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Chapter 2

Vista of Oral Hygiene

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Additional information is available at the end of the chapter

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Abstract

For maintaining good general health, good oral hygiene is very important. Nature gave some instinct to all animals for that. Man, since his existence, has been 'aware' of maintaining oral hygiene. Avoiding dental infections was most important for ancient man to avoid malnutrition and eventual death. Initially, man managed it through his instinctual dietary habits. Later the nature of diet and dietary habits changed and it was needed to practice some extra measures. A protocol for good oral hygiene changed from just dietary measures to chewing various materials and use of early dentifrices to modern toothbrushes, modern dentifrices, and other measures including professional intervention. Oral hygiene is more important during some specific situations in life, for example, pregnancy and certain sickness.

Keywords: hygiene, oral hygiene, history of oral hygiene, importance of oral hygiene, oral hygiene tools, oral hygiene practices

1. Hygiene and oral hygiene

Hygiene includes 'cleanliness', but it is much more than just 'cleanliness'. According to World Health Organization (WHO), 'Hygiene refers to conditions and practices that help to maintain health and the prevent spread of diseases' [1].

Therefore, many things are included in 'hygiene' like cleanliness of one's body, dwelling and surrounding area, sanitation, hygienic food, safe drinking water, clean clothing and so on.

Personal hygiene involves the care of one's body so that infections and diseases are prevented and one enjoys a feeling of being well. One of the important aspects of personal hygiene is 'Oral Hygiene'.

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Mouth being one of the gateways of body, demands to be well guarded, so that entry of unwanted elements in the body is prevented. That is why good oral hygiene becomes essential. WHO also stressed on the importance on oral hygiene by declaring 'Oral Health for a Healthy Life', its theme on world health day (April 07th), in the year 1994 [2].

1.1. Evolution and teeth

We know that life appeared on earth before approximately 3.8 billion years [3]. Life at that time was primitive. Evolution is a continuous process, which has produced complex life.

During evolution, some creatures developed teeth and some did not, depending upon their requirement for food and to be selected by the Nature to survive. It is said that teeth developed in jawed vertebrates, but few different opinions are also voiced [4]. Most of the mammals have teeth. There are very few groups of mammals, who do not possess teeth and they include pangolins and anteaters.

The incidence of dental diseases in animals living in the natural environment is less, as compared to pet animals. This is because of their unrefined and fibrous food, which does not contain refined sugars. Their saliva may have alkaline pH, which reduces the incidence of dental caries.

Similarly, people during ancient times did not need too much oral hygiene because they did not consume refined sugar. It has been observed that ancient cavemen although lacking in oral hygiene, had a full set of teeth and very low incidence of dental disorders. This is because their diet was mostly natural and unprocessed fruits, vegetables, and meat [5].

Most mammals are diphyodonts, means they get two sets of teeth. Humans (*Homo sapiens* Sapiens) are also diphyodonts and get two sets of teeth, that is, deciduous (Primary or Milk dentition) and permanent (Succedaneums dentition).

In humans, the presence of teeth, though very essential, makes maintaining oral hygiene slightly difficult, due to some reasons. Inter-dental areas and pits and fissure morphology of teeth favor retention of food particles. Also, food consumed by modern man is mostly refined, soft, many times sticky, and many times have a moderate quantity of fermentable carbohydrates. Micro-organisms grow in retained food particles to produce gingival and periodontal diseases, and dental caries; if oral hygiene is not maintained properly.

2. History of oral hygiene maintenance

History of procedures adopted for maintenance of oral hygiene and preventing oral and dental diseases, and even treating oral and dental diseases can be traced as back as the time of Homo neanderthalensis and Cro-Magnons (early *Homo sapiens*), that is, about 40,000 years before, when they co-existed for almost 5000 years in Europe. Interesting is the fact that in fossils, resinous substances (such as the gum Arabic that is used in chewing gum today, and other types of sap) with tooth marks in them have been found, and dated to the time of Homo

neandarthalensis and Cro-Magnons. Ancient *Homo sapiens*, and also Homo neanderthalensis appear to have used gum for chewing [6].

People of most of the major ancient civilizations were concerned about oral hygiene, and prevention and treatment of dental diseases. It is interesting to know about the level of their awareness about dentistry and oral hygiene.

