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Digitizing Dentistry's Multifaceted History: Why It Is Necessary

Chase A. Van Tilburg
Florida State University, cav15c@my.fsu.edu

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Digitizing Dentistry's Multifaceted History: Why It Is Necessary

Abstract

In 1929, the Gies Report, published by William J. Gies, outlined the foundational criteria for a relatively standardized dental education across the United States. Although it was not included in Gies' original report, the history of dentistry would eventually become an essential part of that curriculum. Contemporary dental education has pushed the history of dentistry to the side, however, implying that it is unnecessary. Doing so causes much of the responsibility to educate both dental students and the public to fall on institutions like the Dr. Samuel D. Harris National Museum of Dentistry (NMD). The creation of an open-access digital dental history database at the NMD that highlights the multifaceted nature of dental history will be a necessary step forward and a vital resource for curtailing the ambivalent attitude that has developed towards the history of dentistry.

Much of the scholarship about the history of dentistry has researched various aspects of the discipline's development over time, but has inadequately addressed the reason why the history of dentistry is as vital today as it was fifty years ago. Filling this noticeable gap is necessary because more and more dental students are leaving dental school with little knowledge about the history of their discipline and where they fit within that history. This paper traces the history of dental education in the United States, examining some of its many facets, and provides a comparative analysis of different physical and online dental history collections to fill this gap. First, the author conducted interviews with Dr. Andrew I. Spielman, President of the American Academy of the History of Dentistry, and Dr. Scott Swank, curator of the NMD, to evaluate the state of the history of dentistry in contemporary dental curricula. In addition to these interviews, understanding what makes the history of dentistry multifaceted is integral to comprehending its impact on the profession, contemporary society, and why it needs to be taught or learned. Finally, this paper compares physical and online dental collections to evaluate best practices for creating an online dental history collection and examines how such a database can be used by its stewarding institution.

This article has undergone a double-blind peer review process.

Keywords

visual resources, digitization, digital curation, collection access, preservation, interactive learning spaces, technology, research, databases, digital asset management systems, collection management, usability, art history, history of dentistry, digital humanities, museums, dental education, museum studies, open access, multifaceted, dental history database

Author Bio & Acknowledgements

Chase A. Van Tilburg is pursuing a master's degree in the History and Criticism of Art and Architecture at Florida State University. He was a digitization graduate intern at the Dr. Samuel D. Harris National Museum of Dentistry in Baltimore, MD. His research focuses on the use of contemporary technology, such as augmented and virtual reality, in the digital recording and preservation of art and cultural heritage. He examines how such technologies can enhance art historical study, humanities education, and the advancement/enhancement of the museum visitor experience.

Introduction

The history of dentistry and oral care dates back 13,000 years to the Late Upper Paleolithic era.¹ This history spans all inhabited continents and a multitude of cultures. Studying the history of dentistry allows a multifaceted cross-cultural historical narrative that is found in art, science, technology, and numerous other subjects to be experienced. Dental schools, museums, private companies, and other organizations have all collected pieces of this history to preserve for future generations; however, appreciation, utilization, and understanding of that history are disappearing.² Evaluating and understanding the reasons why this history is disappearing is an important step towards comprehending the value of studying it. This became increasingly evident when I worked as a Digitization Intern at the Dr. Samuel D. Harris National Museum of Dentistry (NMD). Understanding the value that dental history holds for humanity highlights the necessity for digital dental history collections. First one must comprehend the highly multifaceted nature of dental history and how it has been treated in dental education in the United States. Doing so provides context to events that contributed to the history of dentistry being sidelined or in some cases removed from dental curricula across the nation. Then, with this context and by comparing established collections, one can establish what constitutes a dental history collection, evaluate the best practices for building an online dental history database that is freely available, and determine how that database can be used in both dental and museum education.

Initially, the NMD in Baltimore, Maryland presents itself as a natural history museum; a closer look reveals that the museum also presents ethnological and cultural heritage, art, the history of technology, the history of medicine, and many other subjects all through the narrative of dental history. Outside of the NMD and the American Dental Association (ADA), most dental history collections across the United States are smaller, holding less than 10,000 items. Considering this, the NMD holds one of the largest dental history collections in the world and is an example of a collection that encompasses the multifaceted nature of dental history since the contents of the museum's collection fall under each of these subjects. This interdisciplinary nature must be highlighted when designing digital versions of these collections as this allows the stewarding institution to create a more dynamic and engaging experience between the user and the contents of the collection.

The NMD is presented with an opportunity to design a digital collection from the ground up that works to present how the different facets of dental history come together through documents, visual culture, and dental artifacts to deliver a well-rounded historical narrative. Examining how the contents of the NMD and other dental history collections highlight the all-round nature of dental history and evaluating what constitutes a successful or "ideal" digital dental collection is vital if one is to answer the fundamental question posed at the start of any digitization project: "why is digitization necessary and what is to be made available online?" In terms of creating an open-access dental history database, answering these questions becomes particularly important because of the vast array of contents a dental collection can feature. By digitizing dental history collections, stewarding institutions lay the foundation for making their collections available to not just those within their institution, but also the public at large. The digitization of the NMD's expansive collection creates an opportunity for communities across the world to develop a relationship with

¹Gregorio Oxilia et al, "The dawn of dentistry in the late upper Paleolithic: An early case of pathological intervention at Riparo Fredian," *American Journal of Physical Anthropology*, Vol. 163, no. 3 (March 10, 2017): 446.

²The dental schools and museums specifically addressed in this paper include the Baltimore College of Dental Surgery, Dental School, University of Maryland, Baltimore (UMSOD), New York University College of Dentistry (NYU), the Dr. Samuel D. Harris National Museum of Dentistry (NMD) and the finally, University of Nebraska Medical Center Dental Museum (UNMCDM).

dentistry that extends past their six-month check-up and exposes them to a relatively untold and underexplored facet of human history.

The Multifaceted Nature of the History of Dentistry

What makes the history of dentistry multifaceted? Establishing this develops the theoretical foundation upon which the digital collection will be built upon since the versatile nature of dentistry and how the objects interact in a digital space must be kept in mind when designing the open-access digital database.³ Dentistry's influence is found in a variety of fields, including but not limited to: politics and public health, criminological history, art history, religion and mythology, the history of technological evolution, ethnology, biographical histories, cultural anthropology, military history, zoology, fashion, pop culture, entertainment, literature, and, last but not least, advertising. The influence of dentistry crosses these fields fluidly; to illustrate this, art history and religion, pop culture and literature, entertainment, advertising, and finally, criminology and forensic odontology are discussed below.

In both art history and religion, teeth extraction has been depicted in images dating back centuries – a classic example is found in depictions of the torture of Apollonia, the Patron Saint of Dentistry.⁴ *The Martyrdom of Saint Apollonia* depicted by Florentine artist Jacopo Zucchi in the mid to late sixteenth century is an example of such imagery (fig. 1). In washes of brown ink and white chalk highlights, Zucchi orchestrates a frantic scene with dynamic movement. Set in Alexandria, Egypt, the figures stand frozen at the moment Apollonia's teeth are individually broken and extracted as she is tortured during an uprising against Christianity.⁵ Apollonia became a revered figure, inspiring artists to create images in her likeness, like that of *Saint Apollonia*, attributed to Piero della Francesca (fig. 2). This panel, which was originally part of the main altar of the Church of Sant'Agostino in modern-day Sansepolcro, served as the inspiration for Andy Warhol to create a series of approximately one thousand screen prints that appropriated the panel.⁶ Four of these screen prints were donated to the NMD in February 2010 (fig. 3).

