Research Article

Open Access

Dental Anatomy and Physiology of Human Tooth and the Consequences of Pathogenic Microbiota on the Oral Cavity

Firew Admasu Hailu¹, Yodit Admasu Hailu² and Tsion Admasu Hailu³

¹Dilla University, College of Natural and Computational Sciences, Department of Biology, Dilla, Ethiopia

²Addis Ababa Kolfe Health Center, Department of Clinical Nurse, Addis Ababa, Ethiopia

³Addis Ababa Medical and Business College, Addis Ababa, Ethiopia

ABSTRACT

Background: Biologically, there are about 700 microbial species found in our oral cavity with a favorable habitat due to nutrients and insulate for the development of a complex ecosystem in the mouth. The bacterial population is a result of dynamic relationship between pathogens and commensal, increases oral diseases and other risk factors. The non-beneficial microbiome have direct link to dental problems created by chemical, acids produced by bacteria and direct contact of tooth surfaces. In addition, the human teeth is made of many tissues with different thickness, functions, and types and also similar layers and sets of teeth.

Objectives: This article mainly assess the biology of dental anatomy and physiology, impact potential of oral pathogenic microbiota and their consequences on human oral cavity.

Methods: Important information's about dental of human and consequences of pathogenic microbiota from various international published sources, such as researches, reviews, health and biology books, organized and rewrite based on the standard scientific methods.

Results and conclusions: Based on human anatomy and physiology, the human teeth is made up of multiple tissues of minerals with varying thickness and rigidity, four types of teeth with different functions, crown and root parts of a teeth with three layers. In addition, similar to other mammals, human beings develop two sets of teeth as "deciduous and permanent" called diphyodont. Moreover, human mouth is the most colonized parts of our bodies that support as important habitats of heterogeneous microbial communities due to nourished nutrients with optimum insulate for development in the mouth, and they can simply bind on tooth surfaces.

Therefore, due to exogenous material over tooth surfaces produced chemicals and pathogenic microbiota directly contact to occluding or proximal surfaces cause decaying and eroding of human tooth and other potential impacts like bad smell associated consequences on the oral cavity.

*Corresponding author

Firew Admasu Hailu, Department of Biology, Dilla University, College of Natural and Computational Sciences, Dilla, Ethiopia, E-mail: firew.admasu@gmail.com

Received: September 10, 2020; **Accepted:** September 25, 2020; **Published:** October 10, 2020

Keywords: Dental Anatomy, Dental Erosion, Oral Cavity, Pathogenic Microbiota.

Introduction

In biological sciences, human mouth is suitable media for the production of microbial community than other organs of our bodies due to different habitats, suitable temperature, leftover food particles and other factors in our mouth that hold them and thus microbiota are heavily colonized in our mouth constitute central linkage of oral with health. Similar to all other complex multicellular eukaryotes, human beings are not autonomous organisms, but their biological units include many microbial symbionts and their genomes [1]. The microbes in and on our bodies form a fundamental functional organ to our health and physiology with our symbiotic microbial inhabitants used to

form a 'super organism' (holobiont). The microbial component of the human holobiont is substantial, and at least equals the number of our own cells [2]. The term microbiome was coined by the Nobel prize laureate Joshua Lederberg, which means our microbial community inhabitants to indicate ecological symbiotic community, commensal association, and pathogenic microbiota that accurately share the space in our body [3].

About 700 microbial species such as *Strep. mitis*, *Strep. sanguis*, etc found in the oral cavity are nourished with nutrients and provided a favorable habitat due to an insulate, the dental sign provides an insulate for them, while the dextran they secrete allow them to bind to tooth surfaces that provides for development of a complex ecosystem in the mouth [4]. In the oral cavity, the bacterial population is a result of the dynamic relationship

between pathogens and commensals [5]. Therefore, the oral diseases become increasing and associated with decaying of teeth and other independent risk factors for systemic conditions such as cardiovascular disease, osteoporosis, diabetes mellitus and infection in other body sites [6,7]. The commensal microorganisms found in the oral cavity rarely cause invasive infections in adults or children. However, non-beneficial microorganisms have direct link to dental caries, periodontal disease and halitosis. Oral bacteria have been implicated in bacterial endocarditis, aspiration pneumonia, osteomyelitis in children, preterm low birth weight, coronary heart disease and cerebral infarction (or stroke). The incidence of bacteremia following dental procedures has been well documented [8]. The type and distribution of oral microorganism in the biofilm vary with dietary and cultural habits and the health of individuals [9].

