Chapter I

The Beginnings of Military Dentistry, 1617–1860

Introduction

After European armies adopted firearms, soldiers used their teeth to bite open gunpowder tubes and later paper cartridges, making dental health essential to performing infantry duties until after the American Civil War. Despite this requirement for healthy teeth, dentistry was a neglected aspect of military medicine. Armies expected medical surgeons to provide needed dental care until February 1901, when Congress authorized the US Army's Medical Department to hire 30 contract dental surgeons.[1]

The earliest recorded acknowledgement of the dental needs of British soldiers occurred in 1617, when John Woodall, the surgeon general of the East India Company, listed the contents of the typical company surgeon's medical chest in his *Surgion's* [*sic*] *Mate*. This chest was the first military dental supply issued in any army, and it soon became the standard for the British. In 1626 King Charles I authorized it as a "free issue" to surgeons who joined his expeditionary forces against France. Included in the chest were the following eight dental instruments for the scaling and extraction of teeth: paces (crown forceps), pullicans (dislocating forceps), forcers (elevators), punches (chisels), crowes bills (root forceps), flegmes (periosteal elevators), gravers (scalers), and small files. The instruments were described and illustrated in Woodall's *Viaticum, Being the Pathway to the Surgeon's Chest* (1617), in which he states:

> All these recited instruments, and each of them, are needfull in the surgeons chest, and cannot bee well forborne for the drawing of teeth, forasmuch as the cleansing of the teeth and gums, and the letting of the gums' bloud are often no small things for keeping men in health, and sometimes doe save the lives of men both at sea and land. For we see that from an Apostume begun under a rotten or hollow tooth, for want of drawing of the same, sometimes proceedeth great swellings in the face, or in the Amygdals and throat, and the party is suffocated and dieth.[2(p149)]

In this early army, the surgeon and his mate were completely responsible for the soldiers' dental care, including both preventive and surgical procedures.

The Soldiers' Teeth: Biting the Cartridge

Before the formation of a standing British army in 1660, soldiers and their accompanying medical staff were "raised under a system of contract for the duration"

of the campaign, meaning that soldiers were selected for the various arms of the period according to their physiques. Each infantry company was allowed a surgeon and his apprentice mate. The surgeon received an additional 2 pence a month pay per patient for furnishing his own instrument chest.[2]

The standard infantry unit in the early 17th century British army was the company, which consisted of 100 to 300 men. One-third of these soldiers were pikemen, who each carried an 18-foot, metal-tipped pike, and the rest were musketeers. The musketeers carried bandoliers, which were suspended from a shoulder strap and contained gunpowder charges in 4-inch wooden tubes. To load the gunpowder into the musket barrel, it was necessary to remove the tube cap; the easiest way to do this was to use the front teeth to pull it off, making the incisors and canines essential. On the command, "open them with your teeth," the musketeer brought the charge to his mouth and pulled off the cap with his teeth and thumb. At "charge with powder," he brought the charge to the musket's muzzle, turned it up, and poured the powder down the barrel.[2]

Grenadiers, introduced in 1678, were required to have sufficient incisor and canine teeth to bite open the fuse of a grenade. At the command "open your fuse," the grenadier brought the grenade to his mouth, counted to two, and opened the fuse with his teeth.[2]

Pikemen largely disappeared from the military by the end of the 17th century because of the introduction of the bayonet. The paper cartridge, which combined the bullet and powder, replaced the bandoleer tubes. Now the infantryman simply bit the cartridge. At the command "handle cartridge," the soldier drew the cartridge from his box, brought it to his mouth, and bit off the top.[2,3]

At this time, dental standards began appearing in European armies. Although intentionally removing the front teeth of a man of military age, rendering him unfit for military service, was a punishable offense, for some the prospect of war was worth the risk. French conscripts frequently resorted to self-mutilation by filing off their incisors below the gum, destroying them with acid, or extracting them. Other drafted soldiers tried to destroy their teeth with caustics and simulate "sponginess of the gums"—a symptom of scurvy. As a result, medical examiners had to "pass the finger along the jaw" prior to granting an exemption from service because of tooth loss.[4]

In the Continental Army of the Revolutionary War (1775–1783), Baron Friedrich von Steuben's 1778 drill manual described the technique of loading the flintlock musket in one motion under the title "Handle Cartridge":

> Bring your right hand short round to your pouch, flapping it hard, seize the cartridge, and bring it with a quick motion to your mouth, bite the top off down to the powder, covering it instantly with your thumb, and bring the hand as low as the chin, with the elbow down.[5(p18)]

Soldiers needed to possess teeth capable of performing such techniques until the mid 19th century in Europe and after the Civil War in America, when the pin-firing mechanism and the metallic cartridge were introduced in infantry firearms. This advancement in firearms technology ended the need for soldiers to use their teeth to load weapons.[3,6]

Public Toothdrawer.
Reproduced from: http://wwwihm.nlm.nih.gov/ihm/images/A/21/200.jpg.
Courtesy of the National Library of Medicine.

Toothpuller.
Reproduced from: http://wwwihm.nlm.nih.gov/ihm/images/A/23/993.jpg.
Courtesy of the National Library of Medicine.

The Revolutionary War and After: The French Dentists

Despite the relative indifference of the British and American militaries to dental care, civilian dentistry continued to develop in the 18th century, thanks largely to the efforts of the Frenchman Pierre Fauchard (1678–1761). Fauchard established dentistry as a medical field rather than a craft, promoting the growth of professionalism among its practitioners. In 1728 he published *The Surgeon Dentist, or Treatise on the Teeth*, which was translated into English and German in several editions and set the standard for dental scholarship. Throughout his long career, he shared his knowledge generously, inspiring other practitioners to publish their dental care and oral surgery discoveries. His influence assured standards of learning and performance, which led to mandatory dental training for French military surgeons.[7,8]

A French naval surgeon, James (Jacques) Gardette (1756–1831), was probably the first medically trained dentist to arrive in the United States, and the first to treat American military personnel on a regular basis. Born on August 13, 1756, in Agen, France, he began studying medicine in 1773 at the Royal Medical School in Paris. Gardette was instructed by Le Roy de la Faudiniere and Louis Laforgue, both highly respected Parisian dentists, and he also studied the works of Fauchard and Etienne Bourdet. After 2 years of medical school, he spent an 18-month internship at the hospital in Toulouse. He was examined by the French naval board at Bayonne, found qualified, and commissioned a surgeon in the French navy.[9]

Pierre Fauchard, 1786.
Reproduced from: http://wwwihm.nlm.nih.gov/ihm/images/B/08/284.jpg.
Courtesy of the National Library of Medicine.

James (Jacques) Gardette, a French naval surgeon who was the first dentist to treat military personnel on a regular basis. Courtesy of Baltimore College of Dental Surgery.

