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HISTORY OF DENTISTRY: AN OVERVIEW

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ABSTRACT

Dentistry and Dental Surgery are practically synonymous. The trail of evolution of Dentistry from scratch in the antiquity to one of the most developed disciplines of modern medical sciences over the centuries is exciting, interesting and thoughtful. This short article will try to tell that tale.

Dentistry (Latin - "dens" meaning tooth) or Odontology (Greek -"odous" [odont] meaning tooth) is the healing science or art concerned with the embryology, anatomy, physiology, pathology of oral-facial complex, and with the prevention, diagnosis and treatment of deformities, diseases and traumatic injuries thereof. Dentistry and Dental Surgery are practically synonymous. "Surgery" derives from the Greek word - "Cheiro.s" meaning "a hand" and "ergon" meaning "work"; it applies, therefore, to the manual manipulation. So, Dental (Latin- "den" = tooth) Surgery means manual manipulation of teeth in disease. Dental care is one of the most important aspects of overall health care. The mouth and teeth are the gateway to the inside of the body. The human subject is provided with two sets of teeth, which appear at different periods of life. The temporary, deciduous or milk teeth total 20 in number (four incisors, two canine and four molars - 10 in each jaw) appearing between six months to twenty-four months. The permanent teeth are 32 in number - 16 in each jaw (four incisors, two canines, four bicuspids and six molars) appearing between six to twenty-four years. The enamel crown of the tooth represents the toughest tissue in the body.

Dentin (dentine/eburdentis/substantia eburnea) is the ivory (Latin - 'ebur' meaning ivory) forming the main mass of the tooth. About 20% is organic matrix, mostly collagen, with some elastin and a small amount of mucopolysaccharide; the inorganic fraction (70%) is mainly hydroxyapatite, with some carbonate, magnesium and fluoride. It resembles bone in structure, but is denser and contains no cells or blood vessels, though it is penetrated by the cell processes from the connective tissue cells (odontoblasts) in the pulp cavity of the tooth. Ivory (elephant's tusk) is dentine.

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Dental diseases are as old as the Homo sapiens who appeared on this earth, probably some quarter of a million years ago. So, every culture, every tribe, every country, every rural, urban and aboriginal people and the like, through their own experience, have contributed to the development of dental science over the centuries.

Louis Pasteur (1822 - 1895) - the celebrated French medical, scientist, rightly said: "Science has no country". Dentistry is a well-developed science today. Where we arrived today in, our dental detour is less important, more important and exciting, is how we came to where we are today. This short review will try to explore that trail of our arrival; as we know, history with its eternal lamp, sometimes flickering - sometimes dazzling, stumbles along the trail of the past, trying to reconstruct its sciences, to revive its distant echoes and kindle with pale gleams the passion, pleasure, and even pain, of former days.

A peep into the past

There has never been a golden age when Man was free of disease; disease and injury are inseparable from living. Paleopathologists (students of diseases in the long distant past) uncovered abundant evidence in fossil records of Man and in excavations of ancient skeletons that rotten teeth tortured our oldest ancestors. In ancient Egypt dental decay was noted around 4000 B.C. along with other diseases. In a jar of the late Harappan period (Bronze Age - 2500 B.C. - 1500 B.C.) was found a set of unusual teeth with brownish ring of pigmented tartar around the middle (alveolar margin) along with a set of normal teeth and three loose ones (Roy Chowdhury, 1988). The roots of pigmented teeth were partially absorbed and worn out. Ultraviolet emission spectroscopic examination revealed that the pigmented tartar contained copper. Normal teeth did not contain any copper and so also the unstained part of the sample (Harappan) teeth. The distribution of the pigmented tartar suggests that probably a dentist of that period used copper or bronze strings for periodontal splintage in order to keep those defective loose teeth fixed on the jaw, as is now done in modern dental practice. Normal sets of teeth might have been kept for reference to compare with the diseased one - a lyric of lesson for future generations!