These prints were acquired for the museum's inaugural exhibit *32 Terrific Teeth*, and specifically for the "Faith, Folklore, and Magic" display. Warhol's interest in dentistry extended into his interests in novelties. Piece by piece, Warhol accumulated a massive collection of dental models and molds that is now housed at The Andy Warhol Museum in Pittsburgh, Pennsylvania. Andy Warhol is just one of many artists whose interests in dentistry and teeth influenced their works. The NMD holds a variety of artworks such as a postcard titled *Une Dame Pressée (A Lady in a Hurry)* by French artist Albert-André Guillaume (Fig. 4). An entire series of books would be required to thoroughly cover the influences of dentistry and oral care throughout the various periods of art history and religion. The fluid relationship between dentistry and art is just one factor that makes the history of dentistry multifaceted. Another key example of this can be found by examining dentistry's roots in pop culture, entertainment, and advertising across the globe.

³This is opposed to the physical hardware in which the digital collection will be housed.

⁴Although this paper uses an example from Christianity, one should recognize that teeth extraction is depicted in iconography found in religions and cultures all over the world.

⁵Michael Olmert, *Milton's Teeth and Ovid's Umbrella: Curiouser & Curiouser Adventures in History*, (New York: Simon & Schuster, 1996), 66.

⁶William V. Ganis, "Andy Warhol's Iconophilia," *Invisible Culture*, no. 3 (Winter 2000): 12n11.



Figure 1: Jacopo Zucchi, Florentine, *The Martyrdom of Saint Apollonia*, mid-late 16th century, pen and brown ink with brown wash heightened with white over black chalk on laid paper, overall (approximate): 25.2 x 12.9 cm (9 15/16 x 5 1/16 in.), Julius S. Held Collection, Ailsa Mellon Bruce Fund, 1983.74.20, Courtesy of the National Gallery of Art, Washington, D.C.



Figure 2: Attributed to Piero della Francesca, Italian, *Saint Apollonia*, c. 1455/1460, tempera on panel, overall: 38.8 x 28 cm (15 1/4 x 11 in.) framed: 56.5 x 45.7 x 7.6 cm (22 1/4 x 18 x 3 in.), Gift of The Samuel H. Kress Foundation, 1952.5.19, Courtesy of the National Gallery of Art, Washington, D.C.



Figure 3: Andy Warhol, (clockwise from top left): *Saint Apollonia*, Bronze Background/Blue Cape (2010.1.1); *Saint Apollonia*, Black Background/Brown Cape (2010.1.3); *Saint Apollonia*, Yellow Background/Purple Cape (2010.1.4); *Saint Apollonia*, Red Background/Brown Cape (2010.1.2), (each): 41/250, 1984, Screenprint, 30”w x 38.5”h, The Dr. Samuel D. Harris National Museum of Dentistry, Gift of Mr. H. W. Hasse, Courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.

Examples of dentistry’s influence are seen in many forms of literature and media. For example, the NMD has an installation that talks about the fluoridation of water in North America during the 1900s. The installation lists a book written by Isabel Jansen titled *Fluoridation* (Fig. 5). In her book, the registered nurse argued against adjusting the levels of fluoride in drinking water, suggesting that it acts as a form of mass medication and presenting it as a political threat rooted in communist manipulation. Dentistry also found its way into children’s literature, a classic example being the Scholastic Readers book *The Magic School Bus and the Missing Tooth* by Jeanette Lane, published in 2006. In the book, one of the main characters finds a tooth in the back of their teacher’s classroom. It is tiny, sharp, and does not look like a tooth that would come from a human.



Figure 4: Albert-André Guillaume, *Dame Pressée (A Lady in a Hurry)*, mid-late 19th century, Paris, Carte Postale (Post Card), 5.5" x 3.5", Braun & Cie, Éditeurs, Salons de Paris, Courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.

Pokémon Company, Nintendo, and Game Freak Inc in 2020. Using their parent's smart device's camera to play the game, children brush their teeth to rescue digital creatures called Pokémon. In the canon of the mobile game, the Pokémon were captured by cavity-causing bacteria. Children defeat the bacteria in "battle" by skillfully brushing their teeth in front of the camera. If kids sufficiently brush their teeth, they will rescue the Pokémon. Also, by regularly brushing, children can earn in-game rewards. *Pokémon Smile* allows parents to set reminders of when children should brush, complete with a brushing timer, and the application provides users with toothbrushing advice to help them improve their skills.⁸ To account for every instance in which dentistry has appeared in pop culture would take a series of books, but dentistry's influence does not stop there – it has also had significant influences in science and social science fields such as criminology.

To discover who lost the tooth, the class takes a field trip to learn why teeth function as they do and why they are shaped differently. In this book, the reader learns all about teeth.

Dentistry's influence in pop culture, entertainment, and advertising is found in the videogame industry as well. Between 1982 and 1983, advertisers began dipping their toes into the gaming industry. Companies began producing what were called "advergames" which were distributed via mail-order for the Atari 2600. One of the most famous games was titled *Tooth Protector* and was distributed by Johnson & Johnson. Armed with a toothbrush, floss, and mouthwash, the player controlled the protagonist named the Tooth Protector. The goal of the game was to protect the teeth from sugar cubes dropped by the antagonist called the Snack Attacker. The manual read: "The game ends if [three] teeth disappear or if [three] T.P.s are carried away and eliminated by the Snack Attackers. When you are successful in protecting the teeth, valuable points will be accumulated, and there will be no end to the fun you can have!"⁷

Finally, a more contemporary example of dentistry's influence in interactive media is seen in the recently released mobile application *Pokémon Smile*, published by The

⁷Ilya Vedrashko, "Advertising in Computer Games" MS. Thesis, United States: Massachusetts: Massachusetts Institute of Technology, 2006, 39.

⁸"Pokémon Smile," The Pokémon Company, accessed August 4, 2020, <https://smile.pokemon.com/en-us/>.



Figure 5: “Fluoridation: Public Health Victory,” display installed in *Your Spitting Image*, photographed May 2020, courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.



Figure 6.1: “Forensic Sound Bites,” display installed in *Your Spitting Image*, photographed May 2020, courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.

Criminology and dentistry have worked in tandem for decades. “Forensic odontology is a branch of dentistry which deals with the proper handling and examination of dental evidence and the proper evaluation and presentation of dental findings in the interest of justice.”⁹ The NMD recounts the history of this practice in a series of displays, as a part of their exhibition *Your Spitting Image* (Figs. 6.1-6.7). These displays describe the various tools, methods, and processes that forensic odontologists utilize in their daily practice, such as the use of radiographs. These exhibits explore how dentistry is used to identify DNA, missing persons, and mystery bite marks. They also teach the visitor how dentistry is used in forensic anthropology, and to identify victims in mass disasters such as plane crashes. Art history, criminology, pop culture, and advertising are just some of the aspects of the history of dentistry that are explored within the NMD’s collection and exhibitions. The digital version of the collection will provide another platform to explore these and the many other facets of dental history.