The human teeth is made of multiple tissues with different thickness, functions, and types of teeth but similar three layers, two sets of diphyodont teeth of human beings and other mammals. Dental erosion is dissolution of tooth that produced by chemical or acids secreted in the mouth and microbiota such as bacteria which directly contact the surface of proximal/occluding, and also by external material forced over surfaces of tooth such as tensile forces induced by occlusal surface might lead to wear of tooth from cervical enamel and *abfraction* might cause when lingual surfaces is affected [10]. The most common external erosive causes for dental erosion is acidic drinks, either pure fruit juices or carbonated soft drinks with added hydroxy organic and phosphoric acids [11-13]. During bedtime the flow of salivary is decreased and so, consuming fruit juices can be very harmful [11]. Due to frozen juices slowly consumable and takes time to neutralize, the frozen fruit juices may have dangerous risk for erosion of tooth than fruit drinks [14]. Citric acid is particularly damaging to teeth and some low pH values beers may cause potential problem of erosion of tooth *in vitro* [15-17]. In addition, as increasing use of beverages diet with low calorie, addictive caffeine from soft drinks and diet which contain nature of abrasive can cause loss of tooth tissue [18].

According to human anatomy and physiology, Clemente; and Johnson, (2015), the human teeth is made up of multiple tissues of minerals with varying thickness and rigidity, four types of teeth with different functions to break down the food stuffs by cutting and grinding/crushing them using saliva and tongue in formation of bolus for swallowing via esophagus to the next digestive organs [19]. There are four types of teeth with their specific functions in human known as incisors (I) for cut the food, canines (C) for scratch the food, premolars (PM), and molars (M) both used for grinding or crushing the food [19]. A tooth have two parts separated by neck such as the root of teeth that covered by the gums and the crown of teeth that found above the gums with three layers of enamel, dentine and pulp cavity. Similar to other mammals, human beings develop two sets of teeth as “deciduous and permanent” sets called diphyodont. The first set known as “milk teeth” also called (“primary”) that starts to emerge at the age of about six months that can be replaced and permanent teeth during adult age [20]. Therefore, the main objectives of this article is to update information about dentology and oral cavity health of human, pathogenic oral microbiome and their potential impacts and associated consequences on the oral cavity.

Dentology and Pathogenic Microbiota of Human Tooth: This chapter generally include about the dental anatomy and physiology of human tooth and the consequences of pathogenic microbiota on the oral cavity. Specifically, the dental anatomical structure

of human teeth includes the jaws of teeth, the deciduous and permanent teeth, parts of teeth, types of teeth, layer of a teeth and surfaces of human teeth. Similarly, the dental physiology of human teeth includes the functions of each parts, types, layers and surfaces of teeth, and also the functions of oral organs and glands situated in the oral cavity. Moreover, oral pathogenic microbiota including the ecology of oral microbes, effects of pathogens on teeth and related problems that affect the oral health of human and other related factors why mouth is suitable media for microbiota are explained briefly as follows.

Dental Anatomy and physiology of human tooth: In biological sciences, the dental anatomical structure of human mouth consists of tooth, tongue and salivary glands, including the upper (maxilla) and lower (mandible) jaws, the deciduous and permanent teeth, parts, types, layer and surfaces of human teeth with their functions and glands located in the oral cavity as indicated in figure 1 and explained below.

Dental anatomy of tooth: Dental anatomy is the study of structure of teeth and a taxonomic science concerned with classification, naming of teeth and their structures to serves for dentists to simply identify structures of teeth during treatment. Anatomically, the human tooth have crown, neck and root parts. The crown is the area above the neck of the tooth (Clemente, 1987) and the root is a part of a tooth covered with gum as indicated in figure 1 below. In addition, usually, incisors and canines have a single root, the first maxillary premolars and mandibular (lower jaw) molars structure contain two roots, and molars structure of maxillary (upper jaw) contain three roots [19].

Diphyodont of human teeth: Similar to other mammals, human beings also develop two sets of teeth as “deciduous and permanent” sets called diphyodont. The first set known as “milk teeth” also called (“primary”) usually have 20 primary teeth that starts to emerge at the age of about six months which can be replaced and 32 permanent (adult) teeth during adult age. Among 20 primary teeth, both maxilla and mandible each contain ten and so, I2/2, C1/1, PM2/2 and M0/0 of dental formula. In primary set of teeth, centrals and laterals incisors and also first and second molars. All primary teeth are normally later replaced with their permanent counterparts. Among 32 permanent teeth, both maxilla and mandible each of them contain 16 with the dental formula of I2/2, C1/1, PM2/2 and M3/3. Wisdom teeth also known as the third molars, if any additional fourth and fifth molars form referred hyperdontia teeth and if the usual number of teeth is fewer also called hypodontia [21]. In addition to other biological differences between male and female, there are little differences in their jaws nature, which means, on average, male teeth with jaw is larger than female and also the proportions of internal dental tissue have more dentine in male and more enamel in female teeth [22].

