

2023

Dental Hygiene and Dental Assistant Students' Simulated DVI Radiographic Match Accuracy: A Pilot Study

Samantha C. Vest
Old Dominion University, svest@odu.edu

Brenda T. Bradshaw
Old Dominion University, bbradsha@odu.edu

Marsha A. Voelker
Old Dominion University

Ann M. Bruhn
Old Dominion University, abruhn@odu.edu

Tara L. Newcomb
Old Dominion University, tgarlow@odu.edu

See next page for additional authors

Follow this and additional works at: https://digitalcommons.odu.edu/dentalhygiene_fac_pubs



Part of the [Dental Hygiene Commons](#), and the [Emergency Medicine Commons](#)

Original Publication Citation

Vest, S. C., Bradshaw, B. T., Voelker, M. A., Bruhn, A. M., Newcomb, T. L., & Sikdar, S. (2023). Dental hygiene and dental assistant students' simulated DVI radiographic match accuracy: A pilot study. *Journal of Dental Hygiene*, 97(2), 31-38. <https://jdh.adha.org/content/97/2/31>

This Article is brought to you for free and open access by the Dental Hygiene at ODU Digital Commons. It has been accepted for inclusion in Dental Hygiene Faculty Publications by an authorized administrator of ODU Digital Commons. For more information, please contact digitalcommons@odu.edu.

Authors

Samantha C. Vest, Brenda T. Bradshaw, Marsha A. Voelker, Ann M. Bruhn, Tara L. Newcomb, and Sinjini Sikdar

Dental Hygiene and Dental Assistant Students' Simulated DVI Radiographic Match Accuracy: A pilot study

Samantha C. Vest, MS, RDH

Brenda T. Bradshaw, MS, RDH

Marsha A. Voelker, MS, CDA, RDH

Ann M. Bruhn, MS, RDH

Tara L. Newcomb, MS, RDH

Sinjini Sikdar, PhD

ABSTRACT

- Purpose** Allied dental health care professionals have served on disaster victim identification (DVI) teams; however, the literature is void of statistical measures regarding transferable skills and disaster preparedness. The purpose of this study was to assess second year dental hygiene and dental assistant students' match accuracy for simulated DVI radiographs and compare the match accuracy between the student groups.
- Methods** Five patient cases were chosen at random to retrospectively collect sets of digital bitewing radiographs from two time periods. The five retrospectively selected sets of images served as simulated antemortem (AM) and postmortem (PM) radiographs. A convenience sample of second year dental hygiene and dental assistant students from two institutions (n=48) were invited to participate in this IRB-exempt descriptive observational study. The previously selected AM and PM images were randomly mismatched, and participants were asked to visually compare the image sets and indicate the matches using a drag and drop feature in an electronic survey instrument. Descriptive statistics were used to analyze the data; the significance level was set at $\alpha=0.05$.
- Results** A total of 41 dental hygiene and dental assistant students agreed to participate for a response rate of 85.4%. Eighty-five percent of the participants accurately matched five out of five sets while the remaining 15% accurately matched three out of five sets. A one-sample binomial proportion test revealed that 80% of the participants were able to match at least four out of five sets ($p<0.001$). Dental hygiene students demonstrated increased matching performance as compared to dental assisting students ($p=0.013$).
- Conclusion** Both dental hygiene and dental assistant students demonstrated transferable DVI skills to accurately match simulated AM and PM radiographs. Future research is needed in a larger sample to develop and assess best practices of DVI training to build on existing skills for allied dental health care professionals.
- Keywords** dental hygiene students, dental assistant students, disaster victim identification, forensic odontology, transferable skills, radiographic interpretation
- NDHRA priority area, **Professional development: Education** (educational models)
- Submitted for publication: 7/28/22; accepted after revision: 12/15/22

INTRODUCTION

Forensic odontology was defined in 1970 by Keiser-Neilsen as “that branch of forensic medicine which in the interest of justice deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of the dental findings.”¹ Teams assisting with forensic odontology may include medical examiners, coroners, dentists, dental hygienists, and dental assistants. These professionals collaborate with forensic odontologists for medico-legal purposes including the scientific collection, handling, and reporting of dental evidence. Additionally, these health care professionals serve as essential personnel following large natural and manmade disasters known as mass fatality incidents (MFIs) resulting in an overwhelming number of unknown decedents requiring identification.²⁻⁵ During previous large-scale MFIs, dental hygiene and dental assistant responders have successfully contributed to identification efforts by serving on antemortem (AM) and postmortem (PM) teams, thereby reducing delays in the disaster victim identification (DVI) process.⁶⁻¹⁰