In October 1777 Gardette, an enthusiastic supporter of the American Revolution, sailed with a group of volunteers bound for Boston aboard the French brig-of-war, *La Barquaize de St Jean de Luz*. During the voyage, Gardette's ship was involved in a conflict with two British warships, and the 21-year-old naval surgeon

helped treat the casualties. After the ship arrived in Plymouth, Massachusetts, in January 1778, Gardette promptly resigned from the French navy and adopted America as his home.[9]

In 1780 when Newport, Rhode Island, became the headquarters of the Comte de Rochambeau's newly arrived 6,000-man French army, Gardette rejoined his countrymen as a civilian dentist. Rochambeau's command contributed substantially to the American victory at Yorktown, but it is not known whether Gardette was present at the battle. However, he was reported to have been with the command during their 1781–1782 winter encampment in Providence, Rhode Island. During that time, he became acquainted with a young American soldier, Josiah Flagg (1763–1816), whom he is thought to have instructed in the art of French dentistry. Flagg became the patriarch of an illustrious line of American dentists.[9,10]

Gardette remained in America after the war, establishing a practice first in New York City and then in Philadelphia in 1784. In late 1795 or early 1796, he made a set of ivory (hippopotamus) dentures for George Washington just before the famous Gilbert Stuart portrait sittings, which took place that spring. When asked about the teeth, Gardette claimed it was "impossible to distinguish them from the natural ones," and that a person could "take them out and fix them again themselves with the greatest ease." However, others disagreed, describing them as "too large and clumsy." In 1859 Rembrandt Peale (1778–1860) stated that Gardette's dentures caused Washington's "mouth to be changed." Stuart said that when he painted Washington, "he had just had a set of false teeth inserted, which accounts for the constrained expression so noticeable about the mouth and lower part of the face." Regardless of the success of Washington's dentures, Gardette can be given credit for introducing the advanced techniques of Fauchard into American dentistry.[11-14] In 1829, at age 73, Gardette returned to France, where he later died from gout.[9]

Another French dentist, Jean Pierre Le Mayeur, also provided dental service in Revolutionary America. Le Mayeur was a London surgeon before he came to America in 1781, and in 1782 he was living in British-occupied New York, where he was well known for his ability to transplant teeth. Le Mayeur became one of the many dentists consulted by George Washington, who held him in high regard and recommended him to the Marquis de Lafayette. Le Mayeur treated Washington at the Army headquarters in New Windsor, New York. Over the next 5 years, Le Mayeur was a frequent visitor to Mount Vernon on both social and professional calls. After settling in Mount Pleasant, Virginia, he became an American citizen in 1789, and died in May 1806.[11,15]

In addition to Gardette and Le Mayeur, other foreign-born dentists arrived in the new nation and established themselves in major American cities. Mostly French or English, these immigrants advertised such services as cleaning, extraction, and replacement. Their advertisements often included thanks to long-term patients, indicating the growing use and acceptance of dentistry by the end of the century. At the same time, the increasing professionalism of dentistry was reflected in the growing amount of literature on dental topics. The English immigrant dentist Richard Cortland Skinner published *A Treatise on the Human Teeth* in 1801—the first American book on a dental topic. A year later, BT Longbotham,

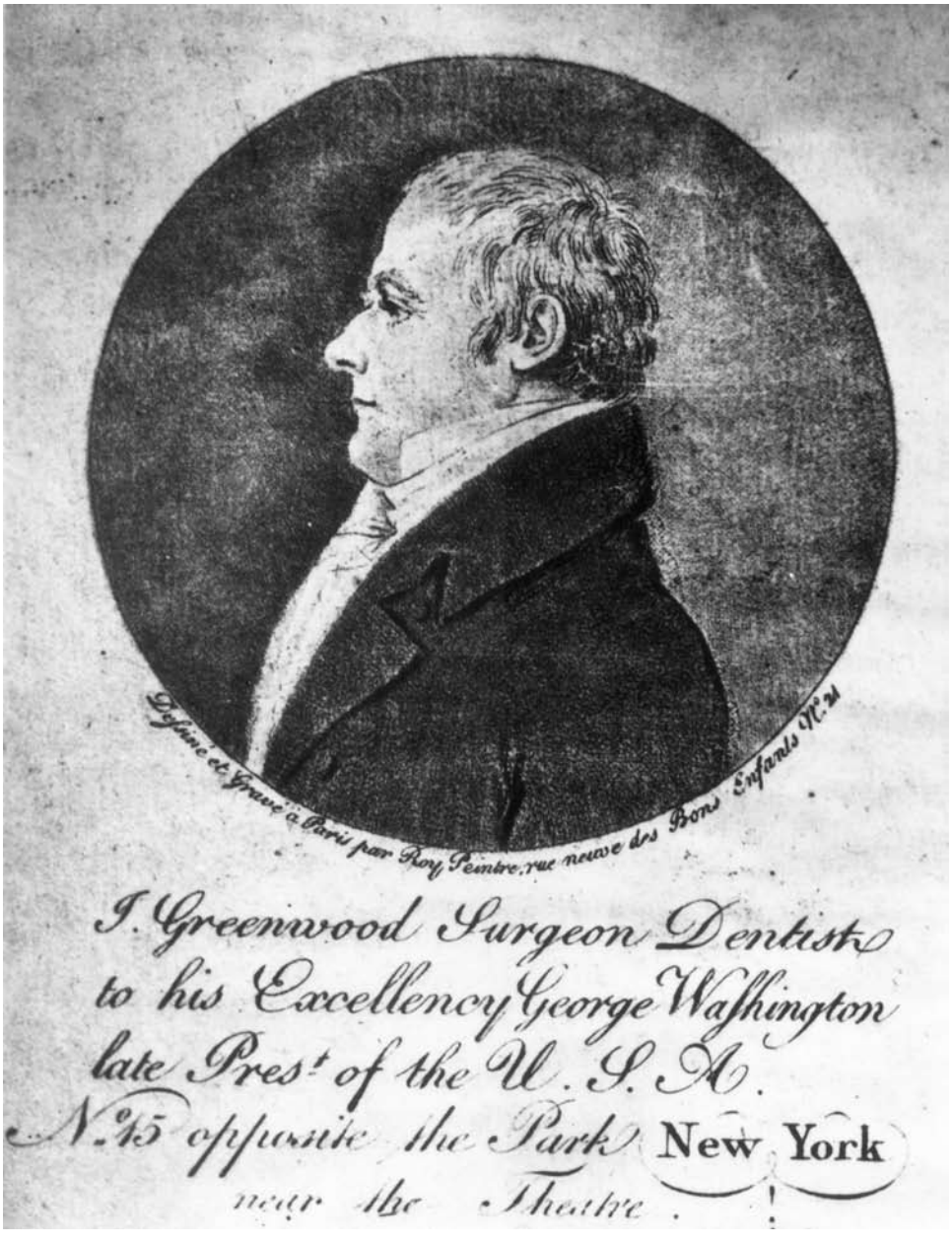
who advocated filling root canals to save teeth, published *Treatise of Dentistry Explaining the Diseases of the Teeth and Gums with the Most Effectual Means of Prevention and Remedy*. Other practitioners of the time patented improved dental instruments and prosthetic devices.[7,16,17]

American Practitioners in the Revolutionary Period

At least one American contributed to the history of military dentistry during the Revolutionary War era. While Paul Revere (1735–1818), the Revolutionary patriot, is not often thought of as a dentist, he did practice dentistry in Boston for about 6 years. He apparently studied the craft under John Baker (1732–1796), a dentist who

"Easing the Tooth-Ach." 1796.
Reproduced from: http://wwwihm.nlm.nih.gov/ihm/images/A/21/943.jpg.
Courtesy of the National Library of Medicine.

