The Development of Anesthesiology in Oral and Maxillofacial Surgery

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KEYWORDS

• Anesthesiology • History • Oral and maxillofacial surgery

KEY POINTS

- Oral and Maxillofacial Surgery (OMS) is a specialty because OMS precursors began to incorporate general anesthesia into office-based practices soon after it was discovered by Horace Wells in the 1840's.
- Many contributions of OMS to the art and science of anesthesiology have been singular, cutting edge when introduced, have stood the test of time, and have subsequently been universally incorporated into the general discipline.
- Beginning in the 1970's, the OMS residency anesthesiology educational emphasis began to drift away from the historical one-third or more temporal curricula.
- With the decreased emphasis on dedicated anesthesia training in OMS residencies, recent graduate OMS are providing more sedation and less general anesthesia. OMS should consider reemphasizing anesthesia training in the future in order to preserve the historical team anesthesia model.

No legitimate history of anesthesiology can exclude the contributions of American dentistry. Similarly, no history of anesthesiology in dentistry can exclude the contributions of oral and maxillofacial surgery (OMS). In other words, many contributions of OMS to the art and science of anesthesiology have been singular, cutting edge when introduced, have stood the test of time, and have subsequently been universally incorporated into the general discipline. The process continues to this day with regard to the clinical, management, and other innovations OMS has proffered to the control of anxiety and pain. This article offers a brief review of some of these gifts.

Although dentistry has played a significant role in the development of anesthesiology since it was first discovered (observed and made known) by Horace Wells in December 1844, but for a series of unsuccessful negotiations by Chapin A. Harris, this article on the importance of dentistry in the development of anesthesiology would not be necessary. In fact dentistry itself, at least as administered by those with a DDS or DMD, would not be necessary.

In 1837 Harris approached the University of Maryland Medical College and proposed that the College include in its medical curriculum dental studies.[1] If Harris' plan had been accepted, Maryland Medical College graduates would have been practitioners of dental surgery as physicians. There were no recognized specialties at that time and the only real differing delineation in medical practice was between surgical and nonsurgical practice. However, Harris' logical suggestion to incorporate dentally based procedures into medicine was rejected outright because dentistry was deemed to be a mechanical trade, not rising to the level of a profession. Unwilling to accept defeat, Harris approached the College again in 1838, but with the same result. Resilient in his efforts, Harris in 1839 ultimately organized the first dental school, the Baltimore College of Dental Surgery, which

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was chartered by Maryland in 1840. The Baltimore College of Dental Surgery established the DDS degree, and in 1867 the Harvard School of Dental Medicine created the DMD (because Harvard preferred a Latin language–based graduation certificate [Dentariae Medicinae Doctorae] and the translation of DDS [Chirurgae Dentium Doctoris] was awkward). Without the creation of the Baltimore College of Dental Surgery, dentists today would likely be physician odontologists or stomatologists.

ANESTHESIA PREQUEL

For millennia man readily understood that the pain from the surgical treatment of physical maladies is often worse than that of simply not treating the condition. Not infrequently, the fear of the pain associated with treatment was such that patients refused treatment altogether, accepting their inevitable fate, often death. Such was the case even if surgical treatment could be predictably successful, simply because patients literally would rather die than submit to the pain associated with surgery.

The Ancients noted that procedures could be completed on unconscious victims, such as those sustaining head trauma, without subjective pain. In short order, therapeutic strangulation to the point of unconsciousness became an option for surgical candidates. Unfortunately, as with any artificial loss of consciousness, complications occasionally occurred. Strangulation, although effective in rendering victims unconscious, also often rendered them dead.

Chapin A. Harris, DDS, MD, believed that dentistry is most properly classified as a profession, an employment requiring advanced education and high ethical standards.

Overdoses of agents, relative to social use, were also used to relieve the pain of surgery. Ethyl alcohol, opiates, and hallucinogens were all used for these purposes from time to time. However, the use of these prescriptions was, sadly, also not predictably safe or effective.

Sensory nerve trunks innervating more peripheral structures could be effectively anesthetized by tourniquets or freezing, which also helped with hemostasis, but these techniques were of limited use. Mesmerism or animal magnetism, hypnosis in modern terms, is effective on some individuals seeking pain relief but, again, is not predictably useful.

It was not until 1799 that Sir Humphrey Davy, the venerable English chemist, noticed that the pain associated with his own erupting third molar was relieved by the inhalation of nitrous oxide. In 1800 he published in *Researches, Chemical and Philosophical*: "As nitrous oxide in its extensive operation appears capable of destroying physical pain, it may probably be used with advantage during surgical operations in which no great effusion of blood takes place."[2] Despite the publication of *Researches*, no practical application of Davy's hypothesis was attempted at this time, and Davy made his name in the course of other chemical pursuits.

The same year *Researches* was published by Davy, future English physician Henry Hill Hickman was born. Hickman's experiments circa 1823 involved in part the partial asphyxiation of animals in glass domes. Hickman confirmed the Ancients' belief that unconscious animals with "animation suspended" could be operated on without reaction to pain. Soon, Hickman added small amounts of carbon dioxide and other agents to the bell chambers, but his use of any more effective agents, such as nitrous oxide, was never documented. Hickman's belief in suspended animation was such that he wrote: "I feel so confident that animation in the human subject could be safely suspended by proper means, carefully employed, that, (although I could not conscientiously recommend a patient to risk his life in the experiment) I certainly should not hesitate a moment to become the subject of it, if I were under the necessity of suffering any long or severe operation."[3] Hickman's suspended animation via asphyxiation found little enthusiasm even after he wrote of his experiments to the Royal Society of London in 1824 (perhaps because Davy was President of the Society that year), and petitioned at least the French courts on the continent.

Many are familiar with Dr Crawford W. Long of Georgia, who successfully administered ether

to his patients for straightforward surgical procedures as early as March 1842. However, although Long was one of the first to observe the potential benefits of such an agent he never made his observations known for the benefit of others, thus forgoing the honor of being the discoverer of surgical anesthesia.