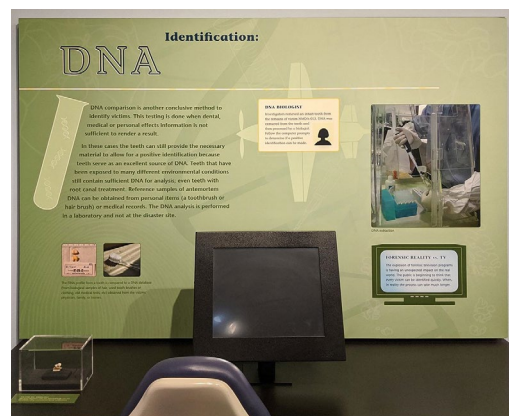


Figure 6.2: “Identification: DNA,” display installed in *Your Spitting Image*, photographed May 2020, courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.

9. Kewal Krishan, Tanuj Kanchan, and Arun K. Garg, “Dental Evidence in Forensic Identification - An Overview, Methodology and Present Status,” *The Open Dentistry Journal*, (online: July 31, 2015), 250, <https://doi.org/10.2174/1874210601509010250>; Quoted in A.D. Goldman, “The scope of forensic dentistry,” in *Outline of Forensic Dentistry*, ed. J.A. Cottone, S.M. Standish (Chicago: Yearbook Medical Publishers, 1982), 15-19.

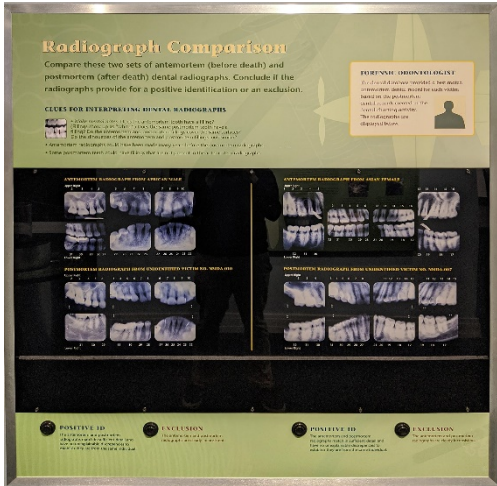


Figure 6.3: “Radiograph Comparison,” display installed in *Your Spitting Image*, photographed May 2020, courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.

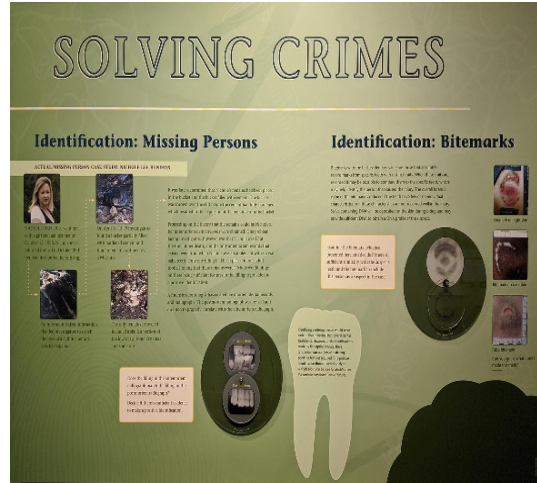


Figure 6.4: “Solving Crimes,” display installed in *Your Spitting Image*, photographed May 2020, courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.

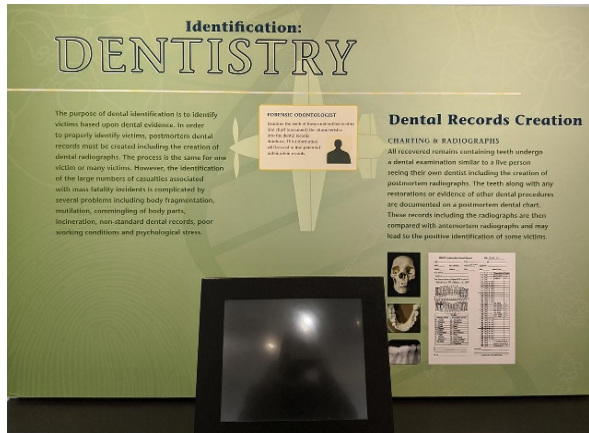


Figure 6.5: “Identification: Dentistry,” display installed in *Your Spitting Image*, photographed May 2020, courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.

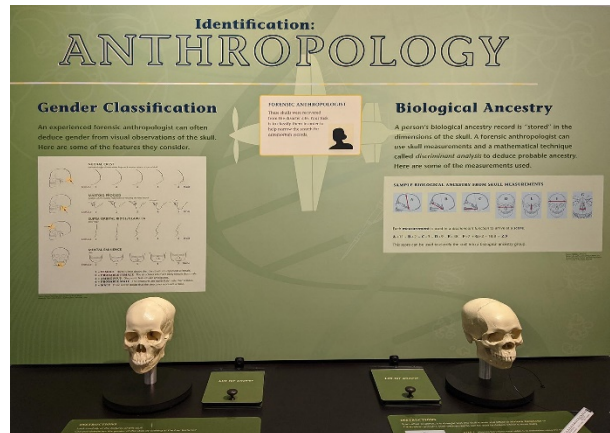


Figure 6.6: “Identification: Anthropology,” display installed in *Your Spitting Image*, photographed May 2020, courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.

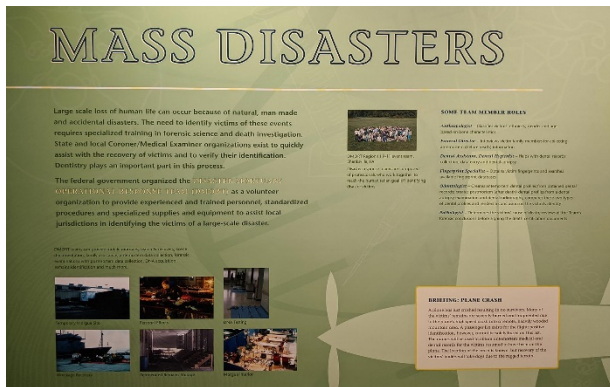


Figure 6.7: “Mass Disasters,” display installed in *Your Spitting Image*, photographed May 2020, courtesy of The Dr. Samuel D. Harris National Museum of Dentistry.

History of Dentistry in Dental Education

To understand why dental history collections and the development of an open access collection database at the NMD are important, a brief survey of how dental history has been treated in dental education throughout the United States is necessary. The history of dentistry as it has been taught in dental school is a topic that few scholars have directly researched so there are no comprehensive surveys of the subject. Nevertheless, this history is available if someone is willing to do the detective work to piece it together.¹⁰ Dr. Stanton D. Harn, curator of the University of Nebraska Medical Center Dental Museum (UNMCDM) stated that “many students come to dentistry and they don’t know the first thing about the history of dentistry and so at many dental colleges if you go back 40 years ago . . . just about every dental college had a course in their curriculum called The History of Dentistry. When time crunches came to dental curricula [the History of Dentistry] was the first thing that [was cut from that curricula].”¹¹

Due to the lack of scholarship on this topic, I conducted two interviews. The first interview was with Dr. Andrew I. Spielman, President of the American Academy of the History of Dentistry and Professor at New York University College of Dentistry (NYU), and the other with Dr. Scott Swank, curator of the NMD and Assistant Clinical Professor at the Baltimore College of Dental Surgery in the Dental School at the University of Maryland, Baltimore (UMSOD). Drs. Spielman and Swank were asked about their thoughts on the state of the history of dentistry in dental education. These interviews were conducted to provide context as to why, out of the 65 dental schools in the United States, only four noticeably advertise the history of dentistry as a part of the listed curricula on their website or have an active dental history scholar (these four are NYU, UMSOD, The University of the Pacific, and the University of Loma Linda).

