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Syndromic Malocclusions

Abstract:

A relatively small number of orthodontic patients are affected by known genetic syndromes that affect oral structures. The greatest value in knowing that a patient has a particular syndrome is that it allows a much better prediction of future development in the individual who will not grow in the normal pattern. Sometimes recognizing a syndrome is made more difficult by incomplete expression of the genes. If a genetic syndrome is suspected, then the orthodontist should have the patient evaluated.

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Introduction

Malocclusion associated with syndromes often needs a multi disciplinary approach with orthodontists playing an important role in planning the overall treatment. This article highlights the following syndromes – Robin complex, Treacher Collins, Cleidocranial dysostosis and Crouzons syndrome. The components of these syndromes and its clinical features are discussed with special emphasis on the associated malocclusion.

Syndrome

An anamolad is a malformation together with its subsequently derived structural changes, the primary defect setting off a series of secondary or even tertiary events resulting in multiple anomalies.

Syndrome is defined as a set of signs or a series of events occurring together that often point to a single disease or condition as a cause.

Syndromes occurring commonly with malocclusions are classified as: (Cohen, Proffit, Bell, White) [1,2]

1. Malformation syndromes associated with mandibular deficiency.
2. Malformation syndromes associated with mandibular prognathism.
3. Malformation syndromes associated with problems of facial height.
4. Malformation syndromes associated with facial asymmetry.

Malformation syndromes associated with mandibular deficiency:

- Robin complex.
- Treacher Collins syndrome. (Mandibulo facial dysostosis; Franceschetti syndrome)
- Nager acrofacial dysostosis.
- Wilder vanck Smith syndrome.
- Goldenhar syndrome (hemifacial microsomia)
- Hallermann – Streiff syndrome.

Malformation syndromes associated with mandibular prognathism:

- Basal cell nevus syndrome (Gorlin Goltz syndrome).
- Klinefelter syndrome.
- Marfan syndrome.

Malformation syndromes associated with problems of facial height:

- Beckwith Weidemann syndrome.

Malformation associated with facial asymmetry:

- Hemifacial microsomia, goldenhar syndrome, hemifacial hypertrophy.
- Mobius syndrome.

Neurofibromatosis (von Recklinghausens disease):

- Parry- Romberg syndrome.
- Crouzons syndrome.
- Aperts syndrome.
- Cleido cranial dysostosis.
- Downs syndrome.
- Pfeiffer syndrome.
- Acrocephalosyndactyly.

Robin Complex [3,4,5,6]

Etiology: Heterogenous, considered a sporadic or non genetic condition with a very low recurrence risk in the family.

Striking Features: Hypoplasia or the arrested growth of mandible produce the characteristic bird facies. Due to jaw malformation the tongue musculature is unsupported allowing it to fall down and back, partially obstructing the epiglottis resulting in respiratory difficulty. Cleft palate (Hypoplasia of mandible prevents the normal descent of tongue between the palatal shelves), Micrognathia and glossoptosis are certain other features. Pierre Robin syndrome can occur solely or in combination with other syndromes like the Stickler syndrome, cerebrocostomandibular syndrome, the camptomelic syndrome and the persistent left superior vena cava syndrom**e.**

Treacher Collins Syndrome (Mandibulo Facial Dysostosis; Franceschetti Syndrome) [7,8]

It involves the structures derived from the 1st branchial arch.

Etiology: The Treacher Collins syndrome encompasses a group of closely related defects of the head and face, often hereditary or familial in pattern following an irregular form of dominant transmission. (Autosomal dominant). The syndrome is thought to result from a retardation or failure of differentiation of maxillary mesoderm at and after the 50 mm stage of the embryo.

Striking Features: Symmetrically hypoplastic low set ears, depressed cheek bones, well developed external occipital protuberance, down slanting palpebral fissures. Hypoplasia of mandible and facial bones especially the molar bones resulting in large nose, macrostomia (failure of fusion of

the maxillary and mandibular processes), micrognathia, sometimes cleft or high arched palate, blind fistulas between the angles of the mouth and the angles of the ears are certain features. The teeth may be hypo-plastic, displaced, widely separated or associated with open bite.