In addition, although Long was honored with a United States postage stamp for his early use of ether, medical student William E. Clark actually administered ether to a Miss Hobbie for a dental extraction performed by dentist Elijah Pope in January 1842, predating Long (Yagelia J, personal communication, 2011).

Davy, Hickman, Long, Clark, Pope, and others such as Robert Collier (who mixed opium with rum in 1839) and E.R. Smilie (who combined opium and ether in 1844) all flirted with the potential to be the "greatest benefactor to mankind" for the discovery of anesthesia, but none effectively publicized their observations. That task was accomplished by Horace Wells, DDS.

Horace Wells, DDS

The story of Dr Horace Wells' observation and publication of the beneficial effects of nitrous oxide in surgical operations is well known. Wells attended Professor Gardner Q. Colton's nitrous oxide demonstration in Hartford, Connecticut on December 10, 1844 and noticed frolic participant Samuel Cooley traumatically lacerate his shin without reaction after inhaling nitrous oxide. Wells, a dentist sorely uncomfortable with the pain subjected to his patients by his treatment, was inspired. He was not slow about developing an experiment to test his insight. The very next day, Wells arranged for John M. Riggs, DDS, to remove Wells' own tooth after receiving nitrous oxide from Colton. Several quotes are attributed to Wells after the successful removal of his tooth by Riggs, but all stress that the operation, and the anesthetic, were a great success. Wells immediately began using nitrous oxide for his own patients. By the time Wells had completed only 12 or 15 procedures in his practice, he had arranged to demonstrate his findings clinically at The Massachusetts General Hospital in the operating room of John C. Warren. On Wells' arrival at the hospital, a patient in need of an amputation was present. However, the patient decided to "die whole" and declined the procedure despite assurances about the likely efficacy of nitrous oxide in relieving his pain. Wells then was allowed to give a lecture to Warren's medical students on his discovery, one of whom determined to have his own troublesome third molar removed at that time with nitrous oxide. Later that day, the student reported that he was completely satisfied and did not recall the extraction. However, while still under the influence of the nitrous oxide he had groaned at the end of the procedure, which led to Wells immediately being hooted out of the ether dome by the student patient's classmates.

Horace Wells, DDS, discoverer of anesthesiology.

Notwithstanding the groan, as time passed the world recognized Wells' singular efforts. In 1864 the American Dental Association (ADA) resolved:

> *…that to Horace Wells, of Hartford, Connecticut, (now deceased) belongs the credit and honor of the introduction of anesthesia in the United States of America, and we do firmly protest against the injustice done to truth and the memory of Dr Horace Wells, in the effort made during a series of years and especially at the last session of Congress, to award the credit to other persons or person.*[4]

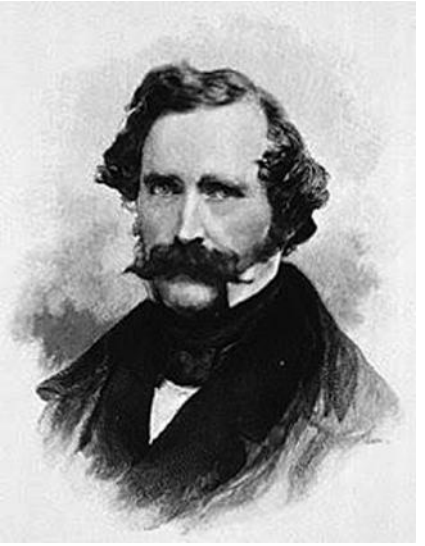
In 1872 the American Medical Association resolved "…that the honor of the discovery of practical anesthesia is due to the late Dr Horace Wells, of Connecticut."[5]

Through the years, perhaps culminating in 1944, the centennial anniversary of Wells' discovery, virtually every anesthesia entity has confirmed Wells' primacy as the Father of surgical anesthesia. That year, a year-long worldwide celebration of the event was coordinated by the ADA, which also published a book memorializing the event.[6] Only the American Medical Association (AMA) hedged its prior endorsement, iterating that Wells was "…one of the first…"; the likely reasons for this shift are discussed later.

William Taggert Green Morton, DDS

Dr William T.G. Morton was a member of the inaugural 1840 class of the Baltimore College of Dental Surgery, and subsequently an associate of Wells in Hartford, Connecticut. Virtually everyone in Hartford, including Morton, was familiar with Wells' well-established use of nitrous oxide. On October 16, 1846, Morton repeated Wells' trek to Warren's Massachusetts General Hospital operating room, but to administer a different inhalational agent. Morton arrived at the hospital late because the new inhaler he had ordered was not quite ready. Reportedly, on Morton's arrival Warren pointedly advised: "Doctor, your patient is ready." Morton then administered his "invention" lethion (ether fragranced with perfume), and after a moment boldly counteradvised Warren: "Doctor, *your* patient is ready." The patient, Gilbert Abbot, was successfully anesthetized and, after a neck tumor was quickly removed, Warren announced to the assembled students and faculty in the literal operating-room theater: "Gentlemen, this is no humbug."

Word spread rapidly about Morton's successful demonstration. Lethion was soon disclosed to be ether, and widespread use of the agent immediately followed. Morton, and an opportunistic peripheral contributor, Charles Jackson, also moved quickly, obtaining patent #4848 for lethion on 12 November, 1846. In this case, a conflict between patent law and medical "law" (really the ethical determination to not restrict access to health care innovations, as opposed to other inventions) resulted. After one precedent setting suit, Morton eventually dropped his patent claims to lethion anesthesia, although the process was time consuming over several years. The United States itself played a large role in resolution of the patent rights controversy when, in the Mexican-American War (1846–1848), ether was used liberally and without Morton's permission by the very government that had granted the patent. To his credit, Morton himself later administered 3000 anesthetics gratis during the Civil War.[7]



William Taggart Green Morton, DDS, was a student of Wells and introduced the world to the beneficial effects of ether in 1846.