Set of dental elevators allegedly owned by Paul Revere.
Photograph: Courtesy of the National Museum of Health and Medicine,
Armed Forces Institute of Pathology. NCP 1331.



Engraving of J Greenwood, surgeon dentist to George Washington.
Courtesy of the National Museum of Health and Medicine,
Armed Forces Institute of Pathology. NCP 3282.

worked in Boston before 1766 and later provided services to George Washington while working in Williamsburg, Virginia, from 1771 to 1773.[11,18]

Revere, an expert goldsmith, silversmith, and engraver, concerned himself mainly with prosthetics, but after 1774 he lost interest in making artificial teeth. However, in 1776, he played a large part in one of the earliest cases of forensic dentistry on record. At the battle of Bunker Hill the year before, Dr Joseph Warren (1741–1775), a physician and major general in the Massachusetts militia, was the first American general officer to be killed in action. His body was buried in a mass grave. A year later, Massachusetts wanted to honor Warren and planned to exhume his body for reburial in a private plot, but his body could not be immediately identified. Finally, after recognizing a prosthetic dental appliance (bicuspid tooth) he had made for Warren, Revere was able to identify him.[11,19]

Revere was one of an estimated 79 professional dentists who were practicing at some level in the years before the Revolution. Newspaper advertisements of the period reveal that John Baker of Boston, Revere's mentor, and Robert Wooffendale (1742–1828) of Philadelphia were offering their services as early as 1767. Both were trained in Britain and offered extraction and cleaning; Baker also sold a simple dentifrice.[20,21] Between 1768 and 1773, numerous advertisements appeared for Michael Poree, a "surgeon dentist" practicing in New York, Boston, and Philadelphia. Moving among the cities because of the limited volume of business, Poree claimed to be able to treat "various complaints incidental to the teeth and gums: as well as to provide prosthetic devices." Poree was the first dentist in America to publish a lay article on dentistry, which appeared in the *New York Gazette* and the *Weekly Mercury* in December 1769.[17,22]

A number of veterans of the Revolutionary War went on to careers in dentistry, many rising to social and professional prominence. One of these, John Greenwood (1760–1819), established himself in New York City in 1786 after working briefly in the South.[13] Greenwood made and maintained several sets of dentures for George Washington between 1789 and 1798, carving them out of hippopotamus ivory and setting them using beeswax molds. He employed spiral springs—invented by the Frenchman Nicholas Dubois de Chemant—to keep the upper and lower plates in place and functioning.[14,23,24]

The War of 1812

Relatively little is known about dental care or the prevalence of oral disease among American soldiers during the War of 1812. Available information is derived from incomplete administrative and hospital records, medical reports, and archeological discoveries and analysis. These sources show that, despite the increasing acceptance and modest growth of the dental profession, little thought was given to soldiers' oral health when the United States entered its second war with Great Britain. In fact, the country was vastly unprepared for war overall. During the first year, one surgeon and two surgeon's mates were authorized for each regiment, with a few others allowed for hospitals. Given little authority or respect, these men were forced to work mostly on their own, and good medical care was hard to come by. In March 1813 Congress approved the positions of surgeon general and apothecary general, which brought order and accountability to military medicine.[25]

Fortunately for the dental surgeons, the newly appointed apothecary general, Francis Le Baron, provided medical supplies surprisingly efficiently. However, poorly trained physicians often overused some of the medications, resulting in serious injury to some patients. The most damaging example of this was the overly generous use of calomel (mercurous chloride), a popular treatment of the day used to remedy intestinal afflictions and repel insects. Calomel caused caries of the jaw, tooth loss, and even death in at least three cases at the Army hospital in Lewiston, New York, on the Niagara frontier.[26,27]

One case of calomel poisoning involves 17-year-old Private Thomas Broughton, 6th Regiment, US Infantry. In 1813 Broughton was being treated for dysentery with large doses of calomel when his physician, Dr Joshua B Whitridge, reported that he had developed mercurial poisoning:

> Mortification had taken place in the buccinator muscle of his right cheek, and under his jaw, and had been progressing several days. The hole in his cheek, occasioned by the sloughing, (when I first saw him,) was about three quarters of an inch in diameter, perfectly round, and had the appearance of being cut out with a knife, or some sharp instrument.[28(p82),29]

The surgeon ordered that the wound be kept clean by using a syringe to inject it with warm water and diluted brandy. Fowler's solution (potassium arsenite) was also used to irrigate the wound five or six times a day, and Broughton steadily recovered.[28]

Archeological investigations have provided more detailed information on the oral health of American soldiers. In 1987 construction at Fort Erie, Ontario, uncovered the remains of 28 US enlisted soldiers killed during the operations there from August to October 1814. These soldiers came from regular and militia units with origins in rural areas of Massachusetts, Vermont, eastern and central New York, and southwest Pennsylvania. In studying the remains, "dentitions from 25 mandibles and 24 maxillae were analyzed, totaling nearly 600 teeth." The remains showed traits such as Carabelli's cusp, which is evidence of European origins, and of early dietary deficiencies revealed in hypoplastic enamel losses. Further analysis showed a strikingly low rate of dental caries when compared to other 19th century military groups. The soldiers' diet was low in cariogenic items and included large amounts of salted meats, which may account for their dental health. Although many of the corpses did show evidence of antemortem tooth loss, there had been little abscessing. The dental condition of this small group suggests that the modest physical requirements for recruits, coupled with a soldiers' diet, made for relatively good dental health, aided only occasionally by extraction.[30]

Josiah Flagg was one of the few dentists recorded as having served in any capacity during the War of 1812. He had received his early training from James (Jacques) Gardette during the Revolutionary War and later, at the age of 49, enlisted in the Navy. After brief service, he was captured by the British and sent to England as a prisoner of war. He was later paroled and allowed to practice dentistry in London from 1813 to 1815. On September 14, 1815, after the conclusion of the war, Flagg was granted a passport to return home. Unfortunately, a few hours

before docking, he was shipwrecked in New York Harbor. After suffering from exposure, he finally reached Boston. He decided to seek a warmer climate for his health and went to Charleston, South Carolina, where he contracted yellow fever and died on September 30, 1816.[11,31,32]

