General etiological factor of malocclusion

Overview

The etiology of malocclusion is the study of its causes. The factors causing malocclusion can be widely classified into two broad categories; general etiological factors and local etiological factors. A given case of malocclusion may be a result of either a single or multiple local or general factors or be caused by a combination of local and general factors. An understanding of the etiology is essential to prevent, intercept, and correct malocclusions.

CLASSIFICATION

Etiologic factors of malocclusion are classified in several ways by different authors and the most commonly referred classifications are by Graber and Moyer. The discussion of etiologic factors in this lecture is based on the classification given by Graber.

General aetiologic factors include the following:

- **Hereditary**
- **Congenital**
- **Environmental**

- **Prenatal**

  - ·Trauma
  - ·Maternal diet
  - ·German measles
  - ·Maternal metabolism.

- **Postnatal**

  - ·Birth injury
  - ·Cerebral palsy
  - ·Temporomandibular joint (TMJ) injury.

- **Predisposing metabolic climate and disease**

  - Endocrine imbalance
  - Metabolic disturbances
  - Infectious diseases.

- **·Dietary problems (nutritional deficiency)**

- **·Abnormal pressure habits and functional aberrations.**

  - Abnormal sucking
  - Thumb and finger sucking
  - Tongue thrust and tongue sucking
  - Lip and nail-biting
  - Abnormal swallowing habits (improper deglutition
  - Respiratory abnormalities, like mouth breathing, etc.
  - Speech defects
  - Tonsils and adenoids.
  - Psychogenetics and bruxism

- **Posture**
- **Trauma and accidents**

Hereditary Factors

Hereditary causes of malocclusion include genetic traits, inherited from the parents, which may contribute to the development of malocclusion. These genetic traits can be further influenced by prenatal or postnatal environmental factors. Since the offspring is a product of a parent of dissimilar heredity, malocclusion can result, if the end product is disharmonious. Furthermore, studies show that the incidence of jaw size discrepancies and occlusal disharmonies is greater in the population, where there has been a mixture of racial and ethnic strain.

The hereditary factors causing malocclusion can be those influencing the following:

- **Dentition**
- **Skeletal structure**
- **Neuromuscular**
- **Soft tissues**

Dentition

The following characteristics of dentition are influenced by heredity.

- **Shape and Size of the Tooth**

Abnormalities of the tooth size, such as macrodontia, microdontia, and abnormalities of tooth shape such as peg lateral are attributed to heredity. Patients with ectodermal dysplasia exhibit conical-shaped incisors and several congenitally missing teeth (Figs 1).

