

Deciduous teeth

Primary Dentition

These are the first teeth to erupt into the oral cavity. The primary dentition is comprised of 20 teeth. These teeth will be exfoliated (lost) as the permanent teeth erupt.

- Primary teeth are also called as temporary , milk , deciduous or baby teeth.
- Significant differences in different aspects distinguish them from their permanent counterparts.
- Primary teeth are essentially placeholders for permanent teeth, but they differ in composition, structure, and number.
- Children begin losing their primary teeth around age 6 and should have 28 permanent teeth by age 13.
- Molars, commonly known as “six-year molars,” are the first teeth to erupt in children, around age 6.
- Good oral care is important for primary and permanent teeth .
- The first primary teeth to erupt are usually the lower central incisors .Although there is natural variation, the average age for eruption is seven months. Occasionally, one or more teeth may be present at birth, or erupt in the first month of life. These teeth, which tend to be in the lower incisor region, may be part of the primary dentition or anomalous tooth-like structures. Natal teeth, which do not form part of the primary dentition, may need to be extracted if there is a danger of detachment and inhalation, difficulties in feeding or ulceration of the undersurface of the tongue (see ‘Photo guide: tooth eruption in children’).
- The deciduous teeth important for phonetics , esthetics , allow proper mastication , prevent malocclusion and guide the eruption of permanent teeth.

Estimation of dental age :

1. To evaluate general health distribution .
2. To know the age of foreign children .
3. In forensic dentistry , to know the victim .

Eruption Sequences

Eruption sequence for primary teeth follows a pattern – incisors-first molars-canines-second molars. ' This pattern is generally followed by both arches, with the mandibular arch preceding the maxillary arch. ' The loss of deciduous teeth tends to mirror the eruption sequence. ' Caries susceptibility is reverse of this order.

For primary teeth

ABDCE

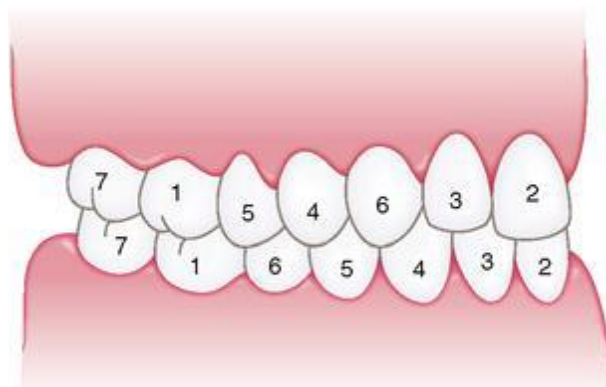
ABDCE



For permanent teeth:

61245378

61234578



Primary dentition :

Age	Crown development starts	Crown fully formed	Eruption
3-6 m. in utero	A , B , C , D , E		
3-6 m. after birth		A , B , D	
6-9m.		C	A , B
1 year		E	D
1½ year			C
2-2.5 year			E

Permanent dentition :

Age	Crown developments starts	Crown fully formed	Eruption
Birth – 6 month	6 , 1 , 2 , 3		
3 years	4 , 5 , 7	6 , 1 , 2	
6 years		4 , 5 , 7 , 3	6 , 1 , 2
9 years			3 7
12 years			4 , 5 , 7 , 1 3

The roots of deciduous teeth are fully formed after eruption , then resorption of these roots starts until exfoliation of the deciduous teeth occurred , followed by eruption of the permanent teeth .

In the eruption of deciduous teeth , there were no differences in the time of eruption in gender , while the lower teeth erupt earlier than upper teeth .while in the permanent teeth , girls earlier than boys , and lower teeth earlier than upper teeth .

Anatomical And Morphological Difference between Primary And Permanent teeth :

- General Differences
 1. No. of teeth present:- primary (20) , permanent (28-32) .
 2. Bicuspid and third molars are absent in the primary set of tooth.
 3. Primary teeth are smaller in size when compare to permanent teeth.
 4. 1st tooth to erupt into the oral cavity is mandibular incisor whereas in permanent teeth it is the mandibular first molar.
 5. Primate space is absent in permanent teeth.

- Primate space is a **naturally occurring spacing between deciduous teeth**. In the mandibular arch, the primate space is observed between primary canine and first molar. The primate space in the maxillary arch is located between primary lateral incisor and canine.

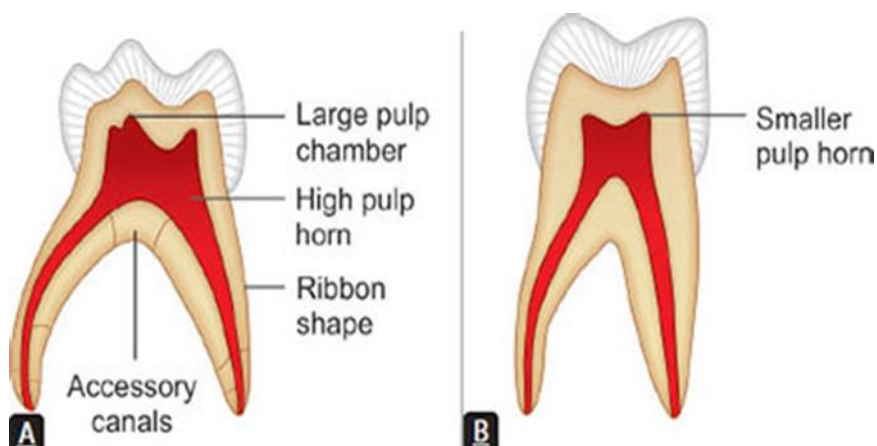
- **Differences in the crown , pulp and root :**

- **Crown**

- Primary Teeth Crown: shorter , narrow occlusal table , constricted in cervical portion. thinner enamel and dentin layers . color is usually lighter. prominent mesio-buccal cervical bulge seen in primary molars. incisors have no developmental grooves or mammelons.
- Permanent teeth crown: bigger , broad occlusal table, cervical constriction is not well marked. thick enamel and dentin layer, color is much darker. permanent teeth have less prominent cervical bulge seen in permanent molars. incisors have developmental grooves or mamelons on newly erupted teeth

- **Pulp :**

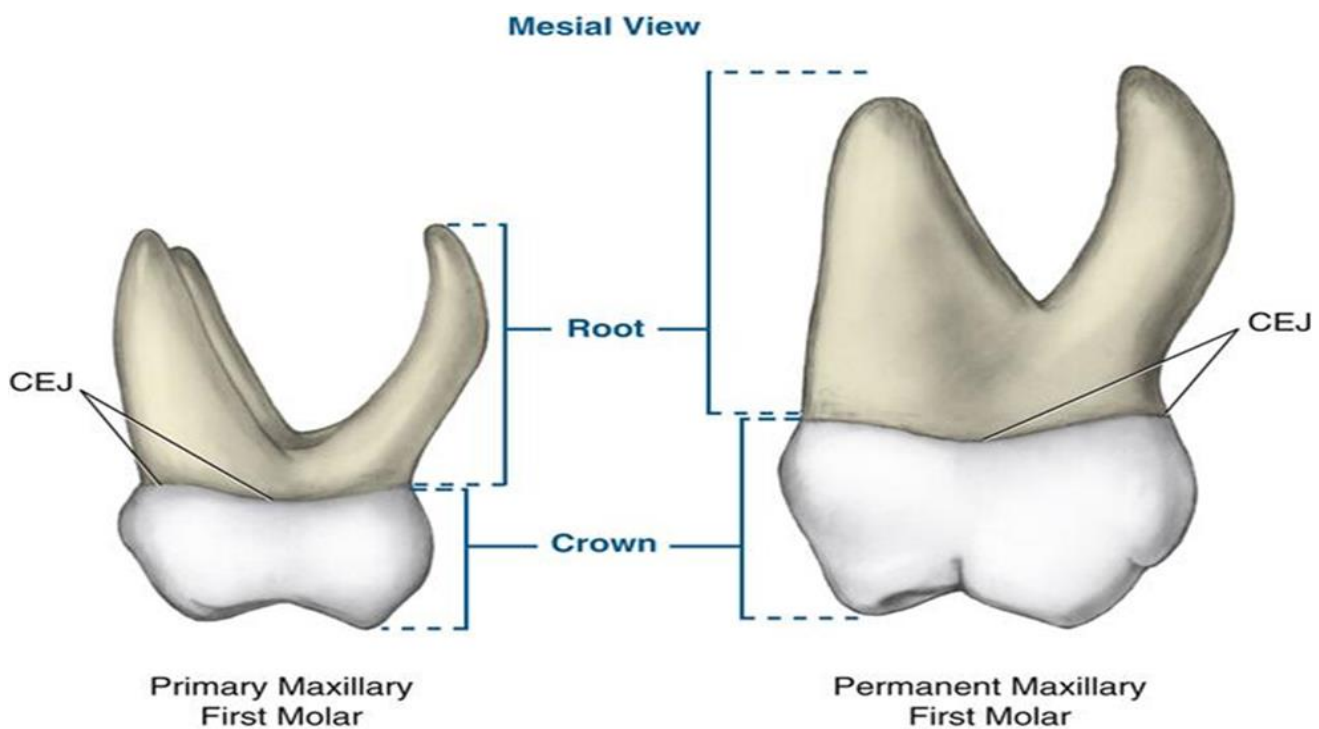
1. **Primary teeth :** pulp chamber is larger in relation to crown size. pulp horns are closer to the outer surface. mesial pulp horn extends to a closer approximation of surface than the distal pulp horn. high degree of cellularity and vascularity in tissue. comparatively less tooth structure. root canals are more ribbon like. the radicular pulp follows a thin , tortuous and branching path.
2. **Permanent teeth :** pulp chamber is smaller in relation to crown size. the pulp horns are comparatively away from the outer surface. ' comparatively less degree of cellularity and vascularity in tissue. .more tooth structure protecting the pulp. ' comparatively lesser thickness of dentin over the pulpal wall at the occlusal fossa of molars. root canals are well defined with less branching.



- **Root :**

Primary teeth : Roots are larger and more slender in comparison to crown size. Furcation is more towards cervical area so that root trunk is smaller . Roots are narrower mesio-distally. Undergo physiologic resorption during shedding of primary teeth.

Permanent teeth : Roots are shorter and bulbous in comparison to crown. Placement of furcation is apical , thus the root trunk is larger. Roots are broader mesio- distally. Physiologic resorption is absent.

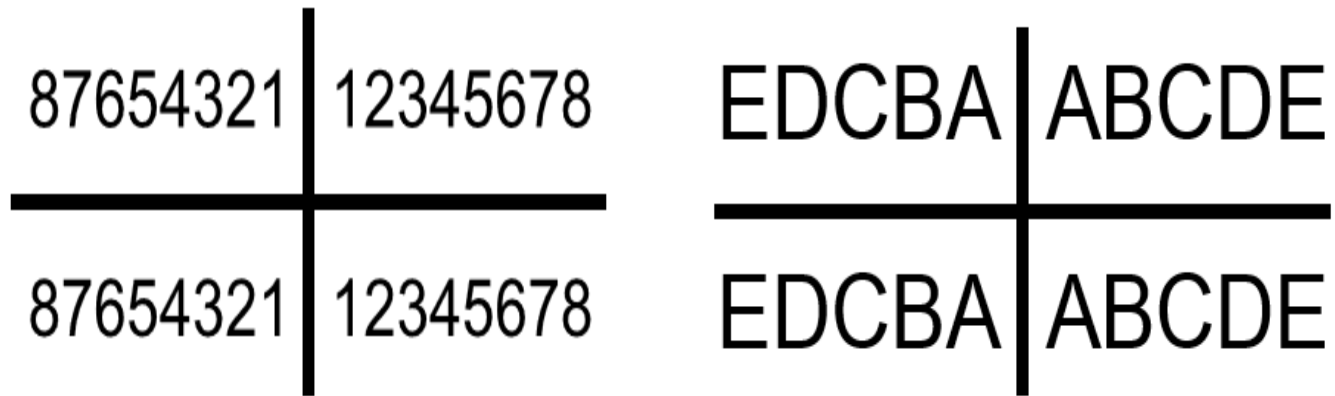


Tooth numbering system

1. Zsigmondy- palmer system

The Hungarian dentist Adolf Zsigmondy discovered this system in 1861, using a Zsigmondy cross to record quadrants of tooth positions. Adult teeth were numbered 1 to 8, and the child primary dentition (also called deciduous, milk or baby teeth) were depicted with a quadrant grid using Roman numerals I, II, III, IV, V to number the teeth from the midline. Palmer changed this to A, B, C, D, E. This makes it less confusing and less prone to errors in interpretation.

The Palmer notation consists of a symbol (\lrcorner \llcorner \ulcorner \lrcorner) designating in which quadrant the tooth is found and a number indicating the position from the midline. Adult teeth are numbered 1 to 8, with deciduous (baby) teeth indicated by a letter A to E. Hence the left and right maxillary central incisor would have the same number, "1", but the right one would have the symbol, " \lrcorner ", underneath it, while the left one would have, " \llcorner ".



Advantages:

- 1) **Easy to implement.**
- 2) **Easy of writing and communication.**
- 3) **Less mistakes in identifying the designated tooth.**

Disadvantages:

- 1) **Cannot be written by the computer.**
- 2) **Non-numeric symbolization.**

2. Universal numbering system

This tooth numbering system was proposed by German dentist Julius Parredidt in 1882. Although it is named the "universal numbering system", it is also called the "American system" as it is commonly used in the United States. The uppercase letters A through T are used for primary teeth and the numbers 1 - 32 are used for permanent teeth. The tooth designated "1" is the maxillary right third molar ("wisdom tooth") and the count continues along the upper teeth to the left side. Then the count begins at the mandibular left third molar, designated number 17,

and continues along the bottom teeth to the right side. Each tooth has a unique number or letter, allowing for easier use on keyboards. As specific numbers are employed for each tooth, it reduces the risk of mistake. Data can also be easily entered in the computer.

Permanent Teeth															
Upper Right								Upper Left							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
Lower Right								Lower Left							

Primary teeth									
Upper Right					Upper Left				
A	B	C	D	E	F	G	H	I	J
T	S	R	Q	P	O	N	M	L	K
Lower Right					Lower Left				

Advantages –

1. Individual number for each tooth.
2. Simple

Disadvantages:

1. Difficult in remembering the tooth no.
2. Matching the specific teeth and quadrants can be confusing.
3. There is no anatomic reference in this system and so it is difficult to follow for the beginners, and needs extra training to practice.

3. International numbering system

The Federation Dentaire Internationale (FDI) system is a two-digit system, the first digit indicates the quadrant (1 through 4 for permanent and 5 through 8 for deciduous teeth) and the second digit indicates the tooth type (1 through 8 or 1 through 5). It is very simple, accurate, it is easy to memorize in the visual and cognitive sense, it is user friendly, and prevents errors in differentiating left and right, upper and lower arches, and tooth type. However, in the case of deciduous teeth, there can be confusion and it is difficult to memorize. For specialists other

than paedodontists, it can be difficult to understand or to define teeth, as in the case for example of 64, 85.

PRIMARY TEETH :

Upper Right					Upper Left					
55	54	53	52	51		61	62	63	64	65
85	84	83	82	81		71	72	73	74	75
Lower Right					Lower Left					

PERMANENT TEETH :

Upper Right								Upper Left								
18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38
Lower Right								Lower Left								

Advantages:

Easy to remember and understand

Unique number for each tooth

Verbal communication is possible

Compatible with computer keyboard

Hence most accepted.

Occupational Hazards in Dentistry

In carrying out their professional work, dentists are exposed to a number of occupational hazards. These cause the appearance of various ailments, specific to the profession, which develop and intensify with years. In many cases they result in diseases and disease complexes, some of which are regarded as occupational illnesses.

DEFINITION :

Occupational hazard can be defined as a risk to a person usually arising out of employment. It can also refer to a work, material, substance, process, or situation that predisposes, or itself causes accidents or disease, at a work place.

Who is at risk ???

All dental healthcare professionals are potentially affected , including :

- The dentist .
- Auxiliary dental workers (nurses , therapist , hygienist) .
- Other at place of the work (service) .