ADDITIONAL EARLY CONTROVERSIES

In addition to the lingering question about who deserved primacy for the discovery of safe, effective, and reproducible anesthesia, other issues arose almost immediately.

The American Association of Dental Surgeons (AADS) opined that:

> *…every itinerating dentist, who gouges out a tooth or fills a cavity with amalgam…can arm himself with an inhaling apparatus, and a bottle of an anesthetic material, with which he expects to prey on the public…Hence, in all minor operations in surgery, their administration is forbidden; and that their demand in the practice of dental surgery is small…*[8]

Then, as today, there seemed to be 3 groups of individuals highly concerned with the practice of anesthesia: (1) doctors who had access to anesthesia, (2) doctors who did not have access to anesthesia, and (3) patients. Interesting dynamics developed within each group.

With regard to doctors who had ready access to the provision of anesthesia, some, such as Wells, stated that anesthesia "should be as free as the air we breathe," seeking first and foremost to provide the gift to the widest patient population possible. Others, such as Morton, by means of his US Patent 4848, sought to significantly restrict the ability of patients to receive anesthesia.

Doctors who did not have ready access to anesthesia, such as the AADS, also generally sought to restrict anesthesia's use by whatever means necessary, including claims that it was uneconomic, unsafe, immoral, hindered healing, and so forth.

Patients, on the other hand, universally wanted more access to anesthesia options, which in part may best explain the incongruous responses of doctors, and others, who saw no need for further anesthesia services. That is, some doctors who had ready access to anesthesia, such as Morton, may have noticed that they had a relative monopoly providing the service, and did not want it to be too easy for other doctors to use the craft. The

same restraining opinion was held by surgeons who did not have ready access to anesthesia when they noticed their patients leaving in droves, gravitating to others who could provide a pain-free option for their surgeries. It is interesting that much of the same dynamic can be seen even today when one looks at economically competing anesthesia and surgical providers.

Those opining that anesthesia should be limited were not restricted to doctors. Even religionists sought to curb anesthesia, quoting Genesis 3:16 as justification: "Unto the woman he said, I will greatly multiply thy sorrow and thy conception; in sorrow thou shalt bring forth children…"[9] Perhaps ministers noted that members of their flocks seemed to take more comfort in ether or chloroform during times of physical pain than from the words of their religious advisor. Be that as it may, another anesthesia pioneer, James Y. Simpson of Scotland, effectively countered preachers constraining anesthesia by noting not only that in the original Hebrew "sorrow" could also be translated as "labor," but also that God himself apparently approved of anesthesia, as noted during Adam's "deep sleep" for the thoracotomy necessary to create Eve by means of Adam's costae verae (Genesis 2:21).[10] The early debate about the propriety of the use of anesthesia during childbirth diminished greatly when Queen Victoria opted for chloroform during the delivery of her seventh child in 1853.

Nathan Cooley Keep, DDS

Although Simpson is generally rightfully acknowledged as the preeminent pioneer obstetric anesthesiologist, it should be noted that Nathan Cooley Keep, DDS, later the first dean of the Harvard School of Dental Medicine, was the first in America to provide obstetric anesthesia in 1847, the same year Simpson started the practice in Scotland. In 1867 Dr Keep became the founding dean of the new Harvard School of Dentistry. Keep was also known for his forensic efforts in the sensational Webster/Parkman murder trial, at which he identified a prosthesis he had made for Dr Parkman after Dr Webster had placed it in a furnace along with Parkman's dissected body parts.[11]

Nathan Cooley Keep, DDS, was the first dean of Harvard School of Dental Medicine and the first to practice obstetric anesthesia in the United States.

First Death

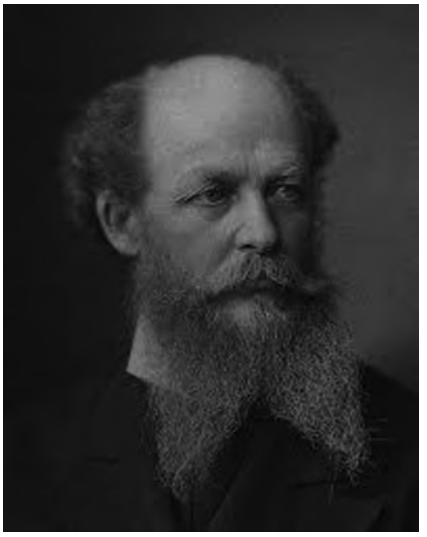
The first death noted in the literature was in 1848 and was that of Hannah Greener, a 15-year-old orphan who passed away during chloroform anesthesia administered by Mr Meggison for surgeon Mr Lloyd, who was addressing an ingrown toenail (unguis incarnatus).[12] The inquest after the incident assigned no legal blame to either Meggison or Lloyd. Later analyses of the cause were mixed, with Mr Sibson opining that the etiology was "paralysis of the heart," the French Academy of Medicine publishing "asphyxia alone," and the AMA stating it was due to "overdosage." For decades, early clinicians vigorously argued between a cardiovascular and pulmonary cause of death under anesthesia.

