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ORAL HEALTH IN FOCUS: A REVIEW ON DENTAL DISEASES AND THEIR GLOBAL IMPACT

BHUJITHRA M, SRILAKSHMI S, SRIKANTH P, KABILAN G AND SAKTHI PRIYADARSINI S*

Department of Pharmacognosy, SRM college of pharmacy, Faculty of Medicine and Health Science, SRM Institute of Science and Technology, Kattankulathur, Chengalpattu District, Tamil Nadu, India – 603203

***Corresponding Author: Dr. Sakthi priyadarsini S: E Mail: sakthips1@srmist.edu.in**

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ABSTRACT

Dental care serves as essential for sustaining both oral and general health, involving preventive, diagnostic, and therapeutic approaches. Dental pain is a prevalent issue among oral diseases, frequently resulting from caries, pulpitis, or periodontitis, which requires precise diagnosis and treatment. Dental caries, caused by interactions within microbial biofilms, continues to be a widespread global concern, addressed through fluoride-based preventive strategies. Periodontitis is a chronic inflammatory condition that results in tissue destruction and tooth loss, along with potential systemic health consequences. Epidemiological studies indicate a substantial burden of dental diseases, exhibiting varying prevalence across diverse populations. Multiple factors, including dietary habits, inadequate oral hygiene, and systemic health conditions, contribute to oral health problems such as halitosis, gingival recession, and dental erosion. Advancements in diagnostic techniques, particularly through making use of laser technology, have enhanced the early detection of conditions such as caries and periodontal disease. Considering the pathophysiology of conditions like bacterial biofilm-induced caries, inflammatory processes in periodontitis, and mechanisms of dentinal hypersensitivity offers valuable insights for effective prevention and management strategies. Addressing these conditions through appropriate oral hygiene, timely interventions, and public health measures is essential for mitigating the global burden of dental diseases. This review presents an analysis of the prevalence, etiology, pathophysiology, and management of common dental diseases, such as dental caries, periodontitis, dentinal hypersensitivity, and dental erosion. This study aims to highlight current trends,

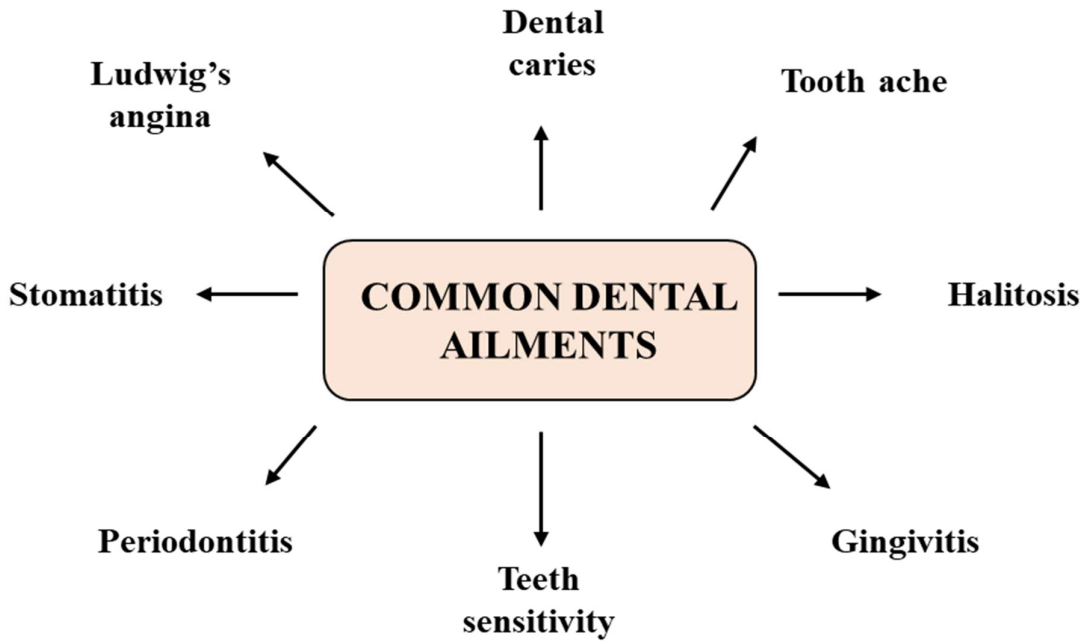
difficulties, and future prospects in oral health care by providing an overview of recent developments in diagnostic methods, treatment approaches, and preventative measures.