Suṣruta (600 B.C.?), known as "the Universal Father of Surgery, invented about 1000 surgical instruments of all sorts. Suṣruta- Saṁhita (600 B.C. - 1000 A.D.) - "Collected works" mentioned diseases of mouth, oral cavity and throat in Nidānasthāna (Section II, Chapter 16).

Among the Hippocratic treatises by Hippocrates (460 - 377 B.C.) - the Father of Rational Medicine, there is one on Dentition. Galen. (130 - 200 A.D.) - "the medical dictator" till the 18th century, described "pruritus of the gums" ("gingivarum exulcerationes") in those treatises. There are references to tooth extraction in Greek medical writings, but Hippocrates assumed that only loose teeth could be extracted. The Arabian writers also referred to extraction, and Abulcasis (936 - 1013 A.D.) of Cordova, Andalusia, Southern Spain (capital of Moorish Spain, 8th century) gave the first illustrations of dental instruments. Many of their writings were translated into Latin by Gerard of Cremona (1114 - 1187 A.D.), by Farajben Salim (around 1280 A.D.) and by others between the 9th and 13th centuries. These translations caused a re-awakening of the intellect in Europe, and provided the staple reading in all branches of medical sciences in the medieval universities.

Dental instruments

There is evidence of the use of various dental instruments from the 15th century onwards. The pelican, so called from its supposed resemblance to a pelican's beak, was used to lever the tooth out of its sockets. The English key was first mentioned about 1740 and was in common use until atleast 1860. The dentist's probe - a small instrument - closely resembled the description of the volsella, referred to by the medical encyclopaedist - Celsus (25 B.C. - 50 A.D.). Dental elevators were in use from Arabian times onwards. The modern type of forceps is due largely to John Tomes (1815 - 1895), who invented the various types in 1839 - 1840 while he was a trainee house-surgeon at the Middlesex Hospital in London.

Artificial teeth

Replacement of naturally lost or extracted teeth by artificial ones was attempted even in the antiquity. The earliest fixed denture was found in a Phoenician grave at Sidon. Phoenicia was the narrow strip in the Eastern Mediterranean between the mountains of Lebanon and the sea, where the cities of Arad, Byblos, Sidon and Tyre are located. They were dominant people in the area and sea traders in the second millennium B.C. The Phoenicians were descendants of Canaanites. In the grave at Sidon, the four substitute teeth were strung together and fitted to the adjacent teeth with a gold wire. Etruscans used fixed dentures. As substitutes for missing teeth, the Etruscans used human teeth or

artificial teeth carved from ox teeth. Each substitute tooth was surrounded at its base by a "gold ring, and these were shouldered together and to other rings which surrounded the two adjacent natural teeth. These Phoenician and Etruscan specimens are the earliest examples of gold bridges (Singer and Underwood 1962). Etruscans are a people of obscure origin in Western Central Italy in the 8th century B.C. - renowned for their artistic, civil engineering, metal work and urban planning. They were heavily engaged in trade with the Greeks. Their cultural influence on the Romans later remained strong.

In the 14th century, "Guy de Chauliac (1300 - 1367)" - physician and chaplain to the Pope at Avignon, France, Clement VI and two of his successors, made a noteworthy contribution to dentistry, giving guidelines for the care and cleansing of teeth in order to prevent decay, and advising on the replacement of lost teeth by other human teeth or by artificial teeth made of bone. A French Huguenot [Protestant Christian - follower of French Protestant reformer - John Calvin (1509 - 1564) - Ambrose Pare (1510 - 1590)] - the Father of Modern Surgery, described the use of artificial teeth carved from bone or hippopotamus or walrus ivory (a dentine). Jacques Guillemeau (1550 - 1613), also of France, a pupil and later son-in-law of Pare was the first to recommend artificial teeth made from inorganic materials; his recipe included white coral and pearls.

