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Long Face Syndrome

A Project Submitted to

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By

Hadi Khudair Abbas

Supervised by:

Dr.Jinan E. Saloom
B.D.S, M.Sc

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Certification of the Supervisor

I certify that this project entitled **"Long Face Syndrome"** was prepared by the fifth- year student fifth year student **Hadi Khudair** Abbas under my supervision at the College of Dentistry/University of Baghdad in partial fulfilment of the graduation requirements for the Bachelor Degree in Dentistry.

Signature:

Supervisor's name: Jinan E. Saloom

Date:

Dedication

First and foremost, I must acknowledge my limitless thanks to Allah ,the Ever-Magnificent the Ever-Thankful help and bless.

This project is dedicated to our parents, who have never failed to provide us with financial and moral support, as well as meeting all of our requirements during the time we were developing our system and taught us that even the most difficult endeavor can be completed if approached in little steps.

This project is dedicated to all those who have worked tirelessly to assist us in completing it.

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List Of Content

List of Figures

List of Abbreviations	
LFS	Long Face Syndrome
ML	Mandibular Body Base
FIG	Figure
SNA	Sella-Nasion-Point A
SNB	Sella-Nasion-Point B
ANS	Anterior Nasal Spine
PNS	Posterior Nasal Spine
GO-ME	Gonion-Menton
TAHF	Total Anterior Facial Height
LAFH	Lower Anterior Facial Height
UAFH	Upper Anterior Facial Height
Go-Gn	Gonion-Gnathion
NA-POG	Nasion-Point A-Gogonion
Co-A	Condylon- Point A
Co-B	Condylon- Point B
SN-MP	Sella Nasion-Mandibular Plane

Introduction

A hyperdivergent facial type, adenoid face, Long Face Syndrome(LFS),highangle patient type, these terms describe patients with increased inclination of the mandibular body base(ML) relative to anterior cranial base **(Collett&West., 1993)**. According to **Schendel (1976)**, excessive vertical growth of maxilla, increased clockwise rotation of the mandible, increased SN-MP angle and adenoid face are the main features of the long face syndrome. However, literature reports often emphasize the fact that excessive vertical growth of maxilla is (maxillary vertical excess) is the main component of skeletal disturbances in LFS **(Sobieska *et al.*, 2015).**

long face morphology is a relatively common presentation among orthodontic patients with an increased lower facial height, an anterior open-bite, a narrow palate, gummy smile and a lack of chin prominence are all classic traits. While abnormal vertical facial growth can often be recognized clinically, several cephalometric features are typically employed to identify the underlying vertical skeletal pattern as normal (normodivergent), short (hypodivergent), or long (hyper divergent) **(Bansal *et al.*,2015)**. The phrase "long face syndrome" only refers to the vertical aspect of the three-dimensional condition that these patients are experiencing. Both genetic and environmental factors have been associated with the etiology of excessive vertical facial development, Etiological factors such as enlarged adenoids, nasal allergies, weak masticatory muscles, oral habits, and genetic factors have all been implicated in the development of the long face morphology **(Collett and West, 1993).**

The treatment objective in a patient having sufficient potential for growth should be to restrain and control maxillary descent and prevent eruption of posterior teeth. When the severity of vertical deformity is so great that reasonable correction cannot be obtained by growth modification or camouflage, the combination of orthodontics and orthognathic surgery may provide the only viable treatment. Despite being described extensively in the orthodontic literature the long face morphology still remains unclear **(Bansal *et al*.,2015).**

Aim of the study

The aim of This study is to describe etiology, the varied clinical manifestations, and treatment modalities for long face syndrome.

Chapter I: Review of literature

1.1 Nomenclature:

A variety of terms have been used for excessive vertical craniofacial growth, such as the long face syndrome, vertical maxillary excess, idiopathic long face, skeletal open-bite, high angle, hyperdivergent**,** dolichofacial and adenoid face, although these terms often refer to the same clinical condition, the multiplicity of terms suggests considerable morphological variation within each facial type **(Sirwat and Jarabak, 1985; Collett and West, 1993).**

