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Forensic Dental Training in the Dental School Curriculum

ABSTRACT: This article reviews the literature regarding forensic education in the dental school curriculum and describes an exercise in forensic identification of victims of a mass casualty. Radiographs were made of dentate human cadavers in the gross anatomy laboratory at the Southern Illinois School of Dental Medicine. The jaws were then removed to provide "wet specimens" for the exercise. Several restorations were performed on the cadaver teeth, after which radiographs of the dissected jaws were made. One author wrote up mock dental records for each of the victims. These records included the first set or "premortem" radiographs. Students participating in the exercise were provided with a plane crash scenario, the dental records of the passengers on the manifest, the dissected jaws, and the second set or "postmortem" radiographs. Students were expected to form three teams. The first two teams evaluated the ante-mortem and postmortem dental records. The third team compared the ante-mortem and postmortem records to arrive at identification. The purpose of the exercise was twofold. It introduced dental students to forensic dentistry and emphasized the need for complete and accurate record keeping in the dental office. Several factors lessened the realism of the exercise and made it difficult to reproduce in the future. These included the uniformity of the dental records and the destruction of cadaver material following the exercise.

KEYWORDS: forensic science, forensic dentistry, education, dental, curriculum

Recent events and television programs have focused the public eye on forensics. Following the attacks of September 11, 2001, dental leaders discussed the critical role that dentistry could play in future attacks. Albert Guay, the chief policy advisor for the American Dental Association, stated, "The predoctoral dental school programs need to devote adequate time to the subject of bioterrorism." Dr. Guay (1) discussed multiple ways the dental community could respond in the event of a terrorist attack. Forensic dentistry is the most traditional role that dentistry plays in a mass casualty situation. Dentists are an integral part of the identification center staff. Unfortunately, formal training in forensic dentistry is lacking. Several articles published in the 1970s and 1980s called for more training opportunities. Although the Armed Forces Institute of Pathology conducts on a week-long course each spring, forensic dentistry is often neglected in the dental school curriculum (2–6). The results of a survey by Edward Herschaft and Robert Rasmussen published in 1978 found that only one half of dental schools in the United States presented any information on forensic dentistry. This included predoctoral, graduate, or continuing education courses. The schools that did present the information did not do so on a regular basis. Individual courses in forensic dentistry were most often electives (2). In 1978, the American Association of Dental Schools (now the American Dental Education Association) passed a resolution requesting the section on pathology develop curriculum standards and encourage training in forensic dentistry. At the 1979 annual meeting, the section on pathology called forensic dentistry a "desirable but

non-essential curricular element in general pathology (3)." The Journal of Dental Education published curriculum guidelines developed jointly by the Sections of Oral Diagnosis/Oral Medicine and Pathology in 1982. These sections revised the guidelines and published again in 1990. These guidelines recommended that education in forensic dentistry be "contained in a separate, required course." Ideally, this course would be placed in the third or fourth year of the dental curriculum. The guidelines stated that the "ability to display both wet and dry laboratory specimens is desirable (7)."

A similar survey of educational programs has not been published since Herschaft and Rasmussen in 1978. Other statements and surveys imply that there is little improvement in the number of educational opportunities in dental schools over the last 28 years. William Morlang, a leader in forensic dentistry, called for more leaders in this area at a conference in 2003 (8). The November 2001 "Question of the Month" in the Journal of the American Dental Association found that 69% of those who responded had not received forensic dental training in the past (9). In addition, there is no competency statement encouraging schools to require the placement of forensic dentistry in the curriculum. To address this need, the Southern Illinois University School of Dental Medicine developed an exercise to introduce students to forensic dentistry.