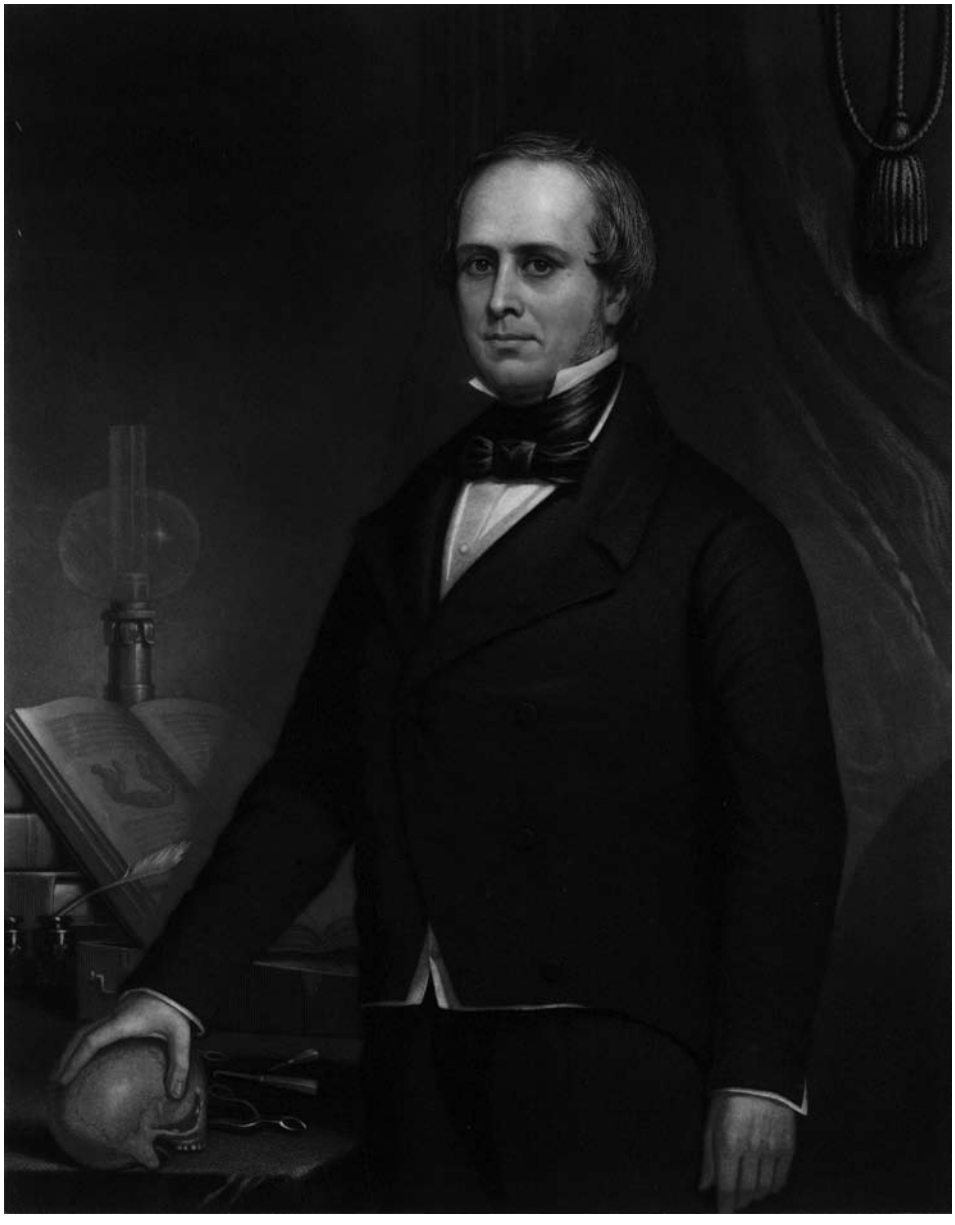
Despite the obvious need for better medical organization, Congress was, overall, slow to react once the War of 1812 was over. At first, the surgeon general's position was eliminated in the initial flurry of force reductions in 1815. However, it was reestablished in April 1818, and in 1821 Army Regulations finally listed sets of "Teeth Instruments" among the Medical Department's supply tables.[33]

Horace Hayden: The First Dental College

Dentist Horace Hayden (1769–1844) served in the War of 1812 as a soldier and assistant surgeon. Hayden was born on October 13, 1769, in Windsor, Connecticut, into a military family. One of his ancestors, William Hayden, had saved his captain's life in the Pequot War of 1637. Horace's grandfather, Daniel Hayden, was a lieutenant in the French and Indian War, and his father, Thomas Hayden, served as a sergeant and then first lieutenant in the Revolutionary War. Hayden began a career in architecture, his father's trade, but a professional visit to Dr John Greenwood in New York influenced him to change his vocation. In 1800 he moved to Baltimore, established a dental office, and began to study medicine, especially anatomy, making a solid reputation for himself. On August 16, 1813, after the first British threat to Baltimore, he enlisted as a private in Captain Christian Andreon's infantry company, in the 39th Regiment (Fowler's) of the Maryland militia. He served for only 8 days (for which he was paid $2.06) before Major General Samuel Smith, aware of Hayden's medical skills, ordered him to serve as an assistant surgeon at the hospital.[34,35]

In 1819 Hayden delivered a course of lectures on dental surgery to the medical students at the University of Maryland. This was the first time a dentist lectured in a medical school in the United States. Together with Chapin A Harris (1806–1860), Hayden founded the Baltimore College of Dental Surgery in March 1840, the world's first institution dedicated to dental education (today known as the Baltimore College of Dental Surgery, Dental School, University of Maryland, Baltimore). Before that time, apprentice dentists were trained by preceptors—experienced dentists who took young students into their offices for anywhere from 3 months to 5 years and taught them the rudimentary facts of dentistry. But because the majority of the early 19th century dentists were itinerant practitioners, moving from town to town in search of profit, standards were difficult to maintain. Progressive dentists such as Hayden and Harris realized that a formal education, either by itself or in conjunction with a medical education, would give dentistry professional credibility. In 1839 Hayden organized the first dental journal ever published, the *American Journal of Dental Science,* which Harris edited until his death in September 1860.[36] Hayden was also instrumental in founding the first national dental society in America, the American Society of Dental Surgeons, in 1840. (In addition to his work in dentistry, Hayden wrote the first general work on geology published in the United States, *Geological*

Engraving of Horace Hayden, MD, DDS (1769–1844).
Courtesy of the National Museum of Health and Medicine,
Armed Forces Institute of Pathology. NCP 3300.



Chapin Harris, AM, MD.
Reproduced from: http://wwwihm.nlm.nih.gov/ihm/images/B/13/841.jpg.
Courtesy of the National Library of Medicine.

Essays or, An Inquiry into some of the Geological Phenomena to be Found in Various Parts of America, and Elsewhere, in 1820). Hayden died on January 26, 1844, in Baltimore.[34,36]

From the War of 1812 to the War with Mexico (1846–1848)

The establishment of a formal training institute was only one of several advances in dentistry in the decades after the War of 1812. Professional societies, such as Hayden's American Society of Dental Surgeons, proliferated at the state level by the mid 1840s. The first state dental society, the Virginia Society of Surgeon Dentists, was organized in 1842 in Richmond.[37] By the end of the decade, several of the societies had formed regional associations to assure better professional standards and to exchange information. The Mississippi Valley Association of Dental Surgeons, which was organized in Cincinnati in 1844, established its own influential dental periodical in 1847, *Dental Register of the West* (later *Dental Register*). This publication was produced until 1923, well after the association itself had disappeared. According to Milton Asbell, author of *Dentistry, a Historical Perspective* (1988), increased activity in dental literature inspired the publication of "about 60 books and pamphlets" during this time, which covered topics as diverse as tooth preservation, anatomy, and tips for parents.[7(p124),38]

Clinical improvements also advanced after the war. For example, dentists began urging the correction of dental bite problems (malocclusion) in young people before they became critical—the first hint of simple orthodontia. Perhaps the most significant discovery was Horace Wells's use of nitrous oxide as an anesthetic in 1844. During an operation at Massachusetts General Hospital in 1846, another dentist, William TG Morton (1819–1868), built on Wells's discovery and demonstrated the successful use of sulphuric ether as a general anesthetic.[7,39] In a letter to Morton that same year, Oliver Wendell Holmes (1809–1894), a professor of anatomy at Harvard Medical School, poet, writer, and father of Supreme Court Justice Oliver Wendell Holmes, Jr, defined the term "anesthesia" as the absence of all sensibility.[40] Inhalation anesthesia has since been called dentistry's greatest gift to humankind.