Types and Layer of human teeth: There are four types of teeth with their specific functions in human known as incisors (I), canines (C), premolars (PM) (bicuspid), and molars (M) with usually 20 primary (replaceable) and 32 permanent teeth as indicate in the following figure with various primary functions like incisors used for cutting the food, canines used for tearing the food, both premolars and molars teeth also used for grinding the food type. In addition, there are three types of a teeth layers, called primary (enamel), secondary (dentine) and tertiary (pulp cavity) [23].

Enamel is the white, hardest and highly mineralized layer about 96% of a teeth and it is one of the four major tissues which make

up the tooth, along with dentin, pulp cavity and cementum and also it is supported by underlying dentin and the rest 4% is water and organic material [23]. The usual color of enamel is vary from light yellow to grayish white, sometimes slightly blue tone and semi translucent, and also the color of dentin and any restorative dental material underneath the enamel strongly affects the appearance of a tooth. Enamel have varies thickness over the surface of the tooth and its primary mineral is hydroxyapatite, which is a crystalline calcium phosphate (to give its strength and brittleness and also ameloblastins, amelogenins, enamelines and tuftelins are the main proteins used for the development of enamel [20].

Dentin is permeable, made up of 70% of inorganic, 20% of organic materials, and 10% of water by weight, the second most layer of a teeth underneath by enamel, and it decays more rapidly if a protective layer (enamel) is affected and if not properly treated and also collagenous proteins of organic matrix and less brittle, and is essential as a support [23]. Dentin is secreted by the odontoblasts of the dental pulp and the formation is known as dentinogenesis and dentin has microscopic channels (dental tubules) which radiate from the pulp cavity to enamel border with tiny side-branches by the radius of the tooth.

Pulp cavity is the central part of the tooth which filled with soft connective tissue (Johnson, 1998), contains blood vessels and nerves that enter the tooth from a hole at the apex of the root and also the pulp is usually known as “the nerve” of the tooth [24]. The cementum is bone like specialized substance, consists about 45% of inorganic, 33% of organic material and 22% water, yellowish in color, softer than both enamel and dentin, which used to cover and attach to the tooth for constancy. In addition, cementum lack of cellular components (acellular) which covers about $\frac{2}{3}$ of the root and $\frac{1}{3}$ of the root apex is more permeable and cellular [24].

Figure 1: The structure of human teeth

Pathogenic Microbiota of human teeth: This part of an article is mainly focus on the main pathogenic microbiota and dental infections, ecology and niche of oral microbiota, the role of pathogens in oral health, dental infections and related problems in human mouth and also reason why mouth is suitable media for microbes.

Biomedical and clinical information of dental infections:- According to medical microbiology and bacteriology information of dental infections indicate that, the human mouth is occupied by 200 to 300 species of bacteria, but only a limited number of these species participate in dental decay or periodontal disease [25]. Dental decay is due to the irreversible solubilization of tooth mineral by acid produced by certain bacteria that adhere to the tooth surface in bacterial communities known as dental plaque. *Streptococcus mutans* is the main cause of dental decay and various lactobacilli are associated with progression of the lesion [25]. Based on pathogenesis information, the tooth surface

normally loses some tooth mineral from the action of the acid formed by plaque bacteria after ingestion of foods containing fermentable carbohydrates and this mineral is replenished by the saliva between meals and so far, when frequently eaten fermentable foods, the low pH in the plaque is sustained and a net loss of mineral from the tooth occurs and this low pH selects for aciduric organisms, like *Streptococcus mutans* and lactobacilli store polysaccharide and continue to secrete acid long after the food has been swallowed [25].

In clinical manifestations, caries become intensely painful when the lesion approaches the tooth pulp. Microbiological diagnosis indicate that, new and chair-side culture procedures allow for an estimate of the number of *Streptococcus mutans* organisms in saliva [26, 27]. According to Dzink, et al., and Page, periodontal disease can establish itself when the gums detach from the teeth as a result of an inflammatory response to plaque. Periodontal infections are usually mixed, most often involving anaerobes such as *Treponema denticola* and *Porphyromonas gingivalis* [27]. According to Zambon, the microaerophile *Actinobacillus actinomycetemcomitans* causes a rare form known as localized juvenile periodontitis [28]. Pathogenesis information indicates that, the plaque bacteria elaborate various compounds (H₂S, NH₃, amines, toxins, enzymes, antigens, etc.) that elicit an inflammatory response that is protective but also is responsible for loss of periodontal tissue, pocket formation, and loosening and loss of teeth. However, prevention and treatment of teeth, the widespread use of fluoride in the water supply, in dentifrices, and in local applications by the dentist has reduced the prevalence of caries by 30 to 50 percent among young people in many industrialized countries. In clinical trials, the use of current antimicrobial agents to eradicate diagnosed *Streptococcus mutans* infections usually significantly reduces decay [29].