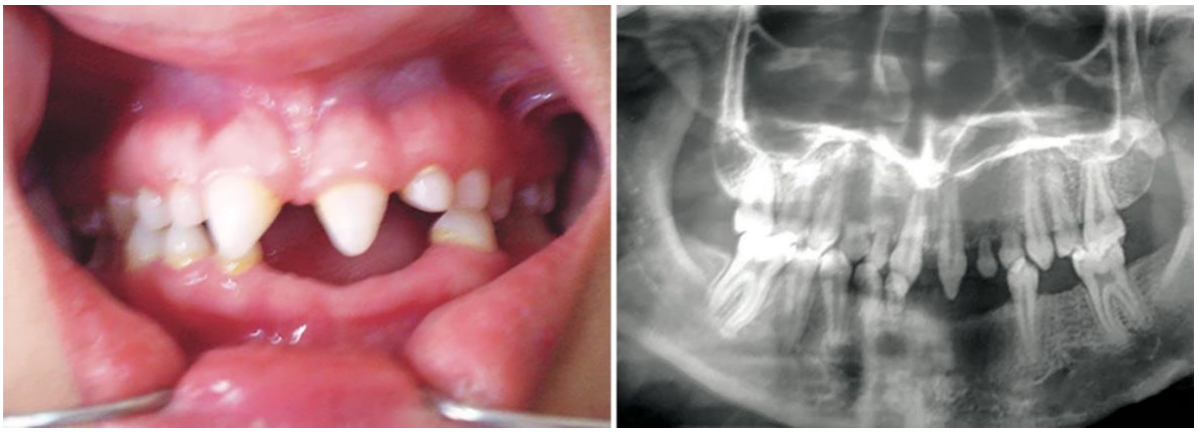
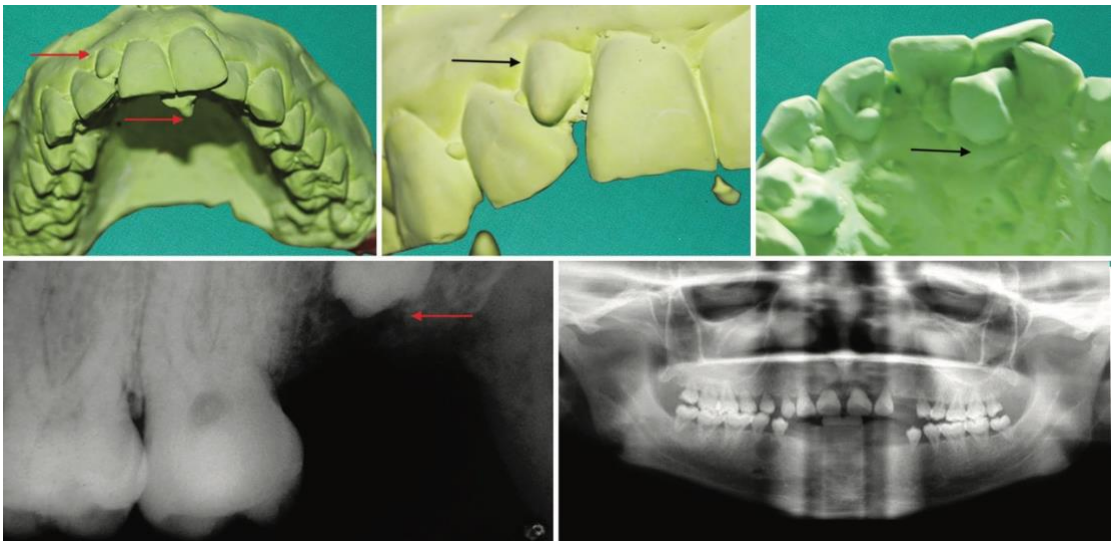


Figure 1 ectodermal dysplasia

- **Number of Teeth**

The presence of supernumerary teeth (Figs 2) or congenitally missing teeth is often hereditary.



Figs 2: (A) Cast showing labially erupted conical-shaped supernumerary tooth and palatally erupted mesiodens with Talon cusp causing crowding in the arch; (B) Impacted distomolar; **Fig 3:** Type I dentin dysplasia exhibiting extremely short conical roots with prematurely lost lower incisors

- **Arch Dimension**

Dental arch length and width are believed to be inherited.

- **Crowding and Spacing**

Arch length-tooth material discrepancy is one of the most common causes of malocclusion and is the result of the disharmonious inheritance of the tooth size from one parent and the jaw length from the other parent.

- **Shedding Pattern of Deciduous Teeth and Sequence of Eruption of Permanent Teeth**

They are to some extent under the influence of heredity.

- **Inter-arch Variation**

Deviation in the transverse sagittal and vertical plane relationship of upper and lower jaw can be inherited.

- **Overjet**

The degree of horizontal overlap of the upper anteriors over the lower anteriors called overjet and it can be inherited.

Skeletal Structures

Skeletal malocclusion, resulting from the malposition or malformation of the jaws is often inherited. Mandibular Class III skeletal pattern with mandibular prognathism is commonly observed to show racial and familial tendencies.

Neuromuscular System

The anomalies that have been found to possess some inherited component include deformities in size, position, tonicity, contractility, and in the neuromuscular coordination pattern of facial, oral, and tongue musculature.

Soft Tissue

The following are some of the soft tissue abnormalities, which can be inherited.

- Size, shape, and attachment of the labial frenum
- Ankyloglossia
- Microstomia.



Congenital Defects

Congenital defects are developmental malformation at the time of birth.

They may be caused due to local or general factors listed below:

General Congenital Factors

- Abnormal state of mother during pregnancy
- Malnutrition
- Endocrinopathies
- Infectious diseases, such as congenital syphilis and maternal rubella infection
- Metabolic and nutritional disturbances
- Intrauterine pressure
- Accidents during pregnancy and childbirth
- Accidental trauma to the fetus by external forces, e.g. forceps delivery.

Local Congenital Factors

- Abnormalities of jaw development due to abnormal intrauterine position
- Cyst of the face and palate
- Macroglossia
- Microglossia
- Cleidocranial dystosis.