1.2 Prevalence

Two of the largest studies on the prevalence of skeletal facial types were conducted in the United States, and both included the study of a large orthodontic patient sample**, t**he long face pattern was found to be prevalent in both studies at around 22%. The prevalence of these vertical development patterns varied greatly depending on Angle's malocclusion categorization, with the highest proportion (35%) appearing in the Class III sample, followed by the Class I (32%), Class II Division 1 (30%),and Division 2 (18%) group **(Proffit *et al*., 1990; Bailey *et al*., 2001; Willems *et al*., 2001).**

1.3 Etiological factors

More than the contribution of a single factor it is a multitude of factors together that contribute to this syndrome **(Ramesh *et al*., 2017).**

The etiological factors have been outlined as follows:

1.3.1 Genetic factors

An abnormal genetic growth pattern is thought to be the most common cause of LFS, whereas environmental factors affect the intensity of symptoms **(Prittinen, 1997).** Innate growth potentials are regulated by genetic constitution of the body. For example control of sagittal, transverse and vertical dimensions are usually inherited in the family such as Hapsburg jaw. Growth and growth rotations occurring in late maturation period are also attributed to the genetic pool of the patient. Facial types such as hyper and leptoprosopic allow the vertical eruption of molars, thus causing an excessive vertical skeletal pattern **(Torres *et al*., 2012).**

Different heritability estimates have been reported for various vertical dimensions of the face. For instance, the heritability of total face height is reported to range from 0.8 to 1.3, while that of the lower anterior face is between 0.9 and 1.6. In contrast, the heritability of the posterior and upper anterior face height ranges from 0.2 to 0.9 and 0.2 to 0.7, respectively However, heritability studies have a variety of limitations that could explain some of the disparities in the literature. Because these estimations are often produced under a variety of environmental conditions, it's difficult to extrapolate the results from one sample to the next or even within the same sample over time **(Amini and Farahani, 2009)**.

1.3.2 Jaw Growth

The pattern of vertical facial development is strongly related to the rotation of both jaws. The rotational patterns of growth are quite different for individuals who have long face type of vertical development, jaw rotations caused by vertical condylar growth have been studied previously and it has been concluded that if growth of maxillary sutures and the maxillary or mandibular alveolar processes exceeds vertical condylar , a backward rotation occurs, and the face becomes longer**(Issacson *et al*., 1971).**

In long-face individuals, who have excessive lower anterior face height, the palatal plane rotates down posteriorly, often creating a negative rather than the normal positive inclination to the true horizontal. The mandible shows an opposite, backward rotation, with an increase in the mandibular plane angle (Fig.1) **(Proffit, 2019).**

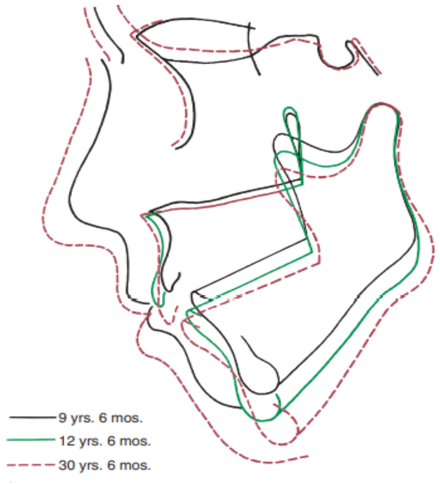


Figure 1: Cranial base superimposition showing the pattern of jaw rotation in an individual with the long-face pattern of growth **(Proffit, 2019).**

The mandibular changes result primarily from a lack of the normal forward internal rotation or even a backward internal rotation. The internal rotation, in turn, is primarily centered at the condyle. This type of rotation is associated with anterior open bite malocclusion and mandibular deficiency (because the chin rotates back as well as down). In these individuals, growth at the condyle is restricted. The interesting result in three cases documented by Björk and Skieller was backward rotation centered in the body of the mandible, rather than the backward rotation at the condyle that is seen in individuals of the classic long- face type **(Proffit, 2019).** It is now clear that the majority of the growth disturbances that contribute to the long face morphology occur below the maxillary plane **(Filho *et al.*, 2010).**

