 13(2): 83–86.
87. Andreasen JO, Andreasen FM, Andersson L. *Textbook and color atlas of traumatic injuries to the teeth*. Munksgaard, Copenhagen. 1994.
88. Krause-Parello C. Tooth avulsion in the school setting. *The Journal of School Nursing*. 2005; 21(5): 279–282.
89. Kane AW, Babacar T, Moustapha D, et al. Attitude and knowledge of primary school teachers of initial management of dental trauma. *Journal of Oral Health and Research*. 2011; 2(2): 51-54.
90. Hamilton FA, Hill FJ, Holloway PJ. An investigation of dentoalveolar trauma and its treatment in an adolescent population. Part1: the prevalence and incidence of injuries and the extent and adequacy of treatment received. *British Dental Journal*. 1997; 182(3): 91-95.

9.0 APPENDICES

Appendix I: Ethical approval from HBMCDM Research Ethics Committee



Appendix II: The original English questionnaire form

Hamdan Bin Mohammed
College of Dental Medicine
Mohammed Bin Rashid City



كلية حمدان بن محمد
لطب الأسنان
مدينة محمد بن راشد

Dental Trauma Awareness Questionnaire

Demographic information:

1. What is your gender?
 - ☐ Male
 - ☐ Female
2. Age:
3. What school are you from?
4. What is your primary position in school?
 - ☐ PE Teacher
 - ☐ Teacher
 - ☐ Nurse
 - ☐ Social advisor
 - ☐ School manager
 - ☐ Manager assistant
5. What grade are you responsible for?
6. Type of school?
 - ☐ preschool
 - ☐ Primary
 - ☐ middle
 - ☐ secondary
 - ☐ All
7. Your level of education?
 - ☐ High school
 - ☐ associates
 - ☐ Bachelors
 - ☐ Masters
8. How long have you been working in this position?
9. How long is your experience in your field?
10. Do you have children of your own?
 - ☐ Yes
 - ☐ No
11. Have you personally observed children with traumatic dental injuries TDIs?
 - ☐ Yes
 - ☐ No
12. Have you ever received any advice regarding TDIs?
 - ☐ Yes
 - ☐ No
 - ☐

13. If yes your primary source of TDIs advice was?

TDIs advice was from :	yes	no
<input type="radio"/> Family physician		
<input type="radio"/> Dentist		
<input type="radio"/> Dental hygienist		
<input type="radio"/> Dental office		
<input type="radio"/> Other health specialist		
<input type="radio"/> Friend		
<input type="radio"/> Teacher		
<input type="radio"/> Sport coach		
<input type="radio"/> others		

14. Do you feel adequately informed about TDIs?

- ☐ Yes
- ☐ No
- ☐ Don't know

15. Did your first aid course cover the management of TDIs?

- ☐ Yes
- ☐ No

Survey questions

16. The Most common type of dental injury you have encountered in children (tick all that apply) :

- ☐ Broken tooth
- ☐ Tooth Mobility
- ☐ Knocked out tooth
- ☐ soft tissue(lip, chin) injury
- ☐ don't know

17. A 9 year old was hit in the face with a soft ball during school hours .His upper front teeth are broken, otherwise unhurt and didn't lose consciousness .Are the damaged front teeth primary or permanent teeth :

- ☐ Permanent tooth
- ☐ (baby) milk tooth
- ☐ don't know

18. Which of the following do you consider a dental injury:

a) A broken /chipped tooth?

- ☐ Yes
- ☐ No

b) A tooth that has moved from its original position?

- ☐ Yes
- ☐ No

c) A tooth that has been knocked out of the mouth?

- ☐ Yes
- ☐ No

19. For broken/chipped tooth, I would look for the broken/chipped tooth piece :
- ☐ Yes
 - ☐ No
20. For a broken/chipped tooth, I believe the child should get treatment :
- ☐ Yes
 - ☐ No
21. After informing the parents of the traumatic incidence and their arrival to school, I would advise them to contact their dentist immediately In case of broken /chipped tooth?
- ☐ Yes
 - ☐ No
22. I think knocked out primary tooth can be saved?
- ☐ Yes
 - ☐ No
23. Once a permanent tooth is knocked out, I will try to find it:
- ☐ Yes
 - ☐ No
24. For a knocked out permanent tooth I believe the child should get treatment : (if your answer is no, please skip to question #31)
- ☐ Yes
 - ☐ No
25. How urgent do you think to seek professional help if a permanent tooth has been knocked out?
- ☐ Within 30 min
 - ☐ Within few hours
 - ☐ Before the next day
26. A knocked out permanent tooth should be held by?
- ☐ The crown
 - ☐ The root
 - ☐ Don't know
27. After informing the parents of the traumatic incidence and their arrival to school, I would advise them to contact their dentist immediately regarding knocked out permanent tooth?
- ☐ Yes
 - ☐ No
28. What is your first action when the permanent tooth gets knocked out?
- ☐ putting the tooth back in its place
 - ☐ Calling a dentist and follow his/her instructions
 - ☐ Transporting the patient to the nearest dentist
 - ☐ Calling patients' parents and advising them to take the child to the dentist.
 - ☐ Keeping the child under observation