In 1844 Samuel Stockton White (1822–1879) established a dental supply house in Philadelphia called Jones, White & Company (later SS White Dental Manufacturing Company). White carved his own metal tooth molds and ground the porcelain materials in a hard mortar. He was a master mold maker, so his porcelain teeth looked real and dentists were quick to recognize the quality. In October 1847 he began publishing *Dental News Letter*, which became another leading publication in the field. In August 1859 it became *Dental Cosmos*, which eventually merged with the *Journal of the American Dental Association*.[36,41] In 1849 Chapin Harris first described a crude "pivot crown" (an artificial tooth designed to be applied to the root of a natural tooth by means of what is usually termed a pivot, but more properly a dowel or tenon) in *A Dictionary of Dental Science, Biography, Bibliography, and Medical Terminology*.[42]

Despite the emerging professionalism of American dentistry, a growing body of specialized knowledge, and skilled dental practitioners, the Army surgeon general remained confident that his surgeons could deal with the dental requirements of the soldiers in the ranks. The 1841 Army Regulations continued to carry "teeth-

extracting" instrument sets in the Medical Department supply table for the doctors' use, but no further accommodation was considered necessary. In fact, at the time of the Mexican-American War (1846–1848), many of the surgeons discounted the use of ether as unnecessary and potentially harmful to blood flow.[43,44]

Many dentists volunteered their service at the outbreak of the war, and some probably provided their comrades-in-arms with dental care unofficially. Among the first to volunteer was Joseph Hassell (1828–1901) of Lexington, Missouri, who had just completed his dental apprenticeship with Dr Clark of Saint Louis. On May 18, 1846, he enlisted to serve 6 months as a private in Company G, 1st Regiment,

Horace Wells, the discoverer of anesthesia.
Courtesy of the National Museum of Health and Medicine,
Armed Forces Institute of Pathology. NCP 1327.

Saint Louis Legion, Missouri Infantry. (Captain Henry JB McKellops [1823–1901], a prominent dentist in Saint Louis and later a leader in the fight for Army dentists, organized and commanded this infantry company, called the Morgan Riflemen, during the war.)[31,45] Hassell was discharged on September 2, 1846, at Jefferson Barracks, Missouri. He then returned to Lexington, established a dental practice, and later received his dental degree from the Missouri Dental College in Saint Louis. During the Civil War, he served in the Confederate army. After that, he resumed his practice in Lexington until his death at age 73. He was one of the earliest dentists to practice west of the Mississippi River.[46-48]

The Amalgam War

In 1805 WH Pepys of London first introduced a fusible metal filling material to seal decaying teeth, but melting the metal required an impractical amount of heat. In 1818 Regnart, a French chemist, overcame this problem by adding mercury to the mix, inventing amalgam (an alloy of mercury combined with another metal).[39,49,50] But in the 1840s and 1850s, the "Amalgam War" divided the dental profession into two distinct groups: the dentists who endorsed amalgam as an alternative restorative material to gold (which was then the accepted standard) and those who did not. This divisive issue fractured the nascent American Society of Dental Surgeons and led to the establishment of both the American Dental Convention and the American Dental Association in 1859 (these two groups became the principal advocates of dentistry in the Army). The issue also spurred the development of new dental amalgams, techniques, and denture technology that influenced the future of American dentistry.

The amalgam conflict began in 1833, when the Crawcour brothers came to New York from Europe with a coin-silver amalgam they called "royal mineral succedaneum." Their dental business boomed, and practitioners who used gold and tin lost patients. The Crawcour brothers' amalgam was a soft, plastic mix of impure material, which they thumbed into cavities without removing the decay. This technique was painless, but the fillings fell out and, because of the amalgam's expansion, caused tooth fractures. As the public became aware of the amalgam's failure, the Crawcours retreated to Europe, leaving amalgam with a bad reputation despite the fact that, if used properly, it was an excellent filling material.[50]

In 1841 the American Society of Dental Surgeons (then the only national dental organization) appointed a committee to study the amalgam problem. Although they had not tested amalgam, the committee reported 2 years later that "the use of amalgam constituted malpractice."[50(p66)] In 1844 the society required its members to sign a pledge never to use amalgam or risk expulsion. In response, many members resigned and, by 1847, only five of New York's 200 dentists remained in the society. The society eventually rescinded the pledge, but the organization folded in 1856.[50,51]

In 1855 Dr J Foster Flagg (1828–1903), professor of dental pathology and therapeutics at the Philadelphia College of Dental Surgery, began testing different amalgam formulas for bicuspid and molar fillings. Flagg modified the then–popular formula of 60% tin to 40% silver, reversing it to 60% silver and 40% tin, and added combinations of other metals, such as copper, zinc, antimony, gold, platinum, and cadmium. In 1881 he published a book on amalgams called *Plastic and Plastic Fillings*

(amalgam fillings were popularly referred to as "plastic fillings" at the time).[50] His cavity preparation and instrumentation techniques were meticulous, and Flagg was convinced he could "save teeth with amalgam which I could not save with gold." In 1861 he presented his findings to the Pennsylvania Association of Dental Surgeons, who decided that silver amalgam was "an excellent filling material," and expanded dentistry's "ability to save teeth."[50]

A major breakthrough in denture construction technology also took place in 1855 with the introduction of vulcanite (named after the Roman god of fire and metal working). Vulcanite was a hard, rubber denture base material, patented by Nelson Goodyear in 1851. His brother, Charles Goodyear, had secured a patent in 1844 for his discovery of the "vulcanization" process, in which a rubber-sulphur mixture was heated into a hard, ebony-like compound. Vulcanite was inexpensive, relatively easy to make, and accurately fit a patient's jaw, bringing an end to the practices of carving ivory or pounding out (swaging) gold or silver denture bases. Other porcelain, cheoplastic metal, celluloid, and aluminum bases were tried during this period, but none could compete against vulcanite, which remained dentists' denture material of choice until the advent of the acrylic resins in the late 1940s.[39]

The Presidents' Dentist: Edward Maynard

The first dentist to make an effort to convince the US War Department that the Army needed dental surgeons was Dr Edward Maynard (1813–1891) of Washington, DC. A former West Point cadet, Maynard was internationally renowned for his dental proficiency and his ordnance inventions, which included a new priming system to replace the percussion cap, a breech-loading rifle, and a metallic center-fire cartridge. These and his many other inventions revolutionized firearms technology prior to the Civil War. Maynard's dental office, located near the White House, catered primarily to a wealthy clientele, including several presidents, cabinet officers, congressmen, Army and Navy officers, and foreign diplomats.[31]