1.3.2 Nasal airway obstruction

Normal respiratory activity influences the development of craniofacial structures by adequately interacting with mastication and swallowing which favour harmonious growth **(Yamada *et al*., 1997).** According to Moss's functional matrix concept nasal breathing is fundamentally vital for normal growth and proper development of the whole craniofacial complex **(Ramesh *et al*., 2017). Kilic and Oktay in (2008)**, have observed that the continuous airflow passing through the nasal passage and nasopharynx during unobstructed breathing produces a constant stimulus for both the lateral growth of maxilla as well as for lowering of the palatal vault**.** Several authors have found that long face individuals have a narrower nasopharynx than other facial types. The presence of any obstacle in the respiratory system, for example, in the nasal or pharyngeal regions, causes respiratory obstruction and forces the patient to breathe through the mouth **(Ramesh *et al*., 2017).**

Nasal obstruction can occur due to several reasons. One of them is nasalpolyps, which are painless benign growths on the lining of the nose that cause nasal obstruction leading to mouth breathing. Another potential cause is a deviated nasal septum. The patients with nasal septal deviation also have a significantly smaller posterior facial height, posterior rotation of the mandible, smaller height of the anterior nasal aperture and shorter nasal ceiling **(Ramesh *et al*., 2017).** Enlarged adenoids is another potential cause of nasal obstruction. It is the most common cause of nasal obstruction in children. Woodside & Linder-Aronson showed closing of the mandibular plane angle and reduction inthe anterior face height after removal of adenoids and tonsillectomy **(Woodside*et al*.,1991)**

1.3.3 Muscle weakness

In a number of muscle weakness syndromes, the facial appearance produces a caricature of the typical long face patient. This observation led to the idea of weak mandibular elevator muscles must cause the long face pattern. If the muscles were weak, biting force would decrease, allowing the posterior teeth to erupt too much and the mandible to rotate downward. Although adult long face patients do have below-normal occlusal forces, pre-adolescent children who already can be recognized a long face types do not. The long face patients appear not to gain muscle strength during adolescence, at least in the mandibular elevators, as do normal individuals (**Proffit and Fields, 1983).**

1.3.4 Oral habit

Oral habits such as abnormal function or size of the tongue and digit sucking have been associated with the classical traits of the long face morphology. Non-nutritive sucking in the first few years of life is consistently associated with vertical malocclusions such as an anterior open bite. These nonnutritive sucking habits are often not limited to the vertical plane, but may also affect the transverse dimension manifesting as posterior crossbites **(Cozza *et al*., 2005)**.

anthropometric points to describe facial morphology, and found a high prevalence of severe facial convexity in adolescents who had been breastfed for relatively short periods and exhibited prolonged mouth-breathing habits that persisted until after the age of 6 to years 9 **(Thomaz *et al*., 2012).**

1.3.5 Mouth breather (Proffit, 2019).

Respiratory needs are the primary determinant of the posture of the jaws and tongue (and of the head itself, to a lesser extent). Therefore it seems entirely reasonable that an altered respiratory pattern, such as breathing through the mouth rather than the nose, could change the posture of the head, jaw, and tongue. This in turn could alter the equilibrium of pressures on the jaws and teeth and affect both jaw growth and tooth position. To breathe through the mouth, one must lower the mandible and tongue and extend (tip back) the head. If these postural changes were maintained, three effects on growth would be expected: (1) anterior face height would increase, and posterior teeth would super-erupt; (2) unless there was unusual vertical growth of the ramus, the mandible would rotate down and back, opening the bite anteriorly and increasing overjet; and (3) increased pressure from the stretched cheeks might cause a narrower maxillary dental arch.

The association has been noted for many years: the descriptive term adenoid faces has appeared in the English literature for at least a century, and probably longer **(Proffit, 2019).**

1.4. Diagnosis of long face syndrome

Diagnosis of the long face syndrome is based on the assessment of morphology of the facial skeleton, intraoral examination of the patient and a cephalometric analysis of lateral cephalograms.

