K. Emerich*, P. Wlodarczyk**, A. Ziolkowski**

*Department of Paediatric Dentistry, Medical University of Gdansk, Gdansk, Poland
**Department of the Theory of Physical Education, Gdansk University of Physical Education and Sport, Poland
e-mail: emerich@gumed.edu.pl

Abstract

Aim The aim of this survey was to establish the current state of knowledge with regard to first-aid procedures and to compare the effectiveness of an educational lecture and a subsequent educational session.

Methods A questionnaire to assess the attitudes and anticipated behaviours of Sport University students related to first-aid procedures following dental injury was administered to the students 3 times (after 3 and 12 months). A lecture on the subject of dental trauma was given just after the first questionnaire survey. A randomly selected students group received an extra educational task.

Results The present study revealed a low level of initial knowledge of physical education students concerning first-aid measures in the case of dental trauma. A 30-minute lecture and an extra educational task significantly improved the knowledge level. Even after one year the knowledge level was still high and sufficient to properly react when faced with dental trauma.

Conclusion Our research proves that the inclusion of dental trauma as a topic in the Sport University students’ curricular training and paedagogical education should be introduced in the form of a clear and concise lecture.

Keywords Dental injury; First-aid; Physical education; Student knowledge,

Introduction

Few of us still need to be convinced that practicing sports can sustain and improve our physical condition, together with our overall psychological state. The World Health Organization guidelines on physical activity for health in children and youths aged 5-17 years recommend at least 60 minutes of physical activity per day, but a greater level of activity provides additional health benefits [WHO, 2010]. This is only one of the reasons why, in developed societies, the practice of sports is on the rise [Coalter, 2007; Tess, 2009]. However, even during moderate sporting activities accidents can and do happen, with some leading to traumas that can handicap a person for life [Myer et al., 2011]. Studies of a large group of children and adolescents showed that as much as 39% of all orofacial injuries are caused by sporting activities [Kumamoto and Maeda, 2005]. Schools and different sporting environments are the locations with the greatest prevalence of dental trauma in children and adolescents [Traebert et al., 2003].

We were interested in investigating people who are most prone to experiencing dental trauma, either as a participant or as a witness. They are the ones who would be able to provide the most help if they knew how to do this properly, thus the level of their knowledge about first-aid in this situation is crucial. In particular, physical education teachers should be able to provide proper first aid and help in different types of orofacial injury. For this reason, all sporting participants, such as athletes, players, coaches and sport instructors, should also be aware of how to act after a tooth injury [Flores et al., 2007]. As reported in the published literature, physical education teachers generally have little knowledge of emergency dental trauma management and, at least up until recently, no dental first-aid management components were included in the Physical Education curriculum [Holan et al., 2006; Glendor, 2009].

Overall, the knowledge of traumatic dental injury has been demonstrated to be insufficient and several papers have recommended the establishment of educational campaigns to improve this deficiency in knowledge [Holan et al., 2006; Glendor, 2009; Lieger et al., 2006; Chan et al., 2001; Hashim, 2011]. In addition, Feldens et al. suggested that lectures and courses, including written and visual communication, should be offered to all school teachers [2010]. This is why we decided to conduct this survey with an aim to establish the current state of knowledge of students at an Academy of Physical Education and Sport with regard to first-aid procedures in cases of dental trauma. After checking their initial levels of knowledge on the subject the second goal was to compare the effectiveness of educational means commonly available to university teachers such as educational lecture and an educational task in the form of a presentation and a board game. Retesting of the knowledge after 3 and 12 months was done in order to come up with a teaching method recommendation. Our intention was to develop and test the most effective and lasting method, to make up for the lack of education among physical education students.
methods

