

DENTISTRY IN THE DEVELOPMENT OF MODERN ANESTHESIOLOGY: A REVIEW

ABSTRACT

Dentistry has played a vital role in the development of modern anesthesia. The evolution of modern anesthesia started in the 19th century with the contributions from dentists like Horace Wells, William Morton and many others. Dentistry was the qualitative and quantitative leader in the provision of anesthesia at this time. Today dentistry has moved towards the use of local anesthetics (with or without sedation) for the control of pain and anxiety. More complicated and major procedures in oral and maxillofacial surgery still rely on the use of general anesthetics although not allowed to administer general anesthetics.

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No history of anesthesiology can exclude the contribution of dentistry especially oral and maxillofacial surgery (OMFS). For years man has understood that the pain from surgical treatment is worse than that of simply not treating the condition. The fear of pain associated with treatment was such that patients often refused treatment, accepting their inevitable fate, often death. The ancients noted that surgical procedures could be done on unconscious patients without subjective pain. Even therapeutic strangulation to a point of unconsciousness became an option for surgical treatment but it often rendered them dead. Overdoses of certain agents like ethyl alcohol, opiates, hallucinogens, or even mesmerism were used to relieve the pain of surgery. These were however not predictably safe or effective.¹



Fig 1: operations without anesthesia

In 1799 Sir Humphry Davy an English chemist, noticed that the pain associated with his own erupting third molar was relieved by the inhalation of nitrous oxide. 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" (1800). English physician Henry Hill Hickman's "experiments circa" in 1823 involved partial asphyxiation of animals in glass domes. He confirmed the ancient belief that unconscious animals with "animation suspended" could be operated without pain. He added small amounts of carbon dioxide and other agents to the

bell chamber. Hickman's suspended animation via asphyxiation found little enthusiasm even after he wrote of his experiments to the Royal Society of London in 1824.³

Dr Crawford W. Long of Georgia successfully advocated ether to his patients for surgical procedures in 1842. Although he was the first to observe the potential benefits of this agent he never made his observations known for the benefit of others, thus forgoing the honor of being the discoverer of surgical anesthesia. Medical student William E. Clark administered ether to a Miss Hobbie for a dental extraction, performed by dentist Elijah Pope in January 1842 predating Long. Davy, Hickman, Long, Clark, Pope, and others such as Robert Collier (mixed opium with rum in 1839) and E.R. Smilie (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. The task was accomplished by Horace Wells, DDS, in 1844.¹

HORACE WELLS, DDS

Wells' observation and publication of the benefits of nitrous oxide in surgery is well known. He had attended Professor Gardner Q. Colton's nitrous oxide demonstration at Hartford, Connecticut, where he saw the subject traumatically lacerate his skin without reaction after inhaling nitrous oxide. Wells' a dentist who was uncomfortable with the pain subjected to patients by his treatment was inspired by what he saw. The very next day he arranged for John M. Riggs, DDS, to remove Wells' own tooth after receiving nitrous oxide from Colton, without pain. He demonstrated his findings clinically at the Massachusetts General Hospital where one of the medical students volunteered to get his troublesome third molar extracted under nitrous oxide and later reported that he was completely satisfied with the procedure and did not recall the extraction. The world recognized Wells' singular efforts in 1864 after a lot of controversy. 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....."⁵

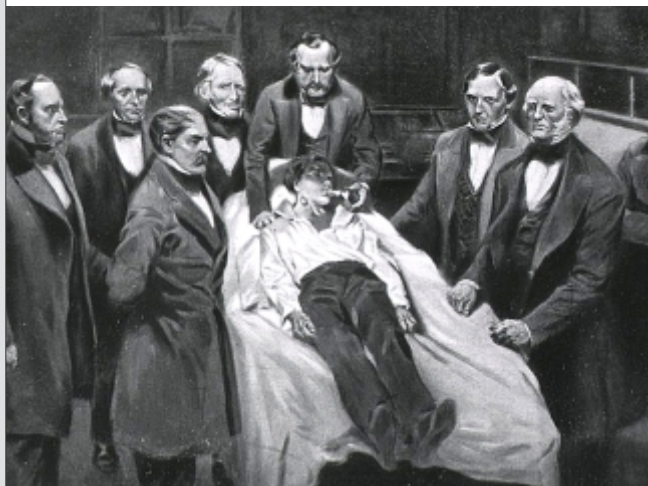


Fig 2: Demonstration of general anesthesia at the Massachuset

In 1872 the American Medical Association (AMA) resolved “.....that the honor of the discovery of practical anesthesia is due to the late Dr. Horace Wells of Connecticut....”⁶

In 1944, the centennial anniversary of Wells’ discovery, virtually every anesthesia entity confirmed Wells’ primacy as the ‘father of surgical anesthesia’. The ADA conducted a yearlong worldwide celebration and also published a book memorializing the event. The American Medical Association (AMA) later on deferred from their previous endorsement and said that Wells was “....one of the first...”