1.4.1 <u>Extral oral Examination</u>

An examination of facial features includes the assessment of: en face facial proportions, profile divergence, nose shape, lip competence and length, and a chin profile. An examination of vertical proportions of the facial skeleton in patients with the long face syndrome reveals elongation of the maxillary segment of the face associated with a skeletal open bite (Fig. 2)(**Wolford *et al*., 1981; Angelillo *et al*., 1982; Sobieska *et al*., 2015).**

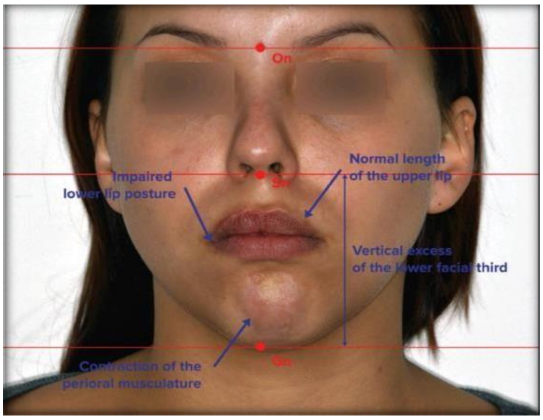


Figure 2: An extra-oral examination of a female patient with the long face syndrome **(Sobieska *et al.,* 2015).**

The analysis of the maxillary face includes an assessment of the rate of the upper lip to the upper incisors at rest and while smiling, and a lip competence test. Patients with LFS demonstrate excessive exposure of the upper incisors when lips are at rest and while smiling, excessive exposure of the gingivae while smiling, the so-called gummy smile, lack of lip competence at rest, drooping corners of the mouth and excessive tension of the mentalis muscle at an attempt to close the lips, a long, humped nose with narrow nostrils is also of note (Fig. 3) (**Wolford *et al*., 1981; Angelillo et al., 1982; Sobieska *et al*., 2015).**

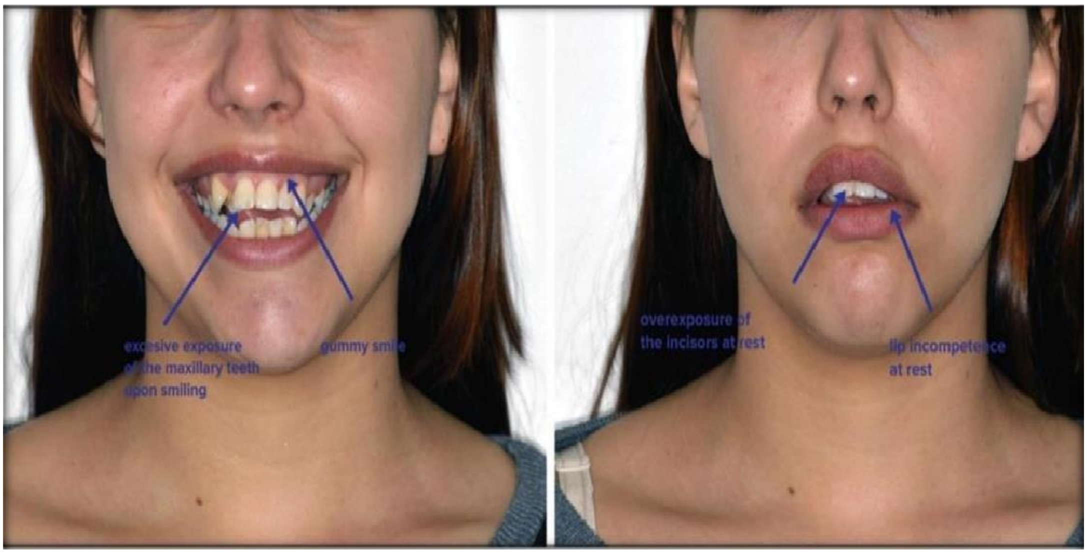


Figure 3: An extra-oral examination of a female patient with the long face syndrome**(Sobieska *et al.,* 2015).**

An analysis of the facial profile demonstrates a typical direction of the facial skeleton growth in a patient with LFS. The profile is convex, oblique posteriorly, there is no chin prominence and it is an effect of posterior rotation of the mandible caused by excessive vertical maxillary growth it results in mandibular rotation towards the bottom and back. The subnasal area is flat and cheeks are not filled **(Wolford *et al*., 1981; Angelillo et al., 1982).**

An examination of the mandibular inclination towards the Frankfurt plane is helpful in the LFS diagnosis and it is performed by placing a dental mirror along the inferior mandibular border **(Fig. 4)**. A steep mandibular plane coexists with high anterior facial height, namely with a tendency towards a skeletal open bite **(Proffit *et al*., 2009).**