The human oral microbiota:-The oral microbiome of human being mainly comprising bacteria which have developed resistance for its own benefit and impact on immune system of human dental cavities. The oral microbiology is the study of oral microbiota with their interactions and host [30]. The human mouth is suitable media to the growth of oral microbiota by providing a source of water, nutrients, and a moderate temperature [31]. The occupier oral microbiota adhere on teeth and gums [31,32]. The human oral cavity contain a number of anaerobic bacteria such as *Actinomyces*, *Arachnia*, *Bacteroides*, *Bifid bacterium*, *Eubacterium*, *Fusobacterium*, *Lactobacillus*, *Leptotrichia*, *Peptococcus*, *Peptostreptococcus*, *Propionibacterium*, *Selenomonas*, *Treponema*, and *Veillonella* and fungi are often found in the mouth includes *Candida*, *Cladosporium*, *Aspergillus*, *Fusarium*, *Glomus*, *Alternaria*, *Penicillium*, and *Cryptococcus* [33,34].

The bacteria that occupy in the oral cavity which provided by surface of tooth and epithelium. However, innate system of host defense mechanism continuously monitors the colonization of bacterial and prevents invasion of bacterial tissues [35]. Based on the role of oral microorganisms, dental caries and periodontal disease are the two major dental diseases [35]. As researches indicate that, poor oral health correlated with the result of oral microbiota that affect cardiac health and cognitive function [36]. In addition, no bacteria species are found in a newborn baby oral cavity, but their mouth is colonized in fast with *Streptococcus salivarius*, *Streptococcus mutans* and *Streptococcus sanguinis*, in the first appearance of teeth [35].

The Niche of oral microbiome: The habitat of the oral microbiome is essentially the surfaces of the inside of the mouth and saliva plays

a substantial role in influencing the oral microbiome [37]. There are more than 800 bacteria species by colonizing in oral cavity due to our mouth is suitable niche for large number of bacteria species by having watery saliva and abundance of nutrients that pass every day. In addition, during 10 seconds kissing, about 80 million species of bacteria exchanged with saliva. However, the result is fleeting as every person that rapidly returns to their possess stability [38,39].

Based on scientific study of oral ecology and techniques of molecular biology, oral ecology including the tongue, the teeth, the gums, salivary glands, etc are the home to these communities of different microorganisms [40]. The host's immune system controls the bacterial colonization of the mouth and prevents local infection of tissues. A dynamic equilibrium exists notably between the bacteria of dental plaque and the host's immune system, enabling the plaque to stay behind in the mouth when other biofilms are washed away [35]. In equilibrium, the bacterial biofilm produced by the fermentation of sugar in the mouth is quickly swept away by the saliva, except for dental plaque. In cases of imbalance in the equilibrium, oral microorganisms grow out of control and cause oral diseases such as tooth decay and periodontal disease. Several studies have also linked poor oral hygiene to infection by pathogenic bacteria [36].

The role of pathogenic microbiota in oral health: In the oral cavity of human being, several factors to prevent pathogenic oral microbiota that can cause the diseases in the mouth. The dental plaque is the adhere materials on the teeth which consists mainly by *Streptococcus mutans* and *Streptococcus sanguis*, the polymers of salivary and extracellular products of bacterial. Plaque is the accumulation of microbiota on the teeth which results in dental illness and if not brushing, it turn into the hardened form to periodontal disease. In addition, when the teeth colonized by *Streptococcus mutans*, proteins used to produce antibodies to create vaccines for inhibition and oral microbiota species of bacteria that associated to be present as vaginosis bacterial found in women and also some fungi such as *Alternaria*, *Aspergillus*, *Candida*, *Cladosporium*, *Cryptococcus*, *Fusarium*, *Glomus* and *Penicillium* are regularly found in the human mouth [25,34,41]. Additionally, poor health of oral cavity resulting from oral microbiota invade the human body can affect cardiac function and also high levels of antibodies circulating to oral pathogens are linked with hypertension in human [36,42].

