

Dental Caries in the Second Millennium



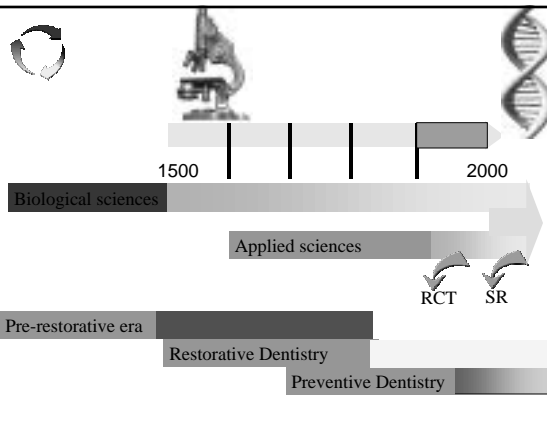
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Outline

- Present a brief review of dental history in the second millennium
- Review the purposes of the history of dentistry, diagnosis and management of dental caries
- Present an exhaustive review of all dental caries interventions and concepts in the second millennium

The charm of history and its enigmatic lesson consist in the fact that, from age to age, nothing changes and yet everything is completely different.

Aldous Huxley—The Devils of Loudon



Methods

- Not a systematic review
- Handsearching the Index of Dental Literature published between 1939 and 1965
- Reviewed 40 textbooks
- Documents were catalogued in Endnote®

Before the Second Millennium

- Dental and oral infections have been mentioned in writings of Romans, Greeks, Egyptians, Mesopotamians, Israelites, Indians, Chinese, Aztec, Maya, Inca, and Arabs
- Egyptian Kings (starting at 3000 B.C.) had a designated staff “who deals with the teeth”
- Mandibles were found with pore holes drilled to treat abscesses
- Gold wire ligatures were found around loose teeth

The Qanun of Avicenna (Ali al-Husain ibn Abdallah ibin Sina) 981-1037

- Tooth extraction was conditionally approved
- Astringent agents and cauterizations were used to treat infections and treat carious teeth
- Filled carious teeth with cypress grass, mastix, myrrh, among others
- Contributed to the dogma of medical practice until the 18th century
- Hand instruments were used to extract and treat carious teeth (drilling, purging or filling)



Natural Sciences—15th Century AD

- Period of European Renaissance
- Anatomy of the face
- Natural sciences



Pierre Fauchard—18th Century AD

- French Surgeon
- First two-volume textbook on dental diseases and their treatment was published in 1728
- Prevention, prosthetic, surgery, orthodontics, dental medicine, and dental instruments
- Toothworm theory was rejected
- Provided ideas for new experiments on caries etiology (acids)
- Enamel hypoplasia is an erosion
 - Recommended smoothing hypoplastic areas using files
- Total excavation of carious lesions and filling cavities with lead, tin or gold foil



The Second Industrial Revolution

- 1840: Samuel Cunard began transatlantic steamship service
- 1856: Henry Bessemer developed the Bessemer converter
- 1859: The first commercial oil well was drilled in Pennsylvania
- 1866: The Siemens brothers improved steelmaking by developing the open hearth furnace
- 1836: Samuel F. B. Morse invented the telegraph
- 1866: Cyrus Field laid the first successful transatlantic cable
- 1876: Alexander Graham Bell invented the telephone
- 1879: Thomas Edison invents the incandescent light bulb
- 1892: Rudolf Diesel patented the diesel engine
- 1899: Guglielmo Marconi invented the wireless telegraph
- 1903: The Wright Brothers made the first successful airplane flight



The Dental Revolution of the Late 19th and 20th Centuries



The New Era in Dentistry— Late 19th Century

- 1844: Horace Wells (DDS) discovered general anesthesia
- 1866: Rubber dam was invented by a New York dentist (Sanford C. Barnum)
- 1870: Greene Vardiman Black, a dentist from Jacksonville, Illinois, was offered the position of a professor at the Chicago Dental College
 - Dr. Black combined his astute clinical observations, skills, and experience with diligent experimental research and changed the practice of dentistry
- 1890: Willoughby Dayton Miller conducted experiments on the microbiology of dental caries in Berlin
- 1895: Roentgen discovered X-rays



The New Era in Dentistry

- 1840: The “Amalgam War”
- 1855: New formula for amalgam
- 1857: Adhesive gold
- 1911: Electric-powered drill (10,000 rpm)
- 1911: William Hunter, an English Physician described
 - “Mausoleums of gold over a mass of sepsis”
 - Systemic diseases and infection around the teeth
 - Focal infection theory
 - Until the 1950s, teeth were extracted to prevent systemic infections
- 1948-49: Air turbine-driven handpiece (Sweden and Washington, DC)



Etiology of Dental Caries

- Worm theory
- Fungi and “leptothrix buccalis”
- In 1881, Drs. Miles and Underwood, after a 4-year investigation suggested that dental caries is caused by microorganisms
- In 1881, W. D. Miller proposed that microorganisms in the oral cavity ferment carbohydrates and produce acids that can initiate demineralization
 - The chemico-parasitic theory (first proposed by John Tomes)



Etiology of Dental Caries

- Why are some individuals immune while others susceptible to caries?
- Gies and Lothrop investigation of saliva in 1910
 - Relation between general composition and qualities of saliva and dental caries
 - “Vicious mucinous coating” on teeth
 - Role of saliva in neutralizing acids formed by bacteria