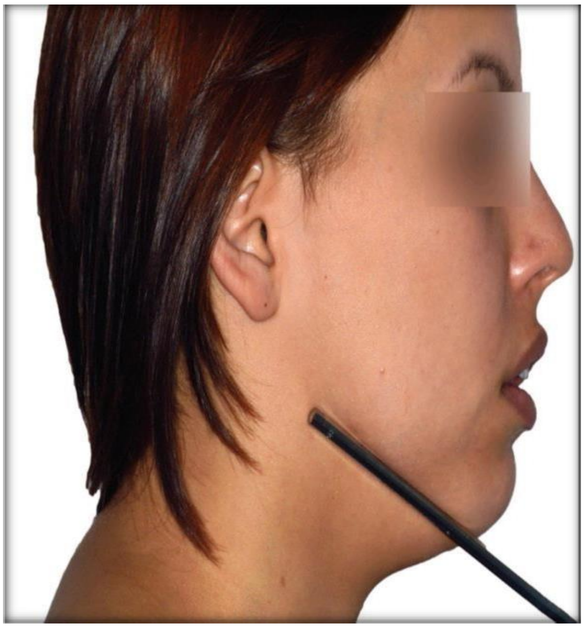


Figure 4: Examination of the inclination of the mandibular plane in relation to the Frankfurt plane **(Sobieska *et al.,* 2015)**

1.4.2 Intra Oral Examination

Excessive vertical maxillary growth combined with mandibular rotation towards the bottom and back manifests with excessive eruption of the lateral teeth and normal or excessive eruption of the anterior teeth. Approximately 60% of patients have a partial anterior open bite, and the remaining patients present compensatory eruption of the incisors resulting in a closed bite in the anterior section **(Proffit, 2009).** There is a high correlation between a vertical maxillary position and vertical and anteroposterior mandibular position. Rotation of the mandible towards the back and bottom usually results in the Angle Class II (71% of patients), even with a normal size of the mandible, the Angle Class I was observed in 13.2% (skeletal Class III rotating to Class I), whereas Class III in 15.8% of patients**.** Posterior rotation of the mandible resulting in verticalisation of the lower incisors during growth contributes to an increased incidence of crowded lower incisors in patients with LFS. In 34.2% of patients there is a partial lateral cross bite associated with maxillary narrowing, and a narrow, high palate, and it may be a result of chronic breathing through the mouth that is often observed in patients with the long face syndrome **(Cardoso *et al*., 2002).**

1.5. Cephalometric findings

A cephalometric analysis is a tool necessary to locate and determine a degree of skeletal disturbances that may result from excessive vertical growth of the condylar process and/or excessive vertical maxillary growth **(Wolford *et al*., 1981).** Three cephalometric criteria that are used together to diagnose the long face syndrome. They are **(Fields *et al*.1984):**

- increased GoGn:SN angle (the angle of the maxillary base plane inclination – GoGn – gonion-gnathion with regard to the base of the anterior cranial fossa – SN – sella-na- sion).
- increased total anterior facial height – N-Me (a linear distance between nasion and menton points).
- reduced percentage ratio of the upper face to the lower face – a percentage ratio between linear measurements: N-ANS:ANS-Me (nasion-spina nasalis anterior: spina nasalis anterior-menton).

1.5.1 Assessment of sagittal apical bases

Examinations of patients with LFS demonstrate a normal sagittal position of the maxilla with regard to the anterior cranial fossa (SNA angle) and its normal length (a linear measurement between Co-A points) **(Filho *et al*., 2010)**. The evaluation of the anteroposterior maxillary position in relation to the cranial base is extremely important when planning procedures related to orthognathic surgery in order to assess the need to change its position. However, each case should be carefully analysed, as there are studies demonstrating a posterior position of the apical base of the maxilla in patients with LFS **(Capelloz *et al*., 2007).** Excessive vertical maxillary growth affects the rotation of the mandible towards the bottom and back (posterior rotation) and it manifests with a posterior position of the mandible in relation to the cranial base, namely a reduced SNB angle in cephalometric measurements. Additionally, the ANB angle is also increased, and it indicates a posterior relation of the mandibular position in relation to the maxilla **(De Oliveira *et al*., 2013)**. A posterior position of the mandible affects an increase in the NA-Pog angle indicating the skeletal profile convexity **(Capelloz *et al*., 2007).**