Pierre Fauchard (1678 - 1761) wrote the first book on oral pathology, oral physiology, anatomy, surgery, prosthetics and orthodontics (removable dentures) - "LE CHIRUGIEN DENTISTE, OU TRAITE DES DENTS" (The Surgeon Dentist or Treatise of the Teeth: 2 volumes, 900 pages) entirely devoted to the subject and to cover it in all its aspects. Before this book, there were other books solely devoted to dentistry - i.e. Charles Allen's - "The Operator for the Teeth" (1685). None, however, matched Fauchard's work in quality or depth. Fauchard carved the teeth on a bone or ivory and fitted it inside the mouth by means of springs. He also employed artificial crown. However, food and fluids of the mouth acted on natural and ivory teeth and produced unpleasant smell and taste. Two Frenchmen - the apothecary (chemist/pharmacist) Duchateu and the dentist Nicolas Dubois de Chemant (1753 - 1824) first produced complete dentures of porcelain in 1788. Neopolitan, Guiseppangelo Fonzi (1768 - 1840), a parisian dentist, succeeded in making individual teeth of porcelain by 1808. Platinum hook was used to fix it inside the mouth. By 1840, difficulties were overcome and the manufacture 'of porcelain had been perfected. In 1838 Claudius Ash introduced the tube tooth which in a modified form is still in use.

In addition to scientific principles, fashion and cosmetic aspects also influenced dentistry, which led to the use of dental crown. Fauchard was one of the first to fit a crown to individual teeth successfully. Gold crown, 'banded crown' (encircled by gold band) were introduced. These were the gifts of 19th century dentistry. In the first decade of the 20th century, William Hunter (1861-1937) of Charing Cross Hospital, London, carried out extensive investigations into the constitutional effects of dental sepsis, especially the production of pernicious anaemia. As a result, the crown, and particularly crown and bridge work, began to fall into disfavour.

Material for mouth - Cast: Radical dentistry

A substance for making accurate impressions of the mouth and for the development of a material for a base, which would be strong, easily worked and not eroded by the acids in the mouth, was needed. Various substances were tried:

* About 1733 - Wax used by goldsmith, Peze Pilleau (1715 -1755) and in 1746 by Phillip Pfaff (1716 - 1780) - dentist to Frederick the Great of Prussia.
* After 1844 - Plaster of Paris
* Currently - Colloids such as agar-agar, mixed with waxes and synthetic resins.
* The following substances were used for the manufacture of the base of the denture:
* Gold - though strong and not erodable, not easily worked and tedius to fix individual teeth.
* Complete denture of porcelain by Dubois de Chemant in 1788.
* Individual porcelain teeth by Fonzi (1808).
* Early 19th century - Gum, Silver paste (amalgam of silver and mercury)
* Gutta-percha by Edwin Truman (1809 - 1905) in 1847
* Tortoise-shell and celluloid in 1850.
* Vulcanite by Charles Goodyear (1800 - 1860) in 1855
* Colloidion and celluloid (about 1870) until the end of the 19th century
* After World War I - Thermo-plastic resins and Thermo-setting resins.
* 1935 - Polymerized acrylic resin (Methyl methacrylate).

This phase could be termed as the history of radical dentistry, that is, the replacement of unsound teeth by artificial ones.

Conser vative dentistry (endodontics)

It means methods used to treat the interior of the tooth and thereby arrest caries in individual teeth. The cause of dental caries has been one of the most discussed subjects in the history of dentistry. Babylonians (18th century B.C.) believed that small worms in the decayed tooth caused the decay. This perception of dental decay was prevalent in India as well. The Roman writer, Scribonius Largas (around 40 A.D.), advised fumigation of the decayed tooth with the vapour produced by casting hyoscyamus seeds on burning charcoal, and worms should be seen falling off the teeth. Guy de Chauliac suggested the same treatment for caries.