Nager Acrofacial Dysostosis [9,10]

It is a congenital anomaly syndrome that may be characterized by accessory tragi.

Etiology: Inheritance pattern said to be autosomal but there are arguments as to whether it is autosomal dominant or autosomal recessive.

Striking Features: Underdevelopment of the cheek and jaw area, down-sloping of the opening of the eyes, lack or absence of the lower eyelashes, kidney and or stomach reflux, hammer toes, shortened soft palate, petite, lack of development of the internal and external ear, possible cleft palate, underdevelopment or absence of the thumb, hearing loss and shortened forearms, as well as poor movement in the elbow. Occasionally sufferers develop vertrebral anomalies such as scoliosis. Nager syndrome is also linked to five other similar syndromes: Miller Syndrome, Treacher-Collins, Pierre-Robin, Genee-Wiedemann, and Franceschetti-Zwahlen-Klein.

Wilder Vanck Smith Syndrome [11,12]

This condition is also known as the Genee-Wiedemann syndrome, Miller syndrome or Postaxial Acrofacial Dystosis (POADS).

Etiology: The incidence of this condition is not known but it is considered extremely rare. Nothing is presently known of its pathogenesis.

Clinical Features: The syndrome consists of severe micrognathia, cleft lip and/or palate, hypoplasia or aplasia of the postaxial elements of the limbs, coloboma of the eyelids and supernumerary nipples. Additional features of the syndrome include downward slanting palpebral fissures, malar hypoplasia, malformed ears and a broad nasal ridge. Other features include supernumerary vertebrae and other vertebral segmentation and rib defects, heart defects (patent ductus arteriosus, ventricular septal defect, ossium primum and endocardial cushion defect), lung disease from chronic infection, single umbilical artery, absence of the hemidiaphragm, hypoplasia of the femora, ossification defects of the ischium and pubis, bilobed tongue, lung hypoplasia and renal reflux.

Goldenhar Syndrome (Hemifacial Microsomia) [13]

It is associated with anomalous development of the first branchial arch and second branchial arch.

Etiology: The cause of Goldenhar syndrome is largely unknown. However, it is thought to be multifactorial, although there may be a genetic component, which would account for certain familial patterns. It has been suggested that there is a branchial arch development issue late in the first trimester.

Clinical Features: It is a rare congenital defect characterized by incomplete development of the ear, nose, soft palate, lip, and mandible on usually one side of the body. Additionally, some patients will have growing

issues with internal organs, especially heart, kidneys, and lungs. Typically, the organ will either not be present on one side or will be underdeveloped.

Hallermann – Streiff Syndrome [14]

It also known as the François Dyscephalic Syndrome, Hallermann-Streiff-François syndrome, Oculomandibulodyscephaly with hypotrichosis and Oculomandibulofacial syndrome.

Etiology: It is a congenital disorder associated with gene GJA1.

Clinical Features: It affects growth, cranial development, hair growth and dental development. Patients with this syndrome are shorter than the average person and may not develop hair in many places, including in the facial, leg and pubic areas. Patients also have eye problems including clouded eyes or reduced eye size, bilateral cataracts and glaucoma. It can be associated with sleep apnea. It can complicate intubation.

Gorlin Goltz Syndrome (Basal Cell Nevus Syndrome) [15, 16]

Etiology: It is an autosomal dominant condition. It is caused by mutations in the PTCH (Patched) gene found on chromosome arm 9q.

Clinical Features: Multiple basal cell carcinomas of the skin, Odontogenic keratocyst- Seen in 75% of patients and is the most common finding. There are usually multiple lesions found in the mandible, rib and vertebrae anomalies, Intracranial calcification, skeletal abnormalities: bifid ribs, kyphoscoliosis, early calcification of falx cerebri, distinct faces - frontal and temporoparietal bossing, hypertelorism, and mandibular prognathism.

Klinefelter Syndrome [17]

Etiology: Klinefelter syndrome is a chromosomal condition that affects male sexual development. Most males with Klinefelter syndrome have one extra copy of the X chromosome in each cell. Variants of Klinefelter syndrome involve more than one extra X chromosome or extra copies of both the X and Y chromosomes in each cell.