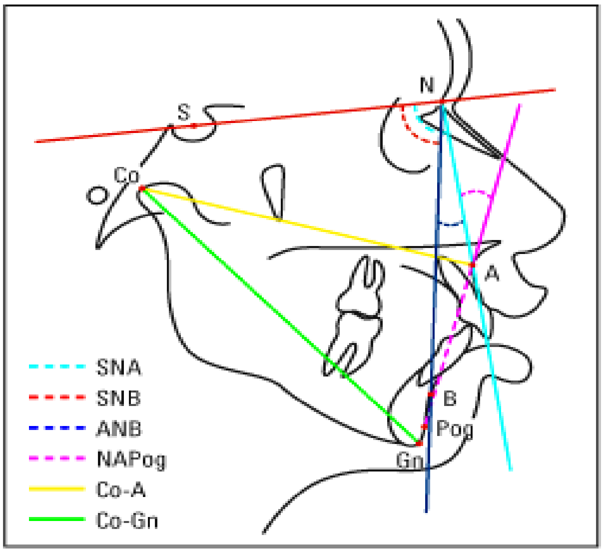


FIGURE 5 - Cephalometric landmarks representative of the sagittal behavior of apical bases: SNA, SNB, ANB, NAPog, Co-A, Co-Gn.

1.5.2 Vertical analysis of the facial skeleton

The angle of the inclination of the mandibular base plane to the anterior cranial plane (SN- NL) is within the normal, and it indicates normal maxillary inclination. In the long face syndrome all disturbances are located below the cranial base plane (ANS-PNS), and it is an important diagnostic criterion **(De Oliveira *et al*., 2013)**. The mandibular structure is typical of patients with posterior rotation described by Björk. **(Janson *et al*., 1994).** The mandibular body is narrow, the angle is obtuse, the ramus is short and narrow, and chin prominence is poorly defined. The mandibular length measured between Co-Gn points may be normal **(Filho *et al*., 2010).** Cephalometric measurements in patients with the long face syndrome demonstrate an increase in the GoGn:SN angle – mandibular inclination in relation to the anterior cranial fossa. Additionally, the percentage ratio of the posterior and anterior facial height is also reduced – SGo:NMe% is below 58%. Moreover, the intermaxillary angle (described as B, MM, NL/ML angle) is also increased – it is between the mandibular base plane (Go-Gn) and the maxillary base plane (ANS-PNS) **(Schendel *et al*., 1976).** It is an angle of clinical importance, and its mean value is 26°. When the value of this angle exceeds 32° expanded diagnostic radiology tests are recommended. It is recommended to monitor the value of the base angle in patients with the long face syndrome who are still in the growth phase, by performing cephalometric scans every six months in order to initiate orthodontic treatment in due time and prevent progression of this syndrom **(Prittinen , 1997).**

The following are also observed in a cephalometric analysis in patients with the long face syndrome **(Filho et al., 2010):**

- increased total anterior facial height (TAHF)
- normal upper anterior facial height (UAFH)

– increased lower anterior facial height (LAHF)

– increased percentage ratio of lower anterior facial height to total anterior facial height (LAFH/TAHF%)