2.1. Mesopotamian civilization

According to Kara Vavrosky, [7] oral care was very important to the Assyro-Babylonian culture. Assyro-Babylonians have mentioned about halitosis and mobile teeth in their literature and given over 100 prescriptions for the care of mouth and teeth. Sufferers of halitosis were advised to wash their mouth and teeth with a finger bound with cloth. To remove deposits and stains people were advised to scrape teeth with a bare finger. This remained the common teeth cleansing method for people of the region until the introduction of the toothbrush by the Chinese at the end of the fifteenth century.

A mouthwash-containing mint, storax (a fragrant balsam obtained from the bark of an Asian tree of the witch-hazel family), rue, myrrh, and salt was used for rinsing. Toothpicks played an important role in dental hygiene for the Assyro-Babylonians. Excavations have discovered vanity sets made of gold, silver, or bronze that included toothpicks along with tweezers and ear-scoops [7].

Galbanum resin, obtained from roots, and trunk of a Persian tree was used by them for massaging on gums of "loosened tooth." Naturopaths believe that galbanum inhibits microbial (fungal or bacterial) growth in the wound area in bits of help in faster healing.

2.2. Ancient Egyptian civilization

Egyptians had detailed knowledge about the human anatomy because, for mummification of bodies they performed, they had to drain blood and remove organs, which made them understand the basic human anatomy [8]. Information about the treatment and healing of oral wounds are present on the Edwin Smith surgical papyrus. The exact time is not known but this papyrus is written sometime before 3000B.C. It gives detailed information about the treatment of oral problems; however, researchers think that at that time actual pathologies associated with teeth were considered as untreatable [9]. Minor dental work was performed, and more complex procedures were developed slowly as time passed. The earliest evidences of performed dental surgery were between 3000 and 2500B.C. and generally involved drilling out cavities or pulling teeth. Egyptians by 1550B.C. had prescriptions for dental pain and injuries. Surprisingly, use of artificial teeth has not been found in literature or in mummified bodies: though ancient Egyptians are known for their wisdom and style [10].

Documents regarding awareness about oral hygiene, during ancient times in Egypt, are not enough; and many skulls recovered from mummies or excavations, show considerable amount of deposition of calculus on various surfaces of teeth. Though most of Egyptians

traditionally considered general hygiene very important; and females as well as males, used many cosmetic items for their daily cleaning, anything like a toothbrush has not been found among various cosmetic items they used. Possibility has been shown that some chewing items were consumed by ancient Egyptians for mouth refreshment.

Priests chewed natron pellets (a mineral salt found in dried lake beds, consisting of hydrated sodium carbonate) as a purification ritual, and the general population, on occasions, also did so before a meal. Perhaps something resembling a miswak, which is a twig, of the salvadora persica tree, with frayed ends, might have been used. Miswak is used for oral care by Islamic traditions [11, 12].

The results of the numerous studies of the dentitions of ancient Egyptians also indicate that oral health was poor; and with little evidence of dental care, infection, and dental pain must have been widespread [13–16].

2.3. Indus valley civilization and ancient Indian civilization (Harappan and Vedic civilizations)

Indus valley civilization existed between 3300 and 1700B.C. probably a draught caused the collapse of the civilization. And later was followed by Vedic civilization in the region of the Indian subcontinent.

Study of Indus valley civilization has suggested, of dentistry being practiced 5000 years B.C. The practitioners of that time treated dental disorders with bow drills.

During the Vedic period, ayurveda, the Indian system of health care developed. Two original textbooks, "Charak samhita" and ''Sushruta samhita" are considered as its basic texts. "Shalya-chikitsa," an important branch of ayurveda, includes dentistry along with other surgeries.

Variety of chewing sticks known as "Datun," which were and are used as an ayurvedic or herbal material for oral hygiene, are obtained from certain trees like babool (*Vachellia nilotica*), neem (Azadiroxtha indica), mango (*Mangifera indica*), and guava (*Psidium guajava*). Some other natural and herbal products, which are used in ayurveda for preventing and treating dental diseases are clove, turmeric (Curcumin longa), amla (Emblica officinalis or Indian gooseberry), *aloe vera*, garlic (*Allium sativum*), ginger (*Zingiber officinale*), guggul (Indian Bdellium gum) and so on [17].