First Sexual Assault Claims

In 1847 a Parisian dentist was convicted of sexual assault on 2 girls. In 1854, United States dentist Stephen T. Beale was convicted and sentenced to 4.5 years in prison after a highly publicized trial in Philadelphia. However, the sentence was immediately overturned,[13] and the legal principle that the accusation of an anesthetized patient needs the corroboration from a noncompromised witness was established. Even today, an important function of OMS anesthesia team members is as objective witnesses to events as they actually occur, particularly when patients' memories are compromised by drugs or psychological reactions.[14]

Samuel Stockton White, DDS

Dr S.S. White, perhaps best known to OMS for carbide burs, was also the first to commercially render N_2O into liquid form in 1881 by means of hand-pump compression. Before this innovation, those administering N_2O had to produce the gas themselves for patient use, stored and delivered via large rubber bags. The SS White Company



Samuel Stockon White, DDS, founder and underwriter of the *Journal of the American Dental Association* precursor *Dental Cosmos*, liquefied nitrous oxide for clinical use.

was also a leading manufacturer of early anesthesia machines and equipment. White's efforts also facilitated Thomas Crapper's (of plumbed toilet fame) creation of an N_2O hyperbaric chamber.[15]

Alfred Coleman, DDS

Dr Ralph Waters, founding director of the first anesthesiology residency in the United States, is widely acknowledged as being the first to use CO_2 absorption clinically in 1919. However, the *British Medical Journal* published that Dr Coleman reported it was possible to save some of the products of respiration for further use as early as 1868. Coleman also described his invention of a CO_2 absorber that allowed N_2O to be reused, naming the device, in true dental entrepreneurial fashion, The Economizer.[16] Coleman was later named the first dental fellow of the Royal College of Surgeons.

Greene Vardiman Black, DDS

Dr G.V. Black, the father of Modern Dentistry and the founding dean of the Northwestern University School of Dentistry, developed the carious lesion classification system ubiquitously used by dentists to this day. Black also lectured on the "Introduction of Bromide of Ethyl as an Anesthetic for Dental Purposes or Any Very Short Operation" in 1883.[17]

Ferdinand Hasbrouck, DDS

When President Grover Cleveland was diagnosed with an intraoral tumor in 1893, the President's

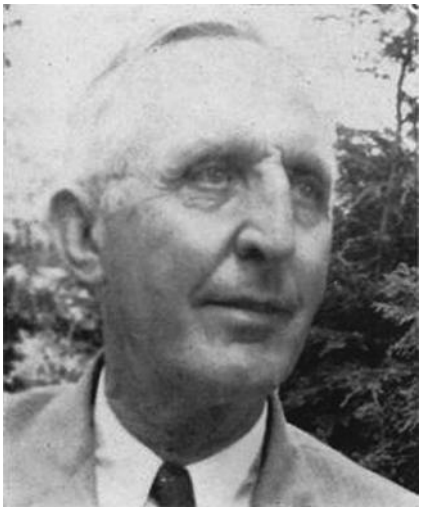
Greene Vardeman Black, DDS, father of modern dentistry, founding dean of Northwestern School of Dentistry, and general anesthesia educator.

surgeons chose Dr Hasbrouck as his dental surgeon and anesthesiologist. The operation was performed in secret on the yacht *Oneida* in the Long Island, New York Sound. Hasbrouck, as an operator anesthetist, induced President Cleveland with 100% N_2O and extracted teeth from the corpus of the tumor. As President Cleveland recovered from the N_2O, Hasbrouck began the administration of ether for the remainder of the procedure as performed by a team of surgeons. This incident was kept secret from the American public for decades.[18]

Statistically, it is not surprising that the President's anesthesiologist was Dr. Hasbrouck because dentistry was the qualitative and quantitative leader in the provision of anesthesia at this time. For instance, at Presbyterian Hospital in New York, 1,714 total anesthetics were administered in 1911. There were only a few hundred medical anesthesia providers in the country. On the other hand, "signs on dental offices everywhere proclaimed" the availability of general anesthesia for tooth extraction.[19] Many dentists administered thousands of anesthetics annually in their own offices.

Charles Teeter, DDS

In 1902, Dr Charles Teeter introduced the first anesthesia machine capable of delivering N_2O/O_2, ether, and chloroform. The gasses could be warmed, rebreathed, and administered under



Charles Teeter, DDS, President of both the American Society of Anesthesiologists and the International Anesthesia Research Society. (*From* ADSA. Available at: adsahome.org. Accessed May 1, 2013.)

positive pressure. Later Teeter added mercury columns to observe the flow of inhalational agents. He also designed the first nasopharyngeal tubes for clinical use. Teeter was well accepted by his medical colleagues, publishing in the *Journal of the American Medical Association*[20,21] and speaking at the AMA annual meeting several times about anesthesia. Teeter was elected President of both the International Anesthesia Research Society and the American Society of Anesthesiologists (ASA).

Jay A. Heidbrink, DDS

Dr Heidbrink successfully modified the Teeter machine into a "rather complicated" unit. The Heidbrink innovation and others were ultimately purchased by the Ohio Chemical Company, a leading manufacturer of anesthesia machines for decades. Heidbrink was the first to color code anesthesia gas tanks, and invented the pin index safety system. An exodontist before the formalization of OMS as a specialty, Heidbrink owned a practice in Minnesota that employed 3 dentist anesthesiologists. Heidbrink would transition room to room, operating as the dentist anesthesiologists would sequentially induce and recover patients with 100% N_2O. The American Dental Society of Anesthesiology (ADSA) Heidbrink Award is named after him.

Edgar Randolph Rudolph Parker, DDS

Dr Edgar R.R. Painless Parker was a highly successful, though controversial, dental entrepreneur

Jay A. Heidbrink, DDS, was an exemplary entrepreneurial exodontist/pre-OMS specialty educator and inventor. The preeminent anesthesia award of the American Dental Society of Anesthesiology is named in his honor. (*From* ADSA. Available at: adsahome.org. Accessed May 1, 2013.)

in California at the beginning of the twentieth century. Parker legally supplemented his name with Painless after the California State Board of Dental Examiners opined that his prior use of "painless" in promoting his dental practice was unethical. Unethical or not, the patients flocked to Parker's offices, enabling him to gross US$3 million in that era. Parker was at least relatively truthful in his use of "painless" because he was an early advocate of the routine use of local anesthesia, formulating his own solution dubbed "Hydrocaine."[22] The routine use of local anesthesia in dentistry did not come to fruition until the 1930s.[23]

1920 TO 1940: ORAL AND MAXILLOFACIAL SURGERY PREQUEL

1920 to 1940 were the years immediately preceding the formalization of OMS. Since the days of Wells and Morton, an insightful number of dentists had used general and local anesthetics in dentistry as they became available. The use of general agents was always controversial, as it also was in medicine, because of the less favorable patient risk/benefit analysis that existed or was perceived to exist for many decades. The success of Painless Parker in ushering in the increased acceptance of using local anesthetic resulted in dentistry gravitating toward that mode of pain relief. However, a core of dentists committed to the use of general

anesthesia successfully persisted. This group, including early exodontists from Wells and Morton to Hasbrouck in the 1800s and followed by Teeter, Heidbrink, and many others, were the precursors of today's specialty practitioners of OMS. Without question, what set OMS pioneers apart from the rest of dentistry was their use of general anesthesia.