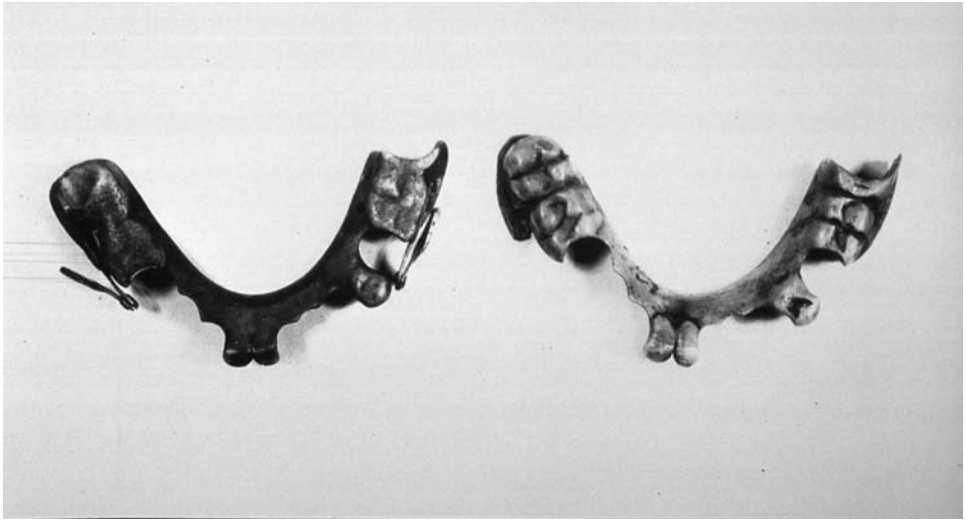
A July 1859 editorial (presumably by Chapin Harris) in the *American Journal of Dental Science* noted that Maynard had personally brought the matter of the need for Army dental surgeons to the attention of President Millard Fillmore during Fillmore's 1850–1853 tenure. The president then "brought it before the cabinet in council," but the secretaries of war and the Navy failed to accomplish any dental legislation.[52]

Later, during the Franklin Pierce administration (1853–1857), Secretary of War Jefferson Davis "received the proposition [for Army dentists] as one of great value." Maynard was well known to Davis because in 1853 the War Department had purchased the right to use his "improved system of firing" for 100,000 firearms. Maynard had also discussed the matter with the surgeon general of the Army, Colonel Thomas Lawson, who "was willing to advocate the establishment of a corps of army dental surgeons of six to begin with, to be entirely distinct from the corps of surgeons in their duties, examinations, promotions and rank." However, no official action was taken. Because a bill affecting the "corps of surgeons of the army" had been pending before Congress for quite some time, many thought it

Die plate, circa 1875. This die plate was used to swage (pound into shape) the occlusal surface of a shell crown made of 22K plate gold. By 1955 this technique was superseded by cast gold crowns. Photograph: Courtesy of the National Museum of Health and Medicine, Armed Forces Institute of Pathology. NCP 3278.

best "not to propose anything that might defeat that bill."[52,53]

At President Pierce's direction, Secretary of the Navy John P Kennedy became involved in the matter. On February 16, 1853, Kennedy addressed the chief of the Naval Bureau of Medicine and Surgery, Dr Thomas Harris, to report on the "propriety of enlarging the requisitions upon Candidates for admission into the Medi-

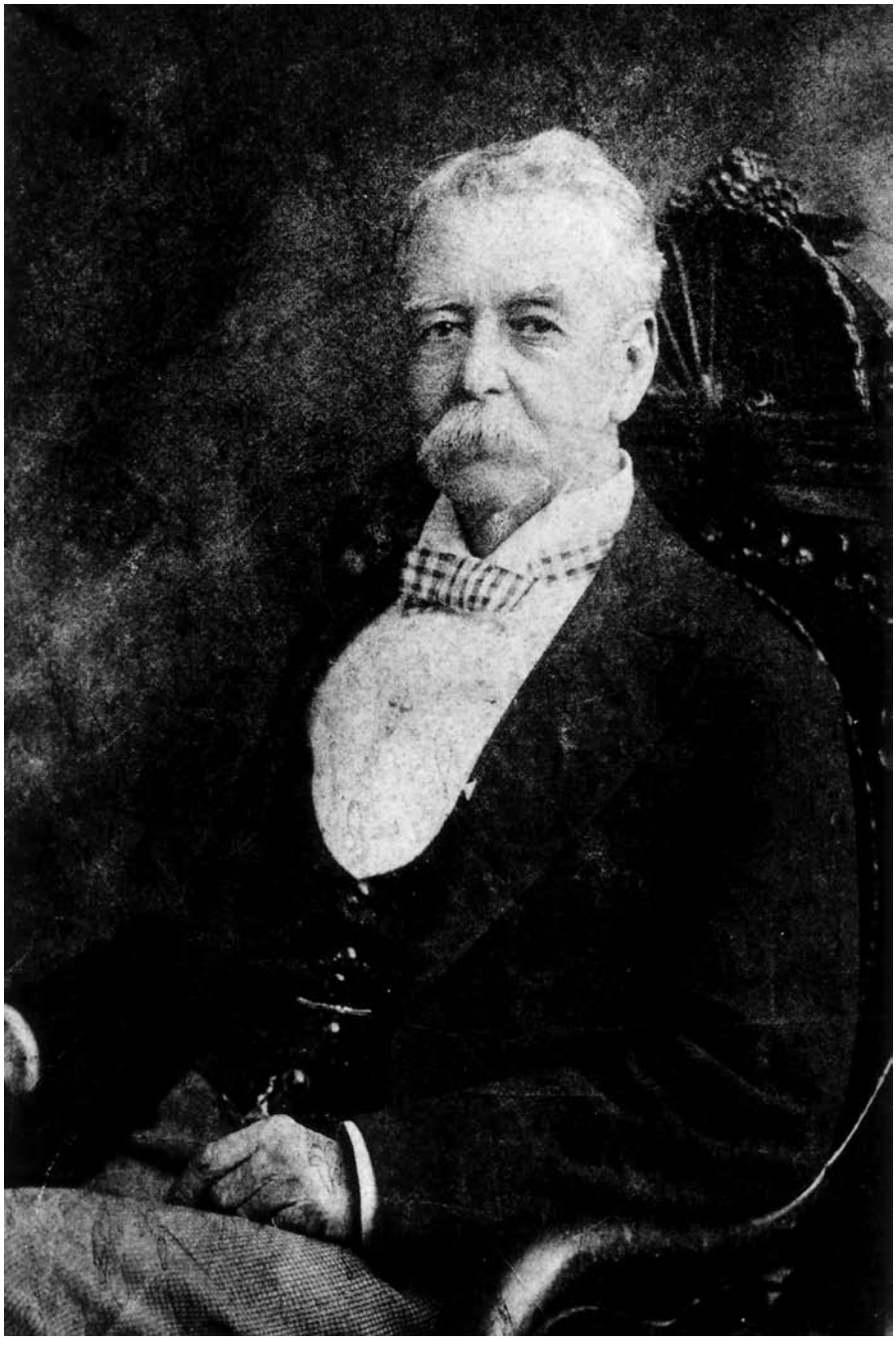


Teeth carved in Paris from hippopotamus tusk before 1854.
Worn by a French naval [undetermined] officer.
Reproduced from: http://wwwihm.nlm.nih.gov/ihm/images/A/23/308.jpg.
Courtesy of the National Library of Medicine.

cal Corps, so far as to demand from them a more full knowledge of the science and practice of Dentistry in preparing them for the duties of the Naval service."[54] Upon hearing this report, Maynard wrote Kennedy's successor, James Dobbin, on April 13, 1853, to ask for a copy. Dobbin replied that he "heartily approved the proposition [dental surgeons for the Navy]," and thanked Maynard "for bringing to his notice a project which his own sufferings from his teeth and benefit from their proper surgical treatment, convinced him was a most humane suggestion." However, once again, no official action was taken. Maynard died on May 4, 1891, at age 78, 10 years before his efforts were finally realized.[31]