Human oral and dental infections:- According to Anne and Naomi, microbial populations colonizing, mouth is a major source of pathogens responsible for oral and dental infections, including periodontal diseases, gingivitis, pericoronitis, endodontitis, peri-implantitis, and postextraction infections with distinct clinical and microbial features. Bacterial species associated with oral infections include *Actinobacillus actinomycetemcomitans*, *Bacteroides forsythus*, *Campylobacter rectus*, *Eikenella corrodens*, *Eubacterium* species, *Fusobacterium nucleatum*, *Peptostreptococcus micros*, *Porphyromonas gingivalis*, and *Prevotella intermedia*. Oral infections in medically compromised patients, including those with AIDS, are associated with similar species and are usually complicated by superinfection with enteric and *Candida* species. Isolation of species causing oral infections requires the collection of appropriate samples and the use of strictly anaerobic techniques. Rapid selective culture, immunofluorescence, and DNA probe methods have been developed for the identification of these oral species. The varied measures required in the management of oral and dental infections may include antimicrobial therapy. Accurate microbiological diagnosis, including antibiotic susceptibility

testing, is indicated for cases that do not respond to therapy [43].

The consequences of oral pathogens and dental hygiene: There are a number of consequences of oral pathogens and dental hygiene of human being. The main consequences of oral pathogenic microbiota and the impact of lack of dental hygiene is explained as follows.

The consequences of oral pathogenic microbiota:- According to Charles Dunlap, (2004) on the abnormalities of human teeth indicate that, there are different consequences of teeth that can caused by pathogenic microbiota and lack of dental hygiene and such as attrition, erosion of teeth, abrasion, hypocalcified amelogenesis imperfecta, pathologic attrition on occlusal surface, etc as located in the following figures 2. According to Mendelian inheritance of man, there are many acquired and inherited developmental abnormalities that alter the size, shape and number of teeth. Individually, they are rare but collectively they form a body of knowledge with which all dentists should be familiar. The oral pathology of those conditions that are inherited such as ectodermal dysplasia, dentinogenesis imperfecta and others (Charles, 2004) [. In addition, such abnormalities of human teeth can be define as follows. Attrition is loss of tooth surface due to normal (physiologic) wear but accelerated wear beyond normal is pathologic. Erosion is the chemical dissolution of tooth structure frequently caused by excessive intake of acidic food or drink. Abrasion is caused by mechanical forces, ordinarily confined to the occlusal and incisal surfaces and ordinarily used when the loss is on a non-occluding surface. Amelogenesis imperfecta is inherited developmental defects in enamel and at least 14 identified phenotypes and autosomal dominant, recessive and X linked inheritance and the conditions is rare, only about 1 in 14,000 have it. Hypocalcified type is a defect not in the quantity but in the quality of enamel and it is poorly mineralized, soft and chips and wears easily.

Figure 2: The consequences of pathogenic microbiota on human teeth

In addition, there are a number of abnormality structure of human teeth, like amelogenesis and dentinogenesis imperfecta, dentin dysplasia, regional odontodysplasia, diastema, etc. According to genetics reference, amelogenesis imperfecta and dentinogenesis imperfecta is defined as a situation in which enamel and dentin does not form properly respectively and also affecting the roots and pulp cavity of human teeth causes the disorder is known

as dentin dysplasia. Similarly, a disorder of teeth that affecting enamel, dentin, and pulp cavity that causes the human teeth to appear is known as regional odontodysplasia and also a gap that caused by the imbalance of the jaw and size between two teeth is called Diastema [44,45].

Human dental caries is the decay of tooth that caused by infectious disease can lead to tooth pain, loss and damages the teeth structures, as indicated in figure 3. Dental caries increases in the prevalence of caries have been associated with diet changes and today, dental caries remains one of the most common chronic diseases throughout the world [46]. In the United States, dental caries is the most common chronic childhood disease, being at least five times more common than asthma and among this children and Europe, dental caries happen 60–80% which is 20% of the population [47]. Tooth decay is the most damage of teeth with the presence of fermentable carbohydrates food like glucose, fructose, and sucrose that caused by certain types of bacterial producing acids [48,49]. According to American Dental Association (2011), the resulting acidic levels in the mouth affect teeth because a tooth's special mineral content causes it to be sensitive to low pH. In addition, tooth decay can be caused when acid-forming foods left on the teeth, mouth, and tongue to demineralize tooth enamel, and eventually the cavity will expose the nerve-filled pulp, and cause pain.

Figure 3: The decay of human tooth caused by pathogenic microbiota

According to American Dental Institute (2011), Ross (2002) and Elmhurst College information, the plaque is a biofilm consisting of large quantities of various bacteria that form on teeth. If not removed regularly, plaque buildup can lead to periodontal problems such as gingivitis. Given time, plaque can mineralize along the gingiva, and forming *tartar*. The microorganisms that form the biofilm are almost entirely bacteria (mainly streptococcus and anaerobes), with the composition varying by location in the mouth. *Streptococcus mutans* is the most important bacterium associated with dental caries. Certain bacteria in the mouth live off the remains of foods, especially sugars and starches. In the absence of oxygen they produce lactic acid, which dissolves the calcium and phosphorus in the enamel and known as “demineralisation”, which leads to tooth destruction. Gradually, saliva neutralizes the acids cause the pH of the tooth surface to rise above the critical pH, considered to be 5.5 and this causes ‘remineralisation’, the return of the dissolved minerals to the enamel.

