

DENTAL CARIES-THE MOST PREVAILING DISEASE-AN OVERVIEW

ABSTRACT:

Dental caries, a chronic disease is unique among human and is one of the most common important global oral health problems in the world today. It is the destruction of dental hard acellular tissue by acidic derivative from the bacterial fermentation of dietary carbohydrates especially sucrose, It progresses slowly in most of the people which results from an ecological disparity in the equilibrium between tooth minerals and oral biofilms which is characterised by microbial activity, resulting in inconstancy in plaque pH” due to bacterial acid production, buffering action from saliva and the surrounding tooth structure) The microbial community of caries is diverse and contains many facultative and obligatory anaerobic bacteria. S. Mutant is the most primary associated with it. Dental caries can affect the human in diverse ways i.e. presence of tooth pain, infection or dysfunction of the stomato- gnathic system can limit the necessary ingestion of energetic foods, affecting the growth in children and adults as well as their learning, communication skills and recreational activities. Moreover, oral and pharyngeal cancers and oral tissue lesions are also significant health concern. Cavernous sinus thrombosis and Ludwig angina can be life-threatening. Due to this, treatment is needed for dental diseases which is expensive and is not feasible for all community due to restricted resources such as time, person and money. Therefore, prevention is more affordable. Personal hygiene cares and dietary modification should be recommended.

KEY WORDS: Dental Caries, Carvernous Sinus Thrombosis, Plaque, Oral Biofilm, Tooth Decay

INTRODUCTION:

There are 16+16=32 teeth in the mouth and are embedded in the alveoli or sockets of the alveolar ridges of the maxilla and mandible. The order of teeth from front to back is Incisors, Canines, Pre-Molars and Molars

The **Incisors** are the median four teeth on the upper and lower jaws. They are used for cutting, tearing and holding food. The biting section of an incisor is wide and thin, making a chisel-shaped cutting edge.

The **Canines** (or cuspids, meaning a tooth with a single point) are on either side of the incisors. They are for holding and tearing food.

Premolars (bicuspid) and molars have a series of elevation (points or 'cusps') that are used for breaking up particles of food. Each premolar generally has two cusps, hence the name bicuspid. They are used for holding and crushing food.

Molars

Molars are the flat teeth at the rear of the mouth. Each molar typically has four or five cusps. They are exclusively used for crushing and grinding.

Wisdom Teeth are also referred as third molars. They erupt from the age of 18 onwards but are often surgically removed. A Tooth can be divided into three principal portions:

Crown: The crown is the part above the level of the gums, and is covered with enamel, the hardest substance in the body that protect the tooth from acids.

Neck: The neck or cervix is the constricted junction between the crown and root.

Root: The root can consist of one, two or three ledge embedded in a socket. Larger teeth like molars will have more than one root.

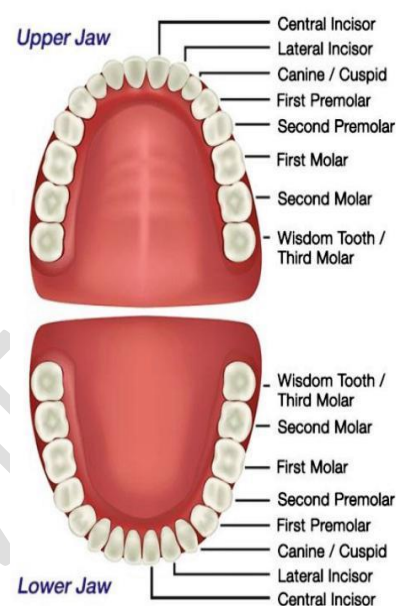


Fig-1 Anatomy Of Tooth

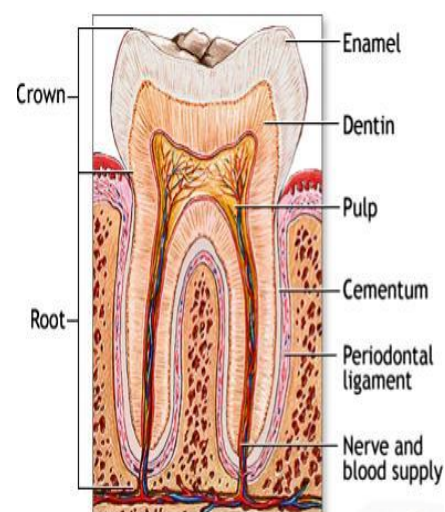


Fig-2 Structure of Tooth

Dentine:

It forms a major part of the tooth and has bone-like structure. Dentine differ from enamel is that it's a living tissue as such can respond to caries attack. Tertiary caries of dentine develops from enamel caries when the lesion reaches the amelodentinal junction lateral extension results in the involvement of great numbers of tubules. The early lesion is cone shaped with base at adjacent

Enamel:

It is the furthestmost covering that covers the crown of the tooth and harder than the bone. The early established lesion (white spot) in smooth surface enamel caries is cone shaped with the pinnacle pointing towards the amelodentinal junction. It consist of series of zone depending upon the degree of demineralization.