A study carried out in the western part of India, by Goryawala S N et al., in 2015–2016, showed that 7% of the study participants used ayurvedic toothpaste and 3.5% used ayurvedic tooth powders. It was also observed that 3.1% of the participants used datun or chewing sticks [18].

Oil pulling is also suggested in "Charak samhita," which is called "kabla graham" or "kabla gardoosa." It has been used extensively as a traditional Indian procedure for years to prevent dental decay, halitosis, bleeding gums, cracked lips, and for strengthening teeth and gums [17]. Dr. F. Karach re-introduced the practice of oil pulling in 1990 in Russia [19]. Sesame seed oil is used most commonly because of its medicinal properties and health

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benefits. Sometimes, sunflower oil is also used. Oil is retained in the mouth for a defined duration of time and then spitted off. The exact mechanism of the action of oil pulling is not known.

2.4. Ancient Chinese civilization

There were many dynasties in ancient Chinese civilization (2070B.C.–1912A.D.)

The oldest medical is book known in China, "Nei Ching" (the laws of medicine), includes two chapters about a toothache and gum diseases. It also recommends gargling and gum massage. Chinese also used acupuncture and moxibustion for treating dental pain [20].

A paste made of musk and a ginger powder was frequently used in ancient China, for the purpose whitening teeth. Ancient Chinese people used their nails, a piece of wood and knife to clear remnants of food from their teeth. They used arsenic to treat decayed teeth. Chinese developed a sort of silver amalgam for filling more than 1000 years before, during Tang Dynasty [20].

Modern toothbrush with the bristles perpendicular to the handle was invented by the Chinese in the fifteenth century, mostly in 1498. The design of the brush was a handle, which was made from bone from an ox or a bamboo, and the hard bristles were made of hair obtained from the neck of a hog. In 1938, Dupont de Nemours, designed "Doctor West's Miracle Toothbrush," which had nylon bristles. Till then, use of boar bristles was most common [21].

2.5. Andes civilizations and mesoamerican civilizations (mainly Maya, Inca, and Aztec civilizations)

The Mayan civilization had developed in regions of central and South American countries of today. It began in about 750–1000 years B.C. and lasted almost up to 1697A.D., till the fall of Nojpeten, the last Mayan city.

One of the Spanish conquistadors, Hernan Cortes (1485–1547), was impressed by the advanced level of dentistry he found in the 'New World' of three cultures, the Maya, Inca, and Aztec. Hernandez, a Spanish physician, in the sixteenth century, found that the Aztecs had been obsessed with oral hygiene, bad breath, and tooth decay. Those ancient dentists filled cavities, extracted teeth, and removed tartar with copper instruments. Amazingly, after a dental procedure was performed, they used to make their patients rinse their mouths with a saline solution. He also found those people treating various dental conditions with natural medicines. They were good in treating gum diseases; oral inflammations tooth decay, bad breath, and fever blisters. They used alum as a cosmetic treatment to make teeth look whiter. Aztecs designed and extensively used toothpick which they called 'netlantataconi'. They used what they called as 'chicle,' an unsweetened gum, for cleaning teeth, and for prevention of dental caries [22].

British Dental Association's museum exhibits specimens of teeth, which are said to have been found from Mayan civilization. Mayans were excellent in dental procedures, which they used to perform for religious rituals and also for oral health and ornamental purposes.

Inlays carved from colored precious stones were placed into cavities prepared in vital front teeth, without traumatizing the pulp. Those inlays made of a variety of minerals of beautiful colors, including jadeite, iron pyrites, hematite, turquoise, quartz, serpentine, cinnabar, and gold, were ground to fit exactly into the cavity [23].

In Mexico City Museum complete skulls can be seen with all the front teeth with colorful inlays.

It is interesting to note that Andes and Mesoamerican civilizations also built pyramids like Egyptians.

2.6. Etruscan and roman civilizations

Etruscan people were the first to take basic work in the mouth to a more artistic level. Etruscans were incredibly intelligent people, who were always striving to increase their knowledge and improve themselves. Luxury was important to them. They were merchants and traveled through land and sea as a part of their profession. They acquired some knowledge of dentistry, during their trade tours, and attempted gold filling restorations. They also tried to make prosthodontic replacement of missing teeth around 700B.C., believed to be the first-ever, using gold bands, and human and animal teeth [24].

