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RESEARCH ARTICLE

MAXILLOFACIAL DEFECTS AND THEIR CLASSIFICATION: A REVIEW.

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Abstract

Numerous classifications and nomenclatures exist in literature to describe maxillofacial defects. These classifications are not only useful for descriptive purpose but also provide guidance to the maxillofacial surgeon and the maxillofacial prosthodontist in reconstruction and rehabilitation phase. There remains, however confusion in use of terminology and nomenclature, as there is no single classification which is accepted universally. Here we have tried to compile all the classifications that exist for both congenital and acquired defects of the face.

Introduction:-

Maxillofacial defects can be broadly classified into two categories:-

1. Congenital Defects.
2. Acquired Defects.

Congenital Defects:-

The word congenital means “present since birth”, so any defect that is present at the time of birth and after birth is called as a congenital defect.

Congenital defects can occur anywhere in the body and can drastically affect the normal life of a person, for example, presence of a cleft palate will not allow the newborn to suckle as he won’t be able to create suction in his mouth required to breast feed.

Congenital defects most commonly occur because of two main reasons, i.e; either when the mother during pregnancy is practicing pernicious habits like smoking, alcoholism and drug abuse or during the developmental phase of the fetus some obstruction hampers the normal development of tissues. In the latter case because of smoking, alcoholism and drug abuse certain harmful substances cross the placental barrier and cause abnormal development of structures.

One of the most interesting congenital defects that has been of great concern and interest to the maxillofacial surgeon and the prosthodontist is the occurrence of clefts. Clefts are basically developmental anomalies that are usually present in the midline of the face and drastically affect the normal anatomy.

Clefts can occur in the maxilla, mandible and the face; clefts of maxilla are most common. Clefts of both maxilla and mandible have been of utmost interest to the oral surgeon, the prosthodontist and the maxillofacial surgeon. In order to devise better treatment modalities several classifications have been given for clefts.

Following are the most accepted classifications of maxillary and mandibular clefts.

Davis and Ritchie (1922)[1] classified the congenital clefts were divided into three groups according to the position of the cleft in relation to the alveolar process:
Group I:- prealveolar clefts, unilateral, median, or bilateral.
Group II:- postalveolar clefts involving the soft palate only, the soft and hard palate or a submucous cleft.
Group III:- alveolar clefts, unilateral, bilateral, or median

Spina (1974)[1] gave the classification as follows:-
Group I:-. Preincisive foramen clefts (clefts lying anterior to the incisive foramen). Clefts of the lip with or without an alveolar cleft-(Harkins)
a. Unilateral
b. Bilateral
c. Median

Group II:- Transincisive foramen clefts (clefts of the lip, alveolus, and palate)-
a. Unilateral.
b. Bilateral.

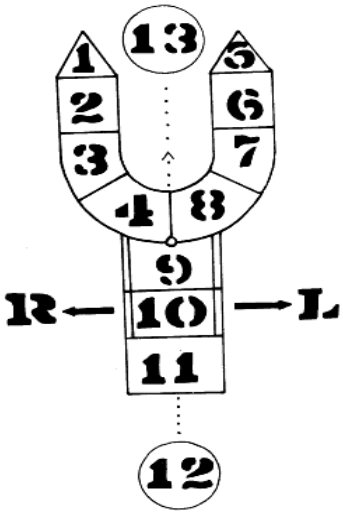
Group III:- Postincisive foramen clefts.
Group IV:- Rare facial clefts.

Veau's Classification (1931)[2]:-
The Veau classification system divides the cleft lip and palate into 4 groups, which are as follows and illustrated in the image below-
Group I:- Defects of the soft palate only (A).
Group II:- Defects involving the hard palate and soft palate (B).
Group III:- Defects involving the soft palate to the alveolus, usually involving the lip (C).
Group IV:- Complete bilateral clefts (D).

Modified Kernahan and Stark Classification (1971)[2]:-
Kernahan and Stark had given a classification for cleft palate. The classification was a symbolic/diagrammatic classification and came to be known as 'The Striped-Y Classification'.

This classification was modified by Elsahy in 1971. The modified classification had several advantages over the original classification, i.e; one could estimate the degree of the cleft, status of the hard and soft palate and the alveolar ridge, described the position of the hard and soft palate, and presence and absence of velopharyngeal closure.

Following is the diagrammatic representation of the classification and its classification-



The triangles 1 & 5 represent the lip, stippling represents the cleft, if the cleft is complete then nasal floor is included (squares1 & 2 and 5 & 6), if the cleft is incomplete then only squares 2 & 6 will be included.

If the collapse of the alveolus then the squares 3 & 4; 7 & 8 will be blackened otherwise they are stippled.