Cementum: It is rigid bone. The alveolar processes are covered by the gums or gingivae that extend slightly into each socket. In the axis of the tooth is the pulp cavity containing blood vessels. Lymph vessels and Nerves which surrounded by dentine.

DENTAL CARIES

It's one of the prevailing diseases which is recognized as the primary cause of oral pain and tooth loss. It is a major communal oral health disease which hinders the achievement and maintenance of oral health in all age groups.

Caries may be specify by the experience of pain, problem with eating, chewing, smiling and communication due to missing, discoloured or damaged teeth [4]. The microbial community of caries is diverse and contains many facultative and obligately-anaerobic bacteria belonging to the genera Actinomyces, Bifidobacterium, Eubacterium, Lactobacillus, Parvimonas & Rothia.

It can also be caused by variant bacteria, including members of the mitis, anginosus and salivarius groups of streptococci, Propionibacterium, Enterococcus faecalis, Scardovi, Pseudomonas, Fusobacterium, Pseudoranibacter, Veillinella, Atopobium, Granulicatella, Prevotella, Dialister, Leptotrichia and, Thiomonas. Bacteroides, Prevotella, and Porphyromonas species are prevalent on mucosal surfaces and reach very high concentrations in dental plaque, gingival crevices and tonsillar crypts. [1]

PERIODONTAL DISEASE

Periodontitis is a infect of Periodontium. Whereas, the word ‘**Perion**’ means Around the tissues of enamel, ‘**odont**’ means teeth and ‘**itis**’ means infection, so the complete time period “Periodontitis” shows continual irritation of gingival. Periodontal ligaments, alveolar bone and dental cementum. According to World Health Organization (WHO) it’s miles extensively



Fig-3 Peridontitis Tooth degree harm of periodontal shape happens through noxious with the aid of using merchandise and enzyme from periodontal microorganism along with leukotoxins, collagenase, fibrinolysis and different Bacteroides species,

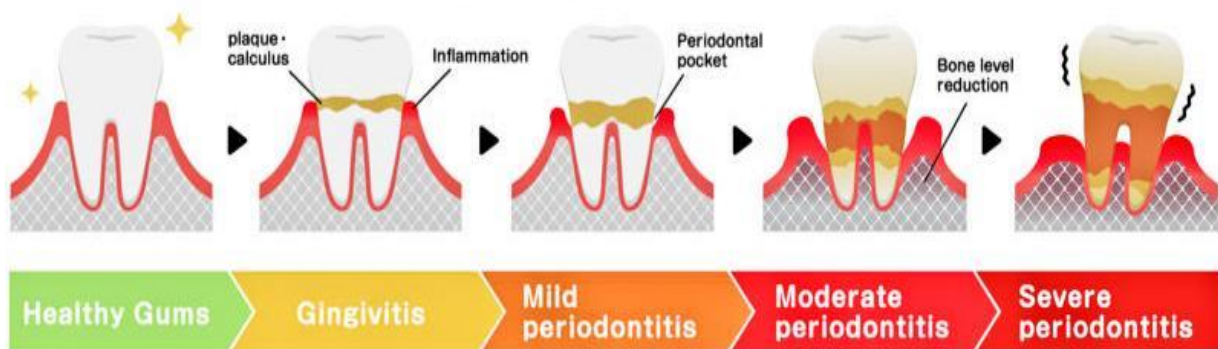


Fig-4 Stages Of Peridontal Disease.

Intermedius and B.Gingivitis, fusiform organisms: Lactobacillus actinomycetemcomitans, Wollina recta and Eikenella spp.; Porphyromonas gingivalis, Taneerella for synthesis and diverse bacilli and cocci; spirochetes; and amoebas and trichomonads. [2]

By preserving top oral hygiene, it could be reversed at preliminary level however if plaque isn’t always eliminated at this level, then formation of tartar or calculus arise which isn’t always detachable through the usage of teeth brush or floss. Because of this tartar, microorganism begin attacking deeper tissues because of which periodontal ligaments round tooth receives degraded and results in resorption of alveolar bone. An area among gingiva and enamel takes place that is referred as “**Periodontal Pocket**” and this circumstance is in particular known as “periodontitis or periodontal sickness”. The severity of this sickness relies upon microbial plaque formation. [3]

TYPES OF PERIODONTITIS

Gingivitis

Gingivitis is irritation and inflammation of gums and can be reversed through preserving oral health hygiene. Gingivitis is the earliest stage of gum disease (periodontal disease). It develops when plaque, tartar and bacteria build up on your teeth, causing redness, swollen, bleeding gums, pain etc.