29. Next to each statement below please rank what you believe is the best immediate management for a knocked out permanent tooth: best 1 to worst 5:

- ☐ leaving a knocked out tooth dry()
- ☐ Placing a knocked out tooth back into its socket (replantation of the tooth) ()
- ☐ Placing a knocked out tooth in milk()
- ☐ Placing a knocked out tooth in water ()
- ☐ Placing a knocked out tooth in saliva()

30. If you decided to replant the permanent tooth back into its socket but it has fallen into the ground and was covered in dirt what would you do?

- ☐ Scrub the tooth gently with a tooth brush
- ☐ Rinse the tooth with normal saline
- ☐ Rinse the tooth under tap water
- ☐ Rinse the tooth with antiseptic or alcohol solution
- ☐ Put the tooth straight back into socket without doing other things.
- ☐ Don't know

31. Do you think tetanus toxoid injection is necessary in dental trauma cases?

- ☐ yes
- ☐ no

Appendix III: Arabic translation of questionnaire form



استبيان قياس الوعي لحوادث الأسنان

معلومات ديموغرافية:

1. ما هي جنسك ؟
 - ☐ ذكر
 - ☐ أنثى
2. العمر؟
3. من أي مدرسة؟
4. ما هي دورك الأساسي في المدرسة؟
 - ☐ مدرس تربية رياضية
 - ☐ مدرس
 - ☐ ممرض
 - ☐ أخصائي اجتماعي
 - ☐ مدير مدرسة
 - ☐ مساعد المدير
5. ما هي الصف المسؤولة عنه؟
6. نوع المدرسة
 - ☐ قبل الابتدائي
 - ☐ ابتدائي
 - ☐ إعدادي
 - ☐ ثانوي
 - ☐ الكلي
7. ما هي مستواك الدراسي ؟
 - ☐ ثانوية عامة
 - ☐ مساعد
 - ☐ بكالوريوس
 - ☐ ماجستير
8. منذ متى وأنت تعمل في هذا المجال ؟
9. كم هي مدة خبرتك؟
 - ☐ هل لديك أطفال ؟
 - ☐ نعم
 - ☐ لا
10. هل سبق أن شاهدت حوادث الأسنان في الأطفال ؟
 - ☐ نعم
 - ☐ لا
11. هل سبق أن أخذت تصليحة عن كيفية التعامل مع حوادث الأسنان ؟
 - ☐ نعم
 - ☐ لا

12. إذا كانت اجابتك بنعم: فمعلوماتك عن حوادث الأسنان كانت من ؟

تصالح حوادث الأسنان كانت من	نعم	لا
طبيب الأسرة		
طبيب الأسنان		
أخصائي صحة		
مكتب الأسنان		
أخصائيين آخرين		
صديق		
مدرس		
مدرس رياضة		
آخريين		

13. هل تشعر بالافتقار من المعلومات عن حوادث الأسنان ؟

☐ نعم

☐ لا

☐ لا أعرف

14. هل تعلمت كيف تتعامل مع حوادث الأسنان من خلال دورة الاسعافات الأولية التي حضرتها مسبقا ؟

☐ نعم

☐ لا

أسئلة الدراسة

16. أكثر حوادث الأسنان شيوعا بين الأطفال :ضع علامة صح على كل الاجوبه الممكنه :

☐ سن مكسور

☐ سن يتحرك

☐ سن مغلوع

☐ جرح في اللثة او الشفاء

☐ لا أعرف

17. طفل في التاسعة من عمره أصيب في وجهه بالكرة خلال ساعات المدرسة فاندكست أسنانه العلوية ولكن لم يتأذى او يفقد الوعي , هل الأسنان المتضررة الامامية لثنيه او دائمة؟

☐ سن دائم

☐ سن لبني

☐ لا اعرف

18. اي من الجمل الاتيه يعتبر حادث اسنان:

أ. كسر في السن

☐ نعم

☐ لا

ب. السن الذي تحرك من مكانه

☐ نعم

☐ لا

ج. السن الذي انخلع من القم

☐ نعم

○ لا

19. في حالة كسر السن سايحت عن القطعه المفقودة ؟

○ نعم
○ لا

20. في حالة كسر السن اعتقد ان الطفل يجب ان يتلقى العلاج ؟

○ نعم
○ لا

21. بعد اخيار الوالدين عن حادث الأسنان وعند وصولهم سأنصحهم بالاتصال الفوري بطبيب الأسنان في حالة كسر السن