The dental hygiene and treatments: Tooth decay can be caused when acid-forming foods left on the teeth, mouth, and tongue to demineralize tooth enamel, and eventually the cavity will expose the nerve filled pulp, and cause pain and also the cavity must be drilled out, cleaned, and filled with gold, silver amalgams (mercury alloy), or tooth-colored composites, ceramics, or inlays. Oral hygiene is the practice of human keeping of their mouth clean to prevent dental caries, gingivitis, periodontal disease, bad breath, and other dental disorders. Regular cleaning of teeth is the removal of tartar with cautious brushing and flossing that done

by professional of dental hygienists and dentists using diverse instruments. According to American Dental Association, the purpose of cleaning teeth is to remove plaque, which consists mostly of bacteria. Healthcare professionals recommend regular brushing twice a day to remove unwanted materials using a toothbrush to maintain human teeth and oral hygiene [49].

According to BBC News in (2003) on thumbs down for electric toothbrush explained as, it is a popular material to protect human oral hygiene and performed with proper training to be used properly, if not as a result strong problems can occur in human oral hygiene. Dental hygiene is important to human in protecting pathogenic oral microflora to maintain the good oral hygiene, preventing losses of teeth and also preventing tooth disease and related problems caused by poor dental hygiene like cardiovascular, diabetes, and osteoporosis diseases and so, to prevent any side effects which caused from poor oral hygiene, it is vital to brush every day using regular cleaning schedule, and feeding a healthy diet [50]. In addition to the importance of protecting of dental hygiene, dental protective treatments like fluoride therapy and dental sealants are also required to have normal dental functions. According to Cate (1998), fluoride therapy used to prevent the decay of dental by attaching to hydroxyapatite crystals in the external layer of a tooth called enamel. Ross (2002) indicates that, the incorporated fluoride makes enamel more resistant to demineralization and thus more resistant to decay with fluoride, such as a fluoride toothpaste or mouthwash to protect teeth surfaces and also dental sealants are preventive therapy frequently used to give a fence to bacteria and decay on the surface of teeth and which are applied by dentist's.

Conclusions and Future Directions

Conclusions:- Anatomically, the human teeth is made up of multiple tissues of minerals with varying thickness and rigidity, four types of teeth with different physiology (functions), crown and root parts and three layers of enamel, dentine and pulp cavity, develop “deciduous and permanent” sets called diphyodont, human mouth is colonized by heterogeneous microbial communities, due to exogenous material over tooth surfaces produced chemicals, directly contact to occluding or proximal surfaces cause decaying and eroding of human tooth and bad smell associated consequences on the oral cavity. The diverse community of oral microbiome is lightly tuned by nature to protect from disease, and has great importance to maintain its natural diversity. The large number of pathogenic bacterial species that present in the oral cavity indicate that the potential for the development of systemic diseases and the non-pathogenic bacteria may be beneficial in maintaining the balance of species in the oral cavity. Oral health prevention methods by educating patients on appropriate lifestyle and application of effective plaque control techniques. Oral hygiene refers to the practice of keeping the mouth and teeth clean to prevents periodontal problems, involving the teeth or gingiva, and bad breath. Once or twice daily brushing with a mild abrasive and flossing with a wax-coated string is recommended. Brushing and flossing helps control the formation of dental plaque, also called tartar or calculus. Treatment include prevention strategies, such as practices of oral hygiene on diet and smoking and also patients alike active maintenance of health rather than management of disease. Establishing the treatment by keeping good oral hygiene and modifying lifestyle factors such as diet and smoking and indiscriminate use of antibiotics for the treatment to avoid oral diseases, to defend the beneficial oral microbiota and avoid antibiotic resistance. In addition, for the control of teeth caries use of topical fluoride, protect from an acidic environment, amount reduction and frequency of the consumption of sucrose and acidic drinks, reduce or use sugar

free can reduce acid production and/or promote alkali generation within dental plaque. For periodontal disease, treatment strategies for mechanical reduction of accumulated biofilm by mechanical removal of plaque back to levels compatible with oral health to reduce inflammation and promote a favorable microenvironment to support formation of a balanced oral microbiome.