Forensic dentistry is an area of expertise in dentistry with several major applications: (1) the identification of individuals, especially those who are victims of crime or mass disasters, (2) identification and evaluation of bite marks that occur during the commission of a crime, (3) diagnostic and therapeutic examination and evaluation of injuries to the jaws, teeth, and oral soft tissues, and (4) the recognition of human abuse and the defining of the dental teams role in reporting abuse. In addition, forensic dentists assist legal authorities and the dental community in maintaining dental records that accurately document dental information unique to the patient to assist in the identification of the patient should it be necessary (10,11). Dentistry assumes a

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Received 15 April 2006; and in revised form 13 Oct. 2006 accepted 29 Oct. 2006; published 5 April 2007.

primary role in the identification of remains when postmortem changes, fire, or other damage to the body render visual identification or fingerprinting impossible. Teeth, like other hard tissues of the body, are usually preserved after death. Identification requires a list of possible decedents so that investigators can obtain ante-mortem records. Unfortunately, the records maintained by dental offices can be inadequate for forensic purposes, making the identification difficult or impossible (12).

At the Southern Illinois School of Dental Medicine, forensic dentistry has not traditionally been part of the curriculum. To rectify this, a 2-h lecture on bioterrorism was added to the second-year general pathology course and a 2-h lecture on forensic dentistry was added to the junior oral pathology course. In addition, a hands-on identification exercise with wet specimens was planned for the third-year students independent of a formal course. This exercise focused on the identification of mass disaster victims. A mock transportation disaster was chosen for two reasons. First, such events represent the majority of cases where forensic dentistry is required for identification. Second, by gaining experience in identification, the students will also understand the importance of accurate documentation in dental records.

Methods

The mock transportation disaster was a charter flight with eight passengers originating at Lambert International Airport in St. Louis, MO, with a destination of Paducah Regional Airport in Paducah, KY. The plane crashed on a farm field in Southern Illinois. The exercise at AFIP Forensic Dental Identification course features actual specimens and records from an aircraft accident. To simulate this as closely as possible, cadaver jaws from the gross anatomy laboratory at Southern Illinois University School of Dental Medicine (SIU-SDM) were used. A waiver was received from the Institutional Review Board (IRB) at Southern Illinois University at Edwardsville to use the cadavers. The cadavers were identified by a code number. The code number was assigned by the University of Oklahoma body donation program. No one on the SIU campus was aware of the identity of the cadavers. The anatomy laboratory had 12 human cadavers, of which six were edentulous. Edentulous cadavers were not used in the exercise. Portable X-ray equipment was brought to the laboratory and used to make bitewing radiographs of each of the dentate cadavers to simulate pre-existing patient films. Several of the cadavers required dissection of the muscles of mastication and the superhyoid muscle to insert the film. When necessary, rubber bands were used to hold the lower jaw in place during exposure. Preliminary charting was completed using clinical findings and the bitewing radiographs. Cadavers that could be used to create more than one "victim" were identified. If a cadaver was used to create more than one victim, one of the radiographs was replaced with an unidentified, discarded radiograph from the SIU-SDM radiology department that was a reasonable match. Discarded patient panoramic radiographs were also used for cadavers that were largely edentulous. All patient information was removed from the radiographs before use in the exercise. Each jaw designated as a patient specimen was then dissected away from the cadaver using a scalpel and a Stryker® (Kalamazoo, MI) saw. A numerical code was written on the specimens to identify which cadaver it came from. An ante-mortem patient chart was created for each victim using blank charts from SIU-SDM. An initial charting was produced along with entries in the chronological record of treatment to reflect treatment present in the jaws. The charting and entries varied in the detail and style to simulate

records from different dental offices. The jaws were taken to the preclinical laboratory where several amalgam restorations were created or replaced to simulate treatment that occurred subsequent to the "initial" bitewing radiographs. Further entries in the chronological record of treatment were written to reflect areas where changes were made or in areas not available in the post-mortem specimen. Entries regarding unavailable portions of the jaws were written to fill out the patient record. Finally, the jaws were brought to the radiology department where "postmortem" radiographs were made of the sections of the jaws that were "recovered" from the accident. Rubber bands were used to hold the film in place.