Major occupational hazards are:

1. Biological health hazards
2. Physical hazards
3. Chemical hazards
4. Musculoskeletal disorders and diseases of the peripheral nervous system
5. Hearing loss
6. Radiation exposure
7. Stress
8. Legal hazards
9. Other risks

Biological Health Hazards : These hazards are constituted by infectious agents of human origin and include viruses, bacteria and fungi. All members of the dental team are at risk of exposure to hepatitis B virus

(HBV), HIV infection, and other types of communicable infections. Several of the common viral agents that can cause hepatitis have been detected in body fluids including saliva and blood. The viruses most commonly implicated include hepatitis A virus (HAV), HBV, and hepatitis C. A dentist can become infected either directly or indirectly.

In the first case, microorganisms can pass into organism, through a cut on the skin of his/her hand while performing a medical examination, as a result of an accidental bite by the patient during a dental procedure, or through a needle wound during an anesthetic procedure. Indirect infection sources include: Aerosols of saliva, gingival fluid, natural organic dust particles (dental caries tissue) mixed with air and water, and breaking free from dental instruments and devices. The following are the main entry points of infection for a dentist: epidermis of hands, oral epithelium, nasal epithelium, epithelium of upper airways, epithelium of bronchial tubes, epithelium of alveoli, and conjunctival epithelium.

Physical Hazards : The dentist and the clinical staff are at risk of physical injuries during many dental procedures. Sources of physical injury can include debris from the oral cavity striking the eyes, cuts from sharp instruments, or puncture wounds from needles or other sharp instruments. Such injuries can result in the transmission of serious infectious disease to the dental worker. Percutaneous exposure incident (PEI) is a broad descriptive term that includes needlestick and sharp injuries, as well as cutaneous and mucous exposures to blood and serum. The most common of them is from needles and drilling instruments such as burs. From the occupational viewpoint, PEI represents the most efficient method for transmitting blood borne infections between patients and health care workers. Eye injuries may occur from projectiles such as bits of calculus during scaling procedures and splatters from body fluids (bacterial and viral aerosols) while using high-speed hand pieces. Another potential source of eye injury is the intense dental curing light. Users of dental curing lights should be advised to employ protective eyewear during use. The use of protective eyewear is an important means of preventing occupational injury related to the use of dental curing lights and high-speed rotary instruments. Injury from splatters and projectiles including calculus and flying debris during cavity preparation is a common cause of damage to the eyes, and the use of protective eyewear should be emphasized.

Chemical Hazards : The chemical environment is one of the most rapidly expanding components of the work environment because new chemicals and solutions are being introduced regularly. Many of these chemicals are among those whose health effects may not be known and may pose health problems taking years to manifest. Many biomaterials and auxiliary products used in dentistry are chemically reactive. Hazardous chemical agents used in clinical dentistry include mercury, powdered natural rubber latex (NRL), disinfectants, and nitrous oxide (N₂O). By far the most important and most dangerous of these agents is mercury.

Musculoskeletal Disorders and Diseases of the Peripheral Nervous System : At work, the dentist assumes a strained posture (both while standing and sitting close to a patient who remains in a sitting or lying position), which causes an overstress of the spine and limbs. The overstress negatively affects the musculoskeletal system and the peripheral nervous system; above all, it affects the peripheral nerves of the upper limbs and neck nerve roots. The posture of the dentist at work, with the neck bent and twisted, an arm abducted, repetitive and precise movements of the hand, are a frequent cause of the neck syndrome and of pain within the shoulder and upper extremities. Operations carried out during extractions stress not only the elbow joint and the wrist joint but may result in chronic tendon sheath inflammation. The long-term effect of all those adverse circumstances occurring in the work of the dental doctor may lead to diseases described as cumulative trauma disorders. The most common injuries reportedly experienced by the dental hygienist are musculoskeletal in nature. The need to work in a fixed working position using a continuous repetitive motion can predispose the clinical dental worker to wrist-ache, lower backache, and neckache.

Hearing Loss : The noise of suction, saliva ejectors, turbines, engines, amalgamators, compressors, etc. may cause impaired hearing. The noise levels of modern dental equipments have now generally fallen below the risk of hearing loss. Still some dentist may be at risk specially where faulty or older equipment is used.

Radiation exposure : Exposure to both ionizing and nonionizing radiation may occur in dental practice. During an average radiological examination, the radiation dose received by an individual is generally low and relatively few cells are damaged. Though cellular repair is expected, it is not necessarily perfect. Thus, the effect of even low levels of exposure to ionizing radiation over periods of time may accumulate and could represent a potential hazard to health.

Stress : Stress is the most common psychological condition that occurs in the dental profession. Stress situations form an inherent part of a dentist's everyday work. Although seldom discussed, they should be considered in view of the hazards connected with this profession, a profession which requires that a dentist should act in two roles: as a psychotherapist and a manually skilled operator. Many clinical situations are the source of stress to a dentist and these include, among others, procedures connected with anesthetization of patients, overcoming of pain and fear, unexpected emergency situations in which a patient's health or life is in danger, or procedures with uncertain prognosis. The following factors, such as the necessity to keep a proper professional standard, aspiration to achieve technical perfection, causing pain or fear in patients, the necessity to cope with cancelled visits or late arrivals by patients, having to cope with different levels of cooperation with patients, are some of the very important sources of stress in everyday dental practice.

Legal Hazards : In every country there are relevant statutes and regulations which apply to the practice of dentistry. The contravention of any of these may warrant that legal actions be brought against a dental practitioner particularly in developed countries where the citizens appear more aware of their rights. To help assure a safe work environment in dental treatment, the hazard awareness and prevention of legal risks should be made known to all clinical workers of the dental hospital/clinic.

Other Risks : Mild neuropathy among dental professionals has been shown to be associated with high frequency vibrations from dental equipments, particularly high and low speed handpieces and ultrasonic scalers.

Prevention of Occupational Hazards

Health risks in dentistry may arise as new technologies and materials are developed. However, once identified and recognized as risk, new guidelines, precautions, and protocols are often rapidly instituted to greatly reduce or even eliminate the occupational hazard. Education is one of the important strategies for the prevention of occupational injuries and diseases. Concerning prevention, the international literature focuses mostly on infection control and proper handling of potentially infected materials, owing to the high profile of dentistry regarding transmission of infection. Barrier techniques include gloves, masks, protective eye wear, high power suction and good ventilation to reduce aerosols and vapor dangers. Hypoallergenic nonlatex gloves are proposed to deal with latex allergy. Lead aprons, periodic maintenance of the X-ray machine and radiation level sensors prevent radiation hazard.

Forensic Dentistry

Forensic dentistry, or forensic odontology, is the application of dental and para dental knowledge to the solution of legal issues in civil and in criminal matters. Dentition and finger prints form the most scientifically reliable identification methods due to their individuality (the uniqueness of individual's dentition) and specificity. Dental identification , like fingerprint identification, is a definitive means of positive identification of unknown human remains .

Constituents of Forensic dentistry

Forensic odontology mainly constitutes the following headings:

1. Postmortem dental identification and disaster victim identification.
2. Age estimation.
3. Anthropology.
4. Bite mark analysis.

Forensic dentists are responsible for six main areas of practice:

1. Identification of found human remains.
2. Identification in mass fatalities.
3. Assessment of bite mark injuries.
4. Assessment of cases of abuse (child, spousal, elder).
5. Civil cases involving malpractice
6. Age estimation.

Means of Identifications in Forensic Dentistry:

1. Teeth: Natural and synthetic (fixed and removable)
2. Bone: Trabecular pattern, tori and osseous anomalies
3. Presence of foreign bodies: Implants, amalgam particles, surgical instruments, bullets, fragments of various origins
4. Sinus configuration: Maxillary and frontal
5. Skull sutures
6. Soft tissue features: Rugae and lip prints.
7. Photographic comparison: Facial or dental superimposition or approximation
8. DNA.

Role Of Teeth In Determination Of Human Identity Important Of Dental Identification

Dental evidence tends to survive much better than does soft tissue evidence such as facial characteristics or fingerprints. Teeth are calcified structures and are the

hardest substance in the human body, even harder than bone. Because they are calcified, they are resistant to the environmental effects that destroy soft tissue evidence. Thus teeth are not destroyed by immersion in water, by desiccation (drying up), or by decomposition. In addition, the dental restorations are frequently completely intact.

Application of Forensic Dentistry:

The dentist may help with problem involving →

1. Ageing. Determination of age:

- In children → concerning with the pattern of teeth eruption, root length (degree of completion of roots erupted teeth and resorption of roots of deciduous teeth). Teeth wear.
- In young adults → development of wisdom (third molar).
- Older adults → include parameters like attrition, gingival recession, periodontal disease progression, multiple fillings and complex restorative work, extractions, formation of physiological secondary dentine, formation of cementum.

2. Gender. Determination of gender can be assessed from:

- Teeth shape (no gender differences regarding teeth morphology).
- Skull shape and form; the male skull tends to be larger, have a lower, sloping forehead, larger muscle attachment sites and smaller, squarer eye sockets when compared to females.
- Development and eruption of teeth (teeth eruption is accelerated in early maturing girls)
- Mandibular canines size (the mesiodistal width of canines of both the jaws is significantly greater in males than females).

3. Race: can be assessed from skull shape and form, anatomical characterization, cusp numbers, grooves and pattern of molars, such as Carabilli cusp, Leong's premolar (6 and 7 cusp), shovel-shaped incisors.

4. Socio-economic status and geographical factors: Endemic fluorosis, dental caries and type of dental restorations.

Bite marks:

Dental evidence most commonly used in the criminal court is the bite marks, which provide details of a kind comparable with infinitive detail that was provided by finger prints. Bites are common in violent crime and child abuse.

Bite marks is defined as "a mark made by teeth alone or in combination with other oral structure", bite marks can be found on:

- The victim (by the attacker)
- The attacker (suspect) when a victim attempts to defend himself
- An object found at the crime scene.

The physical characteristics of both the bite mark wound and the suspect's teeth include:

- The distance from cuspid to cuspid
- The shape of the arch
- The evidence of a tooth out of alignment
- Teeth width and thickness, spacing between teeth
- Missing teeth
- The curves of biting edges
- Unique dentistry
- Wear patterns such as chips or grinding.

Factor that may affect the accuracy of bite mark Identification include:

- ✓ The effects of where the bite mark was found.
- ✓ The damage on soft tissue.
- ✓ The time dependent changes on the bite mark on living bodies.
- ✓ Poor in technique of bite mark.

Dental Identification: dental identification help in person identification includes:

- Dental restorations→ types, their outline, unusual fractures **of** design of filling, also root canal therapies, rehabilitation.
- Dental prosthesis. Denture found in the mouth or in the scence of activity are useful aid in identification.
- Palatine Rugae . the shape and the form of rugae is highly variable between people.It can be recorded by means of dental impression and casts made from them.
- Lip print. Lip prints are unique to the individual in a manner similar to finger prints .
- Dental DNA. The suspect's DNA profile obtained from saliva or blood of bite mark area and it's surrounding proves a more reliable form of identification.

Epidemiological studies

Epidemiological studies are required to measure the rates of disease occurrence and the associated factors in a population, to make an unbiased comparison of those with or without a disease or risk factor and to make interventions.

Epidemiological studies can be classified as :

1. (Non-experimental Observational): in these studies the investigator measures but does not intervene , There are two types of non-experimental designs.

- Analytical studies .
- Descriptive studies.

A. Descriptive Studies : they are the first phase of an epidemiological studies . These studies involve the systematic collection, analysis and interpretation of data to give a clear picture of a particular situation. The main purpose of this study is to describe the occurrence and distribution of the disease with respect to the time , place and person .

1. Cross-sectional study (prevalence study) :

This study measures the prevalence of disease and was called prevalence study . It is based on a single examination at one point in time . In this study the measurement of exposure and effect are made at one time . It tells about the distribution of disease rather than its etiology and provides little information on the natural history of the disease . Data from cross-sectional surveys are helpful in assessing the health care needs of populations .

Advantages of Cross Sectional Studies

1. Can be done in a short time.
2. Are less costly.
3. Provide a wealth of data that can be used in health systems research.
4. May be used in examining and identifying risk factors for acute diseases where the time between exposure and outcome is very short.

5. Useful for monitoring control programs for chronic conditions such as mental illness.

2. Longitudinal study (incidence study) :

In this study repeated examinations are made on the same population over a prolonged period of time in the form of follow-up examination . It is used to study the natural history of disease , for identifying the etiology and risk factors of the disease and for finding out incidence rate .

B. Analytical Studies : It is the next step in an epidemiological study . The term ‘analytical’ implies that the study is designed to establish the cause of a disease by looking for association between exposure to a risk factor and disease occurrence.

- The most common designs of analytical studies are :

1. Case-control studies (retrospective study) : Case control study is useful as a first step when searching for a cause of an adverse health outcome. This hallmark of this type of study is it compares a case group (with disease) with a control group (not diseased) with reference to past exposure to possible risk factors.

2. Cohort study (follow-up or incidence study) : it is also called as prospective study . These studies begin with a group of individuals (a cohort) free from the disease who share a common characteristic or experience within a defined time period , then grouped as per their exposure or non – exposure to a suspect causative factor and then monitored over a period of time for the development of disease .

3. Ecological studies (correlational study) :

In this study , the units of analysis are populations or groups of people rather than individual .

2. Experimental studies (Interventional Studies) :

In contrast to observational studies, where the epidemiologist takes no action but only observes the natural course of events or outcome, experimental studies involve some action, intervention or manipulation such as deliberate application or withdrawal of the suspected cause or changing one variable and the causative chain in the experimental group while making no change in the control group and observing and comparing the outcome of the experiment in both the groups.

The type of experimental study can take one of three forms:

- Randomized Controlled trial
- Field trial
- Community trial.

A. Randomized Controlled trials : A clinical study in which participants are randomly (by chance) assigned to either an experimental group or control group . The experimental group receives the new intervention and the control group receives a placebo or standard intervention . these group are followed for the outcome of interest which could be the development of a new disease or recovery from established disease .

Randomization:

It is a statistical procedure by which the participants are allocated into groups usually study and control groups, to receive or not to receive an experimental preventive or therapeutic measure, procedure or intervention.

Blinding:

Is a procedure done to reduce the bias which may occur due to errors from assessment of the outcome. The subjects need to participate without knowing which type of intervention is being done on them.

Blinding is of three types

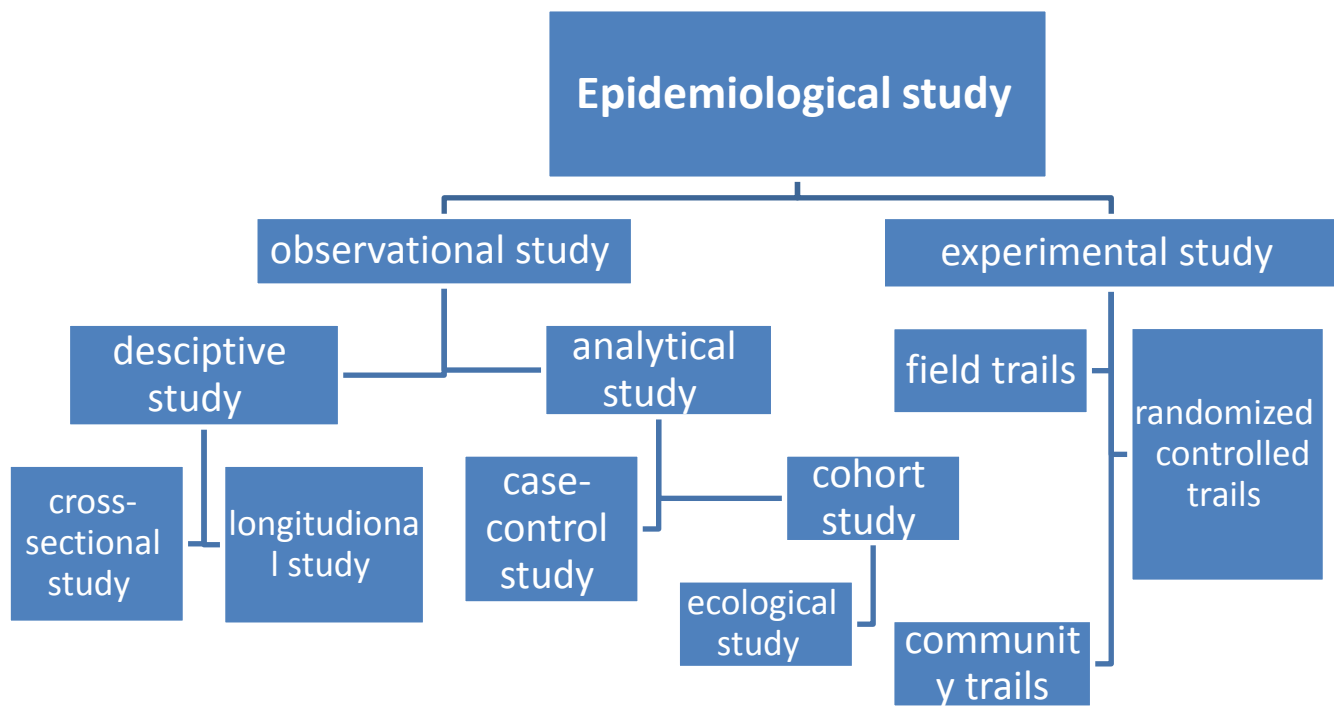
1-Single blind trial: The trial is planned in such a way that the participant is not aware whether he belongs to the study group or control group.