Romans gave much importance to cleanliness and style. Celsus (c 25B.C.–c 50A.D.), insisted that citizens wash their mouths in the morning. They mostly did not use the toothbrush, some formulas to make toothpaste has been described by them. The ingredients they suggested to make toothpaste include bone powder, eggshell powder, pumice, myrrh and so on.

2.7. Greek civilization

Most of the physicians and dentists in Greek civilization, up to and including Hippocrates (460–370B.C.), were members of the sacerdotal caste of asklepiadi. Ancient Greek scholars Hippocrates and Aristotle (384–322B.C.) wrote extensively on dentistry, including eruption patterns of teeth, treatments of decayed teeth and gum disease, tooth extractions using forceps, and using wires to stabilize loose teeth and fractured jaws. The Greeks recommended and used mint, a preferred ingredient in toothpaste even now [24]. Many of medical and dental advice written during this period appear to be simple medical prescriptions similar to those recorded in Egypt.

2.8. Phoenician civilization

Phoenicia was an ancient civilization in Canaan, which covered most of the western, coastal part of the fertile crescent of Syria and Lebanon of the present time. This civilization existed from approximately 1550B.C.–300B.C., when it was conquered by Alexander the Great. Later the region was governed by Egyptians and Romans. This culture known for the spread of alphabets consisted mainly of traders. Phoenician dentistry was influenced by contemporary Egyptian dentistry, which they expanded by techniques of splinting of loose teeth and replacement of missing teeth with artificial teeth made up from ivory and supported and fixed with help of gold wires [25].

3. Importance of oral hygiene

A tooth is an organ, which is supported and held in its position by supporting tissues of gingiva, periodontal ligament, and alveolar bone. It is interesting to note here that more than 700 species or prototypes of micro-organisms are found in oral cavity, [26] which when finding an opportunity, may initiate dental caries, periodontal or other in infections in the mouth. Not maintaining good oral hygiene leads to invasion by micro-organisms, which cause infection. Thus, teeth or supporting tissues get infected. Therefore, basically microbial dental diseases are either dental caries or periodontal infections, which may lead to many complications of different types and severity if not treated.

Dental caries begins with demineralization, and re-mineralization can repair the damage; if proper conditions of repair are fulfilled. Once protein matrix of enamel collapses, the lesion becomes irreversible and a cavity is formed, re-mineralization cannot repair it. Restoration is to be done. Endodontic treatment is warranted, if there is involvement of pulp. Pulp infection may spread to the periapical region and its further spread may cause infection of various perioral spaces and may cause Ludwig's angina.

Similarly, gingival and periodontal infections can damage alveolar bone and may lead to loss of teeth. Untreated periodontal infections may cause trismus and other complications.

Negligence of oral hygiene may cause complications as severe as septicemia, toxemia, pyemia, cavernous sinus infection, bacterial endocarditis, and so on.

3.1. Oral hygiene and pregnancy

There are certain factors, which play their role during pregnancy and may cause dental and periodontal problems. Hormonal changes during pregnancy may cause gingival and periodontal diseases, including pregnancy tumor or pyogenic granuloma or granuloma gravidarum. Craving for more carbohydrate during pregnancy may cause dental caries if oral hygiene is not maintained. Demineralization of calcified tissues may increase, if there is the regurgitation of acids from the stomach, in case there is morning sickness.

For many reasons, dental procedures are avoided during first and third trimesters of pregnancy, unless special considerations and precautions are observed. Pharmacologists, obstetricians, pediatricians, and also FDA of USA advise not to administer medicines having teratogenic effects and many other drugs during pregnancy. It is also wise to avoid dental radiography during pregnancy, though there is just minimal radiation and even if abdomen and thyroid are shielded from radiation. Benefits and potential risk must be taken into consideration, while prescribing medicines and radiography during pregnancy.

Microbial infection from mother may get transmitted to her unborn child and may cause premature birth, low weight baby, and infection of the baby.

Considering these facts, it is recommended that pregnancy is planned, and thorough oral prophylaxis and other required dental treatments are done before, and nice oral hygiene is maintained during pregnancy and also thereafter.