Keywords: Dental care, Ailments, Periodontitis, Stomatococcus mucilaginous, Ludwig's angina

INTRODUCTION

Dental care involves the prevention, diagnosis, and treatment of oral diseases and conditions affecting the teeth, gums, and mouth. It encompasses a range of practices aimed at maintaining oral health, including regular brushing and flossing, professional cleanings, and routine dental check-ups. Effective dental care is essential for overall health and well-being, as oral health is closely linked to systemic health **[1]**. Dental pain is the most common cause of orofacial pain, prompting patients to seek dental care. Diagnosing dental pain, often due to caries, pulpitis, or apical periodontitis, typically involves a thorough patient history and clinical examination, including provocation tests and test-anesthesia. While most cases are easily diagnosed, challenges arise with referred pain, cracked teeth, or complex dental anatomy, especially with multi-rooted teeth. Misdiagnosis can lead to prolonged pain and unnecessary treatments. Key to accurate diagnosis is a detailed history, clinical examination, and, if necessary, local anesthesia to confirm the source of pain **[2]**. Dental caries arises from the complex relationships between tooth structure, microbial biofilm, sugary foods, saliva, and hereditary factors. The procedure consists of alternating stages of demineralization and remineralization, with extended demineralization resulting in carious lesions at particular locations on the teeth. Balancing pathological factors, which promote caries progression, and protective factors, which support remineralization and lesion arrest, is essential. Fluoride toothpaste is regarded as a significant contributor to the worldwide reduction of caries, as it facilitates a shift in the oral biofilm towards a healthier state, enhancing remineralization and inhibiting further decay.

[3]. Periodontitis is defined as gingival inflammation associated with pathological detachment of collagen fibers from the cementum and migration of the junctional epithelium. It also involves resorption of the alveolar bone supporting the teeth. Diagnosing periodontitis requires consistent and accurate criteria, commonly using clinical measures like clinical attachment loss (CAL) and pocket probing depth (PPD). However, inconsistencies in how these indicators are used complicate the diagnosis and epidemiological studies. Recent reviews stress the need for a comprehensive definition that includes multiple signs and symptoms, such as BOP and pocket depth, to reflect disease severity and aid in consistent diagnosis **[4]**.



EPIDERMIOLOGY:

Approximately 20% to 30% of people are affected by 70% to 80% of carious lesions (dental caries) **[5]**. Halitosis is a common condition, impacting an estimated 25% to 30% of the global population **[6]**. Among twelve studies on denture stomatitis, eight reported a prevalence of 45%, with overall prevalence ranging from 17% to over 77% **[7]**. After applying this classification, 46% of respondents from the Black population and 16% from the White population were categorized as severely impacted by periodontitis **[8]**. RT2 and RT3 gingival recessions (GRs) were observed in 88.8% and 55.0% of patients, respectively, affecting the entire mouth **[9].** Sound tooth surfaces were associated with ICDAS-II scores of 0–2, whereas decayed surfaces, as defined by WHO criteria, corresponded to scores of 3–6 **[10]**. The majority of lesions were found on the enamel of the most affected teeth, primarily the upper central and upper lateral incisors. The findings suggest that the prevalence of hidden caries decreases with the widespread use of fluoride in dental products and public water supplies **[11]**. When Augmentin is unaffordable, benzylpenicillin may serve as an effective empirical alternative to reduce fatality rates in cases of severe dental infections **[12]**. Dentoalveolar abscess was the most frequently diagnosed condition (86.3%), with pain being the most common reason for hospital admission (47.1%). Pulpal necrosis was identified as the primary underlying cause in 67.5% of cases **[13]**.

TRIGGERING FACTORS:

The triggering factors involved in common dental problems are depicted in **Figure 1**.