Future Directions: Based on human anatomy and physiology and dental medicine, after identifying the human tooth, dental problems and the consequences of pathogenic microbiota on the oral cavity, it is important to recommend prevention and treatment methods of oral microbiota for future direction. The human oral cavity environmental impacts of the selection of pathogenic microbiota populations from early life to aged, the whole human mouth interact with oral microbiota. Therefore, the oral hygiene require practice of keeping the mouth and teeth clean once or twice daily brushing with a mild abrasive and flossing with a wax-coated string and also brushing and flossing helps control the formation of dental plaque. In addition, a small study shown that the composition of the sub gingival microbiome at baseline, rather than the use of antibiotics, has a predictive potential on the long-term clinical outcome for treatment of chronic periodontitis. Whereas further research is needed to confirm details of predictive value, the finding underlines the important role of the oral microbiome, not only in disease, but also in the response of oral tissues. Furthermore, the present understanding of rapidly evolving scientific field supports the idea that clinical practice needs to shift from its historical focus on management of caries and periodontitis by elimination of the microbiota, to a new focus on practical management of oral health through an ecological approach to the holobiont. Thus, future directions may include individual assessment of the microbiome, host response for the early detection, and personalized approaches to restore a health associated oral microbiome to have direct implications for the patient management in clinical practice.

References

- Bordenstein S R, Theis K R (2015) Host biology in light of the microbiome: ten principles of holobionts and hologenomes. *PLoS Biol*.
- Sender R, Fuchs S, Milo R (2016) Are we really vastly outnumbered? Revisiting the ratio of bacterial to host cells in humans. *Cell* 164: 337-340.
- Lederberg J, McCray A (2001) 'Ome sweet 'omics a genealogical treasury of words. *Scientist* 15: 810.
- Willcox MDP, DB Drucker, VF Hillier, RM Green (1985) Relationship of adhesion in vitro and cariogenicity of oral *Streptococcus* species in germ-free rats. *Arch Oral Biol* 33: 635-636.
- Socransky S.S, C Smith, AD Haffajee (2002) Subgingival microbial profiles in refractory periodontal disease. *J. Clin. Periodontol* 29: 260-268.
- Renvert S (2003) Destructive periodontal disease in relation to diabetes mellitus, cardiovascular disease, osteoporosis and respiratory disease. *Oral Health Prev. Dent* 1: 341-357.
- Meurmann JH, M Sanz, SJ Janket (2004) Oral health, atherosclerosis and cardiovascular disease. *Crit. Rev. Oral Biol. Med* 15: 403-413.
- Li XJ, KM Kolltveit, L Tronstad, I Olsen (2000) Systemic diseases caused oral infection. *Clin. Microbiol Rev* 13: 547-558.
- Bowden GHW, YH Li (1997) Nutritional influences on biofilm development. *Adv. Dent. Res* 11: 81-99.
- Osborne-Smith KL, Burke FJ, Wilson NH (1999) The aetiology of the non-carious cervical lesion. *Int Dent J* 49: 139-143.
- Millward A, Shaw L, Smith AJ, Rippin JW, Harrington E (1994) The distribution and severity of tooth wear and the relationship between erosion and dietary constituents in a group of children. *Int J Paediatr Dent* 4: 152-157.
- Hunter ME, West NX, Hughes JA, Newcombe RG, Addy M (2000) Erosion of deciduous and permanent dental hard tissue in the oral environment. *J Dent* 28: 257-263.
- West NX, Hughes JA, Addy M (2000) Erosion of dentine and enamel in vitro by dietary acids: The effect of temperature, acid character, concentration and exposure time. *J Oral Rehabil* 27: 875-880.
- Touyz LZ, Silove M (1993) Increased acidity in frozen fruit juices and dental implications. *ASDC J Dent Child* 60: 223-225.
- Hughes JA, West NX, Parker DM, van den Braak MH, Addy M (2000) Effects of pH and concentration of citric, malic and lactic acids on enamel, in vitro. *J Dent* 28: 147-152.
- Nogueira FN, Souza DN, Nicolau J (2000) In vitro approach to evaluate potential harmful effects of beer on teeth. *J Dent* 28: 271-276.
- Brunton PA, Hussain A (2001) The erosive effect of herbal tea on dental enamel. *J Dent* 29: 517-520.
- Bishop K, Kelleher M, Briggs P, Joshi R (1997) Wear now? An update on the etiology of tooth wear. *Quintessence Int* 28: 305-313.
- Clemente, Carmine (1987) *Anatomy, a regional atlas of the human body*. Baltimore: Urban and Schwarzenberg.
- Johnson, Clarke (2015) "Biology of the Human Dentition at the Wayback Machine". uic.edu.
- Kokten G, Balcioglu H, Buyukertan M (2008) "Supernumerary fourth and fifth molars: a report of two cases". *Journal of Contemporary Dental Practice* 4: 67-76.
- Sorenti, Mark; Martínón-Torres, María; Martín-Francis, Laura; Perea-Pérez, Bernardo (2019) "Sexual dimorphism of dental tissues in modern human mandibular molars". *American Journal of Physical Anthropology* 2: 332-340.
- Zilberman U, Smith P (2001) "Sex- and Age-related Differences in Primary and Secondary Dentin Formation". *Advances in Dental Research*. 15: 42-45.
- Walton, Richard E, Mahmoud Torabinejad (2002) *Principles and Practice of Endodontics*. 3rd ed. pp. 11-13.
- Walter J. Loesche (1996) *Microbiology of Dental Decay and Periodontal Disease Medical Microbiology*. 4th edition. The University of Texas Medical Branch at Galveston.
- Dzink JL, Socransky SS, Haffajee AD (1988) The predominant cultivable microbiota of active and inactive lesions of destructive periodontal disease. *J Clin Periodontol* 15: 316-323.
- Page RC (1991) The role of inflammatory mediators in the pathogenesis of periodontal disease. *J Periodont Res* 26: 230-42.
- Zambon JJ (1985) *Actinobacillus actinomycetemcomitans* in human periodontal disease. *J Clin Periodontol* 12: 1.
- Loesche WJ (1986) Role of *Streptococcus mutans* in human dental decay. *Microbiol Rev*. 50: 353.
- Schwiertz A (2016) *Microbiota of the human body: implications in health and disease*. Switzerland: Springer. p. 45.
- Sherwood L, Willey J, Woolverton C (2013) *Prescott's Microbiology* (9th ed.). New York: McGraw Hill. pp. 713-721.
- Wang ZK, Yang YS, Stefka AT, Sun G, Peng LH (2014) "Review article: fungal microbiota and digestive diseases". *Alimentary Pharmacology & Therapeutics* 39: 751-766.