A questionnaire survey was undertaken to assess the impact of one 30-minute educational lecture and an extra educational task on the state of knowledge of the physical education students before and after the lecture and the extra education task. In the first stage of the study we have assessed the initial level of knowledge on dental trauma in a group of first year students before an educational lecture. A self-administered questionnaire, developed by the authors, was used as the research instrument. The questionnaire had been modified from those used in similar reports in the published literature [Chan et al., 2001]. A pilot study on 30 students was conducted to ensure clarity of the wording as it was necessary to check the students’ perception and interpretation of the questions in the main study. The pilot study had been performed among the second year students to ensure with certainty that this group was not going to take part in the main study. To ensure that the questionnaire was comprehensible and valid, items were only included if there was a near universal agreement on their meaning and no one from the pilot group had doubts about how to understand the questions. The completion process was surveyed by the teachers and timed as necessary to prevent students consulting each other regarding the correct responses. Three different realistic situations were described in the questionnaire. The first situation concerned a 12-year-old girl with a fracture of a permanent incisor. Questions related to this situation addressed the immediate actions after tooth fracture, such as treatment consisting of reattaching the fractured crown and considerations of the time within which the girl should be seen by a dentist. The second situation described permanent tooth avulsion. Questions related to this situation addressed the immediate actions after tooth avulsion: the treatment of such an injury consists of immediate self-replantation together with rapid dental attention after the accident, not forgetting proper methods of cleaning and transporting the tooth. The third situation described the girl who took part in all three surveys. Of these 99 took part in all the three surveys and therefore only their answers were used for this publication. All student, 99 took part in all the three surveys and therefore only their answers were used for this publication. All important information concerning prevention and first-aid procedures after dental trauma was included in this lecture. The lecture was performed as a PowerPoint presentation containing 36 slides. The first six slides presented dental trauma epidemiology, aetiology and the timing of primary and permanent tooth eruption. The next ten slides presented different primary dentition injuries and their complications. The next part of the lecture presented permanent dentition injuries, particularly crown fractures and tooth avulsion. At the end of the presentation the students were informed how to act in the case of dental injury. Several photographs and one short video presenting dental trauma cases together with the ways of helping a victim after dental trauma were used in the presentation. The lecture was given by a dentist, who was also one of the researchers.

In the second stage of the research study, after the first questionnaire survey, the students were divided into three groups with: high, medium and low levels of knowledge. In order to measure the strength of the memorisation effect, the cohort examined (N=127) was randomly divided into two sub-groups containing the same number of students from each different knowledge level group. From each group (high, medium and low levels of knowledge) half of the students were assigned to an experimental group and were asked to prepare a presentation for primary school students based on literature published about dental trauma. The same material regarding dental trauma was given to all of the students in the experimental group to ensure that they prepared the presentation using the same level of knowledge. The other half of the students formed the control group and prepared a presentation concerning pro-health behaviour related to physical activity. Three months later, in January 2010, a second questionnaire survey was undertaken. A final questionnaire survey was performed one year after initiation of the study, in October 2010. The same questionnaire was used on all three occasions.

The sample size consisted of 127 (in October 2009) and 142 (in January 2010) first year students and 124 (in October 2010) second year students of the Academy of Physical Education and Sport in Gdansk, Poland for the first, second and third surveys, respectively. Of these student, 99 took part in all the three surveys and therefore only their answers were used for this publication. All questions were marked with the students ID number, so in all surveys we were able to identify those individuals who took part in all three surveys. From this group of 99 students, 49 took part in an additional educational task, thus forming the experimental group. To avoid the Hawthorne effect, students were not informed about the possibility of being tested again in future. Each survey was a kind of surprise, because it was held in place of a regular lecture planned for the subject of Theory of Physical Education. The results obtained from the three surveys were compared and analysed to assess the impact of
the lecture and the educational task. Mauchly’s test with the Greenhouse-Geisser correction and Bonferroni post-hoc test were applied first. The overall mean scores and pooled standard deviations were calculated and analysed using the Wilcoxon signed-rank test (Table 2). Wilcoxon’s exact test and Friedman’s ANOVA were used to assess the percentages of positive answers given to questions presented in Table 1. In order to assess the overall results from the whole questionnaire, a one-way univariate repeated measures ANOVA was used. The results were entered in a database using the Statistical Package for Social Science (SPSS) software, 14.0 (Chicago, IL, USA). The study was approved by the Ethics Committee, Medical University of Gdansk, Poland.