Fig 3: Horace Wells

WILLIAM TAGGERT GREEN MORTON, DDS

Dr William T.G. Morton was a member of the inaugural 1840 Baltimore College of Dental Surgery and subsequently an associate of Wells at Hartford, Connecticut. Morton tried a different inhalational agent, his invention “Lethion” (ether fragrancd with perfume), at the Massachusetts general Hospital operating room. The patient was successfully anesthetized and a neck tumor quickly removed. Lethion was soon disclosed to be ether and widespread use of the agent followed. In the Mexican American war ether was used liberally without Mortons’ permission by the government that had granted him the patent. Morton himself later advocated 3000 anesthetic gratis during the civil war.⁷



Fig 4: administration of ether by William Morton

In addition to the question about who deserved the primacy for the discovery of safe and effective anesthesia, there were other issues. The American Association of Dental Surgeons (AADS) said 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 anesthetic material, with which he expects to prey on the public.... Hence in all minor operations in surgery, their administration is forbidden, as that their demand in the practice of dental surgery is small.”⁸

With regard to doctors who had ready access to anesthesia such as Wells, stated that anesthesia “should be free as the air we breathe” seeking to provide to

the widest patient population. Others such as Morton by means of his U.S. patent sought to significantly restrict the ability of patients to receive anesthesia. Doctors who did not have ready access to anesthesia such as the AADS sought to restrict anesthesia use by saying that it was uneconomic, unsafe, immoral, hindered healing, and so on. Patients on the other hand wanted more anesthesia options during their treatment as it significantly reduced pain. 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 they noted that people seemed to take more comfort in ether and chloroform during times of physical pain than from religion. The debate about anesthesia diminished greatly when Queen Victoria opted for chloroform during delivery of her seventh child in 1853.

Samuel Stockton White (DDS) - best known to OMS for carbide burs was also the first to commercially render nitrous oxide into liquid form in 1881 by means of hand-pump compression. Before this those administering nitrous oxide had to provide the gas themselves for patient use, stored and delivered via large rubber bags.¹³

Alfred Coleman (DDS) published in British Journal that it was possible to save some of the products of respiration for further use in 1868. Coleman described his invention of a carbon dioxide absorber that allowed nitrous oxide to be reused, naming the device “The Economizer.”¹⁴ Coleman was named the first dental fellow of the Royal College of Surgeons.

Green Vardiman Black (DDS) the father of modern dentistry and founding dean of the North Western University School of dentistry developed the carious lesion classification system. He also lectured on the “introduction of Bromide of ethyl as an anesthetic for dental purposes or any very short operation” in 1883.¹⁵

Ferdinand Hasbrouck (DDS) in 1893 induced President Grover Cleveland with 100% nitrous oxide and extracted teeth from the corpus of an intra oral tumor. The incident was kept secret from public for decades.¹⁶

Statistically dentistry was the qualitative and quantitative leader in the provision of anesthesia at this time. There were only a few medical anesthesia providers; on the other hand “signs on dental offices everywhere proclaimed” the availability of general anesthesia for tooth extraction.¹⁷

Charles Teeter (DDS) in 1902 introduced the first anesthetic machine capable of delivering nitrous oxide, oxygen, ether and chloroform. The gas could be warmed, rebreathed, and administered under positive pressure. Later he added the mercury column to monitor the flow of inhalational agents. He also designed the first nasopharyngeal tube for clinical use. He was elected president of both the Anesthesia research society and the American society of anesthesiologists.^{18,19}

Jay A. Heidbrink (DDS) was the first to color code the anesthesia gas tubes and invented the pin index safety system. Heidbrink owned a practice in Minnesota that employed three dental anesthesiologists who would induce and recover patients with 100% nitrous oxide. The American Dental Society of Anesthesiology (ADSA) Heidbrink award is named after him.

Edgar Randolph Rudolph Parker (DDS), known popularly as “painless Parker” was an early advocate of the routine use of local anesthesia, formulating his own solution “hydrocaine.”²⁰ The routine use of local anesthesia in dentistry did not come to popularity until the 1930’s.²¹

ORAL AND MAXILLOFACIAL SURGERY PREQUEL

1920 - 1940’s were the years immediately preceding the formalization of Oral and Maxillofacial surgery. Since Wells and Morton, a number of dentists had used general anesthesia as they became available. Their use was highly controversial, as it was also a part of medicine and the less favorable patient risk / benefit analysis that existed. The success of Painless Parker using local anesthesia led to dentistry moving towards that mode of pain relief. However a core group of dentists committed to the use of general anesthesia persisted. This group of exodontists from Wells and Morton to Hansbrouck in the 1800’s and followed by Teeter and Heidbrink and others were the precursors of today’s specialty of Oral and Maxillofacial Surgery (OMFS). What set the OMFS

pioneers apart from the rest of dentistry was their use of general anesthesia.