Fig-5 Gingivitis

Chronic Periodontitis

In chronic periodontal disorder, signs might also additionally of continual irritation of gums, extreme awful breath, and bleeding in the course of brushing or flossing happens. Loss of epithelial tissue, bone and ligaments which isn't always reversible.

Aggressive Periodontitis

Aggressive periodontitis may be distinguished from chronic periodontitis by the age of onset, the rapid rate of disease progression, the nature and composition of the subgingival microflora, alterations in the host's immune response and a familial aggregation of diseased individuals

Necrotizing Ulcerative Gingivitis

It is particularly taking place in folks who are stricken by malnutrition, immune suppressive and HIV. Necrosis causing loss of life of residing tissue. It specifically happens because of deficiency of nourishment wanted through humans to stay healthy.

Peri-implant Mucositis

Inflammatory lesion of the peri-implant mucosa in the absence of continuing marginal bone loss. It is associated to irritation of gentle tissue surrounding dental implants without a signal of bone loss. Symptoms covered purple or soft gums round implants, bleeding at the same time as brushing.

Systemic persistent periodontitis

This form of continual periodontal alimentary takes place in affected person whose systemic syndrome. Inflammation of gums causing systemic ailment together with Diabetes, Heart, ailment, breathing ailment etc. [4]

Global Scenario of Dental Caries.

Dental Caries are the prevalent global oral health problems, although conditions such as oral and pharyngeal cancers and oral tissue lesions are also significant health concern. Worldwide, approximately 2.43 billion people (36% of the population) have dental caries in their permanent teeth. In baby tooth it affects about 620 million people or 9% of the population. The disease is most prevalent in Latin American countries, countries in the Middle East, and South Asia, and least prevalent in China. In the United States, dental caries is the current chronic childhood disease, being at least five times more common than asthma. It is the primary pathological cause of tooth loss in children. Between 29% and 59% of adults over the age of fifty experience caries.

TABLE:1 Prevalence Of Dental Caries In Global Scenario. [5]

S.NO	AGE GROUP	PREVALENCE (%)	SAMPLE SIZE	COUNTRY	YEAR
1	5-9	50	1,598	USA	2004
2	17	78	3249	USA	2004
3	6	97.1	4050	Philippines	2006
4	6-12	92.3	1200	Philippines	2005
5	2-6	59-92	993	Philippines	2003
6	3-5	55	2014	China	2007
7	5-74	100	350000	China	2008
8	5	76	140712	China	2002
9	5-6	84	1587	China	2001
10	6	89.4	178	Taiwan	2006
11	1-6	52.9	981	Taiwan	2006
12	0-5	40	1487	Brazil	2007
13	1-2.5	20	186	Brazil	2007
14	12	53.6	1151	Brazil	2004
15	7-9	78.5	121	Argentina	2006

TABLE-2 Prevalence Of Dental Caries On National Scenario [6]

S.NO	AGE GROUP	PREVALENCE	SAMPLE SIZE	YEAR
1	5-6 12-13	23.23 50.00	638	2007-2008
2.	5-7 8-10 11-14	20.7 48.2 52.46	376 1174 1624	2012
3.	5-6	52	361	2013
4.	1-6	85.2	392	2013

TYPES OF DENTAL CARIES

Early Childhood Caries

Early childhood caries (ECC) is a pattern of decay found in young children with their deciduous teeth. The teeth likely affected are the maxillary antecedent teeth, but all teeth can be affected. This type of caries comes as a result of allowing children to fall asleep with sweetened liquids in their bottles or feeding children sweetened liquids multiple times during the day. The risk for ECC also may be determined by pre-existing developmental defects of the enamel called hypoplasia.



Fig-6 Early Childhood Caries

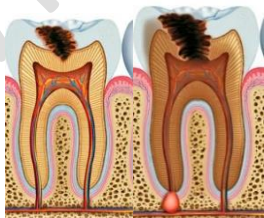
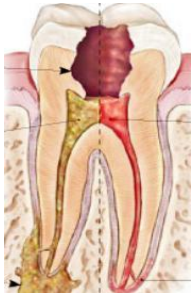
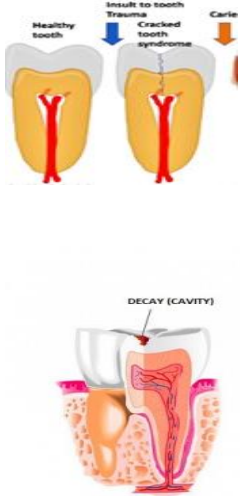
Rampant Caries

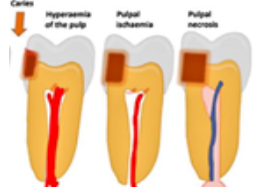
Rampant caries are harsh decay on multiple surfaces of many teeth. It may be seen in individuals with poor oral health hygiene, drug-induced dry mouth or large sugar intake. [7]

CLASSIFICATION OF DENTAL CARIES.

Caries can be classified by rate of progression, affected hard tissues and location. These forms of classification can be used to distinguish a particular case of tooth decay in order to more accurately represent the condition to others and also indicate the severity of tooth destruction.

TABLE-3 DENTAL CARIES CLASSIFICATION [8]

ON THE BASIS	CLASSIFICATION	DESCRIPTION	PICTURES
Rate of progression	Acute Chronic	Signifies the quickly developing condition Signifies the extended time to developing condition	
Affected Hard Tissue	Enamel Dentinal Cementum	Early in its development & may only affect enamel The extent of decay reaches the deeper layer of dentin The decay on root of teeth	
Location	Class I Class-II Class-III Class-IV	Pit & fissure caries (anterior /posterior teeth) Approximal surfaces of posterior teeth Approximal surfaces of anterior teeth without incisal edge involvement. A proximal surface of anterior teeth with incisal edge involvement.	Location 

	Class V	Gingival/cervical surface on the lingual of facial aspects [anterior/posterior].	
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AETIOLOGY

Historically, Researchers have focused on biological and dietary effects on children’s oral health to explain caries development. In recent years, children’s oral health outcomes using a broader framework, which incorporates psychosocial and environmental predictors as well as the biological and dietary effects. The acids that contribute to demineralization are bacterial waste that live within dental plaque. The bacteria that causes tooth decay are living organisms that are mainly present in dietary sugars. These include fructose, lactose, glucose, sucrose, and all cooked starches. These frameworks generally classify into five broad domains. The caries model by **Fisher-Owens** and co-workers includes different levels of the environment that can affect caries development: child-level; family-level and community level.

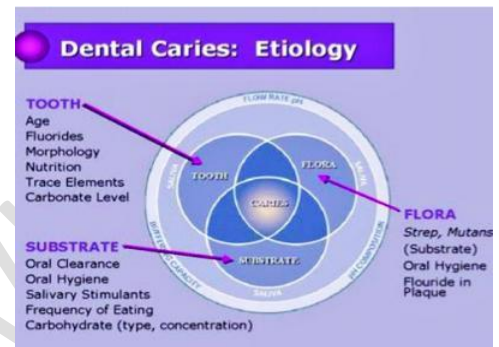


Fig-7 Aetiology of Tooth

Child-level

Visible plaque, early propagating by caries-related bacteria, the presence of mutans streptococci, frequent intake of sweetened drinks, infrequent tooth brushing, illness and use of antibiotics have all been associated with caries developments in pre-school children.

Family-level

Family level associated with caries risk in children included are demographic factors of the family, parental oral health hygiene and attitudes, dental anxiety and dental attendance, maternal health and lifestyle in pregnancy and early childhood.

Community-level

Children’s oral health is likely to be better in a community that values good oral health. Cultural aspects and the neighbourhood may lead implications for caries development. The dental care system and amount of dental care available may affect oral health and the development of caries in preschool children. [9]

PATHOGENESIS OF DENTAL CARIES.

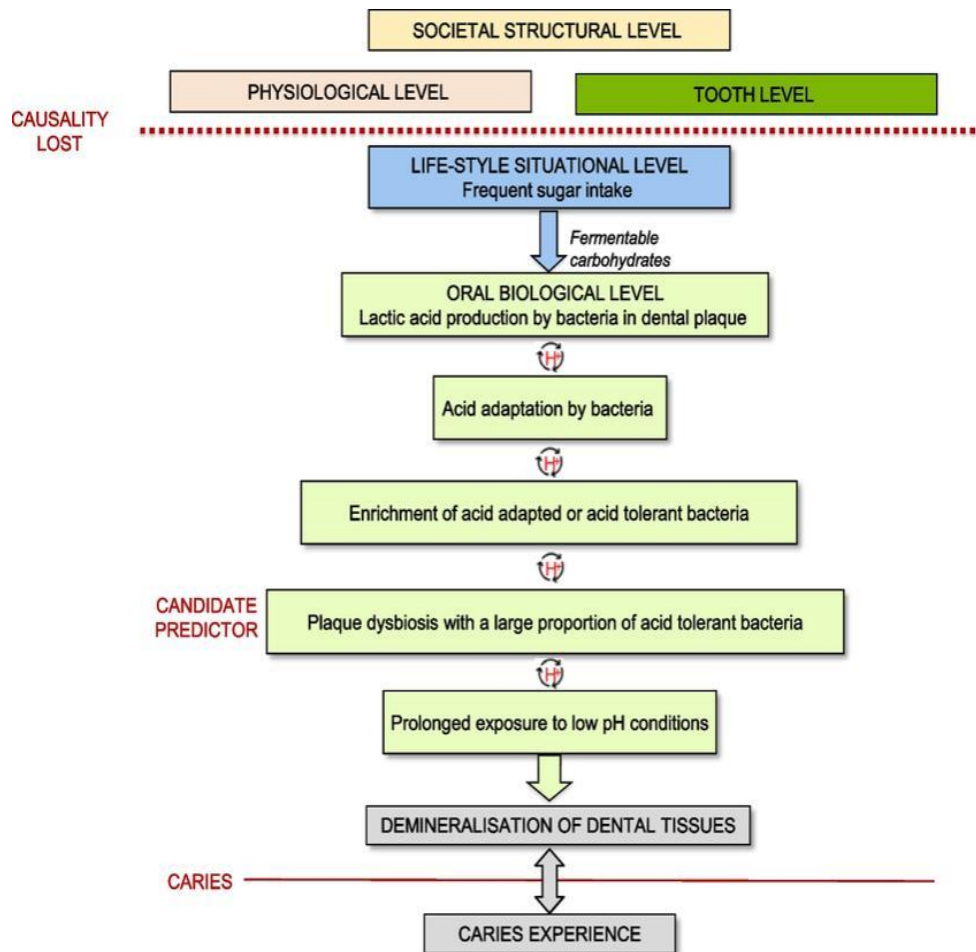


Fig-8: Pathogenesis: Carbohydrates and this acid dissolves the hydroxyapatite crystal structure of the tooth which causes caries.

The description of the cause of dental caries includes three factors: host, bacteria and diet. Dental caries occurs. When a susceptible tooth surface is propagated with cariogenic bacteria and dietary source of sucrose or refined sugar is present. Bacterial pathogen produced lactic acid from fermentation.[10]

SIGN & SYMPTOMS

Toothache can present with a range of signs and symptoms, varying in intensity and duration. The most common indication of toothache include:

Pain: The primary symptom of toothache is pain, which can be sharp, throbbing, or constant. The intensity of the pain varies from mild discomfort to severe agony, depending on the underlying cause.

Sensitivity: Tooth sensitivity is the prevalent symptom of toothache. The affected tooth may become sensitive to hot or cold temperatures, making it uncomfortable to consume certain foods and beverages.

Discomfort when chewing: Toothache can cause, discomfort or pain while chewing or biting down on food. This can lead to difficulty in eating and may affect one's dietary choices.

Swelling and redness: In some cases, the closest gum tissue may become swollen or tender. There might be redness or inflammation around the affected tooth, indicating an underlying dental issue.

Bad breath or foul taste: Persistent toothache can lead to bad breath and an unpleasant taste in the mouth due to bacterial build up and infection.

Fever and headache: If the toothache is a result of an abscess or severe infection, it can lead to systemic symptoms like fever and headache.

Radiating pain: The pain from a toothache can radiate to the jaw, ear or other parts of the head and neck. It is salient warn that toothache can be caused by various factors, including dental carriers, gum diseases, dental trauma, tooth sensitivity or dental abscesses, the specific symptoms experienced may vary based on the underlying cause.[11]

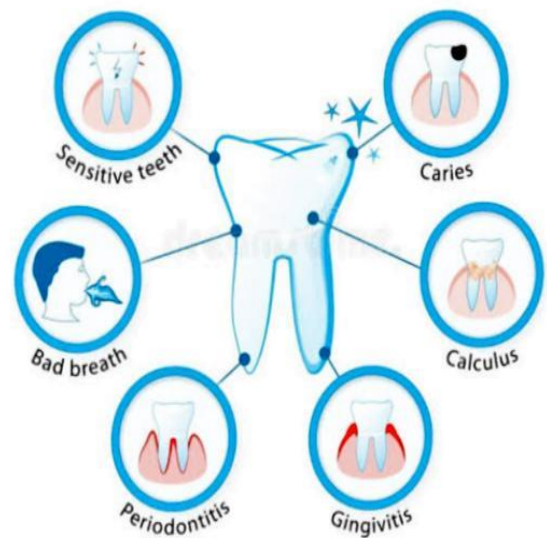


Fig-9 Symptoms of Tooth Decay

COMPLICATIONS

- Cavernous sinus thrombosis and Ludwig angina can be life-threatening.
- Toothache, pulpitis, tooth loss and dental discoloration
- Apical peridontitis
- Periapical abscess
- Periapical granuloma
- Periapical cyst
- Cellulitis
- Abscess
- Periostitis

- Osteomyelitis [12]

CAUSES

1.**Tooth Decay:** One of the most common causes of toothache is dental caries (cavities). Bacteria in the mouth produce acids that erode tooth enamel, leading to the formation of cavities. When these cavities expose the sensitive inner layers of the tooth, it can result in pain and sensitivity.

2.**Gum Disease:** Infections of the gums, such as Gingivitis and periodontitis, can result in toothache. As the gum tissues become inflamed and recede, the roots of the teeth may become exposed, leading to pain & discomfort.

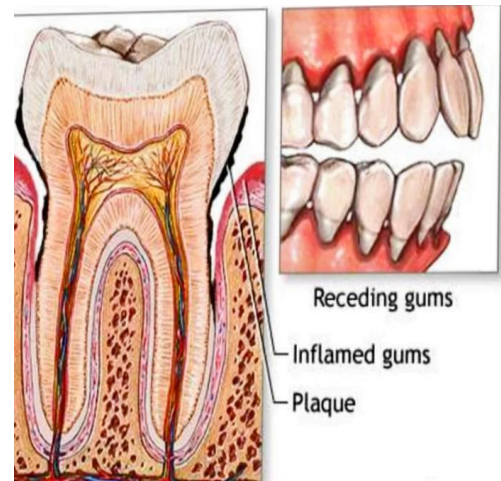


Fig-10 Inflamed Gums

3.**Dental Abscess:** An abscess is a pocket of pus. That forms at the root of a tooth or between the tooth and gum. It is often caused by major tooth decay, trauma, or a bacterial infection. Abscesses can be extremely painful and require immediate dental attention.

4.**Tooth Fracture or Cracks:** Physical trauma to a tooth, biting down on hard objects, or majorly tooth grinding (bruxism) can cause fractures or cracks in the tooth. These fractures may expose the sensitive inner layers of the tooth, leading to pain.

5.**Dental Sensitivity:** Tooth sensitivity can occur When the protective enamel on the tooth's surface wears away, exposing the underlying dentin. This can lead to discomfort and pain, especially when consuming hot, cold, sweet, or acidic foods and Beverages.[13]

6.**Impacted Wisdom Teeth:** When wisdom teeth (third molars) don't have enough space to emerge properly, they may become impacted, causing pressure and pain in the back of the mouth.

7.**Dental Procedures:** Toothache can frequently show side effect of certain dental procedures, such as fillings, root canals, or tooth extractions. The pain is usually temporary and should subside Over time.

8.**Sinus Infections:** Sometimes, sinus infections, can referred pain in the upper back teeth, giving the sensation of a toothache.[14]

TREATMENT AND MANAGEMENT

The **MANAGEMENT** of dental caries should be aimed at

- 1) detecting initial lesions
- 2) determining caries activity
- 3) performing a caries risk assessment
- 4) preventing new carious lesions
- 5) preserving dental tissue
- 6) maintaining teeth for as long as possible. [15]

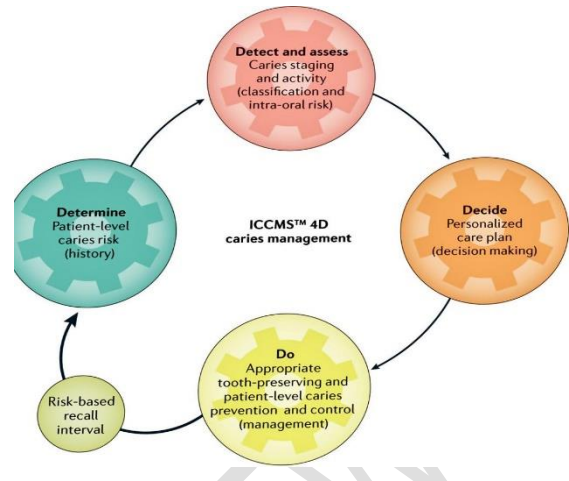





Fig-11 Management Of Tooth

NONOPIOID ANALGESIC

Options include acetaminophen and non-steroidal anti-inflammatory drugs (NSAIDs). These drugs are very effective trusted source for relieving mild or moderate dental pain and are some of the most Frequently recommended analgesics by dentists. Acetaminophen can temporarily relieve mild to moderate pain and fever.[16]

TABLE-4: Examples of NSAIDs a person can take for tooth pain include.

NSAIDS	DOSAGE FORM	RISKS	PICTURES
Ibuprofen	The recommended dose is 400mg every 4-6 hours. People should not exceed more than 3,200 mg daily.	Ibuprofen may impact the heart, gastrointestinal health, and kidneys. It may also cause skin reactions. These drugs are not advisable for pregnant people from 30 weeks	

Aspirin	The recommended dose is 1-2 tablets (325mg) every 4 hours, or 3 tablets every 6 hours. People should not exceed 12 tablets, or 3,900 mg, daily.	Some people may experience an allergic reaction to aspirin, and it can cause stomach bleeding in some individuals.	
Naproxen	Doctors recommend a starting dose of 500mg, then 250 mg every 6-8 hours as necessary. A person should not exceed a daily dose of 1,250 mg.	This drug may impact heart, gastrointestinal, kidney, and liver health and result in skin reactions. Doctors do not advise these for pregnant people from 30 weeks.	
Diclofenac	The recommended dose is 100mg per day. People should not exceed unless a doctor advises	Research suggests that taking diclofenac may increase the risk of heart problems. It may also impact gastrointestinal, kidney, and liver health.	

OPIOID ANALGESICS

Opioids are a class of painkillers that can slow-down pain by binding to opioid receptor. When this occurs, opioids block the body's pain messengers sent through the spinal cord. Dental pain is often the reason for a person's first encounter with opioids.[17]

TABLE-5 Example of Opioid Analgesic

OPIOID ANALGESIC	DOSAGE FORM	LIMIT
Codeine	It is available as a tablet, and can take 15-60 mg every 4 hours per day.	Not exceed 360 mg in 24 hours.[50]
Oxycodone	The recommended dosage is 5-15 mg every 4-6 hours as required for pain.	It is advisable to use oxycodone at the lowest effective dosage for the shortest duration.
Hydrocodone	This option is also available as a tablet that can contain acetaminophen. Depending on the strength of the tablet, a person can take 1-2 tablets every 4-6 hours as necessary.	They should not exceed a daily dosage of 2.5-5 mg tablets or six 7.5-10 mg tablets
Morphine	The recommended dosage to start treatment in adults is 10-20 mg every 4 hours.	Morphine as an oral solution. It is often available in three concentrations: 2, 4, and 20 mg per millilitres

ANTIBIOTICS

If the cause of the tooth pain is a bacterial infection, then a person will likely receive a route of antibiotics to clear the infection.

- Amoxicillin
- Clindamycin
- Azithromycin
- Doxycycline [18]

TOPICAL ANESTHETICS

Topical anaesthetics describe creams or gels that can help reduce pain by numbing a sore area. People can apply them directly to the sore tooth. Traditional topical anaesthetics often contain lidocaine or benzocaine as active ingredients.

Benzocaine can help to bring-down toothache by blocking nerve signals around the painful area. A patient can use benzocaine gels up to 4 times daily or as per the instructions of their dentist or doctor.

Lidocaine is a local anesthetic that is occasionally used in dentistry to relieve pain associated with toothaches or dental procedures. It works by blocking nerve signals in the body, which temporarily numbs the areas.

Local Anaesthetic Injections: In cases of severe toothache or for more invasive dental procedures like root canals, dentists may administer lidocaine as a local anesthetic through an injection. This numbs a larger area and provides more profound pain relief.[19]

DIAGNOSIS

Primary Diagnosis

Preliminary, it may appear as a small chalky area (smooth surface caries) which may eventually develop into a large cavitation. Inspection of all visible tooth surfaces using a good light source, dental mirror and explorer. Dental radiographs (X-rays) are used for less visible areas of teeth in particular caries between the teeth. Lasers without ionizing radiation also used for detection of interproximal decay (between the teeth). Visual and tactile inspection along with radiographs are employed frequently among dentists, in particular to diagnose pit and fissure caries. (20)

TREATMENT

Cavitated lesion, especially if dentin is involved, remineralization is much more difficult and a dental restoration is usually indicated. Such management of a carious lesion is termed “operative treatment”.

Non-cavitated lesions can be arrested and remineralisation can occur with extensive changes to the diet i.e., reduction in frequency of refined sugars. It can be treated with non-operative method by tooth remineralisation. [21]

Tooth Remineralisation

Tooth remineralisation is a procedure in which minerals are returned to the molecular structure of the tooth itself. Destroyed tooth structure does not fully regenerate, although remineralization of very small carious lesions may occur if dental hygiene is kept at optimal level such as tooth brushing twice per day with fluoride toothpaste and flossing, and regular application of topical fluoride. Such management of a carious lesion is termed “non-operative treatment”.

Dental Restoration

A dental filling can be operative in which dental restorative material (including dental amalgam, composite resin, porcelain, and gold) is used to restore the function, integrity and morphology of missing tooth structure. Composite resin and porcelain made to match the colour of a patient’s natural teeth and are prevalently used, Local anaesthetics, nitrous oxide (“laughing gas”) is used.

Tooth Extraction: The removal of a decade tooth is performed, if the tooth has gone to extreme destroyed from the decay process to effectively restore the tooth.

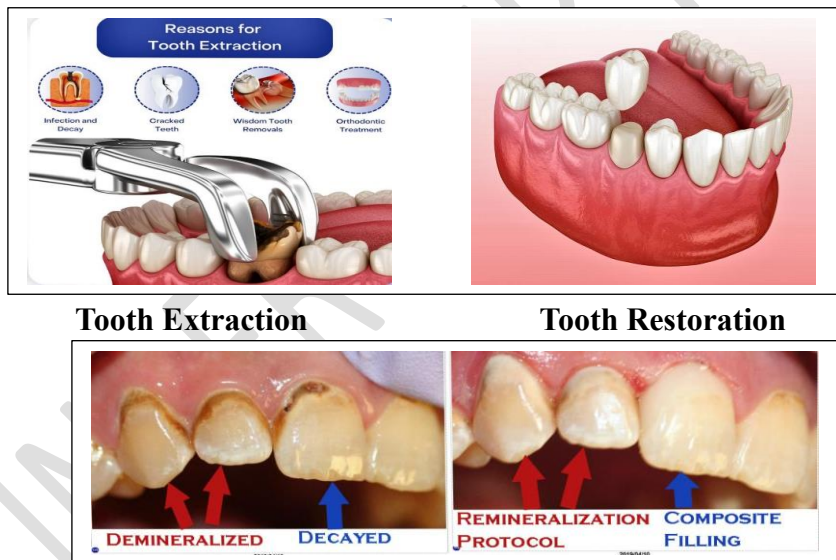


Fig-12 Treatment of Dental Caries

PREVENTION & CONTROL

Oral Hygiene

Personal hygiene care consists of proper brushing and flossing daily. [22] Proper brushing and flossing is to remove and prevent the formation of plaque or dental biofilm. Professional hygiene care consists of regular dental examinations and professional prophylaxis (cleaning).

Dietary Modification

Confined and finite snacking is recommended, however snacking creates a continuous supply of nutrition for acid-producing bacteria in the mouth. Chewy and sticky foods (such as dried fruit or candy) tend to cohere to teeth longer, brushing the teeth after meals is recommended.. Chewing gum containing xylitol (a sugar alcohol) helps in reducing dental biofilm. [23]

Calcium And Flouride

Calcium is found in food such as milk and green vegetables, is often recommended to protect against dental caries.[24] Fluoride helps neutralised decay of a tooth by binding to the hydroxyapatite crystals in enamel. The incorporated calcium makes enamel more resistant to demineralization and, thus, resistant to decay. Topical fluoride include a fluoride toothpaste or mouthwash or varnish is now more highly recommended than systemic. [25]

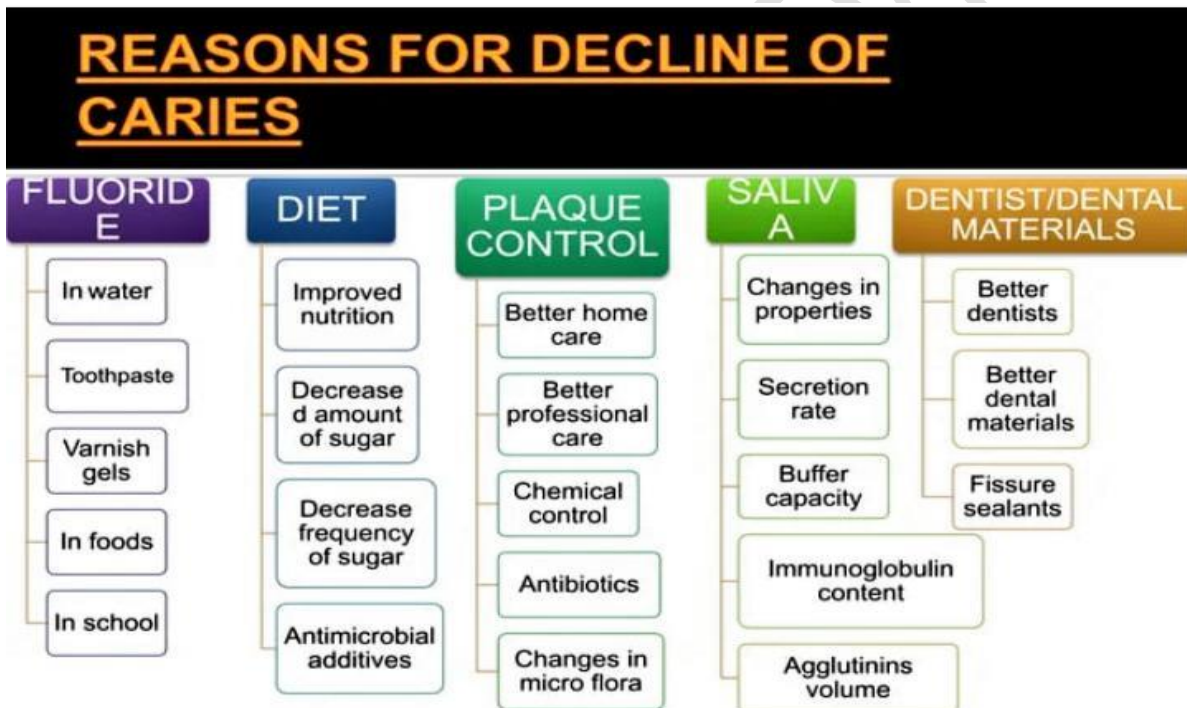


Fig-13 Reason for Decline of Caries

CONCLUSION

The present overview files numerous threat elements of dental caries which had several interventions to prevent caries since extensive damage from caries can lead to major problems for the individuals, affecting quality of life both functionally and aesthetically. Increasing the awareness and knowledge about dental caries in general, can increase knowledge and skills in oral healthcare. Healthcare providers can take an active role in health screening to discover any need for clinical preventive services and c an detect oral health problems.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

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