Clinical Features: Abnormal body proportions (long legs, short trunk, shoulder equal to hip size), abnormally large breasts (gynecomastia), prognathic mandible, infertility, sexual problems, less than normal amount of pubic, armpit, and facial hair, small and firm testicles, tall height.

Marfan Syndrome [18,19]

Etiology: It is a genetic disorder of the connective tissue. It is inherited as a dominant trait. It is carried by a gene called FBN1, which encodes a connective protein called fibrillin-1. People have a pair of FBN1 genes. Because it is dominant, people who have inherited one affected FBN1 gene from either parent will have Marfan's.

Clinical Features: People with Marfan's tend to be unusually tall, with long limbs and long, thin fingers, the dislocated lenses and the aortic root dilation. The general features are aortic aneurysm or dilation, arachnodactyly, GERD, bicuspid aortic valve, cysts, cystic medial necrosis, degenerative disk disease, deviated septum, dural ectasia, early cataracts, early glaucoma, early osteoarthritis,

ectopia lentis, emphysema, eye iris coloboma, flat feet, above-average height, heart palpitations [Hernias, high palate, hypermobility of the joints, kyphosis (hunched back), leaky heart valve, malocclusion, micrognathia (small lower jaw), mitral valve prolapse, myopia (near sightedness), obstructive lung disease, osteopenia (low bone density), pectus carinatum or excavatum, pneumothorax (collapsed lung), retinal detachment, scoliosis, sleep apnea, stretch marks not from pregnancy or obesity, teeth crowded, narrow, thin face, temporomandibular joint disorder (TMD).

Beckwith Wiedemann Syndrome [20, 21]

Etiology: It is an overgrowth disorder present at birth. Most cases are sporadic, meaning that usually no one else in that family has this syndrome. It has been shown to specifically involve problems with a defined region on the short arm of chromosome 11. It can be caused by a range of different genetic defects.

Clinical Features: Congenital hernia, large tongue - macroglossia, and large body (and/or long limbs) – gigantism, increased facial height, macrosomia, midline abdominal wall defects (omphalocele, umbilical hernia, diastasis recti), ear creases or ear pits, and neonatal hypoglycemia (low blood sugar after birth).

Möbius Syndrome [22, 23]

Etiology: The causes of Möbius syndrome are poorly understood. Möbius syndrome is thought to result from a vascular disruption (temporary loss of blood flow) in the brain during prenatal development. There could be many reasons that a vascular disruption leading to Möbius syndrome might occur. Most cases do not appear to be genetic. However, genetic links have been found in a few families. Some maternal trauma may result in impaired or interrupted blood flow (ischemia) or lack of oxygen (hypoxia) to a developing fetus. Some cases are associated with reciprocal translocation between chromosomes or maternal illness. In the majority of cases of Möbius syndrome in which autosomal dominant inheritance is suspected, sixth and seventh cranial nerve paralysis (palsy) occurs without associated limb abnormalities.

Clinical Features: Möbius syndrome results from the underdevelopment of the VI and VII cranial nerves. The VI cranial nerve controls lateral eye movement, and the VII cranial nerve controls facial expression. People with Möbius syndrome are born with facial paralysis and the inability to move their eyes laterally. Often, the upper lip is retracted due to muscle shrinkage. Occasionally, the cranial nerves V and VIII are affected. If cranial VIII is affected, the person experiences hearing loss. Other symptoms that sometimes occur with Möbius syndrome are limb abnormalities - clubbed feet, missing fingers or toes, chest-wall abnormalities (Poland Syndrome), crossed eyes (strabismus), difficulty in breathing and/or in swallowing, corneal erosion resulting from difficulty in blinking.

Neurofibromatosis (Von Recklinghausens Disease) [24]

Etiology: It is a genetically-inherited disorder. It is an Neurofibromatosis is an autosomal dominant disorder. Neurofibromatosis are classified into type I and II.

Clinical Features: Neurofibromas, freckling of the groin, café au lait spots, skeletal abnormalities, tumors on optic nerve, macrocephaly, epilepsy, headache, facial paralysis, facial weakness, deafness.

Parry- Romberg Yyndrome [25, 26, 27]

It also known as progressive hemifacial atrophy.

Etiology: It is a rare, incurable craniofacial disorder.