Some of the commonly encountered and important congenital defects from an orthodontist's point of view are discussed here:

Cleft Lip and Palate

Cleft lip (Figs 4) and palate, occurring separately or in combination are by far the most commonly seen congenital deformities. Cleft lip and palate may have a profound influence on craniofacial development and may cause malocclusion of varying degrees of severity. The cleft palate may retard the nomal development of the maxilla thereby causing class III malocclusion.





Figure 4 cleft lip and palate

The cleft palate may show several associated dental abnormalities, such as (Figs 6):

- **Congenitally missing teeth in the cleft region**
- **Supernumerary teeth**
- **Microdontia and peg-shaped teeth, especially upper lateral incisor**
- **Crowding of teeth in the area of cleft**
- **Insufficient development of premaxilla**
- **Crossbite due to narrow maxillary arch**
- **Rotation of teeth**
- **Abnormal overjet and overbites.**

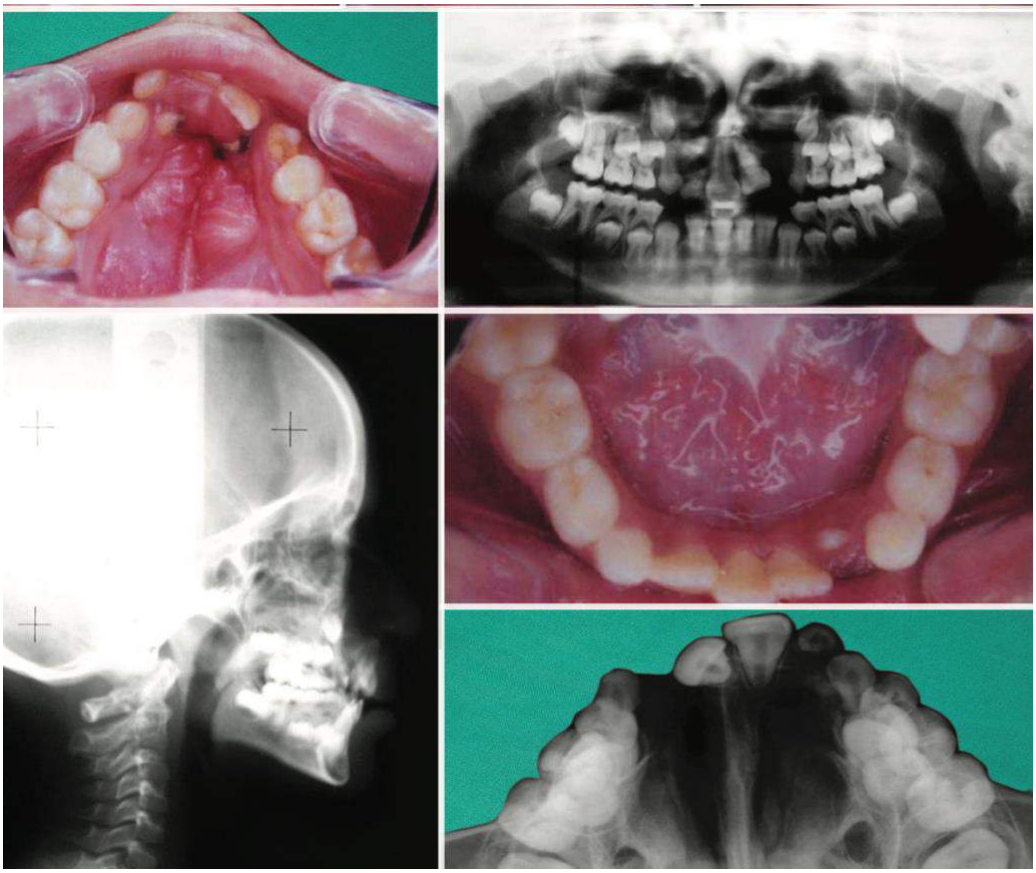


Figure 6 Dental anomalies associated with cleft lip and palate

Cerebral Palsy

It is characterized by paralysis or the lack of muscular coordination, attributed to an intracranial lesion. The condition is often considered to be the result of a birth injury. The uncontrolled or aberrant activities upset the muscle balance that is necessary for the establishment and maintenance of normal occlusion.



Figure 7 Cerebral palsy.