Dr. Spielman could not say with certainty or vouch for other dental schools, but as far as he was aware, his course was one of the few offered by US dental schools.¹² At the NYU College of Dentistry, dentistry’s history was taught by three different professors over 91 years; more recently, however, it has been relegated to an elective course.¹³ This is also true for Dr. Swank’s course at UMSOD.¹⁴ It is tradition to teach dental history at UMSOD; according to Dr. Swank, it would be “a bit incongruous for the first dental college in the world not to provide a course on dental history.”¹⁵ The curriculum was required and taught in the mid-1980s by Dr. Gardner Foley, but eventually was made optional and the responsibility of teaching was pushed onto the NMD staff after Dr. Foley’s retirement.¹⁶ In Dr. Swank’s twenty years of teaching, another school, Indiana University–Purdue

¹⁰The survey that this article presents is by no means “complete.” More research needs to be completed; however, the research provided in this article is the most comprehensive study that has been attempted to date.

¹¹Stanton D. Harn, interview by the University of Nebraska Medical Center Dental Museum, *University of Nebraska Medical Center*, accessed May 17, 2020, <https://www.unmc.edu/dentistry/about/museum/index.html>.

¹²Andrew I. Spielman, email interview by Chase A. Van Tilburg, June 3, 2020. One must note that neither Dr. Spielman nor Dr. Swank have a record of every university program that has taught the history of dentistry. This is because no other historians or dental scholars have specifically investigated the current state of dental history in contemporary curricula across the United States.

¹³These professors were Dr. Bernhard Weinberger from 1929-1933, then Dr. Alfred Asgis during and after World War II, then finally for the past seventeen years, Dr. Spielman.

¹⁴“Dr. Samuel D. Harris”, University of Maryland, Samuel D. Harris National Museum of Dentistry, accessed, June 11, 2020, <https://www.dental.umaryland.edu/museum/about-us/history/dr-samuel-d-harris/>. The Baltimore College of Dental Surgery is the first dental college in the world. The institution was founded in 1840 by Chaplin A. Harris and Horace H. Hayden, which later merged with the University of Maryland School of Dentistry to become the Baltimore College of Dental Surgery, Dental School, University of Maryland, Baltimore (UMSOD).

¹⁵Scott Swank, email interview by Chase A. Van Tilburg, June 11, 2020.

¹⁶Dental history scholars view this as an unfortunate side effect of there being a limited number of people who are knowledgeable enough to teach dental history; this number diminishes each year across the United States.

University Indianapolis (IUPI) dropped their dental history curricula completely. In both interviews, the consensus between Drs. Spielman and Swank was that most institutions, if they lack a dedicated faculty member, establish small dental museums that highlight the history of dentistry but do not offer a dedicated course on the subject. Both scholars addressed the reason for this: the Commission on Dental Accreditation does not list the history of dentistry as a requirement for dental schools. This in turn causes the historical curricula to be pushed to the wayside.¹⁷

Reasons this subject is not prioritized include: a lack of qualified personnel to teach the subject; governing bodies' agnostic attitudes towards the subject's importance to a well-rounded dental education; and students and dental professionals not having the ability, access, opportunity, or encouragement from their superiors to seek out and learn about the history of their profession. The creation of an open-access digital dental collection would help to generate excitement around the history of dentistry and highlight its educational value. This disregard for dental history has negative side effects that Dr. Spielman was quick to identify. He has observed a tendency for dental practices to produce blogs and pages on their websites which situate their practice within the timeline of the history of dentistry. Practices do this to establish how advanced they are and thereby enhance their credibility and worth to prospective patients. This is problematic because these blogs are often poorly researched, filled with inaccuracies, and do not utilize primary source materials. A proper course in the history of dentistry during their education would help to prevent the spread of misinformation.¹⁸ It is understandable that due to the debt incurred due to dental school, the need to make money becomes their primary focus after graduating.¹⁹ However, if dental professionals are going to situate themselves within the history of dentistry to increase their gains, then they need to be properly educated and informed about the history of their discipline. Dental professionals having access to digital dental collections would allow them to become more informed and further prevent the spread of misinformation.

Another negative side effect of disregarding the history of dentistry is the loss of dental artifacts, as is the case with Harvard's lost dental museum. Only one document describes this lost museum's holdings, the 1937 catalog of the Harvard Dental School:

The Dental Museum has been organized to illustrate the growth of dentistry as an art and a science. The evolution of dental practice is portrayed by collections of instruments, appliances, and pathologic specimens, dating from the early days up to the present time. Specimens of human and comparative anatomy, normal and pathologic, have been assembled for teaching purposes and study. Models for comparative studies of the mouth of civilized and primitive peoples are among the Museum's valuable specimens. . . Of especial interest is the Kazanjian Collection of facial casts and appliances, showing the reconstructive surgery and prosthesis performed on wounded soldiers by V. H. Kazanjian, D.M.D. '05, during the World War.²⁰

¹⁷Other attempts have been made to provide dental history resources by organizations such as the American College of Dentists. In approximately 2008-2009, the American College of Dentists assembled a series of DVD lectures on the history of dentistry to disperse them to dental colleges across the nation. This effort did not catch on and the DVDs were not widely used. Scott Swank, email interview by Chase A. Van Tilburg, June 11, 2020.

¹⁸Andrew I. Spielman, email interview by Chase A. Van Tilburg, June 3, 2020.

¹⁹Scott Swank, email interview by Chase A. Van Tilburg, June 11, 2020.

²⁰Among this collection, there were also plaster reproductions of teeth from indigenous peoples from the Yucatan Peninsula, the Northern coast of Labrador, Baffin Land, and Etah. "Decay," Harvard University, Center for the History of Medicine at Countway Library, accessed June 29, 2020, <http://collections.countway.harvard.edu/onview/exhibits/show/lost-museum/decay>.

In response to criticism by museum professionals regarding the disorganization of the dental museum at the time, Dean Leroy Miner expressed the desire to reorganize the dental museum in preparation for Harvard's tercentenary. Miner commissioned Arthur Loveridge, Curator of Harvard's Museum of Comparative Zoology, to take three months and reorganize the museum. This reorganization had consequences, and many specimens were lost when they were moved to other museums at Harvard. Moreover, due to many university policy changes, the curator of the dental museum at the time, Adelbert Fernald, retired. Because of other management policy changes, a new curator would not be appointed until 1937. This was short-lived because "the expansion of the Department of Oral Medicine which was started [in 1936] has been so rapid that we were obliged to take over the space occupied by the Museum."²¹ None of the catalogs in the years after list a curator and the last record of a museum committee is mentioned in the 1940 edition of the catalog.

By the 1940s, the dental school was renamed, and a greater emphasis was put on research that would drive the field forward. As such, "the Dental Museum became a casualty of the growth and changing nature of dental education at Harvard."²² James Morse Dunning described this, saying that while parts of the collection were installed throughout the new facilities, "a good deal of other exhibit material had disappeared forever."²³ Artifacts from the Harvard Dental Museum were lost because of an organizational shift of priorities and a disregard for history. This lost museum serves as a cautionary tale as to how easy it is to lose history, and identifies the necessity for creating digital dental artifact databases now that such a task is technologically possible.