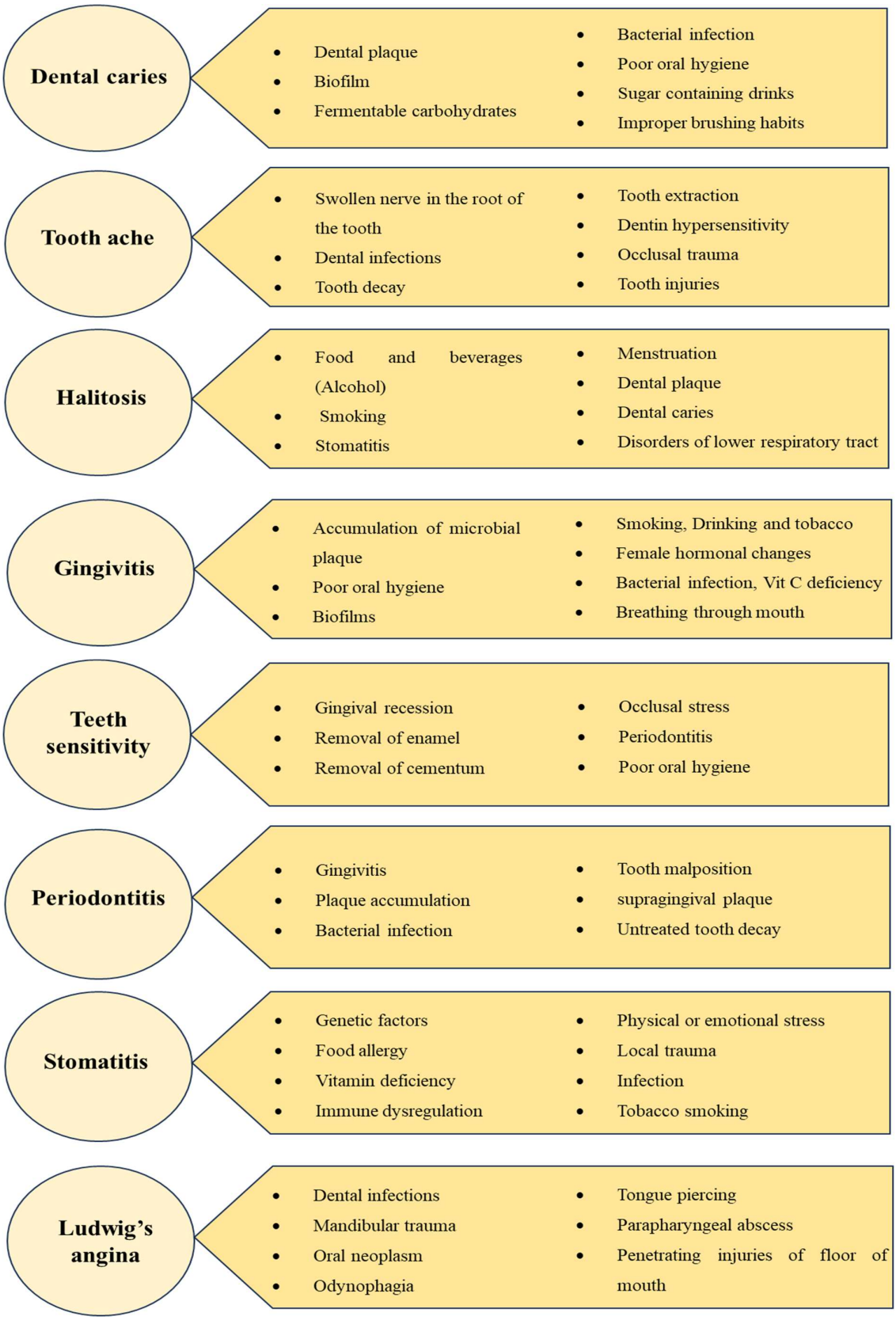


Figure 1: The triggering factors involved in common dental problems

DIAGNOSIS:

To ensure that children analyzed for caries-related pain using the DDQ-B had left untreated teeth necessitating dental intervention—specifically for pulpal extraction and care—a score of 5 or above was established as a dependable threshold. Dental caries diagnosis using laser technology was performed on human teeth to assess the depth of demineralization **[14]**. Ten to twenty percent of all halitosis cases originate from extraoral sources, including poor diet, alcohol misuse, tobacco use, certain medications, disorders of the digestive tract, and systemic conditions **[15]**. While most oral ulcerations are benign and resolve within two weeks, they may also indicate underlying systemic disorders such as vitamin deficiencies or autoimmune diseases **[16]**. In industrialized countries, periodontitis—an anaerobic bacterial infection characterized by a complex immunological response—is the leading cause of tooth loss **[17]**. Diagnosing such conditions can be challenging for clinicians. Classification is based on factors such as location, size, extent, and etiopathogenesis **[18]**. The current caries profile, marked by slower progression and lower prevalence, has increased the need to enhance the dental curriculum, particularly in clinical decision-making and diagnostic reasoning **[19]**. Early identification is the first step in the diagnosis and management of these conditions **[20]**. Recent studies suggest that bleeding reflects the bacteriological, clinical, and histological changes associated with periodontal disease **[21]**. Dentin hypersensitivity is characterized by short, acute pain arising from exposed dentin in response to external stimuli, without any underlying dental disease or structural defect **[22]**. Ludwig's angina is a rapidly spreading infection of the floor of the mouth, with poor dentition being a significant risk factor **[23]**.

CLINICAL CONDITIONS:

Toothache

Toothache is often a result of dental issues such as cavities, gum disease, or infections affecting the tooth pulp. The pain can range from mild to severe, often worsening with temperature changes or chewing. Common causes include tooth decay, trauma, or infection leading to abscesses. Early diagnosis and treatment are crucial to prevent complications like spread of infection or tooth loss. Effective treatment options include pain relief, antibiotics for infections, and restorative dental procedures. Regular dental care and hygiene practices are vital in preventing toothaches and maintaining oral health.

Dentalcaries

Dental caries is the most prevalent chronic disease globally, primarily caused by acids produced by bacteria like *Streptococcus mutans* in the mouth after consuming sugary foods. This leads to the formation of a

harmful biofilm on teeth, causing damage. Early childhood caries, the most common chronic condition in American children, is marked by decayed or missing teeth before age six. The condition is preventable if caught early, with initial signs appearing as white spots on tooth enamel before progressing to cavitation. Caries affects both primary and permanent teeth and can spread rapidly, particularly in underserved areas.

Periodontitis

Periodontitis is a chronic inflammatory disease that affects the tissues supporting the teeth, including the gums, periodontal ligament, and alveolar bone. It is caused by bacterial infections leading to the destruction of these structures, which can result in tooth mobility or loss if left untreated. The disease typically begins with gingivitis, marked by gum inflammation, and can progress to periodontitis if not addressed. Factors such as smoking, diabetes, poor oral hygiene, and certain medications increase the risk. Periodontitis is linked to systemic health issues, including cardiovascular disease and diabetes, making it crucial to manage and prevent.

Stomatitis

Stomatitis is an inflammation of the mucous membranes inside the mouth, which can manifest as redness, swelling, and pain. It can be caused by a variety of factors, including infections (such as viral, bacterial, or fungal), mechanical irritation, allergic reactions, or underlying systemic conditions like autoimmune diseases. Symptoms typically include mouth sores, difficulty swallowing, and bad breath. Treatment varies based on the underlying cause, and may include topical medications, pain relief, or addressing any systemic conditions contributing to the inflammation.

Halitosis

Halitosis, or bad breath, is a common condition that can significantly affect social and professional interactions. It is often caused by poor oral hygiene, leading to the buildup of food particles and bacteria in the mouth. Other factors, such as certain foods, smoking, dry mouth, or underlying medical conditions like diabetes or gastrointestinal disorders, can also contribute to halitosis. Treatment typically involves improving oral hygiene, such as regular brushing and flossing, as well as addressing any systemic health issues. In severe cases, professional treatment may be necessary to identify and treat the underlying cause **[24]**.

Dentalerosion

Dental erosion is a progressive loss of tooth enamel caused by acid exposure, either from external sources like acidic foods and beverages or from internal factors such as gastroesophageal reflux disease (GERD). This condition begins with the softening of the enamel surface, followed by the dissolution of enamel crystals, which eventually exposes the dentin. As erosion

advances, it can lead to increased tooth sensitivity, aesthetic issues, and functional difficulties. Early detection and intervention are vital to preventing severe damage, as later stages often require complex restorative treatments that can result in significant loss of tooth structure. Managing dental erosion in its early stages helps preserve both the function and appearance of the teeth, reducing the need for extensive restorative procedures **[25]**.