2-Double blind trial: The trial is so planned that neither the investigator nor the participant is aware of the group allocation and the treatment received.

3-Triple blind trial: The trial is planned in such a way that the participant ,the investigator and the person analyzing the data are all blind.

B. Field trails : These trials involve people who are disease free but are presumed to be at risk, data collection takes place in the field . Since the subjects are disease free and the purpose is to prevent the occurrence of disease that may occur with relatively low frequency , field trails are often huge undertakings involving major logistic and financial considerations .

C. Community trails : In this type of field trial the intervention is done on a community wide basis rather than individuals. Due to practical difficulties only a small number of communities are included. Random allocation of communities may not be feasible. These studies are appropriate for diseases that have origins in social conditions which can most easily be influenced by intervention directed at group behavior as well as at individuals.



Dental auxiliary and Dental man power in dental clinic

Dental auxiliary : is a person who is gives responsibility by a dentist (generic term for all persons who is assist the dentist in patient management render dental care), the duties undertaken by dental auxiliaries range from simple task (sorting instrument) to complex procedure which form part of treatment of patients, they play an important role in the public dental health.

A dentist is a person licensed to practice dentistry under the law of the appropriate state, province, territory or nation. Dentists are concerned with the prevention and control of the diseases of the oral cavity. They are legally entitled (licensed and registered) to treat patients independently, prescribe certain drugs and to employ and supervise auxiliary personnel.

World Health Organization (WHO) can classify dental auxiliary according to:

- a. The training they have received.
- b. The task they are expected to undertake.
- c. Legal restrictions placed upon them.

Classification:

1. Non-operating auxiliaries. According to revised classification of non-operatory auxiliary are:

- **Dental surgery assistant:**

The duties of the dental assistant are

- ✓ Reception of the patient.
- ✓ Patient preparation for any dental treatment.
- ✓ Sterilization and preparation of instruments.
- ✓ Preparation and provision of all necessary facilities such as mouth washes and napkins.
- ✓ Care of patient after treatment.
- ✓ Preparation and mixing of restorative materials.
- ✓ Preparation of the surgery for the next patient.
- ✓ Assistant with x-ray work and the processing mounting of x- rays.
- ✓ Instruction of the patients where necessary in the correct use of the toothbrush.
- ✓ Aftercare of persons who have had general anesthesia.

- **Dental secretary/ receptions:** Non- operator auxiliary who assist the dentist with his secretarial work and patient reception duties.
- **Dental laboratory technician:** also called dental mechanic a person who fulfills the perceptions provide by dentists regarding extra oral constriction and repair of oral appliance and bridge work(make and repairs dentures and dental appliances, casting of models from impression by dentist, fabrication of denture, splints, orthodontic appliances, inlay, crowns and special trays). Their work is mostly performed in commercial laboratories and not in the dental practice setting.
- **The dental health educator:** give instruction in the prevention of oral /dental diseases.

2. Operating auxiliary:A person who not being a professional is permitted to carry out certain treatment procedures in the mouth under the direction and supervision of a professional. According to revised classification of operator auxiliary are:

- **The school dental nurse:** this a person who

a. Permitted to diagnose dental disease.

b. Plan and carry out certain specified preventive and treatment of dental caries and periodontal disease in a school children groups.

c. The duties of the school dental nurse are

- ✓ Oral examination.
- ✓ Prophylaxis and topical fluoride application.
- ✓ Advice on dietary and fluoride supplements.
- ✓ Administration of local anesthetic.
- ✓ Cavity preparation and placement of amalgam filling in primary and permanent teeth.
- ✓ Pulp capping.
- ✓ Extraction of primary teeth.
- ✓ Instruction of individual , classroom, teacher and parent about tooth brushing , oral hygiene and dental health education.
- ✓ Referral of patient to private practitioners for more complex services such as extraction of permanent teeth ,orthodontic treatment.

- **The dental therapist:** after training dental therapist for about of a period of 2 years is permitted to carry out certain specified preventive and treatment measures including cavity preparation and restoration of teeth under supervision of dentist. The duties of the dental therapist:

- ✓ Diagnosis of dental caries clinically.

- ✓ Cavity preparation of deciduous and permanent teeth.
 - ✓ Material handling and restorative skills.
 - ✓ Vital pulpatomy and extraction of deciduous teeth under local anesthesia.
 - ✓ Taking radiograph under supervision of dentist.
- **The dental hygienist:** this is the person who licensed and registered to practice dental hygiene under the law of the appropriate state, proven, territory or nation. Dental hygienist work under supervision of dentists. The duties of the dental hygienist are
 - ✓ Cleaning of mouths and teeth with particular attention to calculus and stain.
 - ✓ Topical application of fluoride and sealants and other prophylactic solutions.
 - ✓ Screening or preliminary examination of patients (school children) so that may refer to the dentist for treatment.
 - ✓ Oral hygiene instruction.
 - ✓ Resource work in the dental health.
 - ❖ **Expanded function dental auxiliary (EFDA):** they have been referred to expanded function dental assistant, hygienist, techno therapist. Mostly they are assistant and in some cases hygienist with additional training in duties related to the direct dental treatment of patients, through still working under supervision of a dentist.

EFDA performed the following operations:

1. Placing and removing temporary fillings, rubber dam and matrix band.
2. Condensing and carving amalgam restoration in previously prepared teeth.
3. Placing of acrylic restoration in previously prepared teeth, EFDA do not prepare cavities or make decision, but work alongside the dentist who examined and diagnosed the patient and performed treatment plan. EFDA helps him in four handed relationship.

Four handed relationship: the term is given on art of seating both the dentist and the dental assistant in such a way that both are within easy reach of the patient's mouth. The patient is in a fully supine position, the assistant will hand the dentist, particular instrument he needs, in addition to retraction and aspiration. This will decrease the fatigue of dentist and increase efficiency.

Manpower

Can be defined by different ways:

- * Is the total number of people who can work to get something done.
- * The number of people working or available for work or service.
- * All the people who are available to do a particular job or to work in a particular

Dental Manpower

Dentists are concerned with the prevention and control of diseases of the oral cavity and the treatment of unfavorable conditions resulting from these diseases, from trauma or from inherent malformations.

Manpower Surplus

It's a process by which an organization ensures that it has the right number of people and the right kind of people at the right place at the right time, doing things for which they are economically most useful.

Dental Manpower Planning

The process of estimating the number of persons and the kind of knowledge and skills they need to achieve predetermined dental health targets and optimal improvements in dental health of population

STEPS IN MANPOWER PLANNING

1. Analyzing the current manpower inventory.
2. Making future manpower forecasts.
3. Developing employment programs.
4. Design training programs.

Infection control in dentistry

Infection Control : It refers to a comprehensive and systemic program that, when applied prevents the transmission of infectious agents among persons who are in direct or indirect contact with the health care environment.

Why is Infection Control Important in Dentistry?

- Both patients and dental health care personnel (DHCP) can be exposed to pathogens
- Contact with blood, oral and respiratory secretions, and contaminated equipment occurs
- Proper procedures can prevent transmission of infections among patients and DHCP.

The principles of infection control are:

1. Stay healthy: This principle emphasizes the need for dental personnel to be and stay healthy. Strategies include immunizations; post exposure management and medical follow-up by a qualified health care professional; routine hand hygiene procedures; and maintaining hand health.
2. Avoid contact with blood and body fluids: The primary methods to avoid contact with blood and other potentially infectious materials are—handle sharp instruments with care, use safety devices when appropriate, correctly manage occupational exposures to blood, and wear personal protective equipment (PPE) (gloves, protective clothing, and face and eye protection).
3. Limit the spread of contamination: This principle is accomplished by—covering surfaces using surface barriers or cleaning and disinfecting surfaces that are likely to become contaminated; minimizing sprays and splashes to reduce contamination (high volume evacuation, dental dams); and properly disposing of medical waste.
4. Make objects safe for use: The primary methods to make objects safe for use are—cleaning and heat sterilizing patient care items that contact bone, enter previously sterile tissues, or touch mucous membranes before use; monitoring sterilization processes; and following manufacturer's instructions for use and sterilization.

Transmission Of Infection

The two principle *modes of disease transmission* in which infectious diseases are acquired in dentistry are:

1. Contact

- a. Direct contact: Human-human touch. Contact with microorganisms at the source.
- b. Indirect contact: Human-object/animal-human touch. Contact with contaminated items such as surfaces especially dental office equipment and/or instruments including contaminated sharps.

2. Droplet Infection

- a. Splatter of blood, saliva or nasal secretions onto broken mucosa or skin.
- b. Airborne by aerosols of microbes.

The three principle routes of entry of microorganisms into the body are:

a. Inhalation

- a. *Direct inhalation*: Inhalation of small particles of moisture (spatter) generated when a person coughs or sneezes, or when water is aerosolized to a fine mist during dental procedures. Risk of disease transmission is usually limited to persons in close proximity to the droplet source.
- b. *Indirect inhalation*: Inhalation of particles <5 microns in diameter formed by dehydration of airborne droplets containing microorganisms that can remain suspended in the air for long periods of time or which settle on surfaces and can be readily reintroduced to the environment.

b. Ingestion: Whereby droplets of saliva/blood or particles from instruments are swallowed.

c. Autoinoculation/percutaneous injury: Autoinoculation occurs as a result of the operator touching his/her own mucous membrane or non-intact skin surface with contaminated patient care items or contaminated personal protective barriers. Percutaneous injuries are those that occur as a result of breaking the skin especially with a contaminated sharp instrument.

Components Of Infection Control

1. Immunization
2. Patient screening
3. Hand hygiene
4. Barrier techniques
5. Needle and sharp instrument safety

6. Instrument sterilization and disinfection
7. Surface disinfection and general operatory asepsis
8. Radiographic asepsis
9. Laboratory asepsis
10. Disposal of contaminated wastes

Basic infection control procedures :

1. Personal barrier techniques:

(a) Hand Hygiene

Hand hygiene in health care facilities is the most important aseptic procedure in the prevention of health care associated infections. Hand hygiene significantly reduces microbes on the hands and protects both patients and the dental staff. Handwashing products include plain soap and agents with antimicrobial activity. The wearing of gloves does not replace handwashing, but is an adjunct providing consistent protection from blood-borne pathogens.

Hand hygiene is important because:

- Hands are the most common mode of pathogen transmission
- Reduce spread of antimicrobial resistance
- Prevent health care associated infections

(b) Gloves .Gloves used for:

1. Protect the dental team members from direct contact with patient microbes.
2. Protect patients from contact with microbes on the hands of the dental team members.

Gloves should be:

1. Changed between patients and are not to be washed with detergents at any time.
2. Torn or punctured gloves should be removed as soon as possible .

(c) Masks . Facemasks should be worn to→

1. Prevent spatter from patients' mouths or splashes of contaminated solutions and chemicals from contacting the mucous membranes of the mouth and nose.
2. The reduction in the inhalation of airborne particles .

(d) Eyewear

▶ The eyes due to limited vascularity and lower immune abilities are susceptible to macroscopic and microscopic injury (risk from the herpes simplex virus and hepatitis).

▶ Protective eyewear should be available to the patients as well as the dental personnel. The supine position renders the patient susceptible to falling objects in the head and neck area.

▶ All protective eyewear should be cleansed after every appointment. Eyewear should be washed with soap first, then rinsed with water and a surface disinfectant can be used later.

(e) Protective clothing

Protective clothing is the outer layer or covering of garments that would first be contacted by the contaminating droplets, generating sprays, splatter, splashes or spills of body fluids, contaminated solutions or chemicals. This protection can be provided by high neck, long sleeve, knee length garments.

2. Immunization

All dental health care workers should be immunized by taken a vaccine against the most prevalent infectious disease because they are at risk of infection.

3. Medical history of patient

Complete screening of patient medical history must be taken.

4. Intraoral Barrier Technique

1. Rubber dam . It should be used whenever possible for improved vision and access and to reduce dental personnel's exposure to microorganisms in patient's blood and saliva.

2. Pre-procedural mouthrinse Patient's use of an antimicrobial mouthwash of 0.12 percent chlorhexidine gluconate solution for 30 seconds prior to intraoral procedures reduces the number of viable oral organisms.

Instrument processing (sterilization of instruments)

Instrument processing involves:

(a) Presoaking and cleaning

● Presoaking of contaminated instruments keeps them wet until a thorough cleaning can occur. This procedure prevents blood and saliva from drying on the instruments and facilitates cleaning of instrument which is achieved by;

● Hand scrubbing of contaminated instruments.

- Ultrasonic cleaning is a mechanical cleaning system that reduces handling of contaminated instruments and has been shown to be effective in removing dried blood and saliva.

(b) Packaging

After cleaned instruments have been rinsed and dried, they are to be packaged in functional sets before sterilization.

(c) Sterilization

— Sterilization: It is a process of removing or killing all viable micro-organism including substantial No. of resistant bacterial spores using physical & chemical procedure.

— Disinfection: It is a process of removing or killing most, but not all, viable organism (e.g bacterial spores) using physical & chemical procedure.

— Sanitization: The process of removing organic debris in order that disinfection can occur.

— Bacteriostatic: An agent that will inhibit increases in the number of bacteria.

— Bactericidal: An agent that will destroy (kill) bacteria, fungi or viruses.

(d) Drying, cooling, storage and distribution of instruments

- Drying → Instrument packages sterilized in steam become wet and must be allowed to dry before handling so that the packages do not tear.

- Cooling → of warm packages must be done slowly to avoid formation of condensation on the instruments. Using fans to cool down items should also be avoided as, it causes undue circulation of potentially contaminated air around the packs.

- Storage → sterile instrument packages are stored in a cool, dry, protected area, up off the floor, a few inches away from the walls and ceilings and away from sinks, heat sources, and overhead pipes.

- **Use of disposables For patients**

Using of disposable items to prevent patient-to-patient cross-contamination

Numerous disposable items are available in dentistry which include :

Gloves, masks, gowns, surface covers, patient bibs, saliva ejector tips, air water syringe tips, high volume evacuator tips, prophylaxis angles, prophylaxis cups, some instruments, impression trays, fluoride gel trays and high speed hand pieces.

- **Asepsis of Operatory Surfaces**

It is essential to maintain a "disinfected environment" within the working area.

There are two general approaches to surface asepsis :

1. To clean and disinfect contaminated surfaces.
2. To prevent the surface from becoming contaminated by the use of surface covers.

Environmental cleaning Contaminated worktops must be disinfected between patients. The surgery (dental chair, dental unit, worktops and floors) must be thoroughly cleaned at least every day and more frequently if there is obvious contamination. All cleaning agents must be used in accordance with the manufacturer's instructions.

Treatment needs and demands

Need: Is an important concept in public health. It is used to plan and manage health services including health improvement, resource allocation, and equity. However, need is a multi-faceted concept with no one universal definition.