Etiology of Dental Caries

- Lead was associated with dental caries in 1914
- Prior to World War II there were reports on the association between caries, poverty and race



Etiology of Dental Caries—Conclusions

- By the 1960s,
 - Dental caries is a multifactorial infectious disease
 - Transmission of cariogenic bacteria was confirmed
 - Cariogenic bacteria and fermentable carbohydrates are necessary factors
 - Variation in susceptibility among patients and population groups
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Definition and Diagnosis

- By 1880,
 - Dental caries was recognized as a process that always started at the surface of teeth and progressed slowly towards dentin
 - Caries progresses more rapidly in dentin than in enamel
 - Decay is not found on tooth surfaces that are smooth and worn by attrition or mastication



Definition and Diagnosis

- Hidden caries was described in 1886
 - Detection of a carious lesion deep into dentin in teeth that had either no evidence of caries or a small “pin-hole cavity”
- Variation among dentists’ diagnosis of dental caries was reported 1869



Diagnostic Variation

- In 1941, the variability of diagnosis among dentists was also noted in a study that included 8 dentists “all of whom had years of clinical experience and who were considered careful investigators” and 33 individuals who were examined consecutively by three dentists
- The examiners only agreed on the number of carious teeth of one individual out of the 33 examined
- These findings were confirmed in the 1970s, 1980s, and 1990s

Radusch DF. J Am Dent Assoc 1941;28:1959-61.



Diagnosis & Management of Dental Caries

- The year is 1886
- Dr. Emile Magitot
- Dental caries can be divided into three periods
 - Caries of the enamel (reaching but not penetrating the dentin)
 - Caries in dentin
 - Deep caries reaching or close to the pulp

Br J Dent Sci 1886;29:405-10.



Enamel Caries— G V Black 1910

- Caries in enamel appears in the teeth of patients ... from day to day
- These lesions are found in pits and fissures of occlusal surfaces, proximal and facial tooth surfaces
- Black wrote that “the whole subject of caries of the enamel is the most important one in its relation to everyday practice, and I think it is not best to give it to our students in the freshman or junior years, but we want it in the senior year”



Caries ≠ Cavities

- 1948 consensus conference
 - A disease of the calcified tissues of the teeth. It is caused by acids resulting from the action of microorganisms on carbohydrates, is characterized by a decalcification of the inorganic portion and is accompanied or followed by disintegration of the organic substance of the tooth.
- **Most textbooks of restorative dentistry published prior to 1990 defined caries as presence of a cavity**



Labial Decay of Childhood — 1884

- The condition started on the enamel of the labial and buccal tooth surfaces and a green or brown stain usually precedes it
- For these lesions, “prophylactic” as well as mechanical and “constitutional” treatments were recommended
- Interestingly, the author reported that the “labial decay of childhood” often “arrest itself before [it] had penetrated the whole thickness of enamel”

Darby ET. Dent Cosmos 1884;26:218-32.



Preventive Management

- Extension for prevention
 - W. H. Webb in late 19th century
 - Prevent the recurrence of decay and ease of placement of restoration
 - No scientific evidence or assessment of outcomes



Preventive Management

Other untested preventive remedies

- Extraction of first permanent molars to relieve crowding
- Cutting or filing teeth to relieve crowding and prevent caries
- Antiseptics (zinc chloride, silver nitrate, etc.)
- Eating of foods to promote formation of strong teeth
- Use of carbonate or phosphate of lime to manage "white or brown decay"



Preventive Management

Other untested preventive remedies

- Clean teeth never decay
- In 1912, Dr. D. W. Barker of Brooklyn, New York, questioned whether teeth could be kept "surgically" clean for long enough time to prevent them from decay
- Today we spend billions of dollars on professional cleaning of teeth



The Persistent Dr. McKay

- Why teeth are mottled in Colorado Springs?
- In 1930, H. V. Churchill, a chemist at ALCOA, discovered that fluoride may be the factor associated with "mottling of enamel" and prevention of dental caries



The Leader

- H. Trendley Dean was assigned by the USPHS to study the fluoride-carries issues
- Confirmation of the association between exposure to the fluoride ion and dental caries prevention
- The water fluoridation studies



World War II

- Why so many men did not have six opposing teeth?
- Dental health has important social and political consequences



- National Institute for Dental Research
- Division of Dentistry, USPHS
- Growth in funding to NIH
- Fluoride products
- Acid Etching
- Bonding of BIS-GMA to enamel and dentin
- Sealants
- Non-cariogenic sweeteners



Management Models

- Drill and fill
- Management of caries as an infection
- Early detection and prevention
 - Are dental students and dentists rewarded for doing the right thing for the right patient at the right time?
- In 1939, remineralization was called as “one of the next big topics in dentistry”!



Today and the Future

- Successes
 - Understanding of etiology of oral conditions and their prevention
 - Use of the scientific method
 - Restoration of oral health
 - Prevention of oral diseases
 - Decline in prevalence and severity of dental caries
- Challenges
 - Misconception that dental caries is no longer a problem
 - Less funding for caries research
 - Treatment model has not changed since the 1900s
 - Caries researchers?
 - Methods to prevent caries in high-risk population groups



Today and the Future

- Opportunities
 - MicroElectroMechanical Systems (MEMS)
 - Laboratory on Chips (LOC)
 - Regeneration of salivary glands
 - New diagnostic tools
 - Information management



Finally

- Dental Caries is still a major health problem in the U.S. and the world