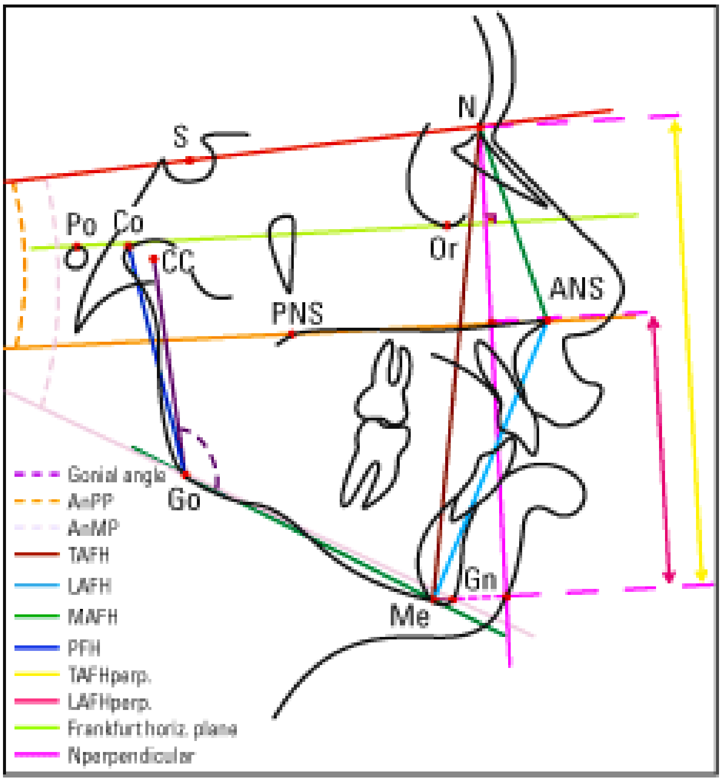


FIGURE 6 - Cephalometric landmarks representative of the vertical behavior of the apical bases: SN.PP, SN.MP, gonial angle, TAFH, LAFH, MAFH, PFH, TAFHperp, LAFHperp.

1.6. Treatment

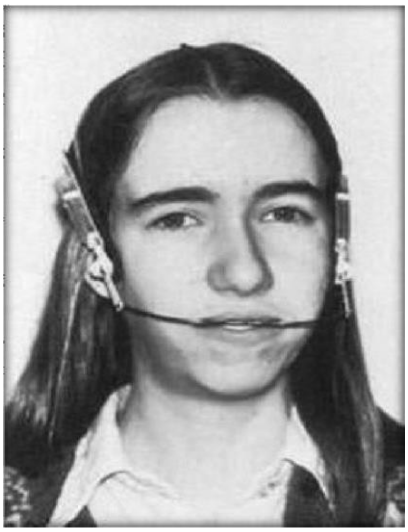
The clinician must address the three-dimensional dentoalveolar and skeletal problems that present in long face syndrome. Treatment modality depends on the growth potential of the patient when he reports as well as the severity of the dysplasia.

1.6.1 Patient with Potential Growth

The primary objective of treatment in a growing child with a long face problem is to restrain and control that area. If vertical movement of the posterior teeth (which is due to a combination of jaw growth and eruption) could be controlled well enough, downward and backward rotation of the mandible could be prevented, and it might even be possible to produce upward and forward rotation of the mandible as growth continues. The long face growth pattern is hard to modify, and it persists until late in the teens; therefore treatment must continue over many years. **(Bansal *et al.*,2015)**.

1.6.1.1 <u>High-Pull Headgear to the Molars</u>

High-pull headgear to the molars (figure 5) maintains the vertical position of the maxilla and inhibits eruption of the maxillary posterior teeth **(Firouz *et al*.,1992).**



. **Figure 7:**High-pull headgear to the molars**(Firouz *et al.*,1992)**

1.6.1.2 <u>High pull Headgear with bite blocks</u>

high-pull headgear can be worn while the functional appliance is in use, gives the most effective control of excessive vertical growth. The effect of this appliance on the maxilla is similar to that of a maxillary splint, but it also controls the vertical position of the lower teeth.Fig.6 **(Bansal et al., 2015).**

Figure 8: Activator with bite blocks fitted with headgear tubes **(Bansal *et al.*, 2015)**.

1.6.1.3 <u>Vertical Pull Chin Cup</u>

Derives and anchorage from the parietal region. It is indicated in high angle cases or long face patients as it helps to close the angle of the mandible increase the posterior facial height. (Fig 7).

Figure 9: Vertical Pull Chin Cup **(Sugawara *et al.,* 1997)**

1.6.1.4 <u>High-Pull Headgear to a Functional Appliance With Bite Blocks</u>

The most aggressive approach to maxillary vertical excess and a Class II jaw relationship, which has been recommended as a way to treat the most severely affected long-face patients, is a combination of high-pull headgear and a functional appliance with posterior bite blocks to anteriorly reposition the mandible and control eruption **(Proffit *et al*., 2019).**

1.6.2 Patients with questionable growth potential (Scheffler *et al.*, 2014)

A camouflage treatment plan based on retraction of the upper incisors by extraction of premolars does nothing to help correct the vertical problem. As the upper incisors are retracted they extrude and the nasolabial angle will increase. The fact that vertical growth continues into the late teens can be both a problem and a potential opportunity. A problem exists because the growth pattern tends to further worsen the long face deformity without treatment. An opportunity is present because at least some growth potential usually is present in long face adolescents which can be modified to meet the treatment goals. However, growth modification after the adolescent growth spurt is more a theoretical possibility as it is almost impossible to get adolescents to wear a functional appliance with bite blocks and headgear regularly enough to really control vertical growth. Anterior open bite in adolescents (adults) often can be corrected with orthodontic treatment. Ideally, this would be accomplished by intruding the posterior teeth which is now a possibility with temporary anchorage devices. However, long term stability and the biological limits of safe intrusion which can be achieved are yet to be established. In this borderline situation, a lower border osteotomy of the mandible to bring the chin upward and forward can greatly improve both dental and facial esthetics, because the lower lip relaxes and moves up as the chin is elevated

1.6.3 Patients with little or no growth potential

For long face patients with no prospect for successful growth modification, surgery is probably the only treatment option. Orthodontic camouflage does nothing to improve the excessive facial height and can even further worsen it. A patient with a genuine long face problem who does not accept a surgical treatment protocol is better off without any treatment **(Proffit *et al*., 2003).**

1.6.3.1 Treatment Progress

1.6.3.2 Pre Surgical Phase

Preparing the dentoalveolar arches for orthognathic surgery necessitated leveling and alignment of teeth, decompensating the retroclination of lower incisors, and achieving ideal arch form that allows surgical expansion through median maxillary split **(Saleh et al., 2018).**

1.6.3.3 Surgical Approach (Proffit *et al*., 1991)

1. LeFort I ostoetomy to superiorly reposition the maxilla. When the maxilla moves up the mandible rotates around the horizontal condylar axis to move up with it, so that the chin moves upward and forward. Indirectly, the maxillary surgery repositions the mandible.
2. Mandibular ramus ostoetomy to bring the lower jaw forward and upward, which could be accomplished in an open-bite patient. The position of the maxilla would not be altered at all .
3. Mandibular inferior border ostoetomy to reposition the chin upward and forward. Rarely is this procedure adequate by itself in an adult, but it is a useful adjunct to either of the other two surgical possibilities

1.6.3.4 Post surgical Phase (Saleh *et al*., 2018)

Maintaining normal anterior overjet and overbite, plus ideal incisors, canines, and molar relationship during this phase is crucially important. The healing of bony parts during detailing of occlusion and any minor corrections if they ever exist is the key for success at this stage. Full-time wear of heavy elastics for Two weeks after surgery to assure full dental interdigitation, arch symmetry, and stable treatment outcome. Four month later, the appliance was removed, and the necessary retainers were constructed, the prosthodontist took good care of the four maxillary incisors upon the patient's request. Follow up for usually 5 years is planned, and the interdisciplinary approach yielded realistic adequate treatment outcome

Chapter II: Discussion

For each patient who requires orthodontic treatment, the orthodontist must undertake a detailed differential diagnosis. A diagnosis of a malocclusion must consider all threecomponents: facial, dental, and skeletal. Each component must be thoroughly examined and comprehended in order to ask the right questions and make the right diagnostic conclusions, which will lead to an effective treatment plan. Growth is unquestionably a crucial period, with the possibility for both orthopedic and orthodontic adjustments as well as relapse into the original disease. The long face pattern of growth in preadolescent children can be approached in a variety of ways. The orthodontist must be able to recognize clinical situations and use treatment options skillfully for the benefit of the patient. Patients now have an option that results in both desirable esthetics and appropriate occlusion in adult humans when carried out with good planning, proper execution, and attention to detail when carried out by both the orthodontist and the oral maxillofacial surgeon.

Chapter III: Conclusions and Suggestions

The long face morphology is well-documented in orthodontic literature. This abnormality has been linked to a number of clinical and cephalometric characteristics.It has a multifaceted etiology that includes both genetic and environmental elements.The open bite version of the condition is the focus of the majority of studies. The Long Face development pattern is difficult to change in growing people, and it can last until late in adolescence; as a result, treatment with headgear or functional appliances must be continued for many years. Surgical intervention is the only viable option for people whose growth has slowed.

For further study, we suggest to search for the etiological factors responsible for abnormal growth of cranial structure to make it possible to eliminate early growth abnormalities that might intensify the disorders.

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