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Evaluation of Effectiveness of Basic Life Support (BLS) Training and Retention of BLS Knowledge and Skills 8 Months after Training Undergraduate Dental Students

SUMMARY

***Aim**: The aim of this study was to evaluate the level of knowledge, skills and learning outcomes of dental fourth-class students after basic life support (BLS) course and to analyse the effectiveness and retention of BLS training after 8 months.*

***Methods**: 52 dental school fifth class students who had received BLS training 1 hour per week and 1 hour practical course over a period of 4 weeks during their 4th year by a certified anaesthesiologist were included. The students were assessed with a test during both at the fourth and fifth years. Following the second test, a practical examination was performed with the same testing scenario on a manikin.*

***Results**: Students showed a significant improvement after 8 months in defining the sequence of actions of BLS ($p<0.001$). However, when compared in terms of providing air-way opening and applying the automated external defibrillator, the difference was not significant. In the practical exam, students achieved many parts of the algorithm correctly, such as checking for response and opening the airway. The students were able to perform opening the airway and giving chest compressions successfully. However; there was a significant decrease in their abilities in defining the sequences of actions of BLS.*

***Conclusion**: These results emphasize the necessity of continuous repetition of BLS training during dental education.*

Keywords: Basic Life Support Training; Dental Students; Dentist; Emergency

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Introduction

First aid and basic life support (BLS) are components of chain of survival for a person experiencing a life threatening emergency. In Turkey, the number of first aiders is few in quantity and yet is required for many settings, such as earthquake, traffic accidents and cardiovascular diseases. In each of the above mentioned situations, it takes time for emergency professionals to arrive at the site of medical emergency[1].

BLS skills are key elements in the undergraduate curriculum for medical, dental and other health-care providers. There are currently no agreed international standards for dental student training and there is a wide variation in its duration, its content and in the years of study in which BLS is taught[7,10]. Also, the methods of teaching are not the same around the world[6,12].

Formal resuscitation training begins in the fourth class, with a 5 hour BLS course, at the Faculty of Dentistry, University of Yeditepe, taught by anaesthesiologists with

a certificate of advanced cardiopulmonary resuscitation (CPR), given by Turkish Resuscitation Society known by European Resuscitation Council (ERC). At the end of the fourth year, the students are expected to be competent in the recognition and initial management of medical emergencies, including the BLS and the procedure of defibrillation with the placement of Automated External Defibrillators (AEDs).

The **aim** of this study was to evaluate the level of knowledge, skills and learning outcomes of dental fourth-class students after a 5 hour BLS course, and to analyse the effectiveness and retention of BLS training after 8 months.

Methods

The BLS is a theoretical and practical course, with the aim of teaching students the essential knowledge and practical skills required for treating the adult patient in need of BLS and the version used was that proposed by ERC in 2005.

Participants

52 dental school (fifth class) students were included in the study. All participants were informed that their performance would be evaluated and the results used for scientific purposes. No personal data except age and gender were collected and furthermore, no damage caused to anybody's health was expected because the training AED uses no current. Therefore, we did not need to obtain informed consent from each person. None of the participants were prompted or prepared in any way prior to the study.

The students had received BLS training and AED course 1 hour per week over a period of 4 weeks and 1 hour practical course (classroom-based demonstration) after the theoretical part during their fourth year by a certified anaesthesiologist (ERC 2005 standards). The learning outcome of the course was to be competent in the recognition and initial management of medical emergencies including, the BLS and the procedure of defibrillation with the placement of AEDs. The assessment stages of the learning outcome were as follows: a) defining the sequence of actions of BLS; b) listing the stages of BLS; c) checking for response; d) providing air-way opening; e) performing chest compression; f) applying the AED.