The square 9 & 10 with extra lines on either side indicate the hard palate whereas the square number 11 represents the soft palate.

The two arrows adjacent on either sides of the hard palate represent displacement of the palate. If there is displacement on either of the sides then an 'X' can be drawn on that side representing the displacement of the palate.

The circle 12 represents the velopharyngeal closure. If there is complete closure then a line is drawn along the dots towards square 11, if closure is not present then a line is drawn along the dots towards square 11. The amount of closure can be depicted by varying the length of the line to be drawn.

The circle 13 represents the premaxilla, if there is protrusion of the premaxilla then a line can be drawn in the direction of the arrow. The amount of protrusion can be depicted by varying the length of the line.

Acquired Defects:-

In the last two decades treatment for head and neck cancers has evolved with multiple modality treatments, including radiation and chemotherapy in an effort to enhance local and regional disease control, reduce distant metastasis, preserve anatomic structures and improve overall survival and quality of life (QOL).

Surgery is first choice for early cancers and for cancers that do not respond to radiation and chemotherapy in the form of salvage. Unfortunately surgery can result in cosmetic, functional and psychological impairment greatly affecting the patient's quality of life.

Such kind of ablative surgeries gives rise to a wide range of maxillofacial defects; such defects are called as acquired defects of the maxillofacial region. Since, presently the thrust in cancer care is not focused simply on survival but on rehabilitation, a need for understanding the defects and their nature has risen. This need gave rise to formulation of several classifications that have attempted to classify acquired maxillofacial defects and have greatly helped the surgeon and the maxillofacial prosthodontist in understanding acquired defects, but still there is a lack of a classification that is widely accepted.

The various systems that classify acquired maxillofacial defects are as follows-

Aramany's Classification for Maxillectomy Defects[3]:-

Aramany presented a classification for maxillectomy defects in 1987. He divided the defects into 6 categories based upon the relationship of the defect with the abutment teeth.

The classification is as follows-

Class 1:- Resection is performed in the anterior midline of the maxilla, with abutment teeth present on one side of the arch.
Class 2:- The defect is unilateral, retaining the teeth on the contralateral side.
Class 3:- Defect occurs in the central portion of the hard palate and may involve part of the soft palate.
Class 4:- Defect crosses the midline and involves both sides of the maxilla, with abutment teeth present on one side.
Class 5:- Defect is bilateral and lies posterior to abutment teeth.
Class6:- Anterior maxillary defect with abutment teeth present posterior to the defect on either sides of the remaining maxilla.

This classification is devised in order to guide the prosthodontist in obturator design. It, however lacks in description of the surgical defect.

Spiro's Classification of Maxillary Defects[4]:-

Spiro et al reviewed 403 maxillectomies performed between 1983 and 1993. They suggested the following classification-

1. **Limited Maxillectomy-** Any maxillectomy in which one wall of the maxillary antrum is removed.
2. **Subtotal Maxillectomy-** Maxillectomy in which atleast two walls of the antrum are removed including the palatal wall.
3. **Total Maxillectomy-** Complete resection of the maxilla.

This classification is simple and easy to use, but it is incomplete in its description of maxillary defects, i.e; it does not describe weather the alveolar process, orbital contents, soft palate or facial skin is resected or retained.

Liverpool Classification of Maxillectomy Defects[5]:-
Brown et al in 2000, classified surgical defects separately according to the vertical and horizontal components of the defect.

The classification is as follows-
Vertical Component-
Class 1:- Maxillectomy not causing oro-nasal fistula.
Class 2:- Maxillectomy not involving the orbit.
Class 3:- Maxillectomy involving the orbital adnexae with orbital retention.
Class 4:- Maxillectomy with orbital enucleation or exenteration.
Class 5:- Orbitomaxillary defect.
Class 6:- Nasomaxillary defect.

Horizontal Component-
Letter a:- Palatal defect only.
Letter b:- Less than or equal to half of the bilateral maxilla.
Letter c:- Less than or equal to half of unilateral maxilla.
Letter d-:-Greater than half of the maxillectomy.

Cordeiro's Classification of Maxillary Defects[6]:-
Cordeiro et al in 2000 proposed a classification for maxillectomy defects. Their aim was to classify maxillectomy in a rational fashion and to provide a reconstruction algorithm for these defects.

Their proposed classification is as follows:-
Type 1:- Limited maxillectomy, one or two walls of maxilla resected with preservation of palate.
Type 2:- Sub-total maxillectomy, 5 out of 6 walls of maxilla are resected preserving the orbital floor.
Type 3:- Total maxillectomy, resection of all 6 walls of maxilla. This type is further divided into two parts-
Type 3a:- Total maxillectomy with orbital contents preserved.
Type 3b:- Total maxillectomy with orbital exenteration.
Type 4:- Orbito-maxillectomy, orbital exenteration with resection of 5 walls of maxilla, preserving the palate.