During the exercise, the students were provided with a passenger manifest, or a list of passengers believed to be on the plane. Dental records for each passenger were provided. The students were allowed to handle the "recovered" jaws and examine the charts. Gloves and periodontal probes were provided. The students were divided into groups of six. Each group was subdivided into three teams. The first team developed an ante-mortem dental record, the second a postmortem dental record, and the third performed the comparisons between the ante-mortem and post-mortem records to identify matches. Comparisons were made using a dental identification summary report. The ante-mortem and postmortem record forms and the summary report form were obtained from the text *Forensic Dentistry* by Stimson and Mertz. Most student questions about the charts were not answered as there would be no one to answer such questions at an actual identification site. In the exercise, one passenger listed on the manifest did not board the plane and one victim was not a passenger on the aircraft. His dental record was withheld until the students inquired about the possibility that one of the victims did not match anyone on the manifest. Following the conclusion of the exercise, the jaws were returned to the appropriate cadaver for cremation.

Discussion

Considering the contributions that forensic dentists make to scientific methods of investigation and identification, it is important that all dental students gain exposure to this specialized area during their dental school curriculum. First, this exposure may stimulate student interest in forensic dentistry. Second, it is important for all students to understand the importance of good radiographic technique and record keeping in forensic identification in the event they are called upon to provide information about one of their patients to a forensic investigator. A 1-h lecture was given before the exercise to introduce the exercise and provide background. Lectures are an excellent way to give students a background on forensic dentistry and should be integral to any forensic education at a dental school. A hands-on simulated scenario, however, can provide the students with an active learning experience. The hands-on scenario gives the students a better idea of the challenges faced by forensic investigators and a better feel of the process of identification.

A few problems were encountered that detracted from the reality of the exercise. First, the number of available cadavers limited the number of victims. The gross anatomy laboratory had 12 cadavers, but only six were found to be at least partially dentate. Dissected specimens were required to be returned to the body for cremation after the exercise. As a result, the victims will have to be recreated each year. A library of "victims" created by photographing the specimens is an alternative. Removing the "wet specimen" in favor of photographs, however, detracts from the reality of the exercise.

Another problem encountered was with the clinical records. All of the dental records were created by the same individual (D. C. S.) and used the same charting methods, forms, etc. To improve on this, dental records should be created by multiple dentists, thereby creating records with different charting methods, nomenclature, and style. Ideally, consent from the decedents' families would allow keeping the jaws of their loved ones as permanent teaching material and also possibly allow for retrieval of an individual's dental records. This would provide permanent teaching material that could be built upon each year. The realism of the exercise would improve by utilizing a wide variety of records that would very closely simulate the material received from dentists of record following an accident. The feasibility of obtaining this material is not known at this time. A kit reflecting the supplies used by a forensic odontologist would also be a useful addition to the exercise. In this exercise, the students were provided only gloves and periodontal probes. The probes were included to provide a means to measure and handle specimens, but proved to be of little use to the students.

Unfortunately, no assessment was performed regarding the exercise. An evaluation of what the students learned would provide a measure of the effectiveness of the exercise. Gathering input and suggestions from the participants would allow creation of a better exercise for the future.

Conclusion

A mass disaster exercise was created to give dental students exposure to the efforts that go into identifying victims of a mass disaster. Whether or not supported by competency documents, experiences such as these are important in the dental school curriculum, giving students an introduction to forensic dentistry. Students also learn the importance of accurate and complete record keeping in the event they are called upon by forensic investigators to provide patient records.

Several problems were identified that detracted from the realism of the exercise. Chief among these was the unrealistic uniformity of the victim's dental records. The inability to use the same specimens from year to year makes the exercise labor intensive each time it is given or detract from the realism as alternate methods, such as photographs, are used in place of wet specimens.

The additional lectures and the exercise are designed to encourage a regular inclusion of forensic dentistry in the predoctoral

and graduate curriculum at SIU-SDM. Once permanent teaching material is obtained, a continuing education course may be developed as well. Hopefully, sharing the experience at SIU will help other dental schools to develop similar exercises and consider forensic dentistry as a permanent and necessary part of the curriculum.

Further studies regarding forensic education are necessary. A survey would be useful to determine what is currently taught regarding forensic dentistry in United States and Canadian dental schools. Additional reports of teaching techniques used in forensic dentistry would be useful to stimulate the development of better, more realistic, and reproducible forensic exercises.

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