Demand: Is the expression by a patient or the public of a preference to receive health care related to their perceived needs.

Utilization: Is the actual attendance by members of the public at dental treatment facilities to receive dental care.

Utilization rate : It is expressed as the proportion of a population who attend a dentist within a given time, usually a year or the average number of visits per person made during a year.

Met need: Is measured by utilization data.

Need for care : is defined as the quantity of dental treatment which should be available over a time period for people to be certified dentally healthy. There are various definition of need.

There are four categories of need:

1-Normative need (defined by the professional) Is that which the professional defines as need in any given situation

2-Felt need (Perceived need) This reflects the individual own assessment of his or her requirement for health care. It is equated with want.

3-Expressed need (demand): This is felt need is converted in to action by seeking care .

4-Comparative need, which is assessed by comparing care received by different people with similar characteristics.

- **The methods of assessment of treatment need has been through:**

1-Clinical examination

2-Measuring patient demand for treatment.

3-Survey system to determine oral health status of the population

Factors affecting dental demands:

1-Age: Utilization are lowest in children < 5 years and in person >65 years.

2-Gender: female more than male but in some age and education, male= female

3-Education: Utilization increased with increasing the level of education.

4-Socioeconomic status: higher social class more than low social class. This is because higher social class often related to high income and good educational level.

5-Occupation: Persons in professional occupation visit their dentist more than nonskilled manual worker.

6-Residence: Urban area more than rural area.

Environment and Health

The term of environment involves all the external factors living and non-living, material and non-material which surround human. Proper environmental management is the key to avoid the quarter of all preventable illnesses which are directly caused by environmental factors. The environment affects our health in many ways through exposure to physical, chemical and biological risk factors, and through related changes in our behavior in response to those factors.

Definition of “The Environment ”according to Public Health

All that which is external to the individual host. It can be divided into physical, biological, social, and cultural factors, any or all of which can influence health status in populations.

1. **Physical:** Water, air, soil, housing, wastes, radiation, etc.

2. **Biological:** Plant and animal life including bacteria, viruses, insects, and animals.

3. **Social:** Customs, culture, habit, income, occupation, religion, etc.

The purpose of environmental health is to create and maintain ecological conditions that will promote health and thus prevent disease.

Pollution of Water

A more serious aspect of water pollution is that caused by human activity-urbanization and industrialization. The sources of pollution resulting from these are: sewage, industrial waste, agricultural pollutants, and physical pollutants.

Water Related Diseases

Ingestion of contaminated water either directly or through food may affect man's health by causing water related diseases. Such diseases may be classified as:

A. Biological water-borne diseases

1. Those caused by the presence of an infective agent:
 - a. Viral : Viral hepatitis A, hepatitis E, poliomyelitis
 - b. Bacterial : Typhoid and paratyphoid fever, bacillary dysentery
 - c. Protozoal : Amoebiasis, giardiasis
 - d. Helminthic: Roundworm, threadworm
 - e. Leptospiral: Weil's disease
2. Those due to the presence of an aquatic host:
 - a. Snail: Schistosomiasis
 - b. Cyclops: Guinea worm, fish tapeworm.

B. Chemical

These include industrial and agricultural wastes. Such pollutants include detergents solvents, cyanides, heavy metals, minerals and organic acids, nitrogenous substances, bleaching agents, dyes, pigments, sulfides, ammonia, toxic and biocidal organic compounds of great variety. These pollutants affect health, directly and indirectly by accumulating in foods which are consumed by human beings, e.g. fishes.

Disinfection

Disinfection is accomplished both by filtering out harmful microbes and also by adding disinfectant chemicals in the last step in purifying drinking water. Water is disinfected to kill any pathogens which pass through the filters. Possible pathogens include viruses, bacteria, including *Escherichia coli*, *Campylobacter* and *Shigella*,

Chlorination

Chlorination is one of the greatest advances in water purification. Chlorine kills pathogenic bacteria, but it has no effect on spores and certain viruses except in high doses. It has limited effectiveness against protozoans that form cysts in water.

Air Pollution

The term Air Pollution signifies the presence in the ambient atmosphere of substances generated by the activities of man in concentrations that interfere with human health, safety or comfort ,or injurious to vegetation and animals and other environmental media resulting in chemicals entering the food chain or being present in drinking water and thereby constituting additional source of human exposure..

Prevention of air pollution:

Scientific groups study the damaging effects on plant, animal and human life. Legislative bodies write laws to control emissions. Educators in schools and universities teach students, beginning at very young ages, about the effects of air pollution.

1. Assessment: is the first step to solve air pollution.
2. Reduce exposure: steps can be undertaken to reduce air pollution. These can be accomplished by regulation of manmade pollution through legislation. Prevention is another key to control air pollution.
3. Adequate ventilation is also a key to control exposure to indoor air pollution. Home and work environments should be monitored for adequate air flow and proper exhaust systems installed.
4. Restricting smoking is an important key to a healthier environment. Cigarette smoke is one of the most dangerous air pollutants.

Dental health education

Health education is defined as any educational activity which aims to achieve a health related goal.

Definition by WHO: any combination of learning experiences designed to help individuals and communities to improve their health, by increasing their knowledge or by influencing their attitude.

Dental health education.

Dental health education is the process of imparting information about dental health. It will help an individual to keep the oral cavity healthy because good oral hygiene helps a person to prevent oral disease such as periodontal diseases, bad breath and other dental problems.

Goal of oral health education

The goal is to improve knowledge that may lead to adoption of desirable oral health behaviors that contribute to better oral health. A basic oral health care program that introduced by World Health Organization for less industrialized countries includes oral health education and emphasizes on the integration of health education with other oral health activities such as provision of preventive, restorative and emergency dental care.

main objectives of health education :

1. Informing people: The primary objective is to inform people or provide them with the scientific knowledge about the prevention of disease and promotion of health. This creates an awareness of health needs and helps people to do away with the misconceptions and ignorance they may have about health and disease.

2. Motivating people: People must be motivated to change their habits and ways of living as many current health problems are directly related with them for example drug addiction, cigarette smoking, pollution of water, sedentary lifestyles, etc.

3. Guiding into action: The people should be encouraged to use judiciously and wisely the health services available to them. They may need help to adopt and maintain healthy lifestyles and practices which may be new to them.

There are three main domains of learning:

1. **Cognitive:** Understanding factual knowledge (for example, knowledge that tobacco chewing is linked to development of oral cancer).
2. **Affective:** Feelings, emotions and beliefs associated with health (belief that milk teeth are not important).
3. **Behavioral:** Skills development (for example, skills required for effective brushing and flossing of teeth).

Setting for oral health education

- Primary care
- Schools and colleges
- Hospitals and clinics
- Preschool education and care
- Local authority services
- Workplace
- Commercial organizations
- Community based initiatives
- Older people's residential homes.

Steps in health education planning

1. Identify needs and priorities.
2. Set aims and objectives.
3. Decide the best way of achieving the aims.
4. Identify resources.
5. Plan evaluation methods.
6. Set an action plan.
7. Evaluation.

Identify needs and priorities

The public health problem must be identified to establish the objectives. The people requiring oral health education also must be identified. Specific group should be selected, in order to ensure health education activity is tailored to their particular needs. In planning effective health education, both professionally defined needs and the target group's concern (felt and expressed needs) should be taken into consideration.

Set aims and objectives

An aim can be set based on the assessed needs of the group specifying the desired change that is planned. One aim could be to improve and maintain the periodontal health through more effective plaque control methods.

Decide the best way of achieving the aims

Once desired aims and objectives have been formulated, the best way of achieving them should be decided. By this stage, the content and method of education should be apparent.

Identify resources

The resources needed and available to implement the program should be identified. In health education, resources may include people's expertise and existing skill, and material such as leaflets or oral hygiene aids.

Plan evaluation methods

A full evaluation of any health education program is a very important element. Evaluation is designed to assess whether the set aims and goals have been achieved. For this, appropriate evaluation measures should be selected.

Set an action plan

The planned action for the program should be initiated.

Evaluation

Evaluation information can be collected both during and at the end of the program to assess the impact of the program.

Pit and fissure sealants

Fissure sealant can be defined as “a material that is introduced into the occlusal pits and fissures of caries susceptible teeth, thus forming a micromechanically or chemically bonded, protective layer cutting access of caries-producing bacteria from their source of nutrients.”

Criteria For The Ideal Sealant

1. A viscosity allowing penetration into deep and narrow fissures even in maxillary teeth.
2. Adequate working time.
3. Rapid cure.
4. Good and prolonged adhesion/bonding to enamel.
5. Low sorption and solubility.
6. Resistance to wear.
7. Be compatible with the oral tissues (minimum irritation to tissues).
8. Cariostatic action.

Types of Sealants

A. Based on generation

1. Generation 1 Sealant (photocured via UV light).
2. Generation 2 Sealant (auto or chemically-cured).
3. Generation 3 Sealant (photocured via visible light).
4. Fluoride containing sealants.

B. Based on fillers

1. Unfilled.
2. Filled sealant (fillers increase abrasion resistance, bond strength).

Fillers: glass and quartz particles.

3. Fluoride –Releasing.

C. Based on Color Helps in quick identification for evaluation during maintenance assessment:

1. Clear: Esthetic but difficult to detect in follow-up.
2. Tinted/opaque sealant: easy to detect.

D. BIS-GMA *versus* non BIS-GMA sealant

Procedure of Pit And Fissure Sealant Application

Sealant Placement Guidelines

Step 1: Prepare the Teeth

- Clean the pit and fissure surfaces , Plaque and debris might interfere with the etching process or sealant penetration.
- Utilize a dry toothbrush, prophylaxis cup with pumice or prophylaxis paste, or air abrasion
- Use an explorer to remove any debris in the pit or fissure
- Rinse for 20–30 seconds
- A widening of the fissures with rotary instrumentation is yet another type of fissure conditioning that has been recommended before etchant and sealant application. This is known as the invasive pit and fissure technique.

Step 2: Isolate the Teeth

Adequate isolation is the most critical aspect of the sealant application process. Salivary contamination of a tooth surface during or after acid etching will have a deleterious effect on the ultimate bond between enamel and resin.

- Use cotton rolls, dryi-angles, and/or rubber dam.

Step 3: Dry the Surfaces

- Dry teeth with air for 20–30 seconds
- Check to make sure there is no moisture coming out of air syringe tip.

Step 4: Etch the Surfaces

There are various etchant materials available, but the most frequently used etchant is 37 percent orthophos-phoric acid. This is available as both a liquid solution and a gel. One should always apply the etchant onto all the susceptible pits and fissures of the tooth and extend it up the cuspal inclines well beyond (at least 2 millimeters) the anticipated margin of the sealant:

- Apply etchant as directed by manufacturer , usually between 30 and 60 seconds.
- If using a gel or semi-gel: Apply gel and let stand for the allotted amount of time
- If using a liquid: Continue to apply etchant throughout the etchant time.

Step 5: Rinsing and Drying the Teeth .

- Rinse surfaces for 60 seconds
- Check for effectiveness of etchant by drying with air; surface should appear “chalky white” , If not, repeat etching procedure
- Placement of new cotton rolls and/or dry angles
- Dry teeth with air for 20–30 seconds.

Step 6: Application of Sealant Material

During sealant application, all the susceptible pits and fissures should be sealed for maximum caries protection. The sealant material can be applied to the tooth in a variety of methods. Many sealant kits have their own dispensers, some pre-loaded that directly apply the sealant to the tooth surface:

- Self-curing: Mix equal parts of the two components
- Will polymerize in 60–90 seconds
- Light-curing: Apply with syringe provided by manufacturer
- Apply curing light to material
- Will polymerize in 20–30 seconds.

Step 7: Evaluate the Sealant

the sealant should be visually and tactually inspected for complete coverage and absence of voids or bubbles. Small voids in the sealant can be repaired simply by adding new material to the void and polymerizing.

Step 8: Occlusal Evaluation

- Check occlusion with articulating paper
- Adjustments must be made with filled resins

Step 9: Re-evaluation

- Recall patient for having the sealants evaluated on a six month basis.

Indications for use

A sealant is indicated for children and adults:

1. Who may be at moderate or high risk of developing dental caries, for a variety of reasons.
2. With incipient caries (limited to enamel of pits and fissures).
3. Who have sufficiently erupted permanent teeth with susceptible pits and fissures.
4. Who have existing pits and fissures that are anatomically susceptible pits and fissures.
5. A deep or irregular fissure, fossa, or pit is present, especially if it catches the tip of the explorer (for example, occlusal pits and fissures, buccal pits of mandibular molar, lingual pits of maxillary incisors).
6. The fossa selected for sealant placement is well isolated from another fossa with a restoration present.
7. An intact occlusal surface is present where the contralateral tooth surface is carious or restored.

Contraindications

A sealant is contraindicated if:

1. Patient behavior does not permit use of adequate dry field (isolation) techniques throughout the procedure.
2. There is an open occlusal carious lesion.
3. Caries, particularly proximal lesions, exist on other surfaces of the same tooth (radiographs must be current).
4. A large occlusal restoration is already present.
5. If pits and fissures are well coalesced and self-cleansing.
6. Life-expectancy of primary tooth is limited.
7. When patients is allergic to methacrylate.

Sealant Failure :

The following list describes common technique errors:

1. Contamination may be caused by either saliva or calcium phosphate products as described earlier. The enamel surface must be re-etched if contaminated.
2. Inadequate surface preparation may be caused by improper cleansing prior to applying the etchant and/or the etching process itself.
3. Incomplete or slow mixing of self-cure sealants affects polymerization of the Bis-GMA material, a new mix should be made.
4. Too slow application of the material results in a less viscous (thicker) mix that cannot flow easily into the pits and fissures, causing an incomplete seal. Place material within the time frame recommended by the manufacturer.
5. Air entrapment due to whipping or vigorous mixing can occur during the mixing of self-cured sealants. It is important to replace the caps on the resin bottles since moisture can be lost through evaporation. The result is a less viscous material which does not flow properly.
6. Overextension of the material beyond the conditioned tooth surface results in a weakened sealant in the areas that are overextended. If the sealant margins extend beyond etched tooth structure, those areas will cause increased micro-leakage beneath the sealant and/or fracture of the sealant. The sealant should be replaced, confining the area of placement to etched tooth structure.
7. Outdated materials may not serve as an effective sealant.

Requisites for Sealant Retention

Placement of pit and fissure sealants is technique sensitive. For sealant retention the surface of the tooth must:

1) **have a maximum surface area** Sealants do not bond directly to the teeth. Instead, they are retained mainly by adhesive forces. The surface area is greatly increased by the acid etch, which in turn increases the adhesive potential

2) **have deep, irregular pits and fissures** (Deep, irregular pits and fissures offer a much more favorable surface contour for sealant retention compared with broad, shallow fossae. The deeper fissures protect the resin sealant from the shear forces occurring as a result of masticatory movements. Of parallel importance is the possibility of caries development increasing as the fissure depth and slope of the inclined planes increases. **Thus, as the potential for caries increases, so does the potential for sealant retention**).

3) **be clean**

4) **be absolutely dry** at the time of sealant placement and uncontaminated with saliva residue.

Programs of public dental care

Programs of public dental care include:

1. School dental health programs
2. Pregnant women
3. Elderly people
4. Individual require special care
5. Mobile dental clinic

1. School dental health programs

Poor oral health can have a detrimental effect on children's quality of life, their performance at school and their success in later life. School health services contribute to goals of both the education system and the health care system. Coordinated school health programs offer the opportunity to provide the services and knowledge necessary to enable children to be productive learners and to develop the skills to make health decisions for the rest of their lives.

The Four Components of the School Oral Health Program :

1. Education

All children receive oral health education. Practical information to promote healthy behaviors is provided.

2. Fluoride

Weekly fluoride mouth rinse is given to children with parental permission. The mouth rinse is swished for one minute and spit out. It strengthens and protects teeth that are already present in the mouth.

3. Dental Screenings

Dental screenings are conducted by each funded School Oral Health Program at least once during each five years grant cycle. Dental screenings help to identify children who need dental care.