In 1918 the American society of Exodontists was formed (ASE) and in 1921 renamed itself the American society of Oral surgeons and exodontists (ASOSE).²² The groups literature and annual presentations from 1920 - 1930 were dominated by the topic of inhalational general anesthesia, but also included intravenous agents such as sodium thiopental as a cutting edge presentation in 1934. During this era dentists were the most prolific providers of general anesthesia not only in dentistry but in all the health professions. The American board of Oral surgery was established in 1940 and for decades board candidates spent nearly equivalent amount of time studying surgery and anesthesiology.

In 1918 Harry Seldon a surgeon anesthesiologist, graduated from the New York University school of dentistry and went on to publish several successful editions of *Practical Anesthesia for dental and oral surgeons - local and General* in the 1930, 1940, 1950's. His texts present a retrospective history of the advancements in anesthesiology and surgery during these years.

1940's was significant in that anesthesiology changed from what was often considered as insignificant, that might be administered by technicians during surgery, to an area that is essential by dentistry, medicine, veterinary medicine and nursing. This remarkable growth was brought about by two major factors. First it marked the 100th anniversary of the discovery of anesthesia even though it was still a controversial thing. The second factor was the World War II which saw the profound use of general anesthesia. The military formally planned the use of general anesthesia during surgery. Leonard Monheim DDS and other dentists such as Milton Jaffe were leaders as dental anesthesia providers during this time.²³ Heidbrink's anesthesia mask was modified for aviators and more than one million masks were produced for aviators. Leonard Monheim published the "A, B, and C's" of pre-anesthetic risk while Henry Archer offered "1, 2 and 3's" risk classification. In 1963 the ASA produced its first physical status classification, of which later versions were added and even used today.

Adrian Orr Hubbell, (DDS) 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 where he was introduced to the new intravenous short acting barbiturate, sodium thiopental which was found to be a valuable drug for office based oral and maxillofacial surgery. He administered more than 300,000 thiopental anesthetics without mortality. He published his findings in dental and medical literature²⁴ and also obtained a US patency for an apparatus for handling fluid, popularly known as the "Hubbell's Bubble".²⁵ It had a hand held rubber bulb by which incremental doses of thiopental could be administered. Hubbell used thiopental as his single agent, usually omitting even local anesthesia. In the 1950's Hubbell along with Harold Krogh, offered this successful thiopental technique as a continuing education to the oral and maxillofacial community, thus establishing the basis of the preferred intravenous technique used by many to this day. Hubbell was the first to publish the term "team anesthesia", the office based outpatient general anesthesia experience developed by oral and maxillofacial surgery.²⁶

The 1950's started with the decision of the ASA to cancel unrestricted membership for dentists, which included many dentist anesthesiologists and oral and maxillofacial surgeons.²⁷ The ADSA was then established by the former dentist members who realized that dentistry needed a platform to address their anesthesia issues.



Fig 5: modern anesthesia equipment

Although most of the anesthetics provided in OMFS in the 1960's were general anesthesia, sedative techniques were present. Niles Jorgenson, DDS at Loma Linda university, developed the popular "Jorgensons technique" of intravenous Phenobarbital, meperidine, and scopolamine. Harry Langa DDS in New York advocated the 'relative anesthesia' technique with a shift from N₂O/O₂ general anesthesia to N₂O/O₂ sedation. Milton Jaffe DDS reported the use of intravenous ether for sedation.^{28,29} Diazepam was made available by Hoffman-La Roche in 1963.

In 1976 the ASA introduced the resident's written examination as the first step in becoming board certified in anesthesiology. 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 with the determination to cancel all unrestricted dentist anesthesiologists membership in the ASA.²⁷

In 1990 the ASA contacted the accreditation council of graduate medical education (ACGME) and opined that residencies that train dentists should not be accredited. The ACGME contacted all anesthesiology residencies and informed that if dentists continued to be trained, programs might lose accreditation. Almost all medical residencies no longer admitted dentists for training. In October 1991, the ADSA voted to discontinue its funding support for a specialty in anesthesiology in dentistry.³⁰

Today dentistry has moved towards the use of local anesthetics (with or without sedation) for the control of pain and anxiety as they were considered relatively safe and well tolerated by the patients for relatively short dental procedures.²

Conclusion

It is interesting to note the contribution of dentistry in the development of modern general anesthesia. History and literature shows that dentists especially oral and maxillofacial surgeons were the qualitative and quantitative providers of general anesthesia once upon a time, not only in the field of dentistry but the whole of medical profession. Today dentistry has moved towards the relatively safer local

anesthetic agents for the control of pain in minor procedures. More complicated and major procedures in oral and maxillofacial surgery still rely on the use of general anesthetics. Although not allowed to administer general anesthetics by themselves oral and maxillofacial surgeons should have a thorough knowledge about the different aspects of the use of these agents; the study of which are included in their curriculum.

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