Bleedingtooth

Bleeding during dental procedures is a common complication that can pose risks, especially in patients with underlying conditions like hemophilia or those on anticoagulant therapy. Hemostasis, a natural process involving vascular spasm, platelet aggregation, and the coagulation cascade, is crucial in controlling bleeding. However, certain medical conditions or medications can disrupt this process, leading to excessive bleeding. Managing this requires a thorough understanding of hemostasis and proper treatment methods, such as blood tests to assess bleeding risk and the use of clotting agents in dental surgeries **[26]**.

Dentifrice

Dentifrice refers to any paste or gel used with a toothbrush to clean and maintain oral health. Its primary function is to prevent dental plaque, remove food particles, freshen breath, and provide active ingredients like fluoride to combat tooth decay and gum disease. Over the years, dentifrice formulations have evolved, incorporating various chemicals and active agents such as abrasives and antimicrobial agents. Herbal dentifrices, using natural ingredients, are gaining popularity for their effectiveness in promoting oral hygiene with fewer side effects. Fluoride-based dentifrices remain widely used for caries prevention **[27].**

Gingivitis

Gingivitis is an inflammation of the gums caused by microbial plaque accumulation at the gingival sulcus, the space between the tooth and gum. It is primarily triggered by the presence of certain bacteria, including *Streptococcus* and *Fusobacterium*. The disease progresses through stages, from an acute inflammation (early lesion) to a more chronic form (established lesion). Gingivitis is marked by symptoms like redness, swelling, and bleeding gums, and can be prevented with effective plaque control. If untreated, it can lead to periodontitis. Effective treatment involves good oral hygiene practices to control plaque buildup **[28]**.

PATHOPHYSIOLOGY:

Dental caries:

Caries is a infection of mineralized tissue triggered by a biofilm, or plaque, which is mostly made up of two aggressive bacterial species: lactobacilli and streptococcus. The caries disease process affects the hard

tissues of teeth exposing to the oral surroundings, with all tooth surfaces susceptible throughout an individual's lifetime. Lactic acid is produced during the fermentation of dietary carbohydrates, demineralizing the enamel surface at the plaque interface. When acids accumulate in the biofilm's fluid phase, the pH falls to the point where the biofilm-enamel interphase conditions become undersaturated and the acid demineralizes the tooth mineral, partially demineralizing the tooth's surface layer. The inter-crystalline gaps between the enamel rods universally increase as a result of continuous plaque contact. Some enamel holes enlarge to around 1 μm in diameter, allowing nutrients to permeate the demineralized area (subsurface lesion). Through the erosion of Ca^{++} and PO^{3-} at the enamel interface, a vigorous subsurface caries process deepens the lesion. The excessive accumulation of reaction products from the degradation of the surface and subsurface, mainly calcium and phosphate, enhances the saturation level and may protect the surface layer from further demineralization. Additionally, fluoride helps prevent the surface layer from demineralizing. The depth of the lesion is directly correlated with the backscattering of incident light by the subsurface demineralized zone. The backscatter effect is enough to make the decalcified lesion visible as a white spot when it is 400 μm deep **[29-30].**

Tooth ache:

Pain that is triggered on by a basic nervous system lesion or malfunction is somewhat popular **[2].** There are non-odontogenic causes for toothache symptoms. Surface nociceptive input converges with extra afferent input from deep tissues and cervical spinal afferents on the second order neurons in the trigeminal brain stem sensory nuclear complex. Central sensitization is the term used to describe the neuroplastic alterations and increased excitability of these neurons caused by the simultaneous release of neurochemicals **[31].**

Halitosis:

The exact cause of halitosis remains unidentified; nevertheless, the predominant idea posits that it arises from the microbiological deterioration of food scraps, desquamated blood, cells, and saliva. The bacterial interactions are not linked to any particular bacterial infection and are primarily caused by a number of anaerobic, proteolytic, Gram-negative bacterial species. Stomatococcus mucilaginous is the only Gram-positive bacterium that has been linked to halitosis so far. The compounds responsible for halitosis are Diamines (Cadaverine, Indole, Putrescine), volatile sulphur compounds (Dimethyl sulphide, Methyl mercaptan, Hydrogen sulphide), and Short chain fatty acids (Propionic acid, Butyric acid, Isovaleric acid) **[32]**.