Various national and governmental groups including the American Board of Forensic Odontology (ABFO), Medical Reserve Corp, and Disaster Mortuary Operational Response Teams (DMORT) have supported and/or enlisted the help of dental hygienists and dental assistants for disaster victim identification during MFIs.^{8,11-12} Dental assistants serving in the United States (US) Air Force have routinely completed DVI tasks for fallen reserve members and government officials housed in a federal mortuary.¹⁰ Dental hygienists assisted DVI teams with the 1978 collision of a Pacific Southwest Airline 727 jet and a Cessna 172 aircraft in San Diego, California,¹³ the 1980 MGM Grand Hotel Fire,¹⁴ the 2001 World Trade Center attacks in New York City,⁶ and the 2011 F5 tornado in Joplin, Missouri.¹⁵

Reports in the literature indicate that over 400 volunteer dental auxiliary team members, including dental hygienists and dental assistants, have supported DVI tasks for 3,100 victims.^{6,13-15} However, current DVI literature does not always specify the

health care discipline or may use a blanket term such as “therapists” or “clinicians”, making it difficult to determine which discipline was actually represented in the DVI efforts. Dental professionals such as dental hygienists and dental assistants are ideal for supporting local and national emergency teams to increase the efficiency and success of DVI efforts due to their dental related expertise.^{6,16-20} Allied dental professionals have been shown to outperform volunteers that have no dental related education.^{6,16-20}

Accredited dental hygiene and dental assisting programs, consisting of didactic, laboratory, and live-patient clinical practice experiences,^{12,14,21-22} have been recognized as being closely aligned with the forensic odontology curriculum.⁹ Skills taught in the dental hygiene and dental assisting curricula have been identified as being beneficial for DVI.¹⁴ The Commission on Dental Accreditation (CODA) develops and implements standards that promote quality and continuous improvement of all dental education programs. Dental hygienists are required to complete at minimum, a CODA accredited academic program consisting of an average of 2,932 instructional clock hours, with 659 of those hours dedicated to clinical dental hygiene instruction.²³ Licensed dental assistants may receive their education from a CODA accredited institution with a minimum of 900 instructional hours and at least 300 clinical based hours.^{22,24} The curriculum at accredited institutions must comply with CODA standards and include cognitive, psychomotor, and affective skill competencies, which all are inherently common to DVI.^{11,25-27}

Curricular guidelines for dental hygiene and dental assisting from the American Dental Education Association (ADEA) include five major curricular topics, anatomy, histo-embryology, dental radiology, pathology, and dental materials that are common to the ABFO Model of Curricular Topics for Forensic Odontology.^{26,27} The Compendium also states that the cognitive knowledge within these interrelated topics should be integrated with opportunities for skill application and critical thinking. Integration of forensic topics could increase the ability of a graduate to transfer this knowledge to DVI tasks.²⁶

Administrative skills such as record management, interprofessional collaboration, and cultural competency are also transferrable to DVI skills.^{8-9,16,28} Research has shown that dental hygienists and dental assistants have demonstrated success while assisting actual DVI events due to their knowledge and skill sets applicable to the various DVI team roles.^{8,9,12,21-22} The antemortem interpretation process is considered the most time-consuming task facing forensic odontologists due to obtaining and transcribing records that may have subjective documentation styles.⁸ For example, dental chart symbols and written abbreviations used to document disease or restorative work may vary across record keeping systems. With specialized forensic training, dental hygienists and dental assistants can assist the PM team by exposing radiographs, taking photographs, cleaning debris from victim remains, charting findings, and assisting with surgical procedures.^{8,9,26} Dental hygienists and dental assistants trained on the operational functions of identification software can organize the ante- and postmortem data for comparative analysis, so the forensic odontologist can determine a degree of certainty for the identification recommendation report.^{8,29}