3.2. Oral hygiene as related to pre and post radiotherapy of oro-facial regions

Many times radiotherapy is prescribed after onco-surgery for treatments of malignancies of the oro-facial region. Radiotherapy reduces salivary flow and produces xerostomia. It also makes bone ischemic and hypoxic. Xerostomia may lead to dental and periodontal infections, if oral hygiene is neglected. If extraction of a tooth is needed and carried out, healing may get complicated due to the ischemic and hypoxic condition of the bone. There are chances that osteo-radio-necrosis may develop. It becomes mandatory to maintain oral hygiene for cases of radiotherapy.

3.3. Other considerations about oral hygiene

Immunologically compromised persons need to be more vigilant about an oral hygiene.

Patients who have undergone a surgery or a procedure in an oral cavity, should also maintain good oral hygiene to allow rapid, better, and uncomplicated healing. Similarly, those suffering from systemic disease need to pay more attention to maintain oral hygiene so that their recovery does not get complicated by oral infections. Some systemic conditions like diabetes mellitus, hormonal imbalance, viral infections, thrombocytopenia, leukemia and so on may predispose to oral diseases. Some systemic conditions, or medicines used for their treatment, may cause xerostomia.

4. Modern oral hygiene practices

Currently available tools for oral hygiene include the following:

4.1. Dentifrice

Dentifrice is a material, which may be in form of powder, paste, or gel and is used for cleaning natural teeth. As it is noted, many different prescriptions have been given to formulating a dentifrice since ancient time. Use of dentifrice became common since nineteenth century. Most preferred form at present is toothpaste. Earlier, toothpastes were available in jars and were known as "dental creams." At present, they are available in convenient collapsible tubes. A modified design of nozzle of a tube can be used for striped or layered toothpaste.

Ingredients of a dentifrice (toothpaste):

4.1.1. Abrasives

They constitute almost 50% in composition and are insoluble fine particles of different silicas, which cause minimal enamel erosion; and remove plaque and to some extent calculus and stains.

4.1.2. Surfactants

Detergent or sodium lauryl sulfate (SLS) is used to reduce surface tension to allow the spread of paste on the tooth surface. SLS may alter the perception of taste for certain short period of time after using toothpaste.

4.1.3. Anti-microbial agents

Many anti-microbial agents can be a part of toothpaste, but most common is triclosan at present. Its use is controversial and debatable.

4.1.4. Fluorides

Fluorides are believed to play important role in the prevention of dental caries. Usual concentration of fluorides in toothpaste remains between 1000 and 1500 ppm. Sodium fluoride (NaF), stannous fluoride (SnF_2), Di-sodium mono fluoro phosphate ($Na_2PO_3F_2$) and so on, may be included.

4.1.5. Flavoring, sweetening, and coloring agents

Common flavoring compounds used are menthol, peppermint oil, and spearmint oil; but many others are also used. Bubblegum flavor is used in toothpaste made for kids. Not flavored toothpastes are also available.

Sometimes ingredients used in toothpaste provide color to it, and there is no need to add additional coloring agent.

Sweetening agent used, must obviously not be sugar, and also must be non-toxic.

The ingredients of a dentifrice are mixed with glycerol, sorbitol, xylitol, or similar compound to give it the form of a paste.

Various medicated toothpastes are also available, and they are mainly used to provide relief from dentinal sensitivity. The compounds used for this purpose, act by plugging exposed dentinal tubules. Desensitizing toothpastes contain one or more of the substances such as stannous fluoride, sodium mono fluoro phosphate, amine fluoride, calcium carbonate, arginine bicarbonate, calcium sodium phospho silicate (Novamin or BioGlass), casein phosphopeptide (CPP), amorphous calcium phosphate (ACP), nano-hydroxy apatite, strontium acetate and so on.

Potassium nitrate when used provides short-lived relief from symptoms of dentinal sensitivity. It acts through the mechanism of conduction of nerve impulse.

Various tooth whitening pastes contain abrasive to remove stains and carbamide peroxide in different concentrations to act as a bleaching agent. Such pastes must be used under the professional guidance and not for a prolonged period to prevent damage to the enamel of teeth.

Herbal or natural dentifrices are also available, which do not contain chemicals like sodium lauryl sulfate (SLS) or fluorides. They contain natural compounds like eucalyptus oil, clove oil, plant extracts and so on.

Nicotine (Tobacco) containing toothpaste, which is available in India and some other Asian countries are actually habit forming, hazardous, and stain teeth. Their use must be avoided.