4.Dental Sealants

Dental sealants are thin plastic coatings that are painted into the deep grooves of back teeth. They help to prevent dental decay by sealing grooves that are most likely to decay. School sealant programs are usually conducted by dental hygienists.

program would include:

1. A school water fluoridation project.
2. A carbohydrate control program.
3. Supervised classroom tooth brushing.
4. A dental examination program.
5. A topical fluoride application program.

In schools where the water supply contains adequate amounts of fluoride, the ideal preventive dental program would include:

1. A carbohydrate control program.
2. Supervised classroom tooth brushing.
3. A dental examination program.

1. Pregnant women

Pregnancy is a unique period during a woman's life and is characterized by complex physiological changes, which may adversely affect oral health. Preventive, diagnostic, and restorative dental treatment is safe throughout pregnancy and is effective in improving and maintaining oral health. In addition to providing pregnant women with oral health care, educating them about preventing and treating dental caries is critical, both for women's own oral health and for the future oral health of their children. Evidence suggests that most infants and young children acquire caries-causing bacteria from their mothers. Providing pregnant women with counseling to promote healthy oral health behaviors may reduce the transmission of such bacteria from mothers to infants and young children, so that delaying or preventing the onset of caries. For these reasons, it is essential for health professionals to provide pregnant women with appropriate and timely oral health care, which includes oral health education.

2. Elderly people

Older peoples' mouths are prone to oral disease and those with natural teeth are more likely to have advanced gum disease (gingivitis or periodontitis). Oral health care for older people is often further complicated by a past dental history including crown and bridge work, partial dentures and implants.

Chronic oral infection can complicate the medical management of general illnesses such as diabetes, chronic heart failure and respiratory diseases.

- Poor oral health results in bad breath and affects people's ability to speak, socialize and feel happy with their appearance.
- Medications taken by older people often cause dry mouth (xerostomia) which affects speaking, eating and also increases the levels of oral bacteria and infection.
- Older people may have a range of health problems or disabilities that affect on their ability to care for their own oral health and may need assistance during their hospital stay as well as follow up care on discharge.

The best ways to maintain a healthy mouth for older people:

1. Brush morning and night.
2. Use fluoride toothpaste on teeth.
3. Use a soft tooth brush on gums, tongue and teeth.
4. Use antibacterial product after lunch (Chlorhexidine product).
5. Keep the mouth moist.
6. Cut down on sugar.

3. Individual require special care

Special Care Dentistry (SCD):

The definition of Special Care Dentistry (SCD) could be as a branch of dentistry that provides oral care services for people with special health care needs (SHCN). It is used in reference to care for individuals with disabilities or those with systemic diseases.

Special Health Care Needs (SHCN)

Special Health Care Needs (SHCN) is defined as any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and / or use of specialized services or programs.

Health care for individuals with special needs required specialized knowledge acquired by additional training, as well as increased awareness and attention, adaptation, and accommodative measures beyond what are considered routine.

Patients with special health care needs including those with:

- Compromised immunity (Leukemia or other malignancies, human immunodeficiency virus)
- Medically compromised patients
- Cardiac conditions associated with endocarditis
- Mental disability
- Developmental disability
- Physical disability
- Amelogenesis imperfecta
- Dentogenesis imperfecta
- Cleft lip / palate
- Oral cancer

5. Mobile Dental Clinic

A Mobile Dental Clinic is a vehicle designed to enable a team of dentists and dentistry providers, to deliver dental care to local communities, allowing your organization to operate beyond the limitations of a fixed facility. A Mobile Dental Clinic may include a variety of equipment and supplies, depending on the client's needs.

Mobile Dental Clinics provide the flexibility to work at various times and locations, connect with outlying and rural communities.

Preventive strategies

- Education of parents to ensure appropriate and regular supervision of daily oral hygiene
- Demonstrating oral hygiene techniques
- Stressing the need to use a fluoridated dentifrice twice daily and to brush and floss daily.
- Use electric or modified tooth brush
- Dietary counseling
- Sealant application
- Use of topical fluoride
- Use of chlorhexidine mouth rinse

Dental public health

- Community :a group of people living in the same place or having a particular characteristic in common.
- WHO defines health as ‘a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity’
- public health defined as ‘The art and science of preventing disease, prolonging life and promoting physical and mental efficiency, through organized community efforts.
- Dental public health is the science and art of preventing and controlling dental diseases and promoting dental health through organized community efforts.

Aims Of Dental Public Health

- To develop, support and promote programs aimed at the prevention of oral diseases and the improvement of general and oral health.
- To provide expertise and advice on (oral) health promotion programs, suitable for various situations.
- To develop collaboration with Member Associations, non-governmental, governmental and voluntary organizations involved in the promotion of general and oral health. To promote the delivery of best possible oral health care.
- To provide a world forum to exchange knowledge and experience in all aspects of oral health and oral health care.
- To provide a comprehensive information and communication system for making relevant information available to members, the media and governments.

Tools of Dental Public Health

1. Epidemiology
2. Biostatistics
3. Social sciences
4. Principles of administration
5. Preventive dentistry

1. Epidemiology : defined as ‘the study of the distribution and determinants of health related states or events in specified populations and the application of this study to control health.

- *Uses*

1. Causation of disease.
2. Used to describe the health status of the population group .
3. Helps in evaluating effectiveness and efficiency of health services [intervention] .

2. Biostatistics : It is the method of collection, organizing, analyzing, tabulating and interpretation of data related to living organisms and human beings.

- *Uses*

1. To test whether the difference between two populations, regarding a particular attribute is real or a chance occurrence.
2. To study the association between two or more attribute in the same population.
3. To evaluate the efficacy of vaccines by controlled studies.
4. To evaluate the progress of public health programs.
5. To define and measure the extent of morbidity and mortality in the community.

3. Social Science It includes sociology, cultural anthropology and psychology. Sociology is the study of human groups.

4. Principles of administration : Administration is defined as “the art and science of guidance, leadership, and control of the efforts of a group of individuals towards some common goal”.

5. Preventive dentistry :

Prevention is defined as “actions aimed at eradicating, eliminating or minimizing the impact of diseases and disability. The concept of prevention is best defined in the context of levels, traditionally called, primary, secondary and tertiary prevention”.

Stages of Clinical and Public Health Practice

1. Examination/survey

A clinical dentist carries out a thorough and careful examination on the 1st visit of the patient which includes a history and clinical assessment. This helps in future treatment planning for patient. Survey is 1st step in public health practice. It means clinical assessment of the extent and severity of disease in a population. Here the public health dentist examines the population to assess the oral health problem unlike a single patient by clinical dentist.

2. Diagnosis/analysis : A clinical dentist makes a diagnosis of the problem based on the examination. In public health the information collected by survey is analyzed. The analysis of data is done to make the obtained data more meaningful. Statistician and computers aid in compilation of data.

3. Treatment planning/program planning : Treatment planning includes both dentist and patient participation. Dentist's professional judgment of treatment, patient interest in treatment and cost factor etc. are involved. The patient may accept the treatment in full or partially or may reject it completely. In program planning similarly the people may accept the ideal program with enthusiasm or may reject it or accept only a part of it. The decision reflects the community's relative value solving the particular health problem.

4. Informed consent/ethics and planning approval : Informed consent of the patient is taken before starting any treatment. Patient is explained all aspect of treatment planned. Similarly all ethical clearance and approval from all the concerned persons and authorities is taken before implementing a public health program.

5. Treatment/program operation : After taking consent the treatment schedule is arranged. Complex treatment may require services of various specialists for different procedures, which is coordinated by the primary dentist.

6. Payment/finance : Payment for treatment in a clinical setup is informed to the patient and mode of payment acceptable to both the dentist and patient is arranged. Funds for community public health program are arranged by local, state or federal grants. The public health professional is expected to know how to secure and manage the funds. Local or voluntary organization may also contribute towards the program.

7. Evaluation/program appraisal : Patient is evaluated by the dentist regularly during the course of treatment. Recording of initial condition helps to compare with later observations. Similarly data collected in initial surveys serves as a baseline against which effectiveness of an oral health program can be evaluated or assessed. Public health team is accountable to the community for a periodic appraisal of their program.

Functions of Public Health Dentistry

The services provided to the community by public health dentist include:

1. Preventive Services

- a. Application of topical fluorides
- b. Pit and fissure sealants application

- c. Promotion of water fluoridation
- d. Defluoridation

2. Public Health Training

- a. School teacher training program.
- b. Training of the health care worker about dental health and oral hygiene measures.

3. School Dental Health Program

- a. Topical fluoride application.
- b. School mouth rinsing program.
- c. Teaching of oral hygiene methods and importance of dental health to children.
- d. Education about safe play areas for children to school authorities.
- e. Knowledge about junk foods and effects of cold drinks to children.

4. Dental Public Health Program

- a. Examination and treatment of community through dental health program.
- b. Screening program for oral cancer.
- c. Dental health check up and treatment like extraction, filling, oral prophylaxis of industrial workers through camps.

5. Dental Health Education

- a. Education about dental health and its importance to community, industrial workers and social organizations.
- b. Imparting knowledge about oral health to expectant mothers.
- c. Knowledge about injury to teeth and importance of mouth guards.
- d. Education to geriatric population about oral health.
- e. Informing people about ill effects of tobacco and smoking.
- f. Educating public about methods of prevention of dental diseases like dental caries, periodontal disease and oral cancer.
- g. educating care takers about maintenance of oral health in special needs patients.
- h. parent counseling for preschool and school children.

6. Program Administration and Promotion

- a. Helping the State / Central agency in conducting epidemiological studies regarding oral diseases.
- b. Conducting surveys to determine dental needs of the population.
- c. Providing dental health knowledge to state agencies or education department.

primary health care and dental public care

Primary health care [PHC]: is essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self -reliance and self -determination.

Components Of Primary Health Care

1. Education is about prevailing health problems and the methods of preventing and controlling them.
2. Promotion of food supply and proper nutrition.
3. Adequate supply of safe water and basic sanitation.
4. Maternal and child health care, including family planning.
5. Immunization against the major infectious diseases.
6. Appropriate treatment of common diseases and injuries.
7. Provision of essential drugs.
8. Prevention and control of locally endemic diseases.

Principles of primary health care:

1-Equitable distribution:

Health services must be shared equally by all people irrespective of their ability to pay and all must have access to health services.

2-Community participation :

Involvement of the community in the planning, implementation and maintenance of health services, besides maximum reliance on local resources such as manpower ,money and materials.

3-Focus on preventive and health promotion The focus of health planners must shift from medical/dental care to prevention and health promotion.

4- Multi-sectoral co-ordination: P.H.C. involves in addition to the health sector ,all related sectors of the community e.g. agriculture ,food industry ,education, housing and other sectors. Oral health can be better integrated into general health programs by including oral health in general health education. For example, smoking effects heart disease, respiratory disease and oral disease.

5- Appropriate technology:

This refers to the technology that is scientifically sound, adaptable to the local needs and acceptable to those who apply it and those for whom it is used.

It refers to avoid using of costly equipment, procedures, techniques when cheaper scientifically valid and acceptable ones are available.

Atraumatic restorative treatment technique offers treatment for caries at low cost where electricity is not available.

Primary dental health care: Dental health may be defined as a state of complete normality and functional efficiency of the teeth and supporting structures and also of the surrounding parts of the oral cavity and of the various structures related to mastication and the maxillofacial complex. Community dental health services: Are those dental health services which have an educative, preventive or curative nature which organized by governments.

P.D.H.C. can be considered under four steps these are:

1-Socially: The community itself must take the principle role in D.H.C. activities . It is the responsibility of dental profession to teach the people that they should not regard dentistry as simply the provision of services to relieve pain and restore function and appearance but they must be motivated to use preventive measures from birth to old age to keep their teeth in a healthy mouth.

Each community must primarily be educated about:

- The benefits of fluoride in reducing dental caries.
- Various oral hygiene measures for removal of dental plaque.
- Correct food habits for children (restriction of eating sweet not more than three times a day and not between snacks).
- Harmful effects of habits such as smoking.
- Early recognition of precancerous and cancerous lesions

-The importance of regular visits to the dentist for routine examination.

2-Technically : Oral health teams must enable both dentist and auxiliaries to guide their community population towards a desired level of oral and general health .

3-Economically: Those responsible for dental health care services must develop systems which utilize the resources available to provide a level of dental health care for everyone . A sound dental health program must be equally spread over the entire population.

4-Politically: Primary dental health care cannot be developed without the full support of national resources . So to become a practical proposition every country must show the political will to examine its health priorities in relation to the social needs of its total population.

Dental Public care: It is that specialized branch of dentistry which deals with delivery of comprehensive dental & oral health care to the masses so as to improve the total dental & oral health of the community as a whole.

Dental care : is the maintenance of healthy teeth and may refer to oral hygiene, the practice of keeping the mouth and teeth clean in order to prevent dental disorders.

- **The steps for personnel dental care :**

1. Floss at least once per day. ...
2. Brush your teeth twice a day with a soft-bristled toothbrush. ...
3. Use fluoride toothpaste. ...
4. Replace your toothbrush every 3 to 4 months or sooner if needed. ...
5. Eat a healthy diet. ...
6. Avoid sweets and sweetened drinks. ...
7. Do not smoke. ...
8. Keep dentures, retainers, and other appliances clean.

• **Similarities between personal and community health care:**

1. **Examination/survey:** purpose of survey is to determine the nature and extent of the problem, just as an examination is done when a patient comes to a dental clinic with a complaint.
2. **Diagnosis/Analysis:** It is the procedure of converting data of survey by meaningful figures or statistics just as a dental clinician uses his examination data to guide him to an accurate diagnosis.
3. **Treatment Planning/program planning:** Once diagnosis is made one can proceed to make plans for effective treatment. Public health professional would like to have the ideal program plan
4. **Treatment/program operation:** Execution of the treatment or program once the plan has been made.
5. **Payment/ program funding:** The patient payment of the dental service can be in the form of cash payment or monthly billing and in community health care the government usually is responsible for funding.
6. **Evaluation/ program appraisal:** is assessing the effectiveness of the treatment or the health program.

• **Differences between private dental health & public health dentistry**

Differences between personal dental health & public health dentistry		
Characteristic	Personal dental health	Dental public health
1.Target 2.Visiting 3. Major emphasis 4. Service provider 5. Supportive disciplines 6. Perspective results 7. Funding	1. Individual patient 2. The patient comes to the practitioner 3.Restorative care 4. Dentist alone, sometimes with an assistant 5. Psychology 6. Immediate 7. By the patient	1. Community or group of individuals 2. The public health practitioner goes to the group of individuals 3. Preventive care 4. Health team professionals 5. Sociology, psychology, education, epidemiology and biostatistics 6. Long term 7. By government or local authorities

Levels of prevention

There are four levels of preventive care—primordial, primary, secondary, and tertiary care.

Primordial prevention :

It is the prevention of emergence or development of risk factors (beginning with change in social and environmental conditions) in countries or population group in which they have not yet appeared. Individual and mass education is main intervention method in primordial prevention.

Primary Prevention (Pre-pathogenesis) :

It is defined as ‘action taken prior to the onset of the disease, which removes the possibility that a disease will even occur’. It is carried out on healthy populations. Primary preventive services are those that prevent the initiation of disease .It may be accomplished by measures designed to promote general health and well-being or by specific protective measures:

- 1)Health education
- 2) Environment modification such as safe water, control of insects
- 3) Nutritional interventions: improvement of nutrition in vulnerable group.
- 4) Lifestyle and behavioral changes; which favor health
- 5)Specific protection: include immunization, use of specific nutrition, avoidance of allergens, protection from carcinogens, the use of fluoridated toothpaste and application of pit and fissure sealants.

Secondary prevention (Pathogenesis: Initial Stage of Pathogenesis):

It can be defined as ‘actions which halts the progress of a disease at its incipient stage and prevents complications’. The focus of secondary prevention is early disease detection, making it possible to prevent the worsening of the disease and the emergence of symptoms, or to minimize complications and limit disabilities before the disease becomes severe. Secondary prevention (‘caution’) suggests that the disease has started but can be reversed, and good health can still be achieved through intervening early, when the disease is just starting, and returning the subject to good health. For example when incipient enamel lesions(white spot enamel lesions) can be arrested and reversed using appropriate ‘preventive’ measures and are reversed before cavities form, other example gingivitis can be reversed before periodontitis sets in, it was well established that frequent oral hygiene reinforcement by dental professionals can prevent caries, gingivitis, and periodontal disease.