○ نعم
○ لا

22. اعتقد ان السن المخلوع يمكن انقاده؟

○ نعم
○ لا

23. اذا اقلع السن الدائم ساحاول ان اعثر عليه ؟

○ نعم
○ لا

24. في حالة انخلاع السن اعتقد ان الطفل يجب ان يتلقى العلاج، اذا كانت اجابته "لا" انتقل الى السؤال 31

○ نعم
○ لا

25. اذا اقلع السن ما هو الحد الاقصى للتصرف في مثل هذه الحالة ؟

○ في غضون 30 دقيقة
○ بضع ساعات
○ قبل اليوم التالي

26. السن المخلوع يجب ان يمسك بـ

○ التاج
○ الجذر
○ لا أعرف

27. بعد اخيار الوالدين عن حادث الأسنان وعند وصولهم سأنصحهم بالاتصال الفوري بطبيب الأسنان في حالة انخلاع السن الدائم ؟

- ☐ نعم
- ☐ لا

28. ماهي تصرفك الأول في حالة اختلاج السن الدائم ؟

- ☐ أضع السن المخلوع في مكانه في الفم
- ☐ أتصل بطبيب الأسنان وأعمل بتوصيحه
- ☐ أخذ المريض إلى أقرب طبيب أسنان
- ☐ أتصل بالوالدين وأُصحهم يأخذ الطفل إلى طبيب الأسنان
- ☐ أضع الطفل تحت المراقبة

29. مقابل كل جملة ضع الأرقام التمسليه من الاصح الى الاسوء اختيارا. كيف تتصرف في حالة اختلاج السن؟

(1 الافضل و 5 الاسوء)

- ☐ تترك السن ليحف
- ☐ نضع السن في مكانه في الفم (اعادة زراعة السن)
- ☐ نضع السن في الحليب
- ☐ نضع السن في الماء
- ☐ نضع السن في اللعاب


30. اذا قررت ان تضع السن مرة اخرى في مكانه في الفم ولكن السن وقع على الارض و اتسخ ماذا ستفعل ؟

- ☐ نغسل السن بالفرشاة
- ☐ نغسل السن بمحلول ملحي
- ☐ نغسل السن تحت ماء الصنبور
- ☐ نغسل السن بمادة مطهرة او الكحول
- ☐ نضع السن في مكانه في الفم من دون أن تفعل الأشياء الأخرى

31. هل تعتقد ان ابرة التيتانيوم توكسايه ضروريه في حالة حوادث الاسنان ؟

- ☐ نعم
- ☐ لا

Appendix IV: Educational poster




عيادة دبي لطب الأسنان
DUBAI DENTAL CLINIC

أنقذ سنك Save your tooth


يمكنك المحافظة على أكثر الأسنان "الدائمة" إذا كنت تعلم ماذا تفعل بعد تلقي ضربة على الفم
Most of your permanent teeth may be saved if you know what to do after a blow to the mouth

Emergency
contact No.
800-DENTAL

ماذا تفعل إذا
كُسِرَ سنك
What to do if your tooth is
BROKEN




1




ابحث عن قطعة السن المكسورة
Find the piece of tooth

2




إن قطعة السن يمكن إلصاقها في عيادة الأسنان
The piece can be glued on

3




لأجل ذلك اطلب حاليًا مساعدة طبيب الأسنان
For this to be possible, seek attention immediately from a dentist

ماذا تفعل إذا
انُخِيعَ سنك
What to do if your tooth is
KNOCKED OUT




1




ابحث عن السن
Find the tooth

2



امسك السن من التاج (الجزء غير المدب من السن)
Hold it by the crown (The non-pointy part of the tooth)


3



(اغلق المغسلة بسدادة) اغسل السن بماء الصنبور البارد
(Plug the sink) Rinse in cold tap water

4 اتبع إحدى البدائل التالية
Follow one of these alternatives

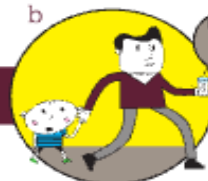
a



ضع السن في مكانه
Put the tooth back on it's place

or

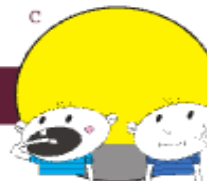
b



ضع السن في كوب حليب أو محلول ملحي فيسيولوجي
Place the tooth in a cup of milk or saline


or

c




إذا لم يتوفر الحليب، ضع السن بحذر في الفم بين اللثة واللسان
When milk is not available, carefully place the tooth in the mouth between the cheeks and gums

5




اطلب حاليًا علاج الأسنان التخصصي، خلال ساعتين من الزمن
Seek immediately specialized dental treatment, within a two hour time period



International Association
of Dental Traumatology

Hamdan Bin Mouslimed
College of Dental Medicine
Mohamed Bin Rashid UMSIS



كلية حمدان بن محمد
لطب الأسنان
جامعة محمد بن راشد للعلوم الصحية

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