A database specifically designed to track and maintain records and surviving objects from the lost museum has not been created yet. However, there is promise in how digital infrastructure can be used to recreate lost collections or, at the very least, attempt to fill gaps in collections where accession documentation may be thin. Harvard University's Center for the History of Medicine at Countway Library has done a considerable job in creating an online exhibit titled *Harvard's Lost Dental Museum*. The online exhibit compiles the surviving historiographic information about this museum and what remains of the collection. If recreating the physical space where the lost museum once existed is not an option, then there is value in recreating the museum in a virtual environment. The virtual museum can become an educational resource in and of itself that is worth maintaining, even if only to further enrich documentation of Harvard's already rich history.

The Need to Generate Interest in Dental History

The need to generate interest in and greater appreciation of the history of dentistry in dental education is one reason to create relevant databases. Another reason is that in the long term, databases can benefit many demographics, not just dental professionals. A well-kept smile is a contemporary privilege that can be taken for granted. An open-access dental history database serves as a space to teach or remind the viewer how relatively young contemporary dental practices are, via the juxtaposition of objects from outdated dental practices. This can further incentivize the public to maintain their oral care. The history of dentistry describes a multi-ethnic, cross-cultural narrative of humanity that is unique and must be valued because without understanding where one came from, one cannot appreciate where they are going. The NMD's website states that the museum:

Celebrate[s] the past, present, and future of dentistry. . . [Their] exhibitions, programming, and collections capture the often-overlooked history hidden behind [the visitor's] smile and

²¹"Decay," Harvard University, Center for the History of Medicine at Countway Library, accessed June 29, 2020.

²²"--And Restoration", Harvard University, Center for the History of Medicine at Countway Library, accessed June 29, 2020, <http://collections.countway.harvard.edu/onview/exhibits/show/lost-museum/decay/--and-restoration->.

²³Ibid.

the scientists, tradesmen, and professionals that have shaped the field throughout history. The NMD's extensive 40,000 object collection of dental instruments and equipment, pop culture, personal oral care items, and artwork . . . is one of the largest and oldest collections in the world related to dentistry. [This is] one of the reasons [the United States] Congress designated the museum as the official museum of the dental profession in the United States.²⁴

The NMD's mission is to “inspire healthy choices about oral health by creating and sharing learning opportunities that celebrate the heritage and future of dentistry, the achievements of dental professionals, and the importance of oral health in a healthy life.”²⁵ Due to the sheer expansiveness of their collection and their national position, the NMD is the ideal institution to house a truly open-access digital database of dental history and is working towards digitizing and providing access to its collections. Examining online databases hosted by other institutions helps to identify answers to key questions such as: what constitutes a dental history collection; why has there been a tendency to hide dental history behind paywalls, memberships, or require tuition and employment; and finally, how can dental history collections be made accessible and utilized in public education moving forward?

What Is a Dental History Collection?

What exactly constitutes a dental history collection? Moreover, how does an institution determine what qualifies as “dental history?” Determining this is vital because there is no set definition. Does a dental collection only encompass dental equipment from generations past or does it include personal items of dentists that may have not been directly related to dentistry? Would it include intact human and animal skulls or taxidermy with intact mouths and jaws? Or rather, should a collection only hold specimens that are unique to dentistry that showcase dental work? Should it include business ephemera or historical dental records? Evaluating these questions and finding answers to them is necessary when establishing an online dental collection. These answers are found by comparing various physical and digital “dental collections” at other institutions. The NMD, the NYU Weinberger Rare Book Collection, the University of Nebraska Medical Center Dental Museum, the American Academy of the History of Dentistry's collection database, American Dental Association (ADA) Library and Archives, and finally Temple University's Kornberg School of Dentistry Historical Dental Museum Collection were chosen for the following comparative analysis.

To answer the question about what should be collected, dental history professionals agree that any object, document, image, icon, instrument, or antique which is dentally related is considered a part of the history of dentistry and can be collected if deemed necessary. In comparing these institutions' collections, the NMD and the UNMCDM are the most similar. Both collections hold various amounts of antique dental equipment and instruments, dating back to the 1800s. Objects such as dental chairs, engines, and cabinets can be found in both collections. Moreover, both collections hold antique bottles and containers which once contained various medications or chemicals used in dental operations. The NMD also houses a substantial library of dental related books, journals, manuscripts, letters, notes, and photographs. Like the NMD, the NYU Weinberger Rare Book Collection is unique – this collection houses approximately 1000 volumes of Dr. Bernhard Weinberger's (1885-1960) 5000 volume collection. In 1931 the *Dental Survey* published an article stating that the collection was “the most complete orthodontic, rare books, historical and

²⁴“About Us,” University of Maryland, Samuel D. Harris National Museum of Dentistry, accessed June 11, 2020, <https://www.dental.umaryland.edu/museum/about-us/>.

²⁵Ibid.

bibliographic dental library in the world.”²⁶ Based on the research that I have compiled, and after comparing these collections, I believe that any item can be considered dentistry-related if it is deemed historically significant by scholars or institutions who specialize in this history. In terms of bringing these collections into a digital space, what matters most is that the digital space is easily searchable, accessible, and intuitive; otherwise, the collection and its scholarly value will not be easily taken advantage of.

Online Collection Analysis

The term “open access” is defined as “a set of principles and a range of practices through which research outputs are distributed online, free of cost or other access barriers.”²⁷ While this definition becomes more antiquated each year, the foundational principle this definition describes remains true to this day. Generally, a decade ago, the idea of a truly open access resource and the legality behind it were difficult to consider. However, since this initial definition was conceived, due to rapid development of technology, cultural and academic institutions have taken great leaps forward in identifying what an open access resource is. If someone says, “Make it open access!” what do they mean? Many questions arise, such as open access to whom? What information needs to be open access? Who will maintain this information? Then, the million-dollar question, who will pay to have this content maintained?

Just because something is “open access” does not mean that the content is inherently free. Nothing is free. Someone is undertaking transactions to make this content available, whether that be the institution paying hosting fees, or the librarian who is paid to spend their time digitizing the resource. Considering this, can anything ever be truly open access? The answer is yes, in theory. One should note that the answer to this million-dollar question will not be found in this article. However, this article does suggest the next steps for developing a truly open access database. For a repository or collection database to be truly open access, *universal design* must be included from its conception. Sina Bahram defines universal design as including “the considerations [someone] make[s] upfront in any project, physical or digital, that allow all users an equitable experience, regardless of any differences in ability.”²⁸ Thus, a database or a service falls within the Open Access movement when they assume a broad audience and use a universal design that accounts for individuals with disabilities.²⁹

²⁶“Bernhard Weinberger Rare Book Collection,” New York University College of Dentistry, accessed July 7, 2020, <https://dental.nyu.edu/aboutus/rare-book-collection.html>.

²⁷Peter Suber, “Open Access Overview,” Web Archive, first posted online June 21, 2004, last revised December 5, 2015, <https://web.archive.org/web/20070519103647/http://www.earlham.edu/~peters/fos/overview.htm>.

²⁸Sina Bahram, “Make Your Website Accessible Before You Are Forced To,” *Museum July/August*, American Association of Museums, 2016, 18.