Reconstruction Algorithm:-
Type 1 Defect:- Reconstruction with free non vascularized bone may be required to replace bone in critical area. Further obliteration can be done by using Radial Forearm Faciocutaneous Flap (RFFF).
Type 2 Defect:- RFFF can be used to reconstruct missing palate. An osseo-facio-cutaneous RFFF can be used to reconstruct anterior maxilla, which will also provide good lip support.
Type 3a Defect:- Free non vascularized bone can be used to reconstruct the orbital floor and the remaining defect can be closed by using rectus abdominus or temporalis flap.
Type 3b Defect:- Reconstruction can be done by using rectus abdominus flap with skin paddles to reconstruct palate, nasal wall or facial skin.
Type 4 Defect:- Reconstruction can be done by using rectus abdominus flap with or without skin paddles.

Okay's Classification of Maxillary Defects[7]:-
Okay et al in 2001classified palato-maxillary defects into 3 major classes and 2 sub classes. The aim was to organize and define the complex nature of the restorative decision making process.

The classification is as follows-
Class 1a:- Defects that involve the hard palate but not the tooth bearing alveolus.
Class 1b:- Defects that involve any part of the maxillary alveolus and dentition posterior to the canines or involving the pre-maxilla.
Class 2:- Defects that involve any portion of the tooth bearing maxillary alveolus but include only one canine. The anterior margin of these defects lies within the pre-maxilla.
Class 3:- Defects that involve any portion of the tooth bearing area and includes both canines, total palatectomy defects and anterior transverse palatectomy that involved more than half of the palatal surface.
Subclasses f and z:- Subclass f includes defects that involve inferior orbital rim, whereas, Subclass z has defects that involve the body of the zygomatic bone.

Durrani et al, Classification of Maxillary Defects[8]:-
Durrani et al in 2013, proposed a classification of maxillary defects based on their research and surgical experience.

Their aim was to develop a simple, comprehensive and easy to use classification which should also act as a guide for the clinician regarding reconstructive and rehabilitation options.

Their classification is as follows-
1. **Alveolectomy:-** These defects involve the alveolar bone alone.
2. **Sub-total Maxillectomy:-** These defects cause oro-nasal or oro-antral fistula but do not disturb the orbital wall of maxilla.
3. **Total Maxillectomy:-** These defects are characterized by absence of complete maxilla including orbital floor but the orbital contents remain intact.
4. **Radical Maxillectomy:-** These defects are characterized by absence of orbital contents along with the maxilla.
5. **Composite Maxillectomy:-** These defects involve resection of facial skin, soft palate, and any other part of the oral cavity.

All these defects can be further classified into Unilateral and Bilateral defects.

Cantor and Curtis Classification of Mandibular Defects[9]:-
Cantor and Curtis in 1971 gave a classification for mandibular defects.
The classification is as follows-
Class I:- Radical alveolectomy with preservation of mandibular continuity.
Class II:- Lateral resection of the mandible distal to the cuspid area.
Class III:- Lateral resection of the mandible to the midline.
Class IV:- Lateral bone graft and surgical reconstruction.
Class V:- Anterior bone graft and surgical reconstruction.
Class VI:- Anterior mandibular resection without surgical reconstruction.

Jewer's Classification of Mandibular Defects:-[10]
Jewer et al in 1989 developed a classification that took into account the complexity of mandibular reconstruction.
The classification is as follows-
C- Central defects of mandible from canine to canine.
L- Lateral defects extending from midline to the condyle.
H- Hemi-mandibular defects including 'L' defects of the condyle.
Thus, there are the following defect variations of the mandible - **C, L, H, LC, HC, LHC, HCL, HH**.

Boyd's Classification of Mandibular Defects:-[11]
In 1993 Boyd modified the Jewer's classification to include defects involving soft tissue resection.
The classification is as follows-
H- Lateral defects of any length up to midline including condyle.
C- Defects involve central segment containing 4 incisors and 2 canines.
L- Lateral defects excluding the condyle.

3 lower case letters describe soft tissue component
s– Skin.
m– Mucosa.
sm- Skin and mucosa.

Classification of Mandibular Defects by Urken et al[12]:-
This classification is based on functional considerations caused by detachment of different muscle groups and difficulties with cosmetic restoration.
The classification is as follows-
C– Condyle.
R– Ramus.
B– Body.
S– Total symphysis.
S^H– Hemisymphysis.

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