Results

The mean age of the investigated population was 22.5 (SD = 1.31) years. The study population was composed of 51

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>I SURVEY</th>
<th>II SURVEY</th>
<th>III SURVEY</th>
<th>STATISTICAL SIGNIFICANCE</th>
<th>WILCOXON EXACT TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I vs. II</td>
<td>I vs. III</td>
<td>II vs. III</td>
<td>Friedman Anova</td>
<td></td>
</tr>
<tr>
<td>Previous history of dental injury</td>
<td>34.3 %</td>
<td>29.3 %</td>
<td>34.3 %</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Witness of dental accident</td>
<td>34.3 %</td>
<td>34.3 %</td>
<td>41.4 %</td>
<td>ns</td>
<td>ns</td>
</tr>
<tr>
<td>Do you feel that you should know more about management of dental injury? – Yes</td>
<td>93.9 %</td>
<td>84.9 %</td>
<td>72.7 %</td>
<td>0.012</td>
<td>0.001</td>
</tr>
<tr>
<td>Reattachment of a fractured crown – yes, it is possible</td>
<td>34.3 %</td>
<td>87.9 %</td>
<td>95.0 %</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Recommendation of immediate replantation</td>
<td>2.0 %</td>
<td>70.7 %</td>
<td>65.7 %</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Rinsing the tooth in tap water before replantation</td>
<td>18.9 %</td>
<td>68.7 %</td>
<td>70.7 %</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Healing process becomes substantially inhibited if the replantation was performed over one hour after tooth avulsion</td>
<td>3.0 %</td>
<td>33.3 %</td>
<td>19.2 %</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Proper behaviour after tooth avulsion</td>
<td>6.1 %</td>
<td>61.6 %</td>
<td>63.6 %</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>After tooth injury a child should be referred as soon as possible to a dentist</td>
<td>32.3 %</td>
<td>80.8 %</td>
<td>79.8 %</td>
<td>0.001</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**TABLE 1** Mean (SD) point scores obtained by students in consecutive questionnaire surveys.

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>I SURVEY</th>
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<th>STATISTICAL SIGNIFICANCE</th>
<th>WILCOXON SIGNED-RANK TEST</th>
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<td></td>
<td>I vs. II</td>
<td>I vs. III</td>
<td>II vs. III</td>
<td>One-way univariate repeated measures ANOVA – results described in the text</td>
<td></td>
</tr>
<tr>
<td>Case I – Proper procedure after tooth fracture – all answers together /max 10 points/</td>
<td>2.7 (2.2)</td>
<td>6.4 (1.8)</td>
<td>6.3 (1.8)</td>
<td>0.001*</td>
<td>0.001*</td>
</tr>
<tr>
<td>Case II – Proper storage and transport media for an avulsed tooth /max 8 points/</td>
<td>0.9 (1.6)</td>
<td>4.1 (1.6)</td>
<td>4.1 (1.7)</td>
<td>0.001*</td>
<td>0.001*</td>
</tr>
<tr>
<td>Case III – Knowledge about primary and permanent dentition – all answers together /max 3 points/</td>
<td>3.3 (3.0)</td>
<td>7.2 (1.6)</td>
<td>7.2 (1.5)</td>
<td>0.001*</td>
<td>0.001*</td>
</tr>
<tr>
<td>Healing process becomes substantially inhibited if the replantation was performed over one hour after tooth avulsion</td>
<td>4.8 (3.7)</td>
<td>15.4 (2.8)</td>
<td>15.2 (3.1)</td>
<td>One-way univariate repeated measures ANOVA – results described in the text</td>
<td></td>
</tr>
<tr>
<td>After tooth injury a child should be referred as soon as possible to a dentist</td>
<td>2.2 (0.8)</td>
<td>2.5 (0.7)</td>
<td>2.3 (0.7)</td>
<td>0.004*</td>
<td>0.341</td>
</tr>
<tr>
<td>child s</td>
<td>10.4 (5.1)</td>
<td>25.9 (4.4)</td>
<td>25.5 (4.4)</td>
<td>One-way univariate repeated measures ANOVA – results described in the text</td>
<td></td>
</tr>
</tbody>
</table>