In 1918 the American Society of Exodontists (ASE) was formed, and in 1921 the ASE renamed itself the American Society of Oral Surgeons and Exodontists (ASOSE).[24] The group's literature and annual meeting presentations from the 1920s and 1930s were dominated by the topic of inhalation general anesthesia, but also included talks about intravenous agents such as sodium thiopental as a cutting-edge presentation in 1934. Non-ASOSE dentists who used general anesthesia also existed, but their numbers began to be dwarfed by the ASOSE members in terms of both practitioners and anesthetics delivered. In large part this was because OMS exodontia operations are of short duration compared with dental restorations, which require a much longer and more labor-intensive general anesthetic. During this era, dentists were the most prolific providers of general anesthesia not only in dentistry, but in all the health professions, largely secondary to the outpatient office-based niche.

The American Board of Oral Surgery was established in 1940, and for decades Board candidates spent nearly equivalent amounts of time studying subject matter relating to surgery and anesthesiology.

Harry Seldon, DDS

The list of major contributors to anesthesia in the specialty at this time is impressive, but this chapter focuses on Dr Harry Seldon as a prototypical exemplar of the surgeon anesthesiologist from this era. In 1918 Seldon graduated from New York University College of Dentistry, and went on to publish several highly successful editions of *Practical Anesthesia for Dental and Oral Surgery—Local and General* in the 1930s, 1940s, and 1950s. He was the Director of Dentistry at the New York Metropolitan Hospital and Chief of Anesthesia of the New York University. He was elected President of the ASOS in 1956, and the Center for OMS at the Israeli Government Hospital in Haifa is named after him. Seldon's texts present a wonderful retrospective history of the advancements in anesthesiology and surgery during these years.

1940S

This decade was significant in that anesthesiology changed from what was often deemed an insignificant afterthought that might be administered by technicians during surgery to an area that began to be embraced as essential by dentistry, medicine, veterinary medicine, and nursing.

The remarkable growth of anesthesiology in the 1940s was brought on by 2 major factors. First, it was the decade that recognized the 100th anniversary of the discovery of anesthesia, even as it was still a somewhat controversial question. A US postage stamp was issued in recognition of Crawford W. Long in 1942, the centennial of his first use of ether. Long did not make known his observation of ether's effectiveness until years later, so cannot be acknowledged as the discoverer of the art.

The ADA, recognizing since 1864 that Horace Wells was the first to observe and make known the benefits of general anesthesia, planned a centennial celebration for its annual meeting in 1944. However, the ADA's plans were truncated by restrictions on travel secondary to World War II. The ADA ultimately issued a book[25] acknowledging Wells' efforts with testimonials from virtually every dental association and developed country in the world.

In 1944 Paramount Pictures released a feature-length movie titled "The Great Moment" based on Rene Fulop-Miller's *Triumph Over Pain* (1940) and starring Joel McCrea as Morton.

The second factor influencing the remarkable recognition of anesthesia was World War II itself. In fact, wars did much to promote the art during the previous century. Morton provided 3000 anesthetics during the Civil War.[7] The American Association of Nurse Anesthetists traces its founding to the same conflict. However, World War II was the first time that the military formally planned for the provision of anesthesia during surgery. For instance, the Pitt Brigade, led by Leonard Monheim, DDS, was just one dental unit that was dedicated to providing anesthesia for wartime surgical procedures. Other dentists such as Milton Jaffe were also leaders in these groups of dentist anesthesia providers.[26] Heidbrink's anesthesia mask was modified for aviation use and more than 1 million such masks were produced for aviators.

In 1945, the ASA underwent its fifth and final name change after being initially formed in 1905. The American Board of Anesthesiology was formed in 1941, 1 year after the American Board of Oral and Maxillofacial Surgery (ABOMS).

Also in this decade, Leonard Monheim published "A, B, and C" preanesthesia risk categories while Harry Archer offered "1, 2, and 3" risk

classifications. In 1963 the ASA first produced its Physical Status Classification, of which later versions are ubiquitous today.

Adrian Orr Hubbell, DDS

Adrian Orr Hubbell graduated from the University of Southern California School of Dentistry in 1937 and subsequently trained as a resident in oral surgery and anesthesiology at the Mayo Clinic through 1939. The Mayo Clinic was the second anesthesiology residency, established by John Lundy, MD, following Wisconsin's program Chaired by Ralph Waters, MD.

While at the Mayo Clinic, Hubbell was introduced to the new intravenous short-acting barbiturate sodium thiopental. Contrary to all the current conventional wisdom, Hubbell determined that thiopental would be a valuable drug for office-based OMS procedures and immediately began to use it at his private practice in Long Beach, California after successful completion of his dual residency training. During the course of his career, Hubbell administered more than 300,000 thiopental anesthetics without mortality. Hubbell demonstrated his preoperative diagnostic acumen, evidenced by the fact that 3 patients he admitted for inpatient anesthetics succumbed during the hospital procedures.