4.2. Toothbrush

A brush for cleaning teeth has been used since the use of chewing sticks. After stick was chewed, its end became brush-like and was used as a toothbrush.

Modern toothbrush having bristles perpendicular to the handle was first made by Chinese people at the end of the fifteenth century (1498) [20]. The material used for bristles and also handle kept on being changed and modified as time passed. Initially for bristles, hairs from pig's back or tail and for the handle, an ox bone or bamboo were used. Other materials to be used for bristles were horse hairs, badger hairs, Siberian boar hairs, porcupine quills and so on. For handles wood, ivory, and also gold were used.

First mass production of toothbrushes was done by William Addis of Clerkenwell, London, England, in around 1780 [27]. H. N. Wadsworth became the first American to patent a toothbrush (patent number 18653) on November 7, 1857 [28].

Toothbrushes with nylon bristles and plastic handle were designed by Dupont de Nemours in 1938 and were made popular by American army during Second World War as American soldiers were advised to use these brushes [27]. Size and shape of head and handle of a toothbrush may vary. Sometimes, it is claimed that certain angles in the design of handle of a toothbrush help to guide the head to the areas difficult to access. Consideration should also be given to the belief that basically, it is the movement of the wrist of the user, which guides the head to different areas of the dental arch.

Squibb and Sons Pharmaceuticals of America launched first electric toothbrush in the market in 1959–1960, under the name, 'Broxodent' [29]. Many brands of the powered toothbrushes are available at present and they are of more help to physically compromised persons. Many varieties of the powered toothbrush are available.

The purpose of using a toothbrush along with toothpaste is to remove plaque and debris from surfaces of teeth, to provide a gentle massage to gingiva and to suppress halitosis. A toothbrush should be having soft bristles and should be used with a scientific brushing technique, so as to prevent damage to gingiva, and avoid abrasion of cervical enamel and cementum.

Specially designed brushes are also available to clean inter-dental areas and are used for maintaining gingival health.

4.3. Tongue cleaners

Tongue cleaners available at present may be boilable, made up of stainless steel, or plastic material, which can withstand high temperature or disposable. Various toothbrushes also may have a tongue cleaner on another side of the head where bristles are located. Many times soft toothbrush itself may be used to clean tongue.

Tongue cleaners remove debris from the dorsal surface of the tongue and prevent fungal infection.

4.4. Dental floss

Threads and rags, which were used in old times for cleaning proximal surfaces of teeth, have become dental floss. Dental floss available at present is basically mounted or unmounted waxed silk thread, which may be flavored.

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4.5. Mouth washes

Mouth washes have also been used since old times and many formulae have been suggested from time to time.

Rinsing the mouth removes loose debris from teeth and mouth and, depending upon the composition of the solution used, may perform some other task. If it is an antiseptic mouth wash, it reduces the number of oral micro-organisms.

If a mouth wash contains fluoride, it may help prevent dental caries or may sooth symptoms of dentinal sensitivity. Flavored mouth washes provide a feeling of refreshment.

4.6. Some other tools for oral hygiene

Sugar-free gums when chewed, stimulate salivary flow and help in maintaining neutral pH in an oral cavity.

Toothpicks (of proper material and design) are useful for removal of food lodged interdentally if used properly. Water jets may be used for maintaining periodontal health during orthodontic treatment and even otherwise. Plaque disclosing solutions help in efficient removal of plaque. Caries detection solutions are also available for early detection of dental caries.

The following may be recommended to maintain good oral hygiene.

Minimum twice a day brushing of teeth, using a soft toothbrush and good toothpaste, which may be fluoridated if needed, with recommended scientific brushing technique, should be done.

Daily dental flossing should be done for cleaning proximal areas.

Fluoridated or other mouth washes should be used if recommended.

Sugar-free gum may be chewed to stimulate salivary flow, for maintaining neutral pH in an oral cavity.

Regular dental checkups and prophylaxis should be performed by the professional consultant. Orthodontic treatment can be executed to relieve crowding of teeth, which may cause food lodgment and initiate a disease.

The balanced diet is essential for maintaining good general as well as dental health.

5. Conclusion

Mankind, since its existence has been concerned about oral hygiene. Maintaining good oral hygiene is one of the important tools to remain healthy.

Conflict of interest

There is no conflict of interest.

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