²⁹Jay Dolmage, “OPEN ACCESS(IBILITY?),” In *Circulation, Writing, and Rhetoric*, eds. Gries Laurie E. and Brooke Collin Gifford, (Logan: University Press of Colorado, 2018), 273-74.

If the NMD is to create a successful online dental database, looking at what other online repositories have done is an important first step. Doing so allows one to evaluate what best practices they want to implement and expand upon within their database. Moreover, thinking about the basics of database design while evaluating what others have done is vital. The analysis put forth here will outline a simple set of criteria to open a discussion regarding what makes a database effective. This is not to suggest that the criteria put forth in this article are “the end all be all” of what makes a database effective. The very idea of effectiveness is circumstantial and dictated by what the database is intended to record, maintain, and make accessible. The goal of this analysis is to use selected criteria to evaluate and outline what other dental databases have done successfully so as to not reinvent the wheel since there is presently no literature that directly engages with dental history databases.

When evaluating a database or an online catalog there are three levels that one can evaluate. The Getty Foundation provides a useful analysis for determining these three basic levels that make up an online catalog in their *2017 Online Scholarly Catalogue Initiative Report*. Their description is also applicable to databases. In short, an online catalog (or database, in terms of this analysis) is made up of three levels that come together. First is the base, which consists of all the background metadata that is stored for each object in a collection. Second, the content management system, which

manages the objects in a collection and their metadata. Finally, the third level is the web interface on which stored content is presented to and interacted with by the user.³⁰

This article’s analysis focuses on this third level. The web interface of each dental museum and library database is evaluated on three basic criteria: (1) Legibility: How do the database and the presented content read? Can the information presented be followed by a broad audience? (2) Content interconnectivity: How well does the presented information interconnect and build off each other, if at all? (3) Web flow: How intuitive is the web interface? Does the design imply that prior experience with academic databases is required to know how to navigate the interface? Moreover, does the web interface follow universal or inclusive

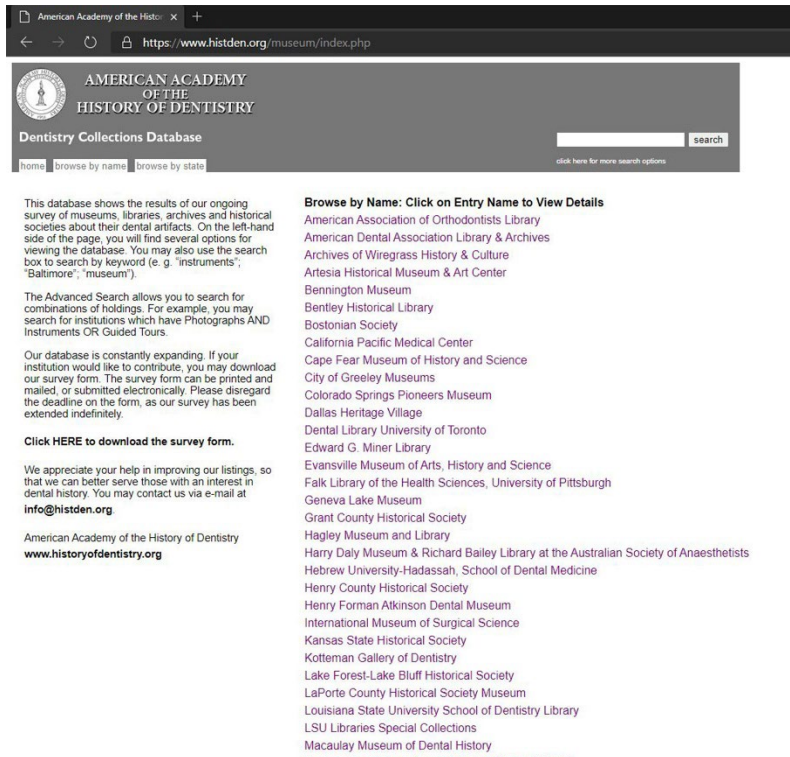


Figure 7: Screenshot of the American Academy of the History of Dentistry Dental History Collection Database, Screenshot courtesy of the American Academy of the History of Dentistry, July 16, 2020, <https://www.histden.org/museum/>.

³⁰The Getty Foundation, “Three Approaches to Online Catalogues,” in *Museum Catalogues in the Digital Age: A Final Report on the Getty Foundation’s Online Scholarly Catalogue Initiative (OSCI)*, published by the Getty Foundation, 2017, <https://www.getty.edu/publications/osci-report/three-approaches/>.

design? There is no perfect online digital database since improvements can always be made; however, if the NMD is to introduce their collections and resources to an online space, the flow of information and the user interface must be easy to follow.

The American Academy of the History of Dentistry (AADH) offers an excellent example of a database that was updated and redesigned to offer a more user-friendly experience. The AADH offers a collection database that provides a list of every dental history collection, archive, and database that has self-reported to the AADH. The database provides links to approximately eighty-five museums and academic institutions with dental history collections (Fig. 7). This online database serves the general purposes that it was designed for. However, various links needed to be updated and the overall design of the database needs to be worked on to further accommodate individuals with disabilities. Much of the text was listed too close together, making it difficult to read.

The AADH and the U.S. National Library of Medicine (NLM) have since established an updated version of this collection database. The new database builds on the former, introducing necessary improvements that make the database more accessible than its predecessor. The new database is significantly more fleshed out – each listed collection has an abstract and descriptions of those collections holdings included with the listing. The user is also able to easily refine their search based on various criteria, such as organization type, state or province, country, collection subject strengths, and organization name. Above all, the layout and design of the interface are much more fleshed out, making it simpler to read and follow along (fig. 8). In compliance with the Americans with Disabilities Act, the NLM assists with all areas of their website for researchers with disabilities.³¹ The NLM collection database is an excellent example for how a database should