Study Protocol

After the theoretical and practical course, the students were assessed with a test containing 5 multiple-choice questions which were based on the content of BLS training. (Tab. 1)

Table 1. Questions at the Theoretical Test

Correct sequence of actions for adult BLS
Listing stages of BLS
Provide air-way opening
Chest compression
AED application

4 months after the BLS training, handouts showing the stages of BLS were given to students to remind them the knowledge of BLS. 8 months after the initial testing, when they were at the fifth class, the students were again assessed with the same test theoretically. Following the second test, an identical setting was established and a practical examination was performed with the same testing scenario on a manikin. After prompting, each subject was given a standardised phrase "An earthquake was happened and you were in the rescue team. You saw a person laying on the street. This person is unconscious, not breathing and has no signs of circulation. What will you do? Show how to apply AED". The answers were compared to the expected management listed in the first aid manual of ERC. All participants were tested individually without knowing other participant's performance.

Each of the students was asked to manage the situation as instructed in the previous training without any assistance, and using only the equipment provided. The students were not prompted or encouraged to use any equipment or undertake any first aid activities, and the scenario lasted 10 minute. To provide a standardised and reproducible setting the manikin was positioned on a table. Manikin was suitable for providing airway, performing chest compression (4-5 cm), ventilation (400-500 ml) and rescue breaths. AED was monophasic, giving 150 J. 1 physician (certified instructor of the Turkish Resuscitation Society known by ERC), skilled in providing and teaching BLS, was present during the performance of each participant and recorded data. Accurate listing of the stages of BLS, application of air-way opening and chest compression were tested in the practical exam. Correct placement of the electrode pads was attested if the left pad covered at least 50% of an area circumscribed by the nipple line superiorly, costal margin inferiorly, mid-clavicular line medially and mid-axillary line laterally. The right pad had to cover at least 50% of an area circumscribed by the clavicle superiorly, nipple line inferiorly, anterior axillary line laterally and right sternal margin medially.

Statistical Analysis

The test for the significance of difference between 2 independent percentages was calculated.

Results

52 dental fifth class students, 24 males (35.6%) and 28 females, (64.4%), with a mean age of 23.6 ± 1.1 years, (range 22-27 years), were included in the study. A *p* value of <0.01 was considered to indicate significance. Figure 1 shows the results of the first, whereas figure 2 shows the results of the second theoretical exam. Students showed a significant improvement after 8 months in defining the sequence of actions of BLS (51.9% and 90%, respectively, p<0.001). However, when compared in terms of providing air-way opening (84.6% and 90%) and applying the AED (57.7% and 76.9%), the difference was not significant. Positioning of the electrode pads was performed correctly by 57.7% of the subjects in the initial test without instructions, and increased to 76.92% in the second evaluation. During initial testing, students scored better in listing the stages of BLS (80.9% and 42.3% respectively, p<0.001) and performing chest compression (84.6% and 76.9%). However, in the latter, the difference was not significant.

Figure 3 shows the practical exam results. In the practical exam, students achieved many parts of the algorithm correctly, such as checking for response and opening the airway. All of the participants demonstrated some components of initial assessment (airway opening manoeuvres, breathing and circulation) before moving on to CPR. However, 39 participants could not demonstrate safety, responsiveness. Only 2 participants performed all components in the correct sequence. Some participants experienced difficulties delivering initial ventilations and this delayed the start of chest compressions. Many participants had difficulty in finding the correct hand position for chest compressions, delivering compressions at the midline of the lowest third of the sternum.

All participants placed the sternal AED electrode in the correct location, but only 3 participants placed the apical electrode on the left side of the upper abdomen. All subjects responded appropriately to the pulseless electrical activity (PEA) component of the scenario by following the AED voice prompts, demonstrating an appropriate assessment and commencing CPR.