*Statistically significant

**TABLE 2** Mean (SD) point scores obtained by students in consecutive questionnaire surveys.
(51.5%) women and 40 (48.5%) men. Around 30% of the study population had already experienced a dental injury and over 34% had witnessed a dental accident (Table 1). Most students felt that they should know more about the management of dental injury. In the first, second and third surveys 94%, 85% and 73% of the students wanted to expand their knowledge, respectively. As shown in Table 1, at the beginning of our project only 34% of students knew that a fractured tooth crown could be reattached, but after one year 95% of students remembered that this is a recommended procedure. The biggest difference in knowledge could be seen when asking about immediate tooth reimplantation. In the first survey only 2% of students knew that this is a recommended procedure, whereas one year after the educational lecture 66% of students remembered this fact. The mean total knowledge score obtained in the first survey was 10.3 points (SD=5.10) (Table 2). The result of the second survey was twice as high as the first, achieving a mean value of 25.9 points (SD=4.36) as result of second survey and 25.5 points (SD=4.35) in the third survey one year after the experimental interaction (the lecture). The data did not comply with the sphericity assumption analysed by Mauchly’s test (W=0.755; df=2), so the Greenhouse-Geisser correction was applied. Thus, the result of the analysis was: F (2.157)= 504.52; p<0.001; h²=0.837; which means that the results achieved for particular measurements significantly differed. Bonferroni post-hoc tests proved that there was a significantly lower level of knowledge in the first measurement than in the second and third measurements, where the second and third measurements were virtually the same. This proves that the intervention introduced by us, in the form of a 30-minute educational lecture, had a great influence on the level of knowledge of the students in the second survey. One year after the first survey the students’ knowledge was assessed for a third time and a mean value of 25.5 (SD=4.35) was scored. Results were similar to the mean score in the second survey. Despite having introduced an additional educational task after the first questionnaire survey, no significant difference was found between the knowledge levels of both groups (experimental and control group) for the second and third questionnaire surveys. It was concluded that the result of the educational task was negligible and not worth the effort.

Discussion

The present study initially revealed a low level of knowledge on the part of the university physical education students regarding first-aid measures in the case of dental trauma. The students scored an average of 10 points for the first questionnaire compared to the maximum of 35 for answering all questions correctly. Such a result was observed also in other studies performed in different countries [Chan et al., 2001; Jorge et al., 2009; Mori et al., 2009]. This situation can only be explained by the complete absence of this topic in the physical education curriculum. Our introduction of a 30-minute educational lecture into the curriculum allowed us to significantly improve their knowledge level. In the second questionnaire the students scored an average of almost 26 points. The 3-month time gap between the two surveys was introduced on purpose to determine whether or not this increased level of knowledge would be long lasting. The same survey was performed 12 months after the first one. In the third survey the students scored a mean of 25 points. The one year gap between the educational lecture and the final survey was the reason for the slight reduction in knowledge because the students had forgotten some of the information. Nevertheless, it is still an astounding result considering that a 30-minute educational lecture is such an easy way of reducing the extensive consequences and in wider aspect it could be also assumed that it might possibly reduce costs of a sudden dental injury through the provision of adequate first aid at the site of an accident. Even after one year the students were able to remember the most important information, which would enable them to act properly in the case of dental injury. The introduction of a very basic lecture with elements of treatment gave the most surprising result. Distinctive, colourful pictures showing post-traumatic conditions, being elements of treatment according to Bartlett’s concept [Bartlett and Remembering, 1932], guaranteed numerous associations that improved the level of memorisation of the presented content. The lecture proved that instructions given to students during short educational lectures should be short, precise and comprehensible. This indeed seemed to be the case and very positive conclusions can be drawn from the second survey performed 3 months later, which clearly shows that in the learning process of such a practical and simple set of procedures useful in many situations, the “learn, pass the exam and forget it” process did not take effect. This constitutes a strong argument for introducing this subject into the curriculum of all physical education establishments. Half of the student population took part in an extra educational task concerning the subject of dental treatment according to Bartlett’s concept [Bartlett and Remembering, 1932], they had to prepare a PowerPoint presentation for primary school students.