Hubbell published his findings extensively in the dental and medical literature,[27–34] and also obtained US Patent #2,471,623 for An Apparatus for Handling Fluids.[35] Popularly known as the "Hubbell Bubble," the device featured a handheld rubber bulb by which incremental doses of thiopental could be conveniently dosed. Later versions were modified so that dosing could be accomplished by a knee or foot bulb. Similar to earlier N_2O/O_2 practitioners, Hubbell used thiopental as his single agent, usually omitting even local anesthesia.

Adrian Orr Hubbell, DDS, intravenous office-based outpatient anesthesia pioneer. (*From* American Association of Oral and Maxillofacial Surgeons. The building of a specialty: oral and maxillofacial surgery in the United States. J Oral Maxillofac Surg 1989; 47(10 Suppl 2):1–271.)

In the early 1950s, Hubbell and Harold Krogh, another early Mayo Clinic OMS/anesthesia resident, offered their successful thiopental techniques as nationwide continuing education to the OMS community, thus establishing the basis of the preferred intravenous techniques used by many OMS to this day. Hubbell was the first to publish the term "team anesthesia" to describe the office-based, outpatient general anesthesia experience developed by OMS.[36]

1950S

The decade started with the momentous decision of the ASA to rescind unrestricted membership for dentists, which included dentist anesthesiologists and many OMS.[37] The ADSA was then established by and for former ASA dentist members and others who realized that dentistry needed a platform from which to address anesthesia issues.

As an interesting aside, in 1953 the AMA attempted to define Oral Surgery and produced a document the ADA found to be inaccurate and objectionable. The Board of Trustees of the AMA subsequently rescinded the document.[38] The AMA's 2009 Scope of Practice Data Series comments on OMS are nothing new…but have not been rescinded to date.[39]

1960S

In 1960 The American Association of Oral and Maxillofacial Surgeons (AAOMS) (American Society of Oral Surgeons [ASOS]) Committee on Graduate Training issued the document "Essentials of an Adequate Training Program in Oral Surgery." The document stressed the primacy of anesthesia training in OMS residencies, which were 3 years' duration at that time, by iterating: "Ideally, training in anesthesia should extend throughout a twelve-month period. Such a schedule of study allows for the other 2 years to be devoted exclusively to the various aspects of clinical oral surgery." In addition to the ideal 12 consecutive months of operating room–based anesthesia, OMS residents were generally immersed in OMS office-based team general anesthesia paradigms such as the Hubbell Los Angeles County/University of Southern

California/Medical Center (LAC/USC/MC) intravenous thiopental paradigm and OMS Morgan Allison's Ohio State University intubated inhalational model.

Although most of the anesthetics provided by OMS in the 1960s were general anesthetics, sedative techniques were present. Niles Jorgensen, DDS, at Loma Linda University, had developed the popular "Jorgensen Technique" of intravenous pentobarbital, meperidine, and scopolamine. Harry Langa, DDS, in New York, advocated the "relative anesthesia" technique, which was a shift from N_2O/O_2 general anesthesia to N_2O/O_2 sedation. Milton Jaffe, DDS, reported his use of intravenous ether for sedation, an effective technique familiar to the author.[40,41] Diazepam was made available by Hoffmann-La Roche in 1963.

In 1967 the ADSA initiated its Fellowship Examination process, open to any dentist who had a minimum of 1 year of operating room–based anesthesia residency training.

The Southern California Society of Oral and Maxillofacial Surgeons

In 1967, the Southern California Society of Oral and Maxillofacial Surgeons (SCSOMS) began voluntary in-office anesthesia evaluations as a society.

Southern California OMS leaders, such as John "Jack" Lytle, DDS, MD, who trained at LAC/USC/MC in the 1950s and 1960s, were purists of the "Hubbell School," although thiopental had been largely replaced by methohexital. The LAC/USC/MC technique typically used 8 to 14 mL of a 1% solution. Patients generally became apneic, but the initiation of the surgery as the last of the methohexital was entering the vein stimulated ventilation. No monitors were attached to the patient, so skin and mucosal color were used to determine the level of oxygenation.[42]

John "Jack" Lytle, DDS, MD, authored many early OMS anesthesia safety articles in the professional literature. (*From* American Association of Oral and Maxillofacial Surgeons. The building of a specialty: oral and maxillofacial surgery in the United States. J Oral Maxillofac Surg 1989;47(10 Suppl 2):1–271.)

Harry Seldin, DDS, had reported about OMS office anesthesia safety beginning in the 1950s.[43,44] Lytle magnified the early reporting efforts of Seldin on morbidity and mortality, beginning a series of publications about anesthesia in OMS offices in 1974.[45–47] Similar studies are now regularly published to this day. Over the years, the OMS-coordinated team paradigms have seen the incidence of mortality reported initially by Seldin as 1 in 66,000 decrease to less than 1 in 720,000, a safety record second to none for any surgical procedure in any venue.

1970S

That the AAOMS (ASOS) was supportive of the rapidly spreading concept of state component in-office evaluations was demonstrated by the publication of the ASOS *Office Anesthesia Manual*, cost $4.50 prepaid, in 1976. The eighth edition of this resource was published in 2012.

In 1977 the prescient SCSOMS initiated its OMS Anesthesia Assistant Courses, which are still ongoing and are scheduled to be presented in large part online in 2013. The AAOMS Oral and Maxillofacial Anesthesia Assistant Program started in 1986 and evolved into the Dental Anesthesia Assistant Certification Examination (DANCE) in 2009.

The 1970s saw the AAOMS residency educational emphasis begin to change markedly with regard to anesthesia rotations. Even as single degree programs increased to 4 years and dual degree programs to 6 years, operating room–dedicated anesthesia experiences were reduced to 6 months. The additional years of training were composed of medical school and/or rotations with emphasis on internal medicine. This change came about in an effort to prepare OMS to effectively represent the specialty in hospitals when competitor physicians questioned the OMS's ability to complete adequate history and physical (H&P) examinations and hospital admissions overall. ABOMS applicants of this era might never be asked a question about teeth, but could fully expect queries about ectopic tubal pregnancies or be asked to listen to and diagnose heart sounds.