Cleidocranial Dysostosis

This condition is characterized by partial or complete absence of the clavicle on one or both sides.
Various features that may lead to the development of malocclusion are:

- **Maxillary retrusion and possible mandibular protrusion**
- **Retained deciduous teeth**
- **Retarded eruption of permanent teeth**
- **Numerous impacted supernumerary teeth.**



Figure 8 cleidocranial dysostosis

Maternal Rubella Infection during Pregnancy

Rubella infection in a pregnant mother can cause several dental defects in the child such as:

- **Retarded eruption of teeth**
- **Hypoplasia of teeth**
- **Extensive caries**

Congenital Syphilis

The incidence of congenital syphilis has been greatly reduced in recent years. The following features may be seen in the affected child:

- **Hutchinson's incisors**
- **Mulberry molars**
- **Maxillary deficiency in relation to mandible**
- **Anterior crossbite**
- **Extensive dental caries.**

Environmental Causes

Various prenatal and postnatal environmental factors can cause malocclusion.

- ### Prenatal Environmental Factors

The following are some of the prenatal factors that can cause malocclusion:

- **Abnormal fetal posture during gestation**
- **Maternal fibroids**
- **Amniotic lesions**
- **Maternal diet and metabolism**
- **Intake of certain drugs during pregnancy, for example, thalidomide intake can cause congenital deformities, such as clefts.**

- ### Postnatal Environmental Factors

The following are some of the postnatal factors that can cause malocclusion:

- **Traumatic injuries to the condyle and the TMJ area during birth can cause mandibular growth retardation.**
- **Ankylosis of the TMJ may lead to the hypoplastic mandible and marked facial asymmetry in case of the unilateral ankylosis.**
- **The presence of scar tissue, caused by cleft palate surgery may cause malocclusion as they can restrict growth of maxilla.**
- **Milwaukee braces used for the treatment of scoliosis derive support from the mandible, and thus can cause retardation of the mandibular growth.**

Predisposing Metabolic Climate and Diseases

Endocrinal imbalance may predispose to the development of malocclusion. Thyroid hormones play an important role in the normal development of bones and teeth. Parathormone, released from the parathyroid glands, has an active role in calcium metabolism and thus is directly involved in the development of teeth and bones.

Hypothyroidism

It may cause the following effects:

- **Retardation in the rate of calcium deposition in bone and teeth**
- **Delaying tooth bud formation and eruption Prolonged retention of primary and delayed eruption of permanent teeth**
- **Irregularities in tooth arrangement and crowding of teeth may occur.**

Hyperthyroidism

This condition is associated with an increased metabolic rate and increased rate of maturation. Patients with hyperthyroidism may exhibit premature eruption of primary and permanent dentition.

Hypoparathyroidism

It is often associated with delayed eruption of teeth, altered morphology and hypoplasia of teeth.

Hyperparathyroidism

It causes an increase in blood calcium level by resorption of bone. Trabecular pattern of jaw may get disrupted due to the demineralization of the bone. In children, tooth development may become mobile due to the loss of cortical bone and resorption of the alveolar process.
Osteoporosis in such parts contraindicates orthodontic tooth movement.
Acute febrile disease during development years may cause disturbances in tooth eruption and shedding pattern and thus may predispose to malocclusion.

Dietary Problems (Nutritional Deficiencies)

- Nutritional deficiencies may cause malocclusion primarily by upsetting the dental developmental timetable and resulting in premature loss, prolonged retention, and abnormal eruptive paths.
- Disturbances, such as rickets, scurvy, and beriberi can produce severe malocclusion. Nutritional deficiencies during pregnancy have been associated with certain malformations in the child, including cretinism and cleft lip and palate.

Abnormal Pressure Habits and Functional Aberrations

Abnormal pressure habits, such as digit sucking, tongue thrusting, lip biting, and functional aberration, such as mouth breathing may cause a variety of malocclusions. These aspects are described in detail in a separate lecture on Oral Habits

Posture

Mandibular retrusion has been observed in some stoop-shouldered children with heads hung so that the chin rests on the chest and in some children who rest their chin on the hand to support their head. However, poor posture as a cause of malocclusion is not proven. Nevertheless, it might accentuate an existing malocclusion.

Accident and Trauma

Traumatic injuries to the dentofacial region are quite common during the early years of life when child learns to crawl, walk and even while playing. Such traumatic experiences often go unnoticed and may result in the following problems predisposing to malocclusion:

- Nonvital deciduous teeth that do not resorb.
- Deflection of permanent tooth germs.
- Abnormal eruption path of permanent successors.