Hollow teeth were filled with wax, resin and gold foil. The celebrated medical compiler, though probably not a physician, Aulus Cornelius Celsus (10 - 37 A.D.) - author of the earliest scientific medical work in Latin - "DE RE MEDICA", (30 A.D.) mentions this practice. Joannes Arculanus (about the 15th century) probably used gold foil extensively for this purpose. In the Middle Ages (200 - 1450 A.D.) the cautery was probably used to prevent further decay. Girilamo Fabrizio, generally called Fabricius ab Aquapendente (1533 - 1619) of Padua, Italy, used a drill, followed by the instillation of strong acid and the cautery, and finally filled the cleaned cavity with gold leaf. Guillemeau's paste was used not only for the preparation of artificial teeth, but also for filling of cavities. Giovani Arcolani or Joannes Arculanus (? - 1484), a Professor of Medicine and Surgery at Bologna, Italy (1422 - 1427) and Padua - author of the surgical treatise- "practica" (Venice, 1483), also described the filling of hollow teeth with gold leaf.

Later, Pierre Fauchard's recipe was to clean out the carius cavity with instruments and then to fill the cavity with tin, lead or gold foil by inserting in very small portions with specially designed pluggers. The use of "silver paste" (silver, mercury, plastic) became controversial. It took over 40 years to produce more satisfactory amalgam, due to the dedicated work of John Tomes (1815 - 1895), Thomas Fletcher (around 1880) and Charles Sissore Tomes (1846 - 1928) in England and of Josiah Foster Flagg (1789 - 1853) and Greene Vardiman Black (1836 - 1915) in the U.S.A. The use of solid fillings for cavities, made of gold inlays and porcelain and also silicate compounds, began.

There were several types of drills - simple drill and jeweller's bow-drill, both innovated by Fauchard, wheel-toothed hand drill, invented by Charles Merry of St. Louis,

U.S.A. (about 1850), which was further improved by fitting to it a flexible shaft, consisting of a close coiled spiral wire, by the Scottish engineer, James Nasmyth (1808 - 1890). The improved Mary Drill was therefore the forerunner of the modern dental engine. In 1870, a foot-operated engine, on the same principle, appeared, and in 1908 electric power was first used to operate flexible cable. A sheet of rubber was used to dry up the cavity around 1864. In recent years, rolls of gauze were used and final drying of the cavity was done by blowing hot air. Indeed, it was a tale of innovation demanded by the necessity of the real condition.

Modern dentistry

The scion of comparative anatomy and a surgeon, John Hunter (1728 - 1793) of Scotland, is usually regarded as one of the founders of modern dentistry. In two books "The Natural History of the Human Teeth" (1771) and "A Practical Treatise on the Diseases of the Teeth" (1778), Hunter described the pathophysiology of dental caries, appliances for malocclusion. He concluded that the carious process starts on the surface of the tooth and not in its interior, and that the process is liable to be found where food particles tend to lodge. This view was completely substantiated by Levi Spear Parmly, an American dentist, working in London, who examined thousands of teeth taken from the bodies of those who died in battle. He showed (1820) that the initial aperture in the enamel is so minute as to escape attention unless it is looked for deliberately. Causes of dental caries might be multifactorial - microbial infection, dietary deficiencies (calcium, phosphorum, certain vitamins) and structure of the tooth, which is determined largely by the diet in the developmental period.

Charles Gaine of Bath wrote the first book devoted exclusively to irregularities of teeth in 1858. In 1880 the distinguished American dentist, Norman William Kingsley (1829 - 1913) published his book entitled "Oral Deformities", a comprehensive treatise which is generally regarded as having laid the foundation of the subject. Another prominent American dentist was John Nutting Farrar (1839 - 1913) who developed the mechanical appliances which were considered necessary to correct malposition of the teeth. The modern practice of orthodontics (Greek - "odous" = teeth) - branch of dentistry concerned with the correction and prevention of irregularities and malocclusion of the teeth - was founded by Edward Hartley Angle (1855 - 1930), who in 1900 gave the first specialized course in the subject. Preventive dentistry started in Britain in 1912 with the establishment of school dental clinics.