Antebellum Legislative Efforts: The McKellops Resolution, 1858–1859

Despite a lengthy and distinguished civilian career, as well as military service in the Saint Louis Legion and Missouri National Guard during the 1840s and 1850s, Henry JB McKellops is best known for his efforts to lobby Congress for Army dental surgeons. A prominent dentist in the Mexican-American War, McKellops undoubtedly witnessed the dental sufferings of his fellow volunteer soldiers, who rarely had the opportunity to see a qualified dentist. Many soldiers went to Mexico "with sound and beautiful teeth, and returned within a year or two with them almost destroyed, and in some cases entirely so, and almost all much diseased."[31,56] On July 21, 1858, at a meeting of the Western Dental Society in Quincy, Illinois, McKellops offered the following preamble and resolution:



Henry JB McKellops, a distinguished civilian dentist who also served in the Saint Louis Legion and Missouri National Guard during the 1840s and 1850s. McKellops is best known for his efforts to lobby Congress for Army dental surgeons. Photograph: Courtesy of the American Dental Association.

> *Whereas*, Owing to the great inconvenience of the officers and soldiers in procuring competent dentists, when necessarily required, and knowing the difficulty in which they are placed, being stationed at distant posts, where it is absolutely impracticable for a regular practitioner of dentistry to visit them; therefore,
>
> *Resolved*, That this Society appoint a committee of five, for the purpose of memorializing Congress on the necessity of appointing dentists to be attached to the regular army, and that we recommend the same to the consideration of the American Dental Convention [which replaced the nearly defunct American Society of Dental Surgeons as the national dental association in 1855], and ask their co-operation with us.[38,55]

The society adopted his resolution and formed a committee consisting of Drs McKellops, Christopher W Spalding, Isaiah Forbes, IB Branch, Lewis, and WW Allport.[31,56]

At the American Dental Convention meeting in August, another committee was formed after McKellops repeated the proposal.[57] Apparently the committees met with little success, for no congressional action was taken. In April 1859 Dr John R McCurdy, the coeditor of *Dental News Letter*, commented on the subject:

> The soldier has as much need for a dentist as for a surgeon, and that in the aggregate, he suffers as much or more from diseases of the teeth as from any cause incident to his profession. He certainly has as much use for his teeth as for his limbs, and we are quite sure he does more eating than fighting, and should, therefore, be as well furnished with the needful appliances for the effective performance of the former, as he is for the latter, and as his occupation is a hard one at best, he is deserving and entitled to as many comforts and as much exemption from annoyance and suffering as it is possible to afford him.[58(p206)]

When the American Dental Convention met the next year, McKellop's proposed committee admitted that their report was not ready, and they were directed to continue their efforts.[59]

Foreign Influences

In its efforts to secure dentistry for the US military forces during the 1850s, the American dental profession did not let the health and sanitary problems of the recent Crimean War (1854–1856) go unnoticed. The war, which involved Imperial Russia, Turkey, Great Britain, France, and several other European countries, had drawn attention to the "sad misfortunes" endured by the British army because of poor sanitary conditions. British soldiers' and sailors' teeth were known to be in "deplorable condition," but all attempts to provide dental surgeons for them failed. French soldiers were at least supplied with toothbrushes and obliged to clean their teeth.[60]

The dental requirements for recruits were similar for all armies of the time. In the French army, the manual for the recruiting service, the *Aide Memoire*, listed the following dental causes for rejection of an applicant: "Loss of the whole or part of either jaw-bone; Deformities of either jaw bone, interfering with mastication, speech, or the tearing of the cartridge; Anchylosis of the jaws; Loss of the incisor and canine teeth of both jaws." The British army regulations mention the "loss of

many teeth, or teeth generally unsound," and "extensive deficiency, particularly of the front teeth." In 1859 Sir Charles Trevelyan, then governor of Madras, India, recommended that European medical officers should be "instructed in dental surgery, that the teeth of all soldiers . . . be examined, and operative assistance rendered to such as require it." Commenting on this recommendation, the *British Journal of Dental Science* suggested "a dentist should be appointed to every division of the [British] army." Although gunshot wounds of the face and jaws would come under a dentist's care, "diseases of the teeth and necessary artificial work would be his special province."[61]

US Army Dental Care Before the Civil War

In his 1856 medical manual, *Hints on the Medical Examination of Recruits for the Army*, Dr Thomas Henderson writes, "extensive loss of teeth, particularly the incisors (front teeth), is good cause for refusing a certificate. The teeth should be amply sufficient for healthy mastication, and for distinct enunciation. The front cutting teeth are especially necessary to tear the cartridge." The US Army Medical Department's official 1857 supply table included one instrument set, "teeth extracting (key and 3 claws, gum lancet, straight and curved forceps)," in its list for each military post.[62–64]

Unfortunately, the growing support for military dental service in the late 1850s meant little to the soldier in the field. Sergeant Percival Lowe of the US Dragoons recalled that, "in my whole five years of service [1849–1854] while on the plains, every summer on a long campaign and always expecting it, we never had a doctor." According to Lowe, only one fellow soldier, who had joined the unit with his dental instruments in hand, performed dental work on the soldiers. Unfortunately, this man later deserted. The advent of the Civil War in 1861 raised hopes among dentists that the crisis would bring formal recognition of the need for dental care in the military.[65]

References

1. *Congressional Record, 56th Cong, 2nd Sess*. Act of Feb 2, 1901. Sec 18, 31 Stat 752. Vol 34. Washington, DC: Government Printing Office.

2. Woods SH. An outline of dentistry in the British army, 1626-1938. *Proc R Soc Med*. Cited in: *Br Dent J*. 1939;66:147–152.

3. Allen WGB. *Pistols, Rifles and Machine Guns*. 2nd ed. London, UK: English Universities Press Ltd; 1961: 12–13.

4. Gavin H. Dental information for drafted men. *On Feigned Diseases.* Cited in: *NY Dent J*. 1863;6:187–188.

5. Von Steuben FWA. *Regulations for the Order and Discipline of the Troops of the United States*. Philadelphia, Pa: Styner and Cist; 1779. Reprint. Philadelphia, Pa: Ray Riling Arms Book Co; 1966.

6. Godden LJ, ed. *History of the Royal Army Dental Corps*. Aldershot, UK: Royal Army Dental Corps; 1971.

7. Asbell MB. *Dentistry: A Historical Perspective*. Bryn Mawr, Pa: Dorrance and Co; 1988.

8. Weinberger BW. Dentistry in America up to the middle of the nineteenth century, I. *Dent Items Interest*. 1943;65:681.

9. Gardette EB. Biographical notice of the late James Gardette, surgeon dentist, of Philadelphia. *Am J Dent Sci*. 1850:375–376.

10. Viau G. French dentistry in the United States: James Gardette, 1756–1831. *Dental Cosmos*. 1925;67:389–390.

11. Weinberger BW. *An Introduction to the History of Dentistry in America*. Vol 2. St Louis, Mo: CV Mosby Co; 1948: 137–150.