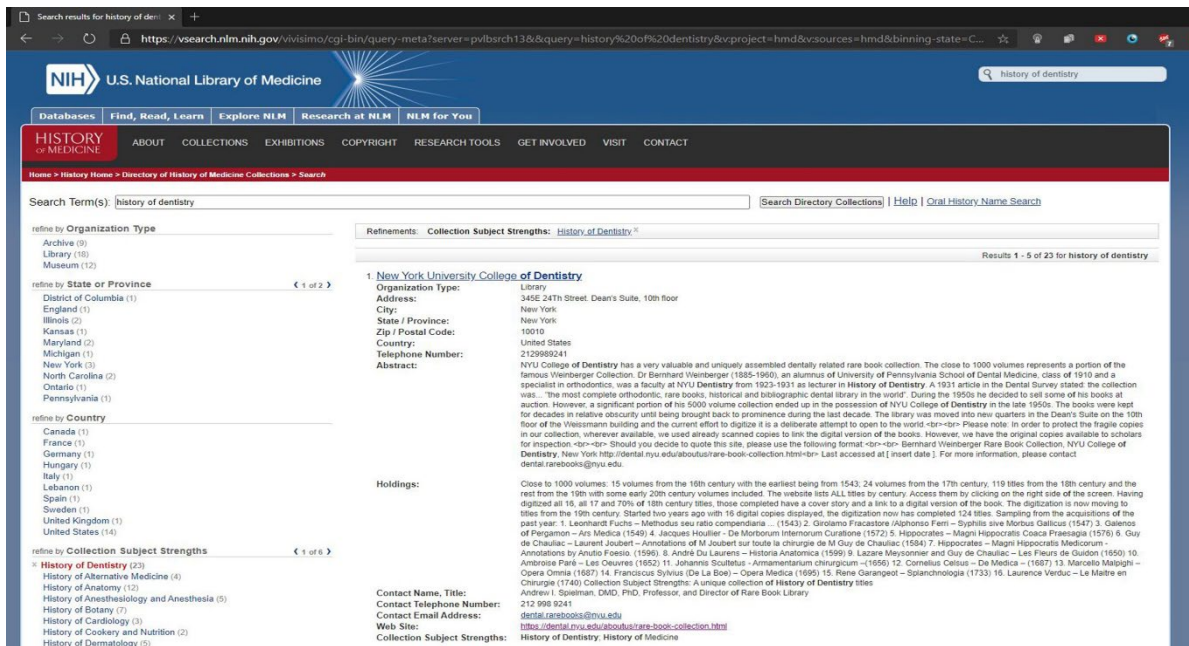


Figure 8: Screenshot of the U.S. National Library of Medicine Dental History Collection Database, Screenshot Courtesy of the History of Medicine Division at the U.S. National Library of Medicine, July 16, 2020, <https://vsearch.nlm.nih.gov/vivisimo/cgi-bin/query-meta?server=pvlbrsch13&&query=history%20of%20dentistry&v:project=hmd&v:sources=hmd&binning-state=Collection-Subject-Strengths%3d%3dHistory%20of%20Dentistry&>.

³¹“National Library of Medicine Accessibility,” U.S. National Library of Medicine, last modified November 19, 2015, <https://www.nlm.nih.gov/accessibility.html>.

organize and deliver text-based information as it works similarly to other academic databases, such as JSTOR.

While it is not primarily a dental history database, the American Dental Association (ADA) Library and Archives provides another great example of how to direct the flow of information in an online space. The website provides an extensive list of academic databases about dentistry that students, dental professionals, and researchers can access if they are a member of an institution or the American Dental Organization. Direct links are provided with each listing. The website does fall short in that it does not provide a link to the AADH collection database, the NYU Weinberger Rare Book Collection, the NMD's website, or other online repositories that focus on the history of dentistry. The ADA Library and Archives do provide a semi-interactive timeline that surveys the development of dentistry since 5000 BC; however, they do not list the sources they cite. They do provide a bibliography for further reading and frequently asked questions about the history of dentistry.

Linking to online dental history collections and resources here would be valuable as it would make their list of dentistry resources more well-rounded. Moreover, in the name of transparency and accessibility, it would be ideal if, under each resource, the website listed whether an institutional login or subscription would be required to access the resource. In summary, the ADA Library and Archives website is a well-organized series of webpages that effectively use navigation menus to make the information simple to locate and the website simple to navigate. Furthermore, the effective use of menus allows easy navigation of the website for those using screen readers, keyboards, and touch screens, or users with fine motor skill difficulties or limited attention or short-term memory to more easily navigate the website.³² In doing so, they serve as a positive example of how to properly

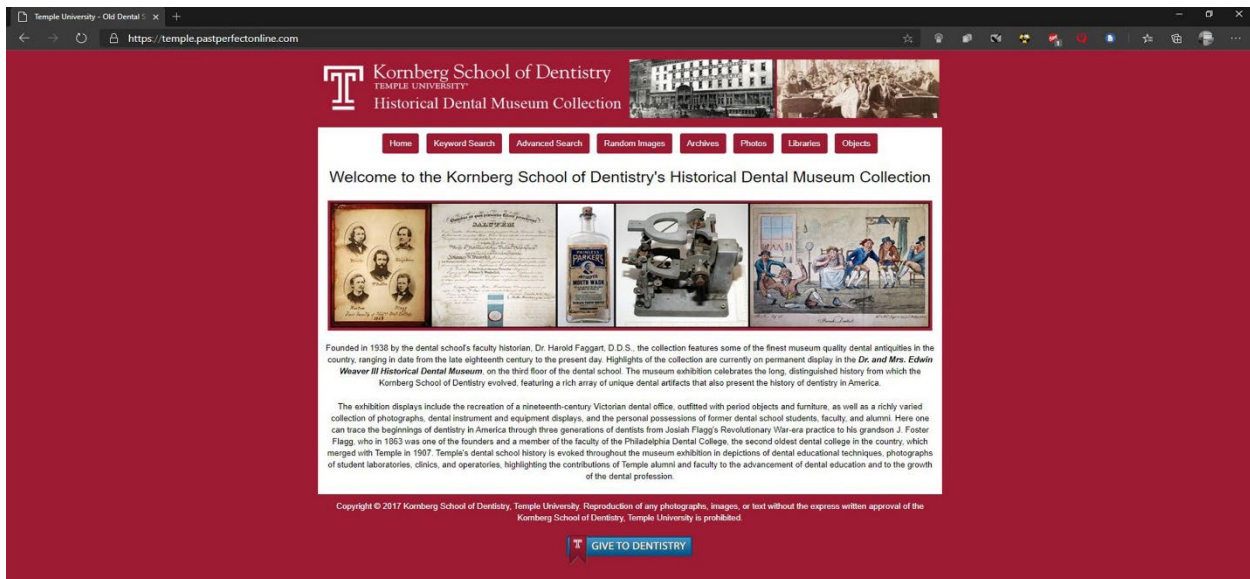


Figure 9: Screenshot of the Temple University Kornberg School of Dentistry Historical Dental Museum Collection Online Database, July 16, 2020, <https://temple.pastperfectonline.com/>.

direct the flow of various forms of information within an online platform.

Another positive example is Temple University's Kornberg School of Dentistry Historical Dental Museum Collection (Fig. 9). This online database provides eight different pages that dictate a

³²Web Accessibility Initiative, "Menu Concepts," *Web Accessibility Tutorials: Guidance on how to create websites that meet WCAG*, accessed August 8, 2020, <https://www.w3.org/WAI/tutorials/menus/>.

different method of searching depending on what one is searching for. Each search option provides clear instructions on how to search and navigate the database. Each entry into the database supplies a corresponding ID or accession number along with standard archival information that could be pertinent for the viewer to know. This database is an excellent example because it is user friendly, its entries are properly supported, and finally, it is completely free to use – no institutional login required nor is the user's access to the information blocked by a paywall. This site provides evidence of a clear method used to organize materials so that the individual histories of those objects support the greater collective narrative of the history of dentistry, takes active measures to maintain the collection free of charge for the public, and employs a user interface for an online collection is functional for the average consumer. Furthermore, these are elements that an online dental history database must retain if it is to be an effective tool for researchers and overcome agnostic attitudes towards the history of dentistry. By looking at these different databases, one is able to see how each institution designed its database to best display the types of information that they are presenting and to best fit their needs.