During this decade the author was a dentist anesthesiology resident at the University of Utah Medical Center Department of Anesthesiology,

1 of more than 150 programs that had produced dentist anesthesiologists up to that time.[40] Not a few OMS at this time completed 2 years in anesthesiology, 1 year as a dedicated anesthesia resident and an additional year during OMS residency training. This training gave OMS a cadre of individuals with training and insight into both anesthesiology and OMS, doctors who were valuable to the profession clinically, academically, in research, and politically.

In 1976 the ASA introduced the resident's written examination as the first step in becoming board certified in anesthesiology. Dental residents at the University of Utah were enrolled for the test, and one first-year dental resident achieved the second highest score in the program on the examination, competing against more than 30 other first, second, and third (research) year physician residents. The University of Utah and other medical anesthesiology programs petitioned the ASA to allow dentists to continue on the track to ASA board certification. These requests were refused by the ASA, in a decision reminiscent of the 1950 determination to rescind full unrestricted dentist anesthesiologist membership in the ASA.[37]

During the author's residency, the ADA Council on Judicial Procedures determined that dentist residents in anesthesiology residencies were in parallel situations to those in Commission on Accreditation (CODA) accredited residencies (W. Elliott Dunn. Secretary, Council on Judicial Procedures, Constitution and Bylaws, American Dental Association. personal communication, 1976). Dental anesthesiology residencies ultimately became CODA accredited in 2005.

In early 1976 the opening of Utah's first outpatient surgical center was announced to university anesthesia residents at rounds. It was explained that this was a facility where patients could be admitted in the morning, receive an anesthetic for a surgical procedure, and return home on the same day! The anesthesia faculty discussed in an animated fashion whether this new model was safe and questioned if it would even survive. One of the dental residents then commented that dentistry had been doing the same thing for 100 years (actually since December 1844), out of private dental offices in fact, causing consternation for the physician anesthesiologists in the room. There is no question that dentistry, and specifically OMS, in large part helped to develop the outpatient anesthesia paradigm that grew rapidly after Hubbell's contributions. That medicine finally began to adopt part of this model in the 1970s is telling. Only recently has medicine begun to investigate the second component of the dental model, namely providing outpatient services outside the operating room.[48]

One final note about the author's anesthesia residency experiences is somewhat humorous and relates to differences in dental/medical training. For students learning anesthesia in dental schools, training usually involves student-on-student practice, particularly with local anesthesia. This model has been criticized, but has been the status quo in dentistry since the day dentistry adopted the use of local anesthesia.[49] One evening, preparing for the next day's case load, 2 of Utah's dental residents determined to administer an interscalene brachial plexus block for an upper extremity procedure. Part of the dentists' late evening preparation involved intentionally eliciting digital paresthesia while practicing needle placement for the block on each other in classic dental-school fashion. When discussing the proposed upper extremity case anesthetic the next morning with the faculty, it was difficult to determine who was more incredulous, the speechless faculty when advised of the practice session, or the dental students who could not fathom the faculty's shock at the resident's dental-school mode clinical practice session.

1980S

Although the basic OMS office-based team anesthesia paradigm has remained essentially the same for decades, it has progressed in terms of monitoring, that is, from skin color in the early 1970s to end-tidal CO_2 today. The drugs used have changed too, from sodium thiopental to sodium methohexital to propofol for typical Hubbell-type short general anesthesia cases.

With the decreased emphasis on dedicated anesthesia training in OMS residencies, many more recent graduate OMS have moved to drugs that can be classified as more of a sedative than a general anesthetic. From the early days of the Jorgensen technique, the introduction of diazepam produced a significant number of diazepam/meperidine OMS sedation providers. The introduction of midazolam, which is shorter acting than diazepam, in 1986 produced a logical midazolam/fentanyl sedation combination that is popular to this day.

Ketamine is commonly used today, largely because OMS clinicians who realized early on that one could avoid the infamous emergence deliria by a marked reduction of the Physician Desk Reference (PDR) suggested dosage, which was originally designed for longer-duration general anesthesia. The PDR-advised doses of more than 1 mg/lb were reduced to less than 1 mg/kg, and were found to be effective for dental office-based procedures.[50]

Tony Protopappas, DDS

Not everything related to dental anesthesia that emanated from Southern California was positive. The 1980s also saw the beginnings of media sensationalization of dental office–related morbidity and mortality. This continuing trend of disproportionate media scrutiny, relative to surgical center–based or hospital-based anesthetic complications, started in 1983 when Orange County dentist Tony Protopappas was prosecuted for second-degree murder for mishandling anesthesia for 3 patients who died under his care. Protopappas was sentenced to life in prison, but was paroled in August 2011.[51] This case helped voluntary societal SCSOMS office examinations evolve into nationwide state board regulated general anesthesia permits for all dentists.

Popular Media Assaults

The American Broadcasting Company (ABC) aired a 2-part exposé on dental anesthesia in 1983. The ratings-driven cyclical media assault on dental anesthesia has continued, and occasionally OMS paradigms are specifically mentioned. Fortunately, dental/OMS office–based anesthesia has flourished in the United States, in part because the ADA have a well-trained cadre of dentist anesthesiologist spokespersons who effectively defend dental anesthesia, including the OMS model, when dealing with the media.

Poswillo Report

In other areas of the world, for instance in Great Britain since 2002, dentists have lost the legal ability to provide general anesthesia in their offices. The National Health Service, after evaluation of the 1990s Poswillo Report, opined that the only safe place to administer general anesthesia was in a hospital. Historically, millions of general anesthetics were safely administered in dental offices in Great Britain annually, as is the case now in the United States. A mere 8 dental-office mortalities from 1996 to 1999 precipitated the Report. OMS David Poswillo's committee recommended that dentists needed to receive standardized postgraduate training (other than that received in dental school). The recommendation was impossible to implement because there was no formalized residency or specialty training in dental anesthesiology in Great Britain.[52] Poswillo passed away in June 2003 in London.