Forensic odontology and disaster preparedness topics are rarely included in dental hygiene or dental assisting curricula, possibly due to a lack of specific accreditation standards related to forensics and emergency preparedness.³⁰⁻³⁴ It has been recommended that forensic odontology curriculum and DVI competencies be developed for allied dental professionals.¹⁸ However, there is a gap in the literature addressing forensic-based curricula designed to prepare dental hygiene and dental assistant graduates. Additionally, information on the basic skills acquired during dental hygiene and dental assisting education that are transferrable to DVI are not well understood. The purpose of this study was to assess second year dental hygiene and dental assistant students' match accuracy for simulated antemortem (AM) and postmortem (PM) DVI radiographs and compare the match accuracy between the student groups.

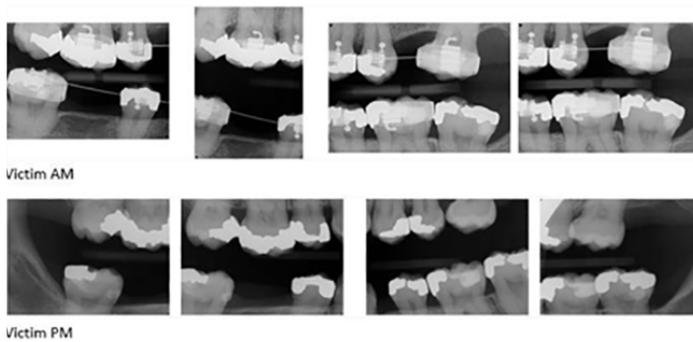
METHODS

This observational descriptive study was given exempt status by the Old Dominion University Institutional Review Board (#1693121-4). A convenience sample of senior dental hygiene and second year dental assistant students were recruited via email to participate in the electronically delivered study activity (n=48). Participants signed informed consent via email and created a unique identifier to retain anonymity.

Five patient cases were chosen at random to retrospectively collect sets of digital bitewing radiographs from two time periods. The five retrospectively selected sets of images served as simulated AM and PM radiographs. The digital horizontal bitewing radiographs were obtained at random from the Old Dominion University School of Dental Hygiene Care Facility. Once the images were selected, informed consent was obtained from the five patients permitting their record data to be used for teaching purposes or scientific publications. Two separate bitewing radiograph sets from differing time periods of the same person served as an AM radiographic set and as a simulated PM radiographic set. Selected radiographs were evaluated by the researchers and deemed appropriate for research purposes. Corresponding AM and PM radiograph sets included a variety of characteristics such as missing teeth, restorations, mixed dentition, and orthodontic treatment— differences of the characteristics could be observed from AM to PM by keen visual scrutiny; and participants were able to enlarge the images for enhanced viewing (Figure 1).

An online survey software program was used to deliver the matching activity (Qualtrics; Provo, UT, USA). The untimed radiographic comparison/match activity presented ten mismatched AM and PM horizontal bitewing radiographs. Participants were asked to visually compare, then identify five matching radiograph sets by using a drag and drop feature of the online software and indicate their degree of certainty for each match using drop down choice boxes. As an incentive, respondents were given the option to be entered into a raffle to win one of four \$25 Amazon gift cards.

Figure 1. Sample AM and PM bitewing radiographs



Prior to data collection, the radiographic comparison activity was pilot tested on eight dental hygiene faculty to establish content validity and clarity of the instructions. Descriptive statistics were used to analyze the data and all results were based on $\alpha=0.05$ significance level.

RESULTS

A total of 27 dental hygiene students and 14 dental assistant students completed the study, yielding a response rate of 85.4% ($n=41$). All participants were female and most were 18-22 years old ($n=21, 51.2\%$) and self-identified as White ($n=24, 58.5\%$). Sample demographics are shown in Table I.

Radiographic matches indicated by participants were made dichotomous with either correct matches or incorrect matches. A one-sample binomial proportion test revealed that 80% of the participants were able to accurately match at least four out of five AM and PM sets ($p<0.001$). Of the 41 participants, 85% ($n=35$) correctly matched five out of five radiographic sets; and 15% ($n=6$) correctly matched three out of five sets.