Striking Features: It is slowly progressive degeneration (atrophy) of the soft tissues of half of the face. There may be changes in eyes and hair, neurological abnormalities, trigeminal neuralgia.

Crouzons Syndrome [28, 29]

The craniosynostosis syndromes constitute a group of conditions each characterized by premature craniosynostosis (closure of cranial sutures) occurring in association with a variety of other abnormalities.

Etiology: Majority of cases have followed an autosomal dominant trait.

Clinical Features: The premature closure of cranial sutures leads to brachycephaly (short head) with a large frontal bony swelling. The affected patients shows exophthalmos, hypertelorism, hypoplasia of the maxilla, mental retardation and nose resembling parrot's beak. Underdevelopment of the maxilla is more severe in the premaxillary area, cause crowding of teeth and V shape to the arch. Cross bite or open bite with either high narrow arched palate or complete cleft palate, bifid uvula and partial anodontia are also seen.

Aperts Syndrome [30, 31]

Etiology: Apert syndrome is a form of acrocephalosyndactyly, a congenital disorder. It is a autosomal dominant disorder. However research is yet to determine an exact cause.

Clinical Features: It is characterized by malformations of the skull, face, hands and feetThe cranial malformations are the most apparent effects. Cranialsynostosis occurs, with brachiocephaly being the common pattern of growth. Another common characteristic is a high, prominent forehead with a flat posterior skull. A flat or concave face may develop as a result of deficient growth in the mid-facial bones, leading to a conditir prognathism.

Cleido Cranial Dysostosis [32]

Etiology: Most cases are sporadic, few familial instances in which transmitted as autosomal dominant.

Clinical Features: Marked abnormalities in skull, clavicle and jaws.
Abnormalities of the skull characterized by marked frontal, parietal and occipital bossing, delayed closure of fontanels and sutures are evident. The skull will be large and short. The clavicle may be unilaterally or bilaterally totally aplastic which gives the patient a long neck and narrow shoulders appearance. The shoulder movements permitted by this defect is very remarkable, frequently allowing the individual to approximate his shoulders in front the chest. Patient with cleido cranial dysostosis characteristically exhibit a high narrow arched palate or complete palatal cleft involving both hard and soft tissues.

Numerous supernumerary teeth, underdeveloped maxilla and delayed or failure in eruption of both deciduous and permanent teeth are also noticed.

Downs Syndrome [33, 34]

Etiology: Down's syndrome or trisomy 21, is a chromosomal condition caused by the presence of all or part of an extra 21st chromosome.

Clinical Features: Mental retardation, stunted growth, atypical fingerprints, separation of the abdominal muscles, flexible ligaments, hypotonia, brachycephaly, smaller genitalia, eyelid crease, eyelid crease, oval palate, low-set and rounded ear, small teeth, flattened nose, clinodactyly, umbilical hernia, short neck, shortened hands, congenital heart disease, single transverse palmar crease, Macroglossia (larger tongue), microgenia, epicanthal fold, Strabismus, Brushfield spots (iris).

Pfiffer Syndrome [35, 36]

Etiology: It is a rare genetic disorder.

Clinical Features: Premature fusion of certain bones of the skull (craniosynostosis), which prevents further growth of the skull and affects the shape of the head and face. Other features that included are coronal synostosis, turribachycephaly (high prominent forehead) and maxillary hypoplasia and eyes with a bulging appearance due to small underlying cheek bones.

Management

A multidisciplinary approach involving:

- Surgeons
- Prosthetists
- Speech therapists
- Pediatricians
- Orthodontists

It is important for us to recognize the common syndromes enumerated above in order to bring about effective treatment which would benefit the society.

Orthodontists intervention consists of:

1. Aligning of teeth
2. Management of cleft
3. Functional shift management
   a) Occlusal adjustment (minor deviation),
   b) Arch coordination using fixed appliance
   c) Occlusal splints / orthopedic appliances – to eliminate habitual posturing and De- programming the skeletal musculature
   d) Skeletal asymmetry – RME, Orthognathic surgery
4. Dis-impaction of teeth
5. Distraction for mandibular hypoplasia with appropriate pre and post distraction orthodontics.

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