Based on cognitive psychology, we thought that such a task would more efficiently strengthen the learning and memorization processes for this new knowledge on dental trauma due to processing of knowledge on a deeper level (through analysis, evaluation processes and planning), thus it should help to memorise the content processed with the use of cognitive models more efficiently [Sternberg, 1986; Zimmerman, 1989]. However, from the results, we believe that a clear and concise lecture is sufficient for introducing basic knowledge that is crucial in order to be able to act properly in the case of dental injury. The extra educational task did not improve the university students’ knowledge, so there is no need to introduce such extra exercises into the curriculum. As known from the published literature,
the overall level of knowledge on traumatic dental injury is insufficient [Chan et al., 2001; Feldens et al., 2010; Sae-Lim and Lim, 2001; McIntyre et al., 2006; Mesgarzadeh et al., 2009; Biagi et al. 2010]; several papers have recommended the establishment of educational campaigns to improve this deficiency [Fux-Noy et al., 2011; Leger et al., 2009]. These educational measures have ranged from lectures to pamphlets and have been proven to be a positive measure for increasing teachers’ knowledge and awareness of traumatic dental injury management. Leger et al. [2009] found that an educational campaign in the form of a poster presentation significantly improved the presentation of knowledge. Similar results, presented by McIntyre et al. [2001] based on pamphlets and lectures, had positively changed knowledge levels concerning the management of dental trauma injury. Also, a lecture followed by a discussion, as applied by Al-Asfour et al. [2008], proved to be an effective method for achieving sufficient knowledge levels and allowing proper action in the case of dental injury. Interesting results were presented by Holan et al. [2006], who reported that the effects of different educational campaigns transcended the population who attended or received the instructions and demonstrated a great dissemination effect. The education of all sports participants about the prevention of and first-aid procedures after dental injury is essential in order to reduce significantly the consequences of such injuries and thus the enormous costs of treatment and rehabilitation of the patient. To assist physical education schools in introducing the subject of dental trauma into their teaching curriculum, an international board of experts should propose a new curriculum (although small in terms of cost and effort) for teaching sport university students about on-site first aid procedures for treating dental trauma.

The study was based on a limited number of participants who were selected from one Sport University. There are 15 Sport Universities in Poland, so the population can be considered representative of groups of people to whom results will be generalised or transferred. The results may not necessarily reflect the state of knowledge of all students in the country; however, the study was exploratory in nature and did identify the existence of lack of relevant knowledge among the students. On the other hand, although we have tried to prevent the students looking to each other for correct answers, but in no way would we claim to have prevented it 100%, this certainly can constitute another possible limitation. Furthermore, as the questionnaire was based on self-reported data - a subjective assessment of the views of the participants, thus may introduce a source of error.

Conclusion

The frighteningly poor level of knowledge of first-aid procedures in the case of dental injuries in physical education environments makes the introduction and continuation of education in this area vital. Our research proves that the inclusion of dental trauma topic in the Sport University students’ curricular training and pedagogical education should be introduced as a clear and concise lecture, being the most effective.

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References