12. Greenwood IJ. Remarks on the portraiture of Washington. *Magazine Am Hist*. 1878;2:37–38.

13. Manchester HH. Post-Revolutionary dental announcements. *Dent Dig*. 1925;31:764.

14. Brown L. The antiquities of dental prosthesis, part III, section II, eighteenth century. *Dental Cosmos*. 1934;76:1156–1160.

15. Weinberger BW. Jean Pierre Le Mayeur in America: no longer the man of mystery. *Dental Cosmos*. 1934;76:573–574.

16. Asbell MB. First article on dentistry published in America. *Outlook Bull South Dent Soc N J*. 1964;33:49–52.

17. Robinson B. *The Foundations of Professional Dentistry*. Baltimore, Md: Waverly Press Inc; 1940: 27–34.

18. FitzPatrick, JC, ed. *The Diaries of George Washington 1748-1799*. Vol 2. Boston, Mass: Houghton Mifflin Co; 1925.

19. Brown, RK. *Fallen in Battle: American General Officer Combat Fatalities*. New York, NY: Greenwood Press; 1988.

20. Manchester, HH. The first dentists in America. *Dent Dig*. 1925;31:162–63.

21. Historical review of the progress of dental surgery in the United States, with reflections upon the causes that have accelerated it, and the means necessary for its further advancement. *Am J Dent Sci*. 1851;2:97.

22. Manchester HH. Dentists notices of the Revolutionary period. *Dent Dig*. 1925;31:687–689.

23. DeLessert CG. The origins of spiral springs. *Br J Dent Sci*. 1870;13:550.

24. Hayden HH. An opening address. *Am J Libr Dent Sci*. 1841;2:23–24.

25. Duncan LC. The medical service in the War of 1812, II. *Milit Surg*. 1932;71:542.

26. Duncan LC. Sketches of the medical service in the War of 1812. *Milit Surg*. 1932;71:439.

27. Anderson FJ. Medical practices in Detroit during the War of 1812. *Bull Hist Med*. 1944;16:267.

28. Mann J. *Medical Sketches of the Campaigns of 1812, 13, 14*. Dedham, Mass: H Mann & Co; 1816: 82.

29. Edgar J. The Army Medical Department in the War of 1812. *Milit Surg*. 1927;60:307.

30. Pfeiffer S, Williamson RF. *Snake Hill, an Investigation of a Military Cemetery from the War of 1812*. Toronto, Ontario, Canada: Dundurn Press; 1991: 226-234.

31. Thorpe BL. Biographies of pioneer American dentists and their successors. In: Koch C. *History of Dental Surgery*. Vol 3. Ft Wayne, Ind: National Art Publishing Co; 1910: 223.

32. Lockley F. Impressions and observations of the Journal Man. *The Oregon Journal*. 1936 (March).

33. US War Department. *General Regulations for the Army: or, Military Institutes*. Philadelphia, Pa: M Cary and Sons; 1821: 293–294.

34. Thorpe BL. A biographical review of the careers of Hayden and Harris. In: *Transactions of the Fourth International Dental Congress* [1904]. Vol 3. Philadelphia, Pa: The SS White Dental Mfg Co; 1905: 413-416.

35. National Archives and Records Administration. Compiled Military Service Record. Record Group 94. 39th Regiment (Fowler's) Maryland Militia (War of 1812).

36. Lufkin AW. *A History of Dentistry*. Philadelphia, Pa: Lea & Febiger; 1948: 198–203 .

37. Powell H, ed. *100 Years of Dentistry in Virginia*. Richmond, Va: Virginia State Dental Association; 1969: 10–11.

38. McCluggage RW. *A History of the American Dental Association: A Century of Health Service*. Chicago, Ill: American Dental Association; 1959.

39. Taylor JA. *History of Dentistry*. Philadelphia, Pa: Lea & Febiger; 1922.

40. Tilton EM. *Amiable Autocrat. A Biography of Dr. Oliver Wendell Holmes*. New York, NY: Henry Schuman; 1947: 187.

41. SS White Dental Mfg Co. *A Century of Service to Dentistry*. Philadelphia, Pa: The SS White Dental Mfg Co; 1944: 3–4.

42. Harris CA. *A Dictionary of Dental Science, Biography, Bibliography, and Medical Terminology*. Philadelphia, Pa: Lindsay and Blakiston; 1849: 595.

43. US War Department. *General Regulations for the Army of the United States, 1841*. Washington, DC: J and GS Gideon, Printers; 1841: 313.

44. Duncan LC. Medical history of General Scott's campaign to the city of Mexico in 1847. *Milit Surg*. 1920.

45. Obituary, Dr. Henry J.B. McKellops. *Dental Cosmos*. 1901;43:704.

46. Obituary, Dr. Joseph F. Hassell. *Dental Cosmos*. 1901;43:963.

47. National Archives and Records Administration. Compiled Military Service Record. Record Group 94. JF Hassell. First Regiment, St Louis Legion, Missouri Infantry.

48. National Archives and Records Administration. Compiled Military Service Record. Record Group 15. JF Hassell. Pension file. First Missouri Volunteers. Certificate no. 19521.

49. Prinz H. *Dental Chronology: A Record of the More Important Historic Events in the Evolution of Dentistry*. Philadelphia, Pa: Lea & Febiger; 1945: 87.

50. Sweet PA. Amalgam and the "New Departure." *Dent Radiogr Photogr*. 1959;32:66–69.

51. Allen C. A society of dental surgeons in New York. *NY Dent Rec*. 1847;2:2.

52. [Harris CA]. Importance of Army and Navy dentists. *Am J Dent Sci*. 1859;9:444.

53. Dunbar R, ed. *Jefferson Davis Constitutionalist: His Letters, Papers and Speeches*. Vol 2. Jackson, Miss: Mississippi Department of Archives and History; 1923: 281.

54. Hodgkin WN. Edward Maynard, a progenitor of the United States Army and Navy Dental Corps. *J Am Dent Assoc*. 1941;28:1970.

55. Meeting of the western dental society. *Quincy Whig and Republican*. Cited in: *Dental News Letter*. 1858;12:37–38.

56. Taft J. The influence of camp life upon the teeth. *Dental Register of the West*. 1861.

57. American Dental Convention, fourth annual session [proceedings]. *Dental News Letter*. 1858;12:6.

58. McCurdy JR. The employment of dentists in the Army. *Dental News Letter*. 1859;12:206.

59. Barker G. American Dental Convention [proceedings]. *Dental Cosmos*. 1859;1:81.

60. Roberts W. Remarks on dentistry in the Army. *American Medical Times*. Cited in: *Dental Cosmos*. 1861;3:51–52.

61. Dental reform in the Indian army. *Friend of India*. Cited in: *Br J Dent Sci*. 1859;3:45–46.

62. Taft J. The teeth of Army recruits. *Dental Register of the West*. 1861;15:435.

63. Henderson T. *Hints on the Medical Examination of Recruits for the Army; and on the Discharge of 60 Soldiers from the Service on Surgeon's Certificate*. New rev ed. Philadelphia, Pa: JB Lippincott & Co; 1856: 99.

64. US War Department. *Regulations for the Army of the United States, 1857*. New York, NY: Harper & Brothers; 1857: 250.

65. Lowe PG. *Five Years A Dragoon ('49–'54) and Other Adventures on the Great Plains*. Norman, Okla: University of Oklahoma Press; 1965: 34,100–101