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Long Face Syndrome: A Literature Review

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Review Article

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Abstract: Long face syndrome has by far presented itself as a challenge to the present day orthodontist. Inspite of being critically reviewed in literature long face syndrome still remains unclear. This article aims at critically reviewing the literature for the available resources in handling this condition and providing the clinician a helpful tool to handle such patients in their clinic with clarity and ease. Internet search was performed using google scholar with keywords ‘long face syndrome, adenoid facies, nasal obstruction and anterior open bite’ to collect published literature with regard to long face syndrome. Published articles that described this condition in detail were reviewed and have been discussed here. Information available from the collected articles was segregated under various headings of prevalence, etiological factors, clinical features, cephalometric features, treatment plan and modalities. Long face syndrome has a multivariate etiology with both genetic and environmental factors associated. Timely diagnosis of the etiology and its treatment can allow normal growth to continue in children. As different age groups require different modalities of treatment based on the severity and etiology, it is necessary to understand the treatment planning protocol of this condition and follow it with precision.
Keywords: Open bite, long face, fixed appliance

INTRODUCTION

Orthodontics has always been a challenging field due to the varied clinical manifestations of different malocclusions and their impact on the general health of an individual.

One such challenge that the profession often encounters is management of patients with a long face syndrome. As, such cases are regularly encountered in our practice we must have a reliable management protocol to help us handle these patients. In this review we have attempted to bring together all the available literature on long face syndrome that can serve as a valuable lookup for the present day clinicians.

A variety of terms have been used for excessive vertical craniofacial growth, such as the long face syndrome and vertical maxillary excess[1], idiopathic long face [2], skeletal open-bite[3,4] high angle [5], hyperdivergent [6,7], dolichofacial [8] and adenoid face [9]. The multipilicity of names describing this syndrome partially arises from the difficulty in describing vertical skeletal dysplasias by the traditional anteroposterior classifications and failure to direct enough effort toward describing the frontal or full-face esthetic aspects of dentofacial deformities. Despite being described extensively in the orthodontic literature the long face morphology still remains unclear.

MATERIALS AND METHODS

Internet search was performed using google scholar with keywords ‘long face syndrome, adenoid facies, nasal obstruction and anterior open bite’ to collect published literature with regard to long face syndrome. Published articles that described this condition in detail were reviewed and have been discussed here with data obtained classified under different headings.

RESULTS AND DISCUSSION

Information available from the collected articles was segregated under various headings of prevalence, etiological factors, clinical features, cephalometric features, treatment plan and modalities.

Prevalence

Two of the largest studies that investigated the prevalence of skeletal facial types were undertaken in the United States, and involved the evaluation of a large orthodontic based patient sample [10, 11]. In both studies, the prevalence of the long face pattern was approximately 22%. This extreme form of vertical craniofacial growth was also reported to be the second most common cause for seeking and receiving orthodontic/surgical treatment [10]. The prevalence of these vertical growth patterns differed significantly according to Angle's classification of malocclusion, with the highest proportion occurring in the Class III sample (35%), followed by the Class I (32%), Class II Division 1 (30%) and Division 2 (18%) groups[12]. These findings were consistent with those of another retrospective study investigating the occurrence of skeletal malocclusions in a Brazilian sample [13].

Chew investigated the distribution of dentofacial deformities in an ethnically diverse Asian population receiving orthognathic surgery and found that the overall prevalence of vertical maxillary excess (VME) was nearly 22%, although significant differences existed in the distribution of VME among the three Angle classes. The highest prevalence of VME occurred in the Angle Class I (50%) and Class II malocclusions (48%), followed by the Class III group (10%) [14].

Etiological Factors

More than the contribution of a single factor it is a multitude of factors together that contribute to this syndrome. It is therefore a necessity for the orthodontist to be aware of the possible factors involved to equip himself with the necessary knowledge to treat the patient.

The factors have been outlined as follows –

Genetic Factors

Heritability estimates have been reported in the literature 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 [15].

However, the limitations inherent in these studies account for some of the inconsistent findings reported in the literature. As these estimates are typically derived under different environmental conditions, it is difficult to generalize the findings from one sample to another or even within the same sample over a substantial period of time.

Jaw Growth

Jaw rotations caused by vertical condylar growth have been studied previously and it has been concluded that if growth of the maxillary sutures and the maxillary or mandibular alveolar processes exceeds vertical condylar growth, a backward rotation occurs, and the face becomes longer [16, 17]

Racial Predilection

Long face, open bite problems seem to be proportionately more frequent in blacks than in Whites or Asians.

Environmental factors

Several local environmental factors have been implicated in the etiology of the long face morphology, including nasal obstruction, parafunctional habits and weak muscle activity [16-18].

Nasal airway obstruction

Laboratory studies indicate that most children and adults with the long face condition breathe through the nose, making a seal between the nasal and oral cavities posteriorly with the soft palate rather than anteriorly with the lips. On the other hand, more long face than normal children and adults have an increased oral and decreased nasal airflow (i.e. an increased oral/nasal ratio). It appears, therefore, that for some patients, difficulty with nasal respiration may play a role in the development of the long face condition, but this is not the only or the usual cause.

James L. Vaden researched on respiration and came up with two opposing views [19].

The first suggested that total nasal obstruction is highly likely to alter the pattern of growth and lead to malocclusion in experimental animals and humans, and individuals with a high percentage of oral respiration are overrepresented in the long-face population. The second view suggested that majority of individuals with the long-face pattern of deformity have no evidence of nasal obstruction and must therefore have some other etiologic factor as the principal cause.

Vig *et al.*, found that patients with long vertical face height had higher nasal resistance when compared with normal patients, but these individuals did not necessarily have the least amount of nasal airflow [20]. Normal respiratory activity influences the development of craniofacial structures by adequately interacting with mastication and swallowing which favour harmonious growth [21-23]. According to Moss's functional matrix concept nasal breathing is fundamentally vital for normal growth and proper development of the whole craniofacial complex [24]. Kilic and Oktay 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 [25].

According to Proffit, respiratory needs are primary determinants of tongue and jaw posture. Nasal obstruction necessitates mouth breathing and lowered jaw and tongue posture. This leads to eruption of posterior teeth leading to a clockwise rotation of the mandible. This hypothesis is supported by Bresolin D in whose study, compared with their nose breathing counterparts, chronically allergic mouth-breathing children 6 to 12 years of age were found to have narrower maxillas; greater incidence of posterior cross-bites; longer anterior facial heights; steeper palatal, occlusal, and mandibular planes; larger gonial angles; and more retrognathic mandibles[26].

Several authors have found that long face individuals have a narrower nasopharynx than other facial types [27].In fact, both anterior and posterior facial heights appear to be positively correlated with all the volumetric measurements of the airway, with the exception of the middle pharyngeal third [28]. 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 [29].

Mouth-breathing leads to a change in posture to compensate for the decrease in nasal airflow and to allow respiration [30].This results in a lower position of the mandible, and a lower or an anterior position of the tongue, usually associated with lower orofacial muscle tonicity [31].

This will cause abnormality and disharmony in the growth and development of orofacial structures, including narrowing of the maxilla, lower development of the mandible, protrusion of the upper incisors and also alteration of the head in relation to the neck [32].

Dunn *et al*., evaluated frontal and lateral cephalometric radiographs from 33 monozygotic twins aged from seven to twelve years and found an association between nasopharyngeal obstruction and mandibular morphology, with decreased nasopharyngeal airway size; increased gonial angle and increased bigonal width (from gonion to gonion [33].

Nasal obstruction can occur due to several reasons. One of them is nasal polyps, 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.

A deviation of the nasal septum occurs when it is displaced laterally—either to one side, or both. Genetics and environment both play an important role in the development of septal deviations. Some displacement is common, affecting 80% of people and not all cases require treatment. Posterior nasal septal deviations up to 5mm are not considered to affect nasal resistance. A study concluded that the anterior nasal septum is more susceptible to cause nasal resistance and that differences of up to 1mm can be significant[34]. 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 [35]. This was the first study to show that nasal septal deviation may have the ability to affect facial form in humans. Chronic mouth breathing can sometimes be a clinical manifestation of nasal septal deviation.

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 in the anterior face height after removal of adenoids and tonsillectomy [36].

Mouth breathing

Linder and Aronson proposed that mouth breathers with hypertrophied adenoids have narrow maxillas, lower tongue positions, proclined incisors, and increased lower anterior facial heights and thereby concluded that mouth breathing may contribute to the development of orthodontic problems but is difficult to be accepted as a frequent etiologic agent [37].

Mouth is always open as patients with upper airway obstruction become obligatory mouth breathers and it results in abnormal face development with prominent crooked upper teeth and absence of lip seal. This open mouth posture is called as adenoid facies.

The position of the tongue is a necessary physiologic adaptation to long face patients with open bite, not its cause. When the incisors overlap normally, the tongue can be placed behind them to create the anterior seal necessary for successful swallowing or articulation of several consonant sounds. With an open bite, the tongue must protrude to seal against the lips, therefore tongue thrust is a reasonably accurate description

According to O'Ryan *et al*., a critical review of the literature does not support the assumption that mouth breathing that results from a compromised nasal airway is of major etiologic significance in the development of the long-face syndrome [38].

Weak muscles

Ingervall and Thilander have postulated that excessive maxillary posterior dentoalveolar development is associated with weaker masticatory musculature in high-angle patients compared with the strong musculature commonly associated with short anterior facial height patients [39].

The long face patients appear not to gain muscle strength during adolescence, at least in the mandibular elevators as do normal