Fisher's exact test was used to compare participants' performance of matching AM and PM radiographic sets based on the academic discipline; second year (senior) dental hygiene student or second year dental assisting student. Participants' match performance was divided into two categories: five correct matches and fewer than five correct matches. There was a statistically significant increase ($p=0.013$) between matching performance of AM and PM radiographic sets and the academic discipline. All but one dental

Table I. Demographics (n=41)

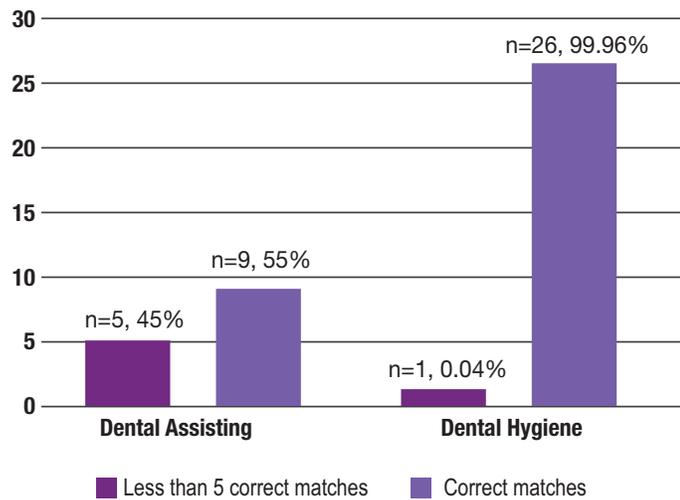
Demographics	n	%
Gender		
Female	41	100.0
Male	0	-
Student Academic Discipline		
Dental Hygiene	27	65.9
Dental Assisting	14	34.1
Age		
18-22	21	51.2
23-27	10	24.4
28-32	6	14.6
33-42	1	2.4
43-47	2	5.0
48+	1	2.4
Race/Ethnicity		
White	24	58.5
American Indian or Alaskan Native	0	-
Black or African American	6	14.6
Asian	8	19.5
Hispanic or Latino	1	2.4
Native Hawaiian or Other Pacific Islander	1	2.4
Mixed or Other	1	2.4

hygiene student ($n=26, 99.96\%$) had five correct matches at a rate of 100% accuracy, compared to a little over half of the dental assistant students ($n=9, 55\%$) with five correct matches (Figure 2).

DISCUSSION

Educational curricula of allied dental professional programs are applicable to the DVI skills that have been identified in forensic manuals. Based on the ADEA Compendium of Curriculum Guidelines, dental hygienists and dental assistants have the foundational knowledge necessary for DVI within their formal curricula.²⁶ This foundational knowledge provides a basis to build additional DVI training necessary for allied dental professionals to successfully apply skills

Figure 2. Radiographic match performance according to discipline (n=41)



on an interdisciplinary forensic odontology team. Allied dental professionals have served as members of DVI teams for MFIs with no additional credentialing outside of their professional licensure. However, current literature lacks statistically analyzed, measurable skills of the personnel who may be enlisted for MFIs such as allied dental health care professionals. Disaster relief organizations are often unclear how best to assign volunteer allied dental personnel during MFIs. There is a need for the use of professional titles, such as registered dental hygienist” or “certified dental assistant, in the DVI literature to better understand how allied dental health professionals contribute in MFIs.

According to the United Nations Office for Disasters Risk Reduction (UNDRR) and the World Meteorological Organization (WMO), there has been an overwhelming surge of natural disasters over the past fifty years, with 45% of those disasters reporting deaths.³⁸ These increases in natural disasters underscore the importance of inclusion of forensics into allied dental curricula. Allied dental health care professionals prepared with specialized training could strengthen local and national emergency management efforts.¹⁶⁻¹⁷ However, existing transferable skills need to be identified and assessed to best understand what additional training is needed to inform disaster curriculum developers.

Results from this study suggest that dental hygiene and dental assistant students have the foundational skills from their educational programs which could be useful when enhanced with forensic training during a MFI. Further research is needed to explore allied dental professionals’ DVI outcomes when involved with MFIs, their perceptions of DVI knowledge and performance skills, and their actual aptitude when tested in research settings.