Modern dentistry has expanded in many directions to form sub-specialities:

* Periodontics - inflammatory disease of the gums (gingivitis) and supporting tissues
* Preventive Periodontology (for caries and dental plaques)
* Endodontics (treating the interior of the tooth)
* Prosthodontics (the fitting of dentures and other appliances)
* Orthodontics (straightening of teeth)
* Paedodontics (Dental care of children)
* Maxillo-Facial and Plastic Surgery/Oral Medicine and Surgery
* Community/Public Health dentistry
* Restorative/Operative dentistry (By means of metallic or non-metallic materials.

The ancillary services to dentistry are also significant and include dental technician, dental nurse, dental hygienists and dental therapists.

Dentistry in different countries

The earliest evidence of the provision of dental care in Britain was during the Roman occupation (55 B.C. to 410 A.D.) when the Roman Emperor (41 - 54 A.D.), Claudius - Tiberius Claudias Nero Germanicus (10 B.C. - 54 A.D.), arrived in A.D. 43 (after its annexation to the Roman Empire) accompanied by his surgeon, Serbonius Largas, who, in addition to his surgical duties, also treated dental ailments. Incidentally, Gaius Julius Caesar (100 - 44 B.C.), Roman Emperor and self-proclaimed (44 B.C.) "Dictator For Life", invaded Britain twice (54 B.C. and 55 B.C.). In the Middle Ages, monastic monks and priests were the healers of the sick. Early dental practitioners were barbers and charlatans. Dentistry was also practised by physicians and surgeons.

In the 14th century "tooth drawers" were admitted to membership of the Company of Masters of Barbery and Surgery, London (Est. 1300 A.D. - Received Grant of Arms, 1451, Royal Charter, 1462). Ultimately, this Company was amalgamated with the Guild of Surgeons (comprising ex-monks) in 1540 under a Royal Charter granted by King (1509 - 1547) Henry VIII (1491 - 1547) after dissolution of monasteries between 1536 and 1539. In 1843, the Royal College of Surgeons was formed, It was this Royal College that was to play a profound and dominant role in the evolution of dentistry from a trade into a profession. Odontological Society of London was founded in 1856, followed

by the opening of the Dental Hospital of London at Soho in 1859. In 1860, the London School of Dental Surgery was opened on the same site.

In France, L'Ecole Dentaire had been founded in 1699 and in 1700 legislation was enacted to govern dental practice. In the U.S.A. the Baltimore College of Dental Surgery was founded in 1839 and awarded a D.D.S. degree. Indeed, one of its earliest graduates, Horace Wells (1815 - 1848), a young dentist of Hartford, Connecticut, in 1843 demonstrated the anaesthetic properties and clinical value of nitrous oxide (laughing gas). Wells had one of his teeth extracted under its influence, and he said afterwards that he did not feel 'so much as the prick of a pin'. William Thomas Morton (1819 - 1868) used ether (Sept. 30, 1846) to produce anaesthesia during tooth extraction.

In India, modern dental education was started during the British colonial rule. At present, there are 120 dental colleges and Indian dentists are well trained. Post-graduate dental education is also available in many Indian universities.

Forensic Odontology (Dental Jurisprudence)

It is a fairly contemporary dento-legal sub-speciality of Dentistry. The application of dental expertise and facts to legal matters is a younger offspring of forensic (Latin "forensis" meaning "forum") pathology. The major contribution of forensic dentistry is in the field of identification, either in individual cases or in the mass disaster, especially aircraft crashes. The dental expert carefully records all the dental data from an unknown corpse and compares this with the dental records made during life. The presence and position of extractions, fillings, bridgework, dentures, and many other features, can give a positive identity, as good as given by fingerprints, as long as ante-mortem data are available. In skeletal or decomposed material, the dentist can put an age to the person, if a child or young adult, by the state of development of the 'milk' or early permanent dentition. Racial characteristics, such as the "Shovel-shaped" incisor teeth of mongoloid races, can also be detected by an experienced dentist.