Uses of Online Collections in Museums

What happens once an “ideal” online dental history collection is created? In what ways can the stewarding institution utilize this new resource? An online database does more than just create a standardized record of the contents of a museum's collection. An online collection becomes an interactive extension of the physical collection serving as a mediator between the viewer and the collection's holdings. By making the digital collection open access, the possibilities of including it within exhibition design, educational materials and programming, and public outreach becomes endless. The Smithsonian's National Museum of American History (NMAH) created an excellent example of an educational and public outreach program that engaged the public with its collections. In 2013, museum curator Katherine Ott in the Division of Medicine and Science instituted a program titled *The Tooth Fairy File*. The children's program takes visitors on a tour of the contents of the museum's many collections in multiple departments. The program is centered around a small box of porcelain teeth that establishes a narrative: the Tooth Fairy, with the help of their tooth-grabbing mouse friend Ratoncito Pérez, stores the teeth they collect from children around the world at the museum.³³ Ott describes the program and the making of the online video accompanying it, saying:

Colleagues from around the museum agreed to deadpan for the camera and show artifacts in their care related to teeth or fairies, to build the case. We saw it as educational yet wacky enough for parents to use the videoed myth to introduce their kids to the material culture of the past. We used real objects and accurate, technical vocabulary: an early 19th-century tooth key used for pulling teeth, a puppet from the early 1930s made by Works Progress Administration artist Donald Cordry, sheet music from the DeVincent collection, a drawer of coins, shells, and other substances used as money, and cartes-de-visite and tintypes of children from the late 1800s. Another intern, Cara Wattanodom, now at Swarthmore College, drew a "Wanted" portrait of the tooth-snatching mouse known throughout Latin America as Ratoncito Perez.³⁴

³³“Opening up the Tooth Fairy File: What does the Tooth Fairy do with all those teeth?”, O SAY CAN YOU SEE? Stories from the Museum, National Museum of American History, February 12, 2013, <https://americanhistory.si.edu/blog/2013/02/opening-up-the-tooth-fairy-file-what-does-the-tooth-fairy-do-with-all-those-teeth.html>

³⁴Ibid.

The program explores just a small part of NMAH's dental collection. Using Flickr, a third-party, online photo archiving and sharing platform, the museum created a photo set of dental objects from their collection. Visitors could then continue to explore other dental artifacts and oddities in the museum's collection after their visit. For future similar educational and exhibition programming at the NMD, the online dental collection proposed here would serve the purposes of the Flickr set in the above example. Following in the footsteps of the NMAH, the NMD could incorporate their new online resource as part of their educational programming, advertising it as a resource for families to continue engaging their children's curiosities.

The creation of an online, open-access digital collection will further enhance the museum visitor experience by presenting the opportunity for the user to actively engage with the collection, whether they are walking among the galleries or seated within the comforts of their home. Moreover, an accessible online database serves as a tool for continuing education after a visitor exits the constructed experience within the museum and re-enters their everyday reality. The online collection becomes a form of outreach that promotes equitable access to the records within it.³⁵ It also protects against human error if something were to happen to the collection or a specific object or document within the collection.³⁶ A museum like the NMD, whose exhibits are actively on rotation, can only highlight a small number of the different facets of the history of dentistry at a time; an online database would offer an extended platform for the museum to explore how the objects in their collection interrelate and support the larger, multifaceted, historical narrative.

What does it mean for an object's individual history to support a greater collective narrative within a virtual space? Consider Dr. Elisa Giaccardi's ideas about the term "virtual." She states that "the term 'virtual' is often associated with the idea of [the] duplication of a [specific] reality."³⁷ Museums collect pieces of history because those pieces are considered significant. Those pieces find a new home at the museum where their relationships with their contexts of origin (i.e. the reality of those objects) are duplicated and thus museums become inherently virtual. This virtuality then extends into the objects themselves because they "present the ambiguity of being physically tangible as a museum piece, but are also. . . subject to change according to the different perspectives in which they can be interpreted and displayed."³⁸

Dr. Giaccardi quotes Benedetto Benedetti, who argued that "cultural objects represent a multifaceted reality in which physical, cultural, and virtual reality interact and may acquire different functions and different degrees of importance."³⁹ One can infer then, for similar reasons, that digitization is an act of virtualization. By picking an object from the museum's collection, the selector has determined that the object and its individual history holds significance and should be made available online. That object or document is then scanned or photographed, duplicating it into a new digital reality where its relationship to the world becomes exposed to an infinite number of new perspectives. Just as the physical counterpart is incorporated within a greater exhibition narrative when displayed, the digital record and its history become a moving cog within the greater

³⁵Lora J. Davis, "Providing Virtual Services to All: A Mixed-Method Analysis of the Website Accessibility of Philadelphia Area Consortium of Special Collections Libraries (PACSCL) Member Repositories," *The American Archivist* 75, no. 1 (2012), 45.

³⁶One should note that an online record is not necessarily permanent, and one must take actions to preserve digital data and protect the infrastructure the data is stored on.

³⁷Elisa Giaccardi, "Collective Storytelling and Social Creativity in the Virtual Museum: A Case Study," *Design Issues* 22, no. 3 (2006): 29.

³⁸Ibid.

³⁹Benedetto Benedetti, "Virtuality and Reality in Enterprise's Museum, Art Museum, Archeological Sites," *Quaderni della Fondazione Piaggio, Nuova Serie: Cultura Europea e Musei* 6, no. 1 (April 2002), 56; quoted in Elisa Giaccardi, "Collective Storytelling and Social Creativity in the Virtual Museum: A Case Study," *Design Issues* 22, no. 3 (2006), 30.

narrative that the database is documenting. The digital record can then be interpreted and function differently depending on how it interrelates with other objects under the overarching narrative. In this sense, the digital objects and records become supporting agents of that greater collective narrative. Dr. Barbara Kirshenblatt-Gimblett advocates that “the task is to sustain the whole system as a living entity and [to] not just collect ‘intangible artifacts.’”⁴⁰ In other words, “the focus should not be on only the archive [or database,] but on the whole ‘repertoire’ . . .”⁴¹ The “whole repertoire” becomes the collective history that the objects within the database tell. The multifaceted history of dentistry and the vast array of objects and documents which fall within this history are particularly ideal for creating a database in which the objects support one another.

Conclusion

The history of dentistry describes a significant narrative of human history that needs to be shared. The multifaceted nature of the history of dentistry and the contents of dental collections present a unique opportunity for the NMD and similar institutions to showcase how relevant and interconnected dentistry is to the lives of their visitors. The NMD presents itself as a natural history museum but quickly takes on the qualities of other genres of museums to engage the visitor within a larger historical narrative around teeth and the profession that cares for them. Due to their national position, the NMD holds the unique ability to reimagine what the “ideal” digital dental history database would or should look like. By factoring universal design into their database and borrowing inspiration from what other dental history institutions have accomplished, the NMD will take giant steps forward in establishing new expectations of what an open access platform looks like for dental history.

Moreover, the NMD can explore how such an asset can be used to revive the importance of the history of dentistry in dental education and instill a greater appreciation for the dental profession in society. Furthermore, making the collection more readily available to dental professionals will help prevent the spread of misinformation within online blogs published by private practices since the online collection can serve as a go-to resource for accessing both primary and secondary resources on the history of dentistry. The database serves as an excellent playground to experiment with how each of the individual historical narratives of the various objects and documents within come together to support a greater collective narrative within an online space. While the preservation of digital objects themselves does present challenges, the virtualization and presentation of the physical objects and documents will assist in maintaining and keeping an ongoing record of the history of dentistry for generations to come.

⁴⁰Barbara Kirshenblatt-Gimblett, "Intangible Heritage as Metacultural Production," *Museum International* 56, no.1-2 (2004), 53

⁴¹Giaccardi, "Collective Storytelling," 41.

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