As seen in previous literature, both dental hygienists and dental assistants are important resources for DVI teams and possess the necessary skills and education needed to perform DVI tasks.^{2,5-7,12} Both professions have similar core curricula including anatomy, histo-embryology, dental radiology, pathology, and dental materials which are also common subject areas for DVI.²⁶⁻²⁷ There is a heavy reliance on dental radiographs for the identification of human remains. Radiographs are often utilized for assessment of match abilities in forensic odontology research making the comparisons of AM and PM radiographic sets a key transferrable skill for assessment.^{19,20,35-38} Most (85%) of the participants correctly matched at least four out of five AM and PM dental radiographic sets. This suggests that dental hygiene and dental assistant students possess the skill to accurately match AM and PM radiographs, a vital skill when serving as consultants for DVI decisions regarding positive matches or exclusions. These findings are similar to Sivanari et al, where most (92.1%) dental students were able to accurately complete a DVI matching activity.³⁸ Pinchi et al., found that experienced forensic odontologists’ matching accuracy outperformed (97%-100%) participants with less education or training, the match accuracy rates of the forensic odontologists were similar to the dental hygiene students in this study (99%).²⁰ The combined dental hygiene and dental assistant participant match scores (85%) were consistent with those of dental students (82%-89%) in the Pinchi et al study.²⁰ These findings suggest that dental and allied dental students have baseline skills and formal educational preparation necessary to successfully assist forensic odontologists with radiographic matches and exclusions during MFIs.

Match performance varied among participants' academic discipline in this study. All but one dental hygiene student (99.96%) was able to correctly match all radiographic sets, compared to only nine of the dental assistant students (55%). While curriculum may be similar, the amount of instructional and clinical hours varies between the disciplines which could explain the performance difference between the two groups. Dental hygiene students may have also worked previously as dental assistants giving them more experience with dental radiology. Dental hygiene students may also have received more didactic content in interpreting radiographs.²⁶ Sholl et al., also assessed match performance among various disciplines including forensic odontologists, dental students, and dental hygiene students.¹⁹ Dental hygiene students outperformed (89.7%) dental students (85.2%) when matching randomly mixed radiographs into sets of three,¹⁹ a design similar to the current study.

This study had limitations. The sample population consisted of a convenience sample of senior dental hygiene and dental assistant students from two institutions and may not be representative of other dental hygiene and dental assistant student populations. The number of enrolled dental hygiene students and dental assistant students was unequal which created challenges in the statistical analysis. However, statistical tests were chosen that did not assume equal sample sizes for comparisons. A Fisher's exact test was chosen because of its use for small sample sizes. It is also possible that the radiographic comparison activity was misinterpreted by the participants; while the images could be enlarged, there was no magnification feature.

Future research is needed to develop and assess best practices of DVI training for allied dental health care professionals. Research published in dental and forensic journals could better standardize the literature, strengthen dental hygiene and dental assistant response for MFIs, and support DVI teams with well prepared allied dental volunteers.

CONCLUSION

Both dental hygiene and dental assisting students demonstrated transferable DVI skills to accurately match simulated AM and PM radiographs. Dental hygiene students demonstrated increased matching performance scores as compared to dental assisting students. Future research is needed to develop and assess best practices of DVI training to build on existing skills for allied dental health care professionals to fully participate as members of interprofessional disaster victim identification teams.

Samantha C. Vest, MS, RDH

Gene W. Hirschfeld School of Dental Hygiene,
Old Dominion University, Norfolk, VA, USA

Brenda T. Bradshaw, MS, RDH

Gene W. Hirschfeld School of Dental Hygiene,
Old Dominion University, Norfolk, VA, USA

Marsha A. Voelker, MS, CDA, RDH

MCC-Penn Valley Health Science Institute
Kansas City, MO, USA

College of Health Sciences

Old Dominion University, Norfolk, VA, USA

Ann M. Bruhn, MS, RDH

Gene W. Hirschfeld School of Dental Hygiene,
Old Dominion University, Norfolk, VA, USA

Tara L. Newcomb, MS, RDH

Gene W. Hirschfeld School of Dental Hygiene,
Old Dominion University, Norfolk, VA, USA

Sinjini Sikdar, PhD

Department of Mathematics and Statistics,
Old Dominion University, Norfolk, VA, USA

Corresponding author:

Samantha C. Vest, MS, RDH;
svest@odu.edu

REFERENCES

1. Keiser-Neilsen S. Person identification by means of teeth: A practical guide. 1st ed. Bristol (UK): J Wright & Sons; 1980. 114p.