OMS Political Shift

OMS support was fundamental to the formation of the ADSA in 1953. The first issue of the *ADSA Newsletter* mentioned, 3 times in the first 3 paragraphs, the advisability of establishing a specialty in anesthesiology in dentistry.[53] In 1979, AAOMS President Bill Wallace openly supported a specialty of anesthesiology in dentistry. Partially in response to the trends seen in Great Britain, in 1980 OMS Tom Quinn recommended anew that the ADSA pursue ADA specialty status for anesthesiology. In 1982 the American Dental Board of Anesthesiology (ADBA) formed, and original Board members included preeminent OMS such as President Dan Laskin, Robert Campbell, and Frank McCarthy. Progress to the specialty application continued, and in 1986 the ADBA proposed that ADSA Fellows, including all dentist anesthesiologists and OMS practitioners, would be grandfathered as anesthesia specialists. However, in 1988 the AAOMS Board determined to not continue to support the specialty application, stating in part that a specialty was not in the best interest of OMS.[54] AAOMS then sent a missive to all AAOMS members of the ADSA encouraging them to oppose the specialty effort for reasons such as: "…may greatly affect the anesthesia practice of OMS…could potentially have a detrimental affect [sic] in a court of law."[55]

1990S

This decade saw 3 anesthesiology specialty applications, sponsored by The American Society of Dentist Anesthesiologists (ASDA), successfully advance through the ADA specialty application structure to the last ADA arbiter, the House of Delegates. Each application, in 1994, 1997, and 1999, failed to be approved by the House of Delegates. In each case organized OMS, via AAOMS, led the fight against the application.

Historically, there were more than 150 anesthesia residencies that had allowed dentist residents through the decades. In June 1990 the ASA was advised about the numbers of dentist anesthesiologists that had been trained in medical residencies through the years. The ASA then contacted the Accreditation Council for Graduate Medical Education (ACGME) and opined that residencies that deigned to train dentists should not be accredited. The ACGME then contacted all accredited anesthesiology residencies and iterated that if dentists continued to be rostered, programs might lose accreditation. Almost overnight, all but a handful of medical residencies determined to no longer admit dentists for training. The AAOMS, however, was able to negotiate continued rotations on anesthesiology services for OMS residents.

In October 1991, the ADSA voted to discontinue its funding support for a specialty of anesthesiology in dentistry.[53]

2000S

In 2000, the AAOMS published its first *USA Today* supplement. Covered topics included the broad scope of all OMS, including a section on anesthesiology.

Also in 2000, the AAOMS initiated the Office Anesthesia Study, which was to evaluate 4 areas: (1) characterization of the types of anesthesia used; (2) variations in the types of anesthesia based on ASA status, OMS training, the surgical procedures, and the facility used; (3) associated complication rates; and (4) patients' views about the anesthesia experience. The overall purpose of the study was to protect the OMS niche from those who would attack it. The results of the study were published in the *Journal of Oral and Maxillofacial Surgery*.

In 2001 Laerdal introduced SimMan, which was first used in an ADSA course in 2002. Beginning in 2005, the AAOMS annual meeting developed continuing education course options for attendees, enabling certification in Advanced Cardiac Life Support and Pediatric Advanced Life Support.

The CODA approved accreditation for dental anesthesiology residency training in 2005. The numbers of 3-year anesthesiology programs available to dentists is now increasing annually.

In 2008 at the annual meeting of the American College of Legal Medicine (ACLM), a professional society comprising dentist and physician attorneys, a paper was presented stating: "In addition, anesthesia is sometimes being administered by the surgeon himself/herself even though it is *far safer* to employ an anesthesiologist or other adequately trained health care professional to manage anesthesia and sedation." This article's author responded with concern to the disingenuous posture of the ACLM paper with regard to anesthesiology in dentistry. To date, the subject has not been broached again at the ACLM.

In 2012 the AAOMS released the eighth edition of the *Office Anesthesia Evaluation Manual*. In addition, all AAOMS members had to now successfully complete an in-office anesthesia evaluation as a prerequisite for membership.

ABC's most recent media exposé on dental anesthesia, "Death, Greed, at the Dentist, American Children at Risk," was aired in July 2012.[56] The ADA continues to reach out to anesthesiology-trained dentist spokespersons to defend in the media all modes of anesthesia in dentistry, including OMS. These ADA voices are able to point to an overall safety record second to none in any venue, and continue to be effective.

The most important issue considered at the October 2012 ADA Annual Meeting was the anesthesia specialty application, the fourth in 20 years and fifth overall. Once again, after vetting and approval of the application by the ADA's Council on Dental Education and Licensure, Committee on Recognition of Specialties and Interest Areas in General Dentistry, and the Board of Trustees, the House of Delegates voted against the application. As with the anesthesia specialty efforts in the 1990s, organized OMS, after leading the opposition to the application, once again applauded its defeat as the result most optimal for dentistry and OMS. OMS once again established itself as the only ADA-recognized specialty with a significant emphasis on advanced pain control. Shortly after the 2012 ADA vote against the anesthesiology specialty application, the ASDA removed language from its founding documents that specifically supported the traditional OMS anesthesia model.

THE FUTURE OF ANESTHESIOLOGY IN OMS

Just as dentistry began to be accepted as a profession only after Wells introduced anesthesiology to the world, so OMS became a specialty primarily because a group of pioneer exodontists set themselves apart from their dental colleagues by embracing general anesthesia.

The modern OMS anesthesia model inspired by surgeons such as Hubbell in the 1930s must be diligently and judiciously enhanced both clinically and politically by today's OMS anesthesia educators, researchers, and private practitioners. Continued progression in the art and science of OMS office-based team anesthesia will do much to preserve OMS's anesthesia heritage and ensure its future preservation.

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