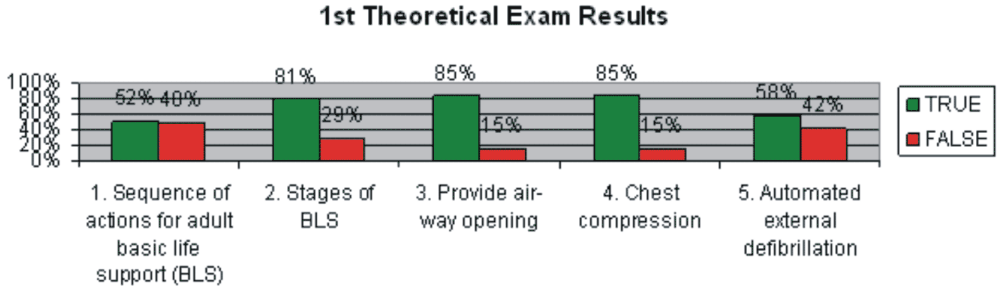

Figure 1. Results of the first theoretical exam

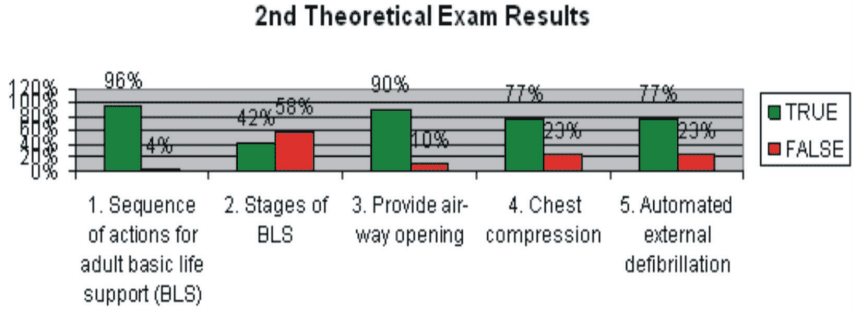

Figure 2. Results of the second theoretical exam

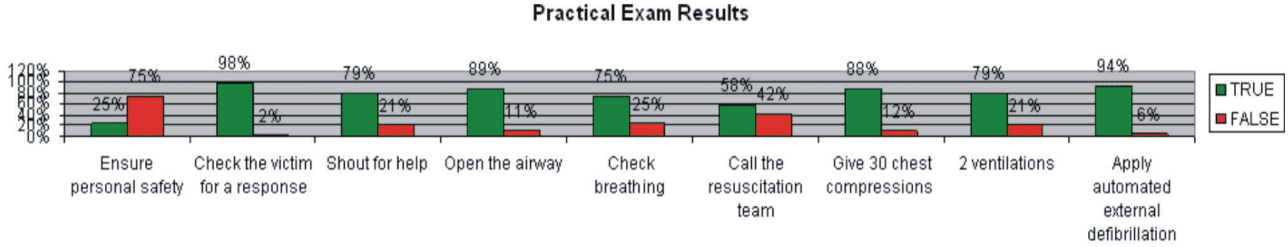

Figure 3. Results of the practical exam

Discussion

Although several reports deal with the resuscitation performance of dental students, with variable results, as to our knowledge, no specific evaluation of retention of BLS has been performed[15]. This study was designed to determine the effectiveness of our BLS educational programme among the students of dentistry and retention of BLS training after 8 months.

BLS with external cardiac compressions (ECC) and rescue breaths is an important part of CPR. In the event of a patient medical incident, there can be delays of more than 20 minutes to several hours before expert assistance is available. When a layperson initiates BLS before the arrival of the emergency medical service (EMS), survival increases two to threefold[14].

Medical emergencies are not rare in the dental office as described by Fast et al[6] and Malamed et al[16]. It is therefore important that dental students be trained to an appropriate level of proficiency in the first aid and resuscitation skills. The major skills required in the CPR are chest compressions and rescue breaths. Chest compressions are important for perfusion of vital organs and priming the heart for successful defibrillation. Delivery of adequate rescue breath volume is required for ventilation and proper performance is vital to minimise stomach inflation[19]. The evidence of the greater importance of BLS procedures, especially of external chest compressions, was recently reviewed by Fries and Tang[9].

However, studies of healthcare and lay rescuers show that resuscitation skills degrade quickly and knowledge is retained longer than skills. Variables affecting skills retention are many and difficult to isolate. Factors that positively affect skills retention include: (1) hands-on practice; (2) instruction simplicity; (3) multi-media presentations; and (4) feedback from instructors. Factors that negatively affect retention are: (1) insufficient hands-on practice; (2) inconsistent teaching; (3) unrelated course content; (4) complex instruction; (5) delays between instruction and skills practice; (6) lack of supervision; (7) low instructor feedback; and (8) instructor incompetence[18].