2. American Board of Forensic Odontology (ABFO). ABFO Reference Manual [Internet]. Colorado Springs (CO): American Board of Forensic Odontology; 2020 [cited 2022 January 25]. Available from: <http://www.abfo.org/wpcontent/uploads/2012/08/ABFO-Reference-Manual-1-22-2013revision.pdf>
3. Acharya AB. Teaching forensic odontology: An opinion on its content and format. *Eur J Dent Educ*. 2006 Aug; 10(3): 137–41.
4. Sweet D. Interpol DVI best-practice standards – An overview. *Forensic Sci. Int*. 2010 Sep; 201(1-3): 18–21.
5. National Association of Medical Examiners. Standard operating procedures for mass fatality management [Internet]. Houston(TX): National Association of Medical Examiners; 2022 [cited 2022 January 25]. Available from: <https://www.thename.org/assets/docs/31434c24-8be0-4d2c-942a-8afde79ec1e7.pdf>
6. Zohn HK, Dashkow S, Aschheim KW, et al. Odontology victim identification skill assessment system. *J Forensic Sci*. 2010 May; 55(3): 788–91.
7. Dietrichkeit Pereira J et al., Forensic odontology education: From undergraduate to PhD – a Brazilian experience. *J Forensic Odontostomatol*. 2017 Dec; 35(2): 149–56.
8. Brannon LM, Connick CM. The role of the dental hygienist in mass disasters. *J Forensic Sci*. 2000 Mar; 45(2): 381–83.
9. Ferguson DA, Sweet DJ, Craig BJ. Forensic dentistry and dental hygiene: How can the dental hygienist contribute? *Can J Dent Hyg*. 2008 May; 42(4): 203–11.
10. Hanks J. Air force dental assistants in forensic dentistry. *The Dental Assistant*. 2008 Jan-Feb; 77(1): 38–9.
11. American Board of Forensic Odontology (ABFO). ABFO Reference Manual [Internet]. Colorado Springs (CO): American Board of Forensic Odontology; 2020 [cited 2022 January 25]. Available from: <http://www.abfo.org/wpcontent/uploads/2012/08/ABFO-Reference-Manual-1-22-2013revision.pdf>
12. Furnari W. A cursory review of forensic dentistry. *Dent Acad of Con Ed*. 2018 Feb; 1: 1–7.
13. Sperber ND. Disaster victim identification: an example of professional cooperation. *FBI Law Enforcement Bulletin*. 1979 Dec; 48(12): 24–7.
14. Rawson R, Nelson B, Koot A. Mass disaster and the dental hygienist: the MGM fire. *J Dent Hyg*. 1983 Apr; 57(4): 12–8.
15. American Dental Hygienists' Association. Missouri dental hygienists' association (MDHA) annual lobby day. Access. 2013; 1–2.
16. Newcomb T, Bruhn A, Giles B. Mass fatality incidents and the role of the dental hygienist: Are we prepared? *J Dent Hyg*. 2015 Jun; 89(3): 143–51.
17. Stow L, Higgins D. Development and evaluation of online education to increase the forensic relevance of oral health records. *Aust Dent J*. 2018 Mar; 63(1): 81–93.
18. Bradshaw BT, Bruhn AM, Newcomb TL, et al. Postmortem dental records identification by dental hygiene students: A pilot study. *J Dent Hyg*. 2020 Aug; 94(4): 39–46.
19. Sholl SA, Moody GH. Evaluation of dental radiographic identification: an experimental study. *Forensic Sci Int*. 2001 Jan; 115(3): 165–9.
20. Pinchi V, Norelli GA, Caputi F, et al. Dental identification by comparison of Antemortem and postmortem dental radiographs: Influence of operator qualifications and cognitive bias. *Forensic Sci Int*. 2012 Oct; 222(1-3): 252–5.
21. Commission on Dental Accreditation. Accreditation standards for dental hygiene education programs [Internet]. Chicago(IL): American Dental Association; 2019 Aug [cited 2022 Jan 25]. Available from: https://coda.ada.org/~media/CODA/Files/dental_hygiene_standards.pdf?la=en
22. Commission on Dental Accreditation. Accreditation standards for dental assisting educational programs. [Internet]. Chicago(IL): American Dental Association; 2021 Feb [cited 2022 January 25]. Available from: https://coda.ada.org/~media/CODA/Files/dental_assisting_standards.pdf?la=en
23. ADA Survey Center. Survey of allied dental education [Internet]. Chicago(IL): American Dental Association; 2015 Nov. [cited 2022 January 17]. Available from: https://www.ada.org/~media/project/ada-organization/ada/ada-org/files/resources/research/hpi/2015-16_sall_da_final.xlsx?rev=593598829b5e4b758fd54ec58d2617d6&hash=1CACC1EF5ED41953D6901365DCF85DAB
24. American Dental Assistants Association. Manual of policies and resolutions [Internet]. Washington DC: American Dental Assistants Association; 2020 Oct [cited 2022 Jan 17]. Available from: <https://www.adausa.org/aboutadaa/policies-and-resolutions>.
25. American Dental Hygienists Association. ADHA policy manual [Internet]. Chicago(IL): American Dental Hygienists Association; 2020 Jun [cited 2022 January 17]. Available from: https://www.adha.org/resourcesdocs/7614_Policy_Manual.pdf
26. American Dental Education Association. Compendium of curricular guidelines: Allied dental education programs [Internet]. Washington DC: American Dental Education