Much of the evidence for the identification of the "demon-genius" German Fuhrer ("The Leader"), Adolf Hitler (1889 - 1945) and his mistress, Eva Braun (1910 - 1945) - [married just before committing suicide in the underground bunker under the Chancellery building in Berlin on April 30, 1945] and his last-time close associate, Martin Bormann (1900 - 1945), etc., was based upon dental characteristics.

A less frequent task for the forensic odontologist is the matching of teeth and bite marks in assaults and murders. Marks upon the skin - and sometimes even on foodstuffs such as cheese or apples - can be matched with the dentition of a suspect using tooth spacing, notching and other characteristics.

The Limitations

We have come a long way. Think of the days when there were no anaesthetic agents, no sterilising agents/dressings, no resuscitation procedure, no suitable surgical instruments! Man was helpless. Five hundred years ago dentistry, largely confined to the extraction of bad teeth, for placing of fillings, initially wax or resin, had hardly begun. There were travelling dentists, mostly mere mountebanks (charlatan/fake/travelling quack dentists). William Shakespeare's (1564 - 1616) scary remarks in his comedy "TWELFTH NIGHT" (1600 - 1602) tells the horrors of any surgical manoevre of the day:

"For the love of God, a surgeon!
(Act V, Scene 1, 171)

Still we have a long way to go. There are limits to medical and dental sciences. Frustrations expressed towards them today are because expectations of people have always been far more than medical sciences can meet. Many ideas and concepts thought to be sanctified absolute truth in the past were held to be completely false at another time in the future. Many aspects of contemporary medicine and dentistry today may prove to be false and even harmful and dangerous in the years to come. At the same time, discarded concepts of the past have been resuscitated and found useful later. This is the intellectual part of the story.

Secondly, and most importantly, medicine is for man. In spite of tremendous advancement in medical and dental sciences during the 19th and 20th centuries, its message has not reached the hearth and home of the vast masses of people (more than 6 billion) in many parts of this planet earth. Medical and dental care is still beyond the reach of many. Here lies the tragedy. Though written in a different context, it could be best expressed ,by the words of our Poet-Philosopher - Rabindranath Thakur (1861 - 1941), Nobel Literature Laureate, 1913, in his self-analytical Bengali poem - "AIKATAN" ("Tune in Unison" - January 18, 1941, written 8 months before his death on August 7, 1941):

".....I know, the incompleteness of my tune, my poetry though plied in diverse directions, have not reached everywhere." (Translation from Bengali by this author.)

The Future

Dentistry will continue to develop but the pattern will change with time. People are now retaining their teeth longer, in many cases into old age, so there is a need for treatment of periodontal disease, which needs the skill of dental hygienists. Universalization of dental care, irrespective of the ability to pay for it, is the demand of the day, and it is the duty of the state to provide it. Cradle-to-grave social and all-round medical welfare is the hallmark of modern civilization. The population is on the increase. The need for restorative care will increase, not only to conserve damaged carius teeth, but also to replace teeth lost through uncontrolled periodontal disease, fractured teeth which becomes more prevalent in ageing dentitions. The pattern of the dental profession is likely to change in tune with time, and dentistry will continue to be an exciting, interesting and satisfying profession.

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सारांश

दन्त चिकित्सा के इतिहास पर एक दृष्टिकोण (पर्यावलोकन)

सिसिर के. मजुमदार

दन्त चिकित्सा और दन्तशल्य वास्तव में व्यवाहारिक पर्याय शब्द है। आधुनिक चिकित्सा विज्ञान के विकास कि खोज दन्त चिकित्सा मे एक महत्वपूर्ण विध्या का साधन शाताब्दियों से चला आ रहा है। यह लधू लेख के द्वारा उपरोक्त वृत्तांत को प्रस्तुत करने का एक प्रयास है।