Acquisition of BLS skills can be difficult. While the ERC recommends a ratio of only 6 students per instructor, we have only 1 qualified instructor for 52 students. One study reported that lay rescuers performed only 1.7% of rescue breaths and 3.5% of chest compressions correctly immediately after instruction. Ventilation technique has been documented to be poorly acquired with ventilation flow rates, tending to be in excess of guidelines[13]. Retention of BLS skills is also poor, particularly chest compressions and rescue breaths[2,19,20]. The evidence of the greater importance of BLS procedures, especially of external chest compressions, was recently reviewed by Fries and Tang[19]. The suggestions made are based on several studies, indicating the increasing importance of external chest compressions even in combination with early defibrillation. The unsatisfactory retention of skills concerning CPR-skills, even of health care professionals, makes it worthwhile to shorten the time devoted to AED instruction, to allow the benefit of more intensive training of BLS procedures[3]. A period of 8 months might be not enough to represent a long term interval since the likelihood of attending a real cardiac arrest within this period for these subjects is very small.

Moser and Coleman reviewed the retention of the skills and found that skill retention starts declining as early as 2 weeks after the initial training and often reaches pre-training levels after 1 or 2 years. The poor acquisition and retention of skills are likely to contribute to the low survival rates from cardiac arrest. A large-scale study has shown that only 2% of patients suffering out-of-hospital cardiac arrest survived to hospital discharge[17].

Woollard et al[24] measured lay subjects' skills with a mean age of 35 years (range 19-65 years) before, immediately after, and 6 months after training and found that although training did produce immediate improvement in skills, the skills had deteriorated significantly 6 months later. For example, 32% of subjects assessed responsiveness adequately before initial training, 84% did so immediately after training, and 72% did so 6 months after training[24]. Braslow et al. showed that only 15% of subjects tested immediately after training in a traditional CPR course met all ensured manikin criteria for compressions and only 25% met all ensured manikin criteria for ventilations. 2 months later, performance declined to 13% and 17%, respectively. Subjects in the same study who had trained using Video self-instruction (VSI) performed better than traditionally trained subjects[4].

Retention of BLS skills diminishes rapidly over time. Training may improve BLS quality and there is evidence that the instructor might be the weak link. The ideal interval between 2 refresher courses is not established. Further research of educational methods for resuscitation training is needed[23].

Resuscitation courses provide an environment in which appropriate skills can be developed and experience gained. More frequent refresher trainings and more time for hands-on skills practices are essential to maintain skills[11,21,22]. Therefore, dentists should be regularly re-trained, although there is no clear guidance on the frequency that this should occur. Clinical Negligence Scheme for Trusts (CNST) guidelines recommends annual BLS updates. Appropriate training should be required to achieve good standing in BLS continuing professional development programme[5].

When the BLS training starts in the first year of dentistry and repeats yearly until students graduate, acquisition of BLS skills will be better and the students will feel more self-confidence. Also each training activity should be supervised by a sufficient number of certified trainers. Although our students improved their acquisition of skills over a training period of 5 weeks, the final results

cannot be considered satisfactory. This fact is especially disappointing among future professional health care providers, such as dentists, who must be specially trained and prepared to deal with patients who suffer collapse. The use of real-time automated feedback devices as part of BLS training and also in the dentistry schools could be considered as a way of improving BLS performance.

The level of training delivered and the training techniques employed are important factors in the retention of BLS and AED skills, but this has not been examined in this study.

Conclusion

The present study provides evidence that 5 hour BLS course during the 4th year of dentistry education is not adequate. More frequent resuscitation refresher courses could help dentists' life-saving skills.

Limitations of the Study

The lack of real-time automated feedback devices as part of BLS training is one of the major limitations that affect the correct evaluation of students.

While the ERC recommends a ratio of only 6 students per instructor, we have only 1 qualified instructor for 52 students.

Conflict of Interest

No conflict of interest to declare.

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