Association; 2016 May [cited 2022 January 17]. Available from: <https://www.adea.org/CADPD/Compendium-Revised-2016.pdf>

27. American Board of Forensic Odontology. Model of curricular topics for forensic odontology [Internet]. Colorado Springs (CO): American Board of Forensic Odontology; 2006 Feb [cited 2022 Jan 17]. Available from: <http://asfo.org/wpcontent/uploads/ABFO-Model-Curriculum-12-14.pdf>
28. Hinchliffe J. Forensic odontology part 2: Major disasters. *Brit Dent J*. 2011 Mar; 210(6): 269–74.
29. Al-Amad SH, Clement JG, McCollough MJ, et al. Evaluation of two dental identification computer systems: DAVID and WinID3. *J Forensic Odonto-Stoma*. 2007 Jun; 25(1): 23–9
30. More F, Phelan J, Boylan R, et al. Predoctoral dental school curriculum for catastrophe preparedness. *J Dent Edu*. 2004 Aug; 68(8): 851–8.
31. Glotzer D, Frederick M, Phelan J, et al. Introducing a senior course on catastrophe preparedness into the dental school curriculum. *J Dent Edu*. 2006 Mar; 70(3): 225–30.
32. Stoeckel D, Merkley P, McGivney J. Forensic dental training in the dental school curriculum. *J Forensic Sci*. 2007 May; 52(3): 684–6.
33. Hermsen K, Johnson D. A model for forensic dental education in the predoctoral dental school curriculum. *J Dent Edu*. 2012 May; 76(5): 553–61.
34. Page M, Lain R, Kemp R, Taylor J. Validation studies in forensic odontology – part 1: accuracy of radiographic matching. *Sci Justice*. 2018 May; 58(3): 185–90.
35. Reynolds A. Forensic radiography: An overview. *Radiol Technol*. 2010 Mar-Apr; 81(4): 361–79.
36. Nicopoulou-Karavianni K, Mitsea AG, Horner K. Dental diagnostic radiology in the forensic sciences: Two case presentations. *J Forensic Odontostomatol*. 2007 Jun; 25(1): 12–6.
37. Tohna S, Mehnert AJ, Mahoney M, et al. Synthesizing dental radiographs for human identification. *J Dent Res*. 2007 Nov; 86(11): 1057–62.
38. Sivaneri M, Wiener RC, Trickett Shockey AK, et al. Dental student skills in matching radiographs for forensic identification and in forensic knowledge. *J Bio Edu*. 2018 Apr; 1-5.
39. United Nations News. Climate and weather-related disasters surge five-fold over 50 years, but early warnings save lives [Internet]. New York (NY): United Nations; 2021 Sep [cited 2022 Sep]. Available from: <https://news.un.org/en/story/2021/09/1098662>

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.