Gingivitis:

Gingivitis is often seen as a localized inflammatory condition resulting from the formation of dental biofilm. It is frequently characterized by mild clinical changes, rarely results in spontaneous bleeding, and is typically painless **[33]**. Vascular alterations, which mostly consist of capillary dilatation and increased blood flow, are the initial signs of gingival inflammation. These early inflammatory alterations happen when leukocytes and endothelial cells are activated by microbes. About a week after the onset of plaque buildup, the early lesion changes from the original lesion. Plasma cells, B lymphocytes, and most likely a pocket epithelium are characteristics of the formed lesion. Clinical observations of the established lesion include color, size, and texture alterations. The fourth stage of periodontal breakdown was defined by the lesion into the alveolar bone **[34]**.

Teeth sensitivity:

Teeth hypersensitivity is defined as pain originating from exposing dentin in response to thermal, chemical, tactile, or osmotic stimuli, which cannot be ascribed to any other dental disorder or deficiency. Dentin is responsive to stimuli, because the odontoblastic process extends into the dentinal tubules and forms the dentin-pulp complex. Hypersensitivity results from the enamel and cementum not meeting, exposing the dentinal tubules. The development of tooth hypersensitivity occurs in two stages: lesion initiation and localization. During the early phase, abrasion, attrition, abfraction and erosion reveal the tubes of the dentin due to the loss of enamel and cementum. The loss of cementum on the buccal surface of canines and premolars, coupled with gingival recession, is principally responsible for the exposure of dentinal tubules. It is essential to recognize that not all observable dentinal tubules are sensitive. During the second stage, the tubular occlusions and smear layer are removed, thereby exposing the pulp and dentinal tubules to the external environment, which results in the sensitization of the exposed dentin. **[35].**

Periodontitis:

Dental plaque is primarily the cause of periodontitis. About 150 different kinds of bacteria can be detected in a single person, while 800 different species of microbes have been documented in dental calculus overall. These species include viruses, spirochetes, and Gram-negative anaerobic bacteria. When these microbes are out of balance, a "pathogenic unit" is created, which is what happens in chronic periodontal disease. Microbial biofilm development is dependent on dysbiotic ecological alterations in harmful byproducts and enzymes that cause periodontal tissue to deteriorate. bacteria biofilms are a type of matrix that is adhered

to the surface of teeth by colonies of various bacteria species. The immune system of host cells is accountable for the degradation of periodontal ligaments. Substantial difference in immune system of the host and dental plaque results from the disruption of the balance between host cells and microbial biofilm, leading to the degradation of periodontal tissue and increase in inflammatory cells. Lower levels of anti-inflammatory cells, including neutrophils, lymphocytes, granulocytes, etc., as a result of microbial biofilms' long-term persistence, which exacerbates osteoclast-induced alveolar bone resorption and causes ligament fiber breakdown, which in turn causes chronic periodontitis **[36]**.

Stomatitis:

Ulcer formation can be brought on by the intricate interactions of several etiological variables. Predisposing variables and precipitating/triggering factors are two categories of etiological factors. Predisposing factors include things like personality type A, immunological dysregulation, dietary deficiencies, and HLA connections. Ulcer formation may be initiated or triggered by microtrauma, infections, or stress. Ulcers tend to form in those who are vulnerable after being exposed to the triggering elements for a specific amount of time. Ulcer begins to expand until the triggering elements are eliminated, depending on their severity and length. The depth of the ulcer and the intensity of the triggering stimuli are strongly correlated with the patients' level of pain **[37]**.

Ludwig's angina:

Ludwig's angina most frequently originates in the second mandibular molar, however it can also occur in the third mandibular molar. Due to connecting gaps, an infection can travel freely between tissue planes once it is present. Ludwig's angina is bilateral in character as a result of this unrestricted connection between spaces. Additionally, infection can migrate to the retropharyngeal and pharyngomaxillary areas **[38]**. A potentially fatal airway compromise can arise from Ludwig's angina, a rapidly developing polymicrobial cellulitis of the sublingual and submandibular regions. Ludwig's angina has a polymicrobial bacteriology that mostly affects mouth flora. Staphylococcus aureus and Streptococcus viridans are the pathogens that are most frequently isolated from people with the illness. Additionally, anaerobes such as bacteroides, peptostreptococci, and peptococci are commonly implicated **[39]**.

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