33. Sutter VL (1984) "Anaerobes as normal oral flora". Reviews of Infectious Diseases 6: S62-6.
34. Cui L, Morris A, Ghedin E (2013) "The human mycobiome in health and disease". Genome Medicine 5: 63.
35. Rogers A H. (2008) Molecular Oral Microbiology. Caister Academic Press.
36. Noble JM, Scarneas N, Papapanou PN (2013) "Poor oral health as a chronic, potentially modifiable dementia risk factor: review of the literature". Current Neurology and Neuroscience Reports 13: 384.
37. Marsh PD, Do T, Beighton D, Devine DA (2016) "Influence of saliva on the oral microbiota". Periodontology 70: 80-92.
38. Bertrand M (2009) "DUHL Olga Anna (dir.), Amour, sexualité et médecine aux XVe et XVIe siècles, Dijon, Editions Universitaires de Dijon, 2009". Genre, Sexualité & Société(n°2).
39. Kort R, Caspers M, van de Graaf A, van Egmond W, Keijser B, Roeselers G (2014) "Shaping the oral microbiota through intimate kissing". Microbiome. 2 (1): 41.
40. Attar N (2016) "Microbial ecology: FISHing in the oral microbiota". Nature Reviews. Microbiology 14: 132-133.
41. Africa CW, Nel J, Stemmet M (2014) "Anaerobes and bacterial vaginosis in pregnancy: virulence factors contributing to vaginal colonisation". International Journal of Environmental Research and Public Health 11: 6979-7000.
42. Pietropaoli, Davide; Del Pinto, Rita; Ferri, Claudio; Ortu, Eleonora; Monaco, Annalisa (2019) "Definition of hypertension-associated oral pathogens in NHANES". Journal of Periodontology 90: 866-876.
43. Anne Tanner and Naomi Stillman. (1993) Oral and Dental Infections with Anaerobic Bacteria. Clinical Infectious Diseases. Oxford University Press 16: S304-S309.
44. Cho, Shiu-yin (2006) "Conservative Management of Regional Odontodysplasia: Case Report" (PDF). J Can Dent Assoc 72: 735-738.
45. ASDC (1980) Journal of Dentistry for Children. American Society of Dentistry for Children 48: 266
46. Suddick RP, Harris NO (1990) "Historical perspectives of oral biology: a series". Crit. Rev. Oral Biol. Med 1: 135-151.
47. Touger-Decker R, van Loveren C (2003) "Sugars and dental caries". Am. J. Clin. Nutr 78: 881S-892S.
48. Hardie JM (1982) "The microbiology of dental caries". Dent Update 9: 199-200.
49. Moore WJ, Moore, WJ (1983) "The role of sugar in the aetiology of dental caries. 1. Sugar and the antiquity of dental caries". J Dent. 11: 189-190.
50. Mayo Clinic. (2019). "Oral health: A window to your overall health".