Tertiary Prevention (Pathogenesis: Late Stage of Pathogenesis) :

Actions taken when the disease process has advanced beyond its early stages i.e. intervention in late pathogenesis phase. It can be defined as 'all measures available to reduce or limit impairments and disabilities, minimizing suffering caused by existing departures from good health and to promote the patients adjustment to irremediable conditions'. The goal of tertiary prevention is to reduce the negative impact of an already-established disease by restoring function and reducing disease-related complications (prevent further complications or death).Tertiary prevention also aims to improve the quality of life for people with disease.

Biostatistics and dental science

Statistics : it's a method of describing , summarizing or displaying a set of data .

Biostatistics : is the branch of statistics responsible for the proper interpretation of scientific data generated in clinical medicine , biology , public health and other health science (the biomedical science) . In the other word , it is the application of statistics in medicine .

Uses of statistics in dentistry :

1. To assess the state of the oral health (define and quantify the disease) in the community and to determine the availability and utilization of dental care facilities .
2. To indicate the basic factors and causation of oral diseases by diagnosing the community and solution to such problems.
3. To plan oral health measures .
4. To determine success or failure of specific oral health care program or measures .
5. For comparison and researches .

Data :_Is any information can be collected like : age , gender , height and weight .

Data collection methods : Is a process of collecting information from all the relevant sources to find answers to the research problem , test the hypothesis and evaluate the outcome .

Variables : It is a characteristic that describes a person , place , thing or phenomena that helps to measure changes of disease process which can take different values .

Types of data :

Quantitative data : quantitative or numerical data is information about quantities ; that is , information which can be measured and written down with a number . e.g : height , number of people in the household .

Qualitative data : is information about qualities : information that can actually be measured . Qualitative data is a categorical measurement expressed not in terms of numbers , but rather by mean of categories . e.g: gender , race , color of eyes) .Qualitative data are classified as :

Nominal: Data is in the form of names, labels, or categories. The data cannot be ranked or grouped in any order at all. Examples: Gender, Race, Type of teeth etc.

Ordinal: There can be some sort of ordering but the differences are meaningless, e.g.: Large – Medium – Small; Good – Bad, Malnourished; Normal – Overweight – Obese, or Decayed – Missing – Filled.

Methods of data collection :

- 1. Oral health examination :** when information is needed on the oral disease , this method provides more valid information than health interview . It is indicated by dentists , technicians and investigator .
- 2. Interviews (face to face) :** In this method, the interviewer asks questions either face-to-face or through telephone to the respondents. In face-to-face interviews, the interviewer asks a series of questions to the interviewee in person and notes down responses. In case it is not feasible to meet the person, the interviewer can go for a telephonic interview. This form of data collection is suitable when there are only a few respondents. It is too time-consuming and tedious to repeat the same process if there are many participants.
- 3. Questionnaire :** A questionnaire is a printed set of questions, either open-ended or closed-ended. The respondents are required to answer based on their knowledge and experience with the issue concerned. The questionnaire is a part of the survey, whereas the questionnaire's end-goal may or may not be a survey.

Sampling methods :

1. Simple random sampling

The simple random sample means that every case of the population has an equal probability of inclusion in sample

2. Systematic sampling

Systematic sampling is where every n th case after a random start is selected. For example, if surveying a sample of consumers, every fifth consumer may be selected from your sample. The advantage of this sampling technique is its simplicity.

3. Stratified random sampling

Stratified sampling is where the population is divided into strata (or subgroups) and a random sample is taken from each subgroup. A subgroup is a natural set of items. Subgroups might be based on company size, gender or occupation (to name but a few). Stratified sampling is often used where there is a great deal of variation within a population. Its purpose is to ensure that every stratum is adequately represented

4. Cluster sampling

Cluster sampling is where the whole population is divided into clusters or groups. Subsequently, a random sample is taken from these clusters, all of which are used in the final sample. Cluster sampling is advantageous for those researchers whose subjects are fragmented over large geographical areas as it saves time and money. The stages to cluster sampling can be summarized as follows:

- Choose cluster grouping for sampling frame, such as type of company or
- geographical region
- Number each of the clusters
- Select sample using random sampling
- Multi-stage sampling

5. Multi-stage sampling

Multi-stage sampling is a process of moving from a broad to a narrow sample, using a step by step process . The main purpose of multi-stage sampling is to select samples which are concentrated in a few geographical regions. Once again, this saves time and money.

Data presentation :

The collection of numerical information often leads to large masses of data which , if they are to be understood , or presented effectively , must be summarized and analyzed in some way . This is the purpose of the subject of statistics .

Various methods are seen in presentation of data but the most common are the tubular and graphical methods .

1. **The tabulation of data :** the presentation of the data in the form of table is called tabulation .

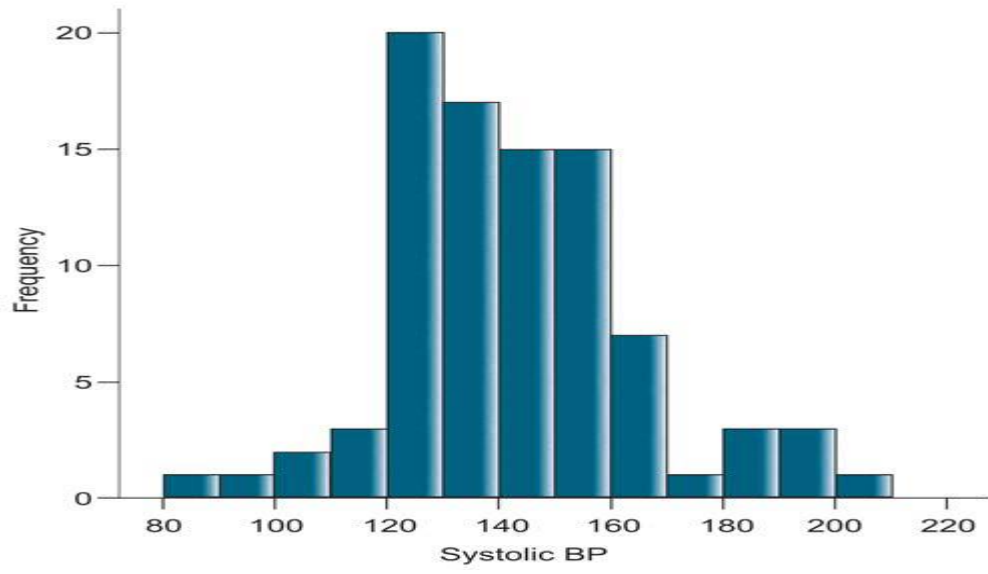
Frequency Tables : is a table which shows the data arranged into different classes (or categories) and the number of cases (or frequency) which fall into each class .

Gender distribution of survey population

Gender	Number	%
Females	44	58.6
Males	31	41.4
total	75	100

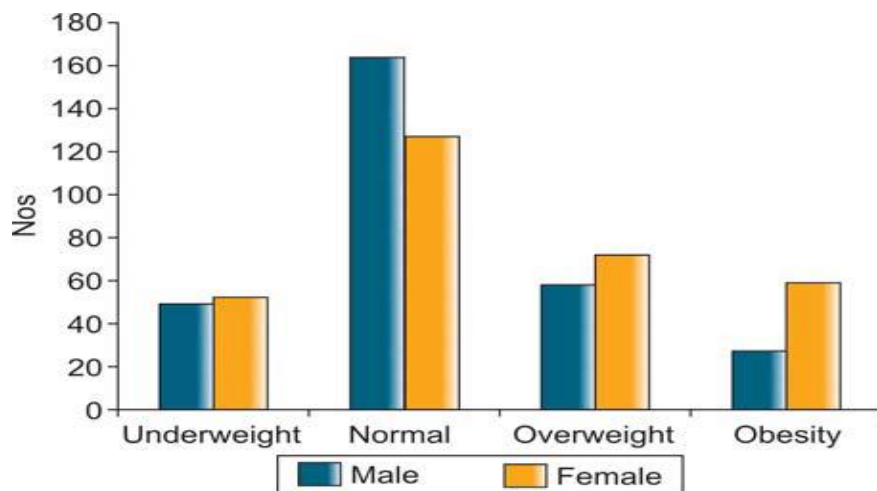
2. **The graphical presentation of the data :** Data can easily be summarized and displayed by a variety of diagrams. The choice of diagram is based on the type of data.

(a) Histogram : A graph for interval or ratio data collapsed into rectangular class which displays the data by using vertical bars of various heights to represent frequencies in each class . This type of graph is used with quantitative data . No gap between the bar , the classes with greater frequencies have taller bar .



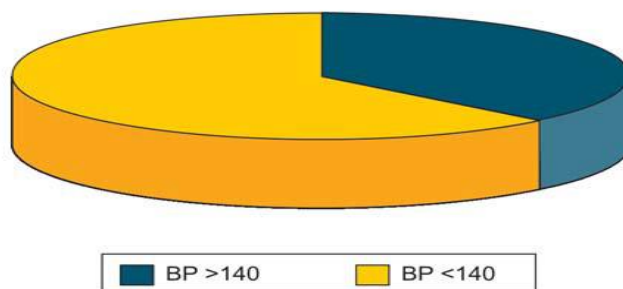
Histogram of systolic blood pressure

(b) Bar graph : A bar chart is similar to a histogram in appearance. However it is used for nominal and ordinal data. Unlike a histogram there are gaps between the bars. The Y axis usually shows the counts or percentage of the total for each group. Two or more variables can be depicted in a multiple bar diagram.



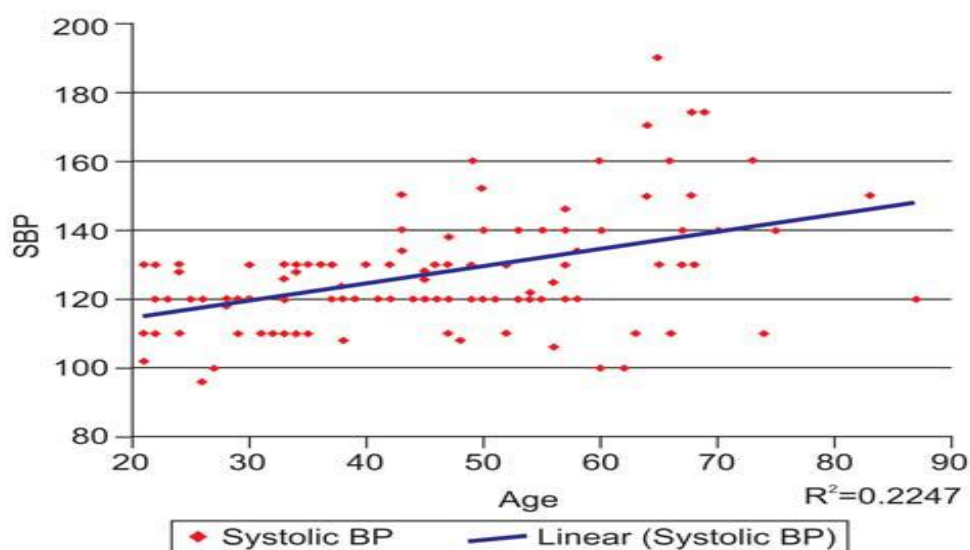
Multiple Bar chart of BMI and Sex in a village

(c) Pie Diagram : Pie charts are used to show the contribution of each item to the whole in which graphical description of data as slices of a pie and the total represents the complete pie . The values are commonly given as a percent or a proportion . It is used for qualitative type of data .



(d)Line Graphs : The frequency is placed along the vertical axis and the class midpoints are placed along the horizontal axis. These points are connected with lines.

(e)Scatter-plots diagram : The scatterplot visualizes a relation (correlation) between two variables X and Y (e.g., weight and height).If the dots cluster round a straight line , it shows evidence of a relationship of a linear nature . If there is no such cluster , it is probable that there is no relationship between the variables .



Scatter plot of systolic blood pressure by age

(f)Statistical maps or dot map: It is used when statistical data refers to graphic or regional distribution of a variables . The areas are shaded with different color and used to present data of varying size .

(g)Pictogram : Popular method of presenting data to those who cannot understand conventional charts . Small pictures or symbols are used to present the data .

Dental caries

Dental caries : It is defined as progressive, irreversible microbial disease of multifactorial nature affecting the calcified tissue of the teeth, characterized by demineralization of the inorganic portion and destruction of the organic portion the tooth.

The Caries Process (Pathogenesis) :

Bacterial Plaque and Acid Production

Plaque on the surface of the tooth consists of a bacterial film that produces acids as a byproduct of its metabolism. To be specific, certain bacteria within the plaque are acidogenic—that is, they produce acids when they metabolize fermentable carbohydrates. These acids can dissolve the calcium phosphate mineral of the tooth enamel or dentine in a process known as demineralization. If this process is not halted or reversed via remineralization (the re deposition of mineral via saliva) it eventually becomes a frank cavity.

Dental caries of the enamel typically is first observed clinically as a so-called “white-spot lesion”. The surface layer forms by remineralization. The process of demineralization continues each time there is carbohydrate taken into the mouth that is metabolized by the bacteria. The saliva has numerous roles, including buffering (neutralizing) the acid and remineralization by providing minerals that can replace those dissolved from the tooth during demineralization.

The critical pH value for demineralization varies among individuals, but it is in the approximate range of 5.2 to 5.5. Conversely, tooth remineralization can occur if the pH of the environment adjacent to the tooth is high due to:

(1) lack of substrate for bacterial metabolism; (2) low percentage of cariogenic bacteria in the plaque; (3) elevated secretion rate of saliva; (4) strong buffering capacity of saliva; (5) presence of inorganic ions in saliva; (6) fluoride; and (7) rapid food clearance times. Whether dental caries progresses, stops, or reverses is dependent on a balance between demineralization and remineralization.

Theories of Dental Caries :

1. The Legend of the Worm

Ancient Sumerian text known as ‘The legend of the worm’ gives reference of the tooth decay and tooth pain. It was obtained from the Mesopotamian areas which date back to about 5000 BC. According to the legend, toothache was caused by a worm that drank the blood of teeth and fed on the root of the jaws.

2. Endogenous Theories

- **Humoral Theory** :The ancient Greek believed that a person’s physical and mental constitution was determined by four elemental humors of the body: blood, phlegm, black bile and yellow bile. An imbalance in these humors is the cause of all diseases including dental caries.
- **Vital Theory** : [Proposed during 18th Century] According to this theory, the tooth decay originated like bone gangrene, from within the tooth itself.

3. Exogenous Theories

- **Chemical Theory :** Parmlly (1819) proposed that an unidentified “chemical agent” was responsible for caries. According to this theory, teeth are destroyed by the acids formed in the oral cavity by the putrefaction of protein which produced ammonia and was subsequently oxidized to nitric acid. Robertson (1895) proposed that dental decay was caused by acids formed by fermentation of food particles around teeth.
- **Chemoparasitic Theory (Miller) :** It is a blend of chemical and parasitic theory, because it states that caries is caused by acids produced by microorganisms of the mouth. According to this theory, microorganisms of the mouth, by secretion of enzymes or by their own metabolism, degrade fermentable carbohydrate food materials to form acids which demineralize the enamel and the disintegrated enamel is subsequently mechanically removed by force of mastication. Miller summarized his theory as follows.- Dental decay is a chemoparasitic process consisting of two stages- decalcification or softening of the tissue and dissolution of the softened residue.
- **Proteolytic Theory (Gottlieb- 1947) :** According to this theory, microorganisms invade the organic pathways (lamellae) of the enamel and initiate caries by proteolytic action. Subsequently, the inorganic salts are dissolved by acidogenic bacteria. According to this theory, dental caries results from an initial bacterial and enzymatic proteolytic action on the organic matter of enamel without preliminary demineralization. This causes the release of a variety of complexing agents, such as amino acids, polyphosphates and organic acids which then dissolves the crystalline apatite.

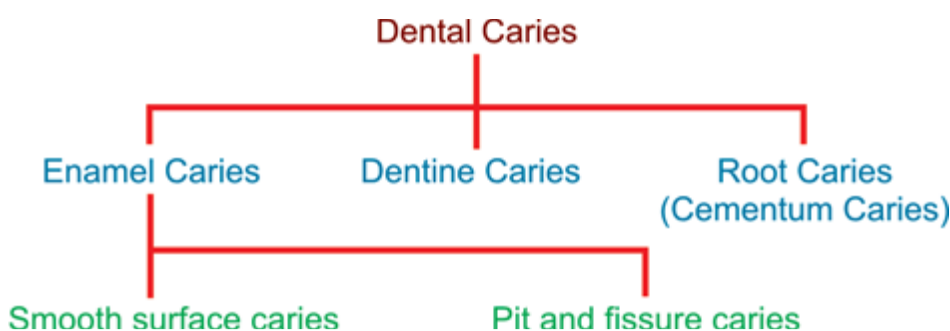
Areas Prone to Dental Caries :

Bacterial plaque is the essential precursor of caries. Hence, sites on the tooth surface which encourage plaque retention and stagnation are particularly prone to progression of lesions.

These sites are:

- Enamel in pits and fissures on occlusal surfaces of molars and premolars, buccal pits of molars, and palatal pits of maxillary incisors .
- Tooth surfaces adjacent to dentures and bridges which make cleaning more difficult, thus encouraging plaque stagnation .
- Approximal enamel smooth surfaces just cervical to the contact point .
- In patients where periodontal disease has resulted in gingival recession, caries occur on the exposed root surface .
- The enamel of the cervical margin of the tooth just coronal to the gingival margin .
- The margins of restorations, particularly those that are deficient or overhanging.

Classification Of Dental Caries :



1. Enamel caries :

a. Smooth surface caries :

Incipient caries is the appearance of smooth chalky white area. The overlying enamel surface is smooth, hard and shiny. Early lesion in enamel caries is conical in shape with its apex towards the dentine and base toward the surface of the tooth. Four zones are present with differing translucency. The early enamel lesion consists of four zones of alternating levels of mineralization. It illustrates the dynamic nature of the caries process. The surface zone blocks the passage of calcium ions into the body of the lesion and may have to be removed to allow the lesion to become arrested. Four zones are clearly distinguishable starting from the inner advancing front of the lesion:

1. Translucent zone
2. Dark zone
3. Body of lesion
4. Surface zone

b. Pit and Fissure Caries

Cariou lesion starts at both sides of the fissure, not at the base. The enamel is thin in fissures so there is early dentine involvement. The carious lesion forms a triangular or cone-shaped lesion with its apex at the outer surface and base towards the dentinoenamel junction (DEJ).

- Lesion begins beneath plaque, with decalcification of enamel.
- Pit and fissures are often deep, with food stagnation,
- Enamel in the bottom of pit or fissure is very thin, so early dentine involvement frequently occurs.
- Here the caries follows the direction of the enamel rods. In pit and fissure the enamel rods are said to flare laterally at the bottom of the pit and caries is said to follow the path of enamel rods hence a characteristic angular/inverted 'V' shaped lesion is formed.
- When reaches DEJ, greater number of dentinal tubules are involved.
- It produces greater cavitation than the smooth surface caries and there is more undermining of enamel.

2. Caries of The Dentin :

The caries process in dentine involves the demineralization of the mineral component and breakdown of the organic component of collagen fibers. The caries process in dentine is approximately twice as rapid as in enamel. Spread of caries is more in dentine compared to enamel because of:

1. Decreased calcification (mineralization).
2. Existence of pathways (dentinal tubules).

Advanced carious lesions in dentine consist of two distinct layers having different microscopic and chemical structures. The outer layer is heavily infected by bacteria which are mainly located in the tubule spaces. The collagen fibers are denatured and the organic matrix is not being remineralized. The inner layer is scarcely infected, but affected by plaque acid. It still contains high concentrations of mineral salts and can be remineralized. The initial dentinal changes are known as dentinal sclerosis or transparent dentine. The dentinal sclerosis is due to calcification of dentinal tubules. The change is minimal in progressing caries and more in slow caries. In transmitted light the dentine appear transparent. In reflected light sclerotic dentine appear dark. In advanced lesions tiny liquefaction foci are

formed. In secondary dentine the dentinal tubules are fewer and irregular. Caries spread laterally at the junction of primary and secondary dentine separating both. Various zones are distinguished assuming the shape of triangle with the apex toward the pulp and the base toward the enamel.

3. Root Caries :

Root caries can be defined as a lesion which is initiated or extends onto the part of the tooth apical to the cemento-enamel junction. The term “primary” as it is used with root caries refers to new dental caries occurring in the absence of a restoration. Secondary (recurrent) root caries refers to caries occurring adjacent to an existing restoration. There is general agreement on this terminology. Root caries most often occurs supragingivally, at or close to (within 2 mm) the cemento-enamel junction. This phenomenon has been attributed to the location of the gingival margin at the time conditions were favorable for caries to occur. The location of root caries has been positively associated with age and gingival recession. This is consistent with the concept that root caries occurs in a location adjacent to the crest of the gingiva where dental plaque accumulates. Root caries occurs predominantly on the proximal (mesial and distal) surfaces, followed by the facial surface. Early root caries tends to be diffused (spread out) and track along the cemento-enamel junction or the root surface. More advanced root lesions enlarge toward the pulp.

• Various Clinical Classification Systems for Caries :

i. According to location

- (a) Pit and fissure
- (b) Smooth surface
- (c) Root surface

ii. According to clinical appearance

- (a) Incipient
- (b) Cavitation
- (c) Gross destruction

iii. According to rate of disease progression

- (a) Acute
- (b) Chronic
- (c) Arrested
- (d) Rampant

iv. According to history

- (a) Primary
- (b) Secondary or recurrent

Factors Affecting Development Of Dental Caries :

I. Host And Teeth Factor

A. Tooth

I. Composition: Number of studies on the relation of caries to the chemical composition have shown that there was no difference found in the calcium, phosphorus, magnesium and carbonate content of enamel from sound and carious teeth. But there was a significant difference in fluoride content of teeth. It was also noted that surface enamel is more resistant to caries than subsurface enamel. Surface enamel is more highly mineralized and tends to

accumulate greater quantities of fluoride, zinc, lead and iron than the underlying enamel. The surface is lower in carbon dioxide, dissolves at a slower rate in acids and has more organic material than subsurface enamel. These factors contribute to caries resistance.

II. Morphology: Morphologic features which may pre dispose to the development of caries are the presence of deep, narrow occlusal fissure or buccal or lingual pits. These fissure trap food, bacteria and debris leading to development of caries.

III. Position: Malaligned, out of position, rotated teeth are difficult to clean, favoring the accumulation of food and debris. This may predispose to the development of caries.

B. Saliva

It can be considered as an environmental factor also as teeth are constantly bathed by it. This influences the process of dental caries. Saliva has a flushing action on teeth.

i. Composition: varies from person to person. Saliva is dilute fluid; over 99 percent being made up of water. Proteins (enzymes, immunoglobins and other antibacterial factors, mucous glycoproteins and certain polypeptides) . In Organic Constituents: Major Ions [Sodium, Potassium, and Chloride and Bicarbonate] contribute to osmolarity of saliva. Bicarbonates: Principal buffer in saliva. Thiocyanate: Has antibacterial action. Fluoride: Has anticaries action.

i. Saliva: It has a critical role to play in the development of caries or its prevention. Saliva provides calcium, phosphate, proteins, lipids and antibacterial substances and buffers. Saliva buffering can reverse the low pH in plaque.

ii. Buffering and neutralization: pH of saliva depends on the bicarbonate concentration. Saliva is alkaline and is an effective buffer system. These properties protect the oral tissues against acids and plaque. After eating a sugary food if saliva is stimulated by chewing substances such as wax or sugar free chewing gum, the drop in pH in plaque which would have occurred is reduced or even eliminated. This salivary neutralization and buffering effect markedly reduces the cariogenic potential of foods.

iii. Quantity: Rate of flow of saliva may be an additional factor which helps contribute to caries susceptibility or caries resistance. Mild increase or decrease in flow may be of little significance, near total reduction in salivary flow adversely affects dental caries. There is an inverse relation between salivary flow and dental caries.

II. AGENT FACTORS

A. Microorganisms

The mouth has a diverse resident microbial flora. The normal inhabitants become established early in life. Acid producing bacteria(*Streptococcus mutans*, *Lactobacillus*) were found to be associated with the formation of dental caries. *Streptococcus mutans* is of interest because it has the ability to form an extracellular polymer of glucose, mutans from sucrose, which aids the microorganism in adhering to the enamel surface and in establishing a stable relationship there. *L. acidophilus* and other acidogenic microorganism in plaque and carious lesion may be capable of producing caries by themselves, or they may be able to act synergistically with *Streptococcus mutans* in caries initiation. *Actinomyces* are also among the earliest colonizers of dental surfaces and may constitute up to 27 % of the pioneer bacteria. They have been implicated in root caries, although their role in dental caries initiation and progression is not well understood.

B. Dental Plaque

Bacterial plaque is a dense non-mineralized, highly organized mass of bacterial colonies in a gel-like intermicrobial, enclosed matrix or slime layer. It is a transparent film that can be *supragingival*, coronal to the gingival margin on the clinical crown of the tooth and *subgingival*, apical to the margin of the gingiva.

III. Environmental Factors

A. Diet

According to acidogenic or chemoparasitic theory, dental caries occurs when acid is produced by bacteria in dental plaque when refined carbohydrates are eaten. The presence of refined carbohydrate as sugar is essential for the majority of caries development and sucrose is the most cariogenic of all sugars. In human consumption, sucrose accounts for 60 percent of all sugars eaten.

b. Oral Hygiene

Inverse relationship has been seen between oral hygiene and dental caries. Poor oral hygiene increases the rate of dental caries.

c. Fluoride

Fluoride in water and soil decreases incidence of dental caries.

Methods Of Prevention Of Dental Caries

1. Increase The Resistance Of The Teeth

A. Fluorides

Widespread use of multiple forms of fluoride is mainly responsible for the marked decrease in caries throughout the world.

- Systemic Use of Fluoride

1. Community water fluoridation
2. Milk and salt fluoridation
3. Fluoride supplementation in the form of tablets and lozenges
4. Consuming a fluoride-rich diet such as tea, fish, etc.

- Topical

1. Use of fluoridated toothpaste
2. Use of fluoride mouthwash
3. Use of fluoride varnishes (in-office application, longer duration of action, high fluoride content)
4. Professionally applied solution
5. Fluoride gels

B. Sealants : Pit and fissure sealants are adhesive resins which help to seal these pits and fissure and prevents dental caries.

C. Saliva Substitutes Containing Fluoride : A saliva substitute may be helpful and sometimes necessary in patients with practically no saliva production due to, e.g. radiation towards the head and neck region, medication, diseases in saliva glands or other reasons that may result in long-lasting oral dryness.

2. Combat Caries-Inducing Microorganisms

This includes combating the microbial plaque by physical and chemical methods.

A. Physical Methods (Removal of Plaque)

- a. Tooth brushing
- b. Use of dentifrices
- c. Prophylaxis by dentist
- e. Use of dental floss/tooth pick

B. Chemical Methods

- a. These include the use of fluoride-containing toothpaste.
- b. Mouth rinses — chlorhexidine 0.2 percent (0.12% in USA).
- c. Use of povidone–iodine mouthwash.

C. Caries Vaccine : The development of a vaccine against dental caries involves identification of appropriate antigens of mutans streptococci against which protective immune responses can be mounted, and the selection of a method of immunization that will generate sustained levels of salivary antibodies.

Epidemiology of malocclusion

Occlusion : Is defined as the anatomic alignment of teeth and their relationship to the rest of the masticatory system.

Normal occlusion : This refers to an occlusion that deviates in one or more ways from ideal yet it is well adapted to that particular environment, is esthetic and shows no pathologic manifestations or dysfunction. Also it is defined as normal occlusion as the occlusion which is within the standard deviation from the ideal.

Ideal occlusion : It is a preconceived theoretical concept of occlusal structural and functional relationships that includes idealized principles and characteristics that an occlusion should have. Also it is defined as ideal occlusion as „a hypothetical standard of occlusion based on morphology of the teeth.

The alignment and occlusion of the dentition are extremely important in masticatory function. The basic activities of chewing, swallowing, and speaking depend greatly not only on the position of teeth in the dental arches but also on the relationship of opposing teeth as they are brought into occlusion .

Malocclusion

The condition in which dental structure are not in acceptable equilibrium with each other or with the facial structures and/or the cranium, thus interfering with or posing a potential threat to the normal tissue development and maintenance, effective function or a psychological behavior problem.

Prevalence Of Malocclusion

- The aim of epidemiologic studies of malocclusion is to describe and analyze the prevalence and distribution of malocclusion in various populations, the ultimate goal being to identify etiologic factors.
- A further aim is to contribute to the solution of the public health problems concerning assessment of need for orthodontic treatment and organization of orthodontic services.
- At an early point, it was realized that due to the complexity of malocclusion, epidemiologic studies had to be based on some kind of

classification. Angle's classification is the only one among several typologic classifications which has gained wide ground in the epidemiology of malocclusion.

- Different surveys have reported data on the prevalence of different types of malocclusion. Most of the studies have been carried out in Europe and North America and a few in Asia. Most of these studies differ in their examination criteria, sampling techniques, age, sex, and availability of radiographs/study casts and examiner accuracy leading to difficulty in direct comparisons.

- **Classification Of Malocclusion**

malocclusions can be broadly divided into three types:

- Individual tooth malpositions.
- Malrelationship of the dental arches or dentoalveolar segments.
- Skeletal malrelationships.

These three can exist individually in a patient or in combination involving each other, depending upon where the fault lies in the individual dental arch or the dentoalveolar segments or the underlying skeletal structure.

Angle's classification of malocclusion :

Class I : most common (maxillary mesiobuccal cusp located in mesiobuccal development groove of the mandibular first molar) .

Class II : posterior positioning of the mandible to maxilla .

Class III : anterior positioning of the mandible to maxilla .

Etiological factor of malocclusion :

- **General Factors**

1. Heredity.
2. Congenital.
3. Environment:
 - a. Pre-natal (trauma, maternal diet, German measles, maternal metabolism, etc.).
 - b. Postnatal (birth injury, cerebral palsy, TMJ injury)
4. Pre-disposing metabolic climate and disease:
 - a. Endocrine imbalance.

- b. Metabolic disturbances.
- c. Infectious diseases.
- 5. Dietary problems (nutritional deficiency)
- 6. Abnormal pressure habits and functional aberrations:
 - a. Abnormal sucking.
 - b. Thumb and finger sucking.
 - c. Tongue thrust (the condition in which the tongue contact any teeth anterior to the molars during swallowing) and tongue sucking.
 - d. Lip and nail biting.
 - e. Abnormal swallowing habits (improper deglutition).
 - f. Speech defects.
 - g. Respiratory abnormalities (mouth breathing etc.).
 - h. Tonsils and adenoids.
 - i. Psychogenic tics and bruxism.
- 8. Trauma and accidents.

- **Local Factors**

- 1. Anomalies of number: Supernumerary teeth, Missing teeth (congenital absence or loss due to accidents, caries, etc.).
- 2. Anomalies of tooth size.
- 3. Anomalies of tooth shape.
- 4. Abnormal labial frenum: mucosal barriers.
- 5. Premature loss.
- 6. Prolonged retention.
- 7. Delayed eruption of permanent teeth.
- 8. Abnormal eruptive path.
- 9. Ankylosis.
- 10. Dental caries.
- 11. Improper dental restorations.

Untreated Malocclusions :

Untreated malocclusions can cause the following:

- Further derangement in the arrangement of teeth
- Lips, tongue, or cheeks that contact biting surfaces due to poor tooth alignment might cause frequent abrasions or cuts .
- Inefficient or uncomfortable biting, chewing, and digestion
- Speech impairments
- Crowded teeth are hard to clean, leading to cavities and gum disease
- Abnormal wear of tooth surfaces might lead to sensitivity or chipping
- Loosening, chipping or fracturing of a malaligned tooth that is overstrained
- Premature loss of teeth
- Injury to a protruding upper incisor
- Thinning of bone and receding gums associated with roots of very crowded or protruded teeth
- Accelerated gum disease and bone loss specially in crowded dentitions
- Temporomandibular joint (TMJ) dysfunction
- Adverse effects on facial development and appearance
- Psychological complexes
- Need for surgery.

Epidemiology of oral cancer

- Cancer is one of the major threats to public health in the developed world and increasingly in the developing world. In developed countries cancer is the second most common cause of death.
- Oropharyngeal cancer is more common in developing countries than developed countries.
- The prevalence of oral cancer is particularly high among men, the eighth most common cancer worldwide.
- Incidence rates for oral cancer vary in men from 1 to 10 cases per 1,00,000 population in many countries.
- Oral cancer term includes cancers of lip, tongue, buccal mucosa, floor of mouth and pharynx.
- Cancer of the oral cavity comprises approximately 30 percent of head and neck region tumors and 3 percent of all cancers in the United States.

Incidence

The disease is almost twice as common in men and the majority of malignancies [90–95%] are squamous cell carcinomas. The incidence increases with age. There is great variation, however, in sex incidence between various sites in the oral cavity.

Type

the majority of malignancies [90–95%] are squamous cell carcinomas. There is great variation, however, in sex incidence between various sites in the oral cavity.

Etiology of oral cancer

1. Established risk factors:

a. Smoking tobacco: It is addictive. Smoked tobacco contains thousands of chemical compounds. Many of these compounds are not only irritants and toxin, but they are also carcinogens.

Constituents Of Tobacco Smoke

Tobacco smoke is a complex mixture of several thousand chemical compounds

a. Nicotine

Nicotine is among the most toxic of all poisons and acts with great speed (**nitrosamines, which are potent carcinogens component**). It is the pharmacological agent in the tobacco smoke that causes addiction among smokers. The addictive effect of nicotine is linked to its capacity to trigger the release of dopamine—a chemical in the brain that is associated with the feelings of pleasure.

b. Tar

Tar is a sticky brown substance which can stain smokers' fingers and teeth yellow brown. It also stains the lung tissue. Benzopyrene as a carcinogen is a prominent polycyclic aromatic hydrocarbon found in tar.

c. Carbon Monoxide (CO)

Carbon monoxide is a colorless, odorless, poisonous gas. Carbon monoxide interferes with uptake of oxygen in the lungs and with its release from the blood to the tissues that need it.

b. ALCOHOL

By 1988 International Agency for Research on Cancer accepted both tobacco smoking and alcohol consumption as independent risk factors for oral cancer. Combined effect of alcohol and tobacco is greater than the sum of the two effects independently.

c. MOUTHWASH USE

Mouthwashes with high alcohol content [25% or higher] may increase risk of oral cancer. Risks generally increased in proportion to frequency and duration of mouthwash use.

Predisposing factors

A. Vitamins And Essential Minerals

Vitamin A: Risk of oral cancer has been inversely associated with consumption of vitamin A, and also consumption of fruits and vegetables in many studies.

Vitamin C: There is a tenuous association of vitamin 'C' with a protective effect against oral, pharyngeal and esophageal cancer.

Vitamin E: Vitamin E like β -carotene is anti-oxidant. Higher serum vitamin levels appear to be associated with decreased risk of oral cancer. Vitamin E use may have some protective effect against leukoplakia and carcinomas.

B. Occupation

There is increased risk for oral cancer and pharyngeal cancer for workers exposed to formaldehyde. There is higher incidence of lip cancer in outdoor and rural population than in office workers or urban population. This may be due to exposure to sunlight and UV radiation.

C. Chemical Agents

Exposure to chemical agents like aromatic amines, Alfa toxins, polycyclic aromatic hydrocarbons, etc. is predisposing factor for oral cancer.

D. Viral Infection

Infection with viruses: There are several viruses that seem to increase the risk for oral cancer such as Human papillomaviruses (HPV) , Epstein-Barr virus is a virus and Herpes simplex viruses cause a viral infection.

Trauma

Many human cases are described of an oral cancer at the site of chronic trauma arising from a broken tooth, a denture clasp, or an ill-fitting denture flange or excrescence. Studies indicate that denture wearing per se is not a risk factor, but that chronic ulceration from an unsatisfactory appliance may promote a neoplasm in the presence of other risk factors.

Pathogenesis

The most common type of oral cancer is epidermoid carcinoma (squamous cell carcinoma). Epidermoid carcinoma originates in abnormal mucosa as either leukoplakia, erythroplakia or speckled leukoplakia. This disease most commonly begins in a leukoplakic lesion which can be smooth or rough, flat or elevated, ulcerated or intact. Leukoplakia is manifested histologically by a thickening of the mucosa.

Potentially Malignant Lesions

Main potentially malignant lesion is:

- Leukoplakia
- Erythroplakia
- Erosive lichen planus
- Submucosal fibrosis.

Such lesion as leukoplakia and erythroplakia can precede the development of malignancies. However the rate of malignant transformation is very low 2–6 percent.

The Importance Of Early Detection

- Early detection saves lives. With early detection and timely treatment, deaths from oral cancer could be dramatically reduced
- The five-year survival rate for those with localized disease at diagnosis is 81 percent compared with only 30 percent for those whose cancer has spread to other parts of the body.

Levels Of Prevention For Oral Cancer

Primary Prevention

1. Avoid tobacco and alcohol use.
2. Avoid betel nut chewing.
3. Avoid smoking.
4. Avoid exposure to sun.
5. Ensure a healthy diet free from vitamin and nutritional deficiency.
6. Dentists may be able to influence politicians and communities to adopt relevant policies, but more importantly they can directly influence smokers to stop using tobacco, reduce alcohol consumption and improve their diet.

Secondary Prevention

- Screening of high risk groups
- Biopsy: any suspicious oral mucosal lesion including any non-healing ulcer [more than two weeks] must be biopsied. Biopsy should be sufficiently large to include enough suspect and apparently normal tissues for correct diagnosis.

Tertiary Prevention

- Surgery, radiotherapy, and chemotherapy.
- In order to stop the recurrence and spread of oral cancers, dentists and other health specialists should work together to provide multi-disciplinary support for patients.
- Treated patients may still have dental needs which dentists should monitor to maintain life quality. There may be special needs as well.
- Prevention of caries by topical fluoride application, dietary advice.
- Management of a dry mouth, and prosthetic rehabilitation following surgery and radiation therapy.

Rehabilitation after Oral Cancer

Rehabilitation may vary from person-to-person depending on the type of oral cancer treatment, and the location and extent of the cancer. Rehabilitation may include:

- ***Dietary counseling:*** Many patients recovering from oral cancer surgery have difficulty eating, so it is often recommended that they eat small meals consisting of soft, moist foods.
- ***Surgery:*** Some patients may benefit from reconstructive or plastic surgery to restore the bones or tissues of the mouth, returning a more normal appearance.
- ***Prosthesis:*** If reconstructive or plastic surgery is not an option, patients may get benefit from dental or facial-part prosthesis to restore a more normal appearance. Special training may be needed to learn to use a prosthetic device.
- ***Speech therapy:*** If a patient experiences difficulty in speaking following oral cancer treatment, speech therapy may help the patient relearn the process.

Fluoride in dentistry

Fluorine is an electronegative, naturally occurring element. It is the most reactive of all chemical elements. The reduced form of fluorine (or its ionic form) is called as fluoride. Fluorine cannot occur in nature in its elemental form, but only as a fluoride ion which continues to play a vital role in prevention of dental caries. The caries-preventive effect of fluoride has been known since the 1930s, when the differences in caries prevalence between communities were attributed to naturally occurring fluoride levels in the drinking water. Scientists have discovered that fluoride helps to protect teeth from dental decay; most of the work in caries prevention has been based on some type of fluoride use. Due to its safety, efficacy and cost-effectiveness in preventing caries the purpose of fluorides in various forms thus remains cornerstone of most caries prevention programs.

Sources of Fluoride

- 1- Ground waters: Rain water, Sea water & river water
- 2- Atmosphere: fluoride- containing soils and gas, underground coal fires and volcanic activities
- 3- Food: present to some extent in nearly all foods. Certain foods contain more F than others, e.g. tea & some seafoods.
- 4- Drugs & fluoride-containing dental products.
- 5- Pollution: in vicinity of industries involved in production of aluminum from cryolit & phosphate fertilizers.

Community water fluoridation:

Water fluoridation considered as one of the "ten greatest public health achievements of the 20th century." It is the controlled addition of fluoride to a public water supply for optimal dental health which effectively prevents caries. It is the best method of delivering fluoride on a population basis.

History:

- The history of community water fluoridation traced back to 1901 Dr. Frederick McKay, a dentist noticed that some of his patients in Colorado springs have permanent stain on their teeth. He named these stains as "mottled enamel" which were intrinsic, or incorporated into the enamel structure, and they were limited to a subgroup of patients who had either been born in Colorado Springs or moved there at a very young age.
- 1916 Dr. McKay & Dr. Black conducted studies on individual in 26 communities in USA & concluded that an "unidentified factor" present in the water was responsible for mottling of enamel. Dr. McKay found that these mottled enamel cases are singularly free from caries."
- McKay had identified the etiologic agent which is the high level of fluoride in drinking water.

- Dean and co-workers conducted a survey on 21 cities to establish the relationship between mottled enamel which replaced by the term dental fluorosis and the level of fluoride in the water supply.

The three types of fluoride that are used to fluoridate water are:

- Sodium fluoride,
- Sodium fluorosilicate
- Fluorosilicic acid.

The optimum level of fluoride in the communal water supply varies depending on the temperature and geographic location, its range from 0.7-1.0 ppm. This concentration allows minimum dental fluorosis with maximum caries reduction.

Community water fluoridation is safe and cost-effective and should be introduced and maintained wherever it is socially acceptable and feasible.

Pre-eruptive Systemic Effects of fluoride :

Fluoride is absorbed through the gastrointestinal system. The rate and degree of absorption depend on the solubility of the source and the amount ingested at a given time. Once absorbed into the bloodstream, fluoride is either deposited into bones and developing teeth or excreted in the urine. The major sources of systemic fluoride are water fluoridation and dietary supplements; food sources are a lesser but potentially important source. During tooth development, fluoride is incorporated into the developing tooth's mineralized structure. Although this is no longer believed to be the most important reason for the effect of fluoride in dental caries, the presence of fluoride in the dental enamel probably increases resistance to demineralization when the tooth surface is exposed to organic acids.

Systemic fluoride may enhance the resistance of the tooth by way of:

1. An alteration in tooth morphology, and
2. A conversion of the hydroxyapatite mineral to a fluoridated state with an attendant reduction in solubility and an enhancement of the remineralization phase of the caries process.

Mechanism of action of fluoride :

1 . Increased enamel resistance

Fluoride reduces the solubility of dental enamel by both systemic and topical action. Fluoride ingested prior to tooth eruption enhances the development of fluorapatite at the enamel surface and that this fluorapatite is resistant to the demineralizing acids that initiate the carious process.

2. Inhibiting Demineralization

If fluoride is present in the solution surrounding the crystals (enamel fluid) it is adsorbed strongly to the surface of carbonated apatite crystals acting as a potent protection mechanism against acid dissolution of the crystal surface . When the entire crystal surface is covered by adsorbed fluoride (fluorapatite), it will not dissolve upon a pH fall caused by bacterial-derived acids. significant protection could be obtained if all crystals along the acid ions diffusion pathway are coated with fluorapatite.

3. Increased rate of post-eruptive maturation

At the time of tooth eruption the enamel is not completely calcified and undergoes a post-eruptive period of approximately 2 years during which enamel calcification continues. Throughout this period-period of enamel maturation' there is continuous accumulation of fluoride as well as other elements in the superficial part of enamel.

4. Enhancing remineralization

As the saliva flows over the plaque and its components neutralize the acid, raising the pH, demineralization is stopped and reversed. The saliva is supersaturated with calcium and phosphate, which can drive mineral back into the tooth. These processes constitute remineralization—the replacement of mineral in the partially demineralized regions of the carious lesion of enamel or dentine (including the tooth root). Fluoride enhances remineralization by adsorbing to the crystal surface and attracting calcium ions, followed by phosphate ions, leading to new mineral formation.

4. anti-bacterial action

fluoride ions within the cell interfere with the glycolytic enzyme (enolase) activity , Thus, fluoride effectively inhibits the carbohydrate metabolism of acidogenic oral bacteria, including the uptake of sugars. Fluoride interferes with oral bacteria in two ways , in low concentration , fluoride is bacteriostatic and in high concentration , fluoride is bactericidal .

Types of fluoride

A- Systemic fluoride : Its benefit in pre-and post-eruptive phase .

1-Communal water fluoridation : Fluoridations is the controlled adjustment of a fluoride compound to a public water supply in order to bring the fluoride concentration up to a level which effectively prevents caries.

2- Alternative methods for C.W. F.:

- School water fluoridation.
- Home water fluoridation.
- Fluoridated tablets.
- Fluoridated salts.
- Fluoridated milk.

B- Topical fluoride: The term topical fluoride therapy refers to the use of systems containing relatively large concentrations of fluoride that are applied locally or topically, to the erupted tooth surface to prevent the formation of dental caries.Its benefit in post eruptive phase .

1. Self applied:

- Dentifrices.
- Fluoridated mouth rinse.
- Fluoridated gel.

2. Professional fl. application: It was seen that when fluoride was applied to teeth, it gets deposited in the outer enamel, making it more resistant to dissolution by acids. Topical

fluoride applications are indicated for patients with active smooth surface caries and those patients in high caries risk groups, this includes special patient groups, such as those undergoing orthodontic treatment, in high-risk groups to reduce tooth sensitivity, active decay, patients undergoing head and neck irradiation (decreased salivary flow). Topical fluoride available in the form of solutions, gel, foam, varnishes, prophylactic paste or pumice.

Many types of fluoridated agent used, mainly:

- ❖ Sodium fluoride (NaF).
- ❖ Stannous fluoride (SnF₂).
- ❖ Acidulated phosphate fluoride.
- ❖ Zirconium fluoride.
- ❖ Titanium fluoride.
- ❖ Amine fluoride.

Choice of fluoride type and dose depends on:

- current levels of fluoride intake.
- caries status.
- age of subjects in the area.

In general, fluoride has many effects in relation to caries reduction(anti-caries effect)these include:

- 1-Decrease solubility of enamel in acid by converting hydroxyapatite into less soluble Fluorhydroxyapatite /fluorapatite.
 - 2- Enhance remineralization of enamel in areas that have been demineralized by acids.
 - 3- Antibacterial action: Bactericidal in high conc. & bacteriostatic in low conc.
- Fluoride affects oral bacteria and dental plaque ecology. It inhibits bacterial adsorption & decreases acid production of plaque bacteria (inhibiting glycolysis in microorganisms).
- 4- Improve tooth morphology making them more self-cleansings.

Metabolism of fluoride

When F is ingested, the absorption occurs mainly in the stomach. F concentration in the blood reaches a peak after about 30 minutes, and returns to the usual level after 11- 15 h. about 99% of F is associated with calcified tissue (bone & teeth). F also can be absorbed following inhalation and through the skin. The main route of F excretion is via the kidney.

Side effects of fluoride:

Fluoride is a hazardous substance when large doses are taken acutely or when lower doses are taken chronically, it could cause:

- o Dental fluorosis.
- o Reversible gastric disturbances.
- o Skeletal fluorosis.
- o Death.

Dental Fluorosis

Hypo mineralization of enamel results from prolonged ingestion of fluoride during the period of tooth development.

Clinically: Opaque white patches in the enamel which may become striated, mottled, pitted or stained yellow to dark brown.

There are many indices for assessment of dental fluorosis, one of these is Dean's Dental Fluorosis Index which was developed by Dean in.

Prevention of dental fluorosis

Alternative water supply with optimal or suboptimal F levels is the only effective preventive measure in area with high level of F in drinking water. If this not possible, the available drinking water can be defluoridated

De fluoridation of water: Is the downward adjustment of F ion concentration in public water supply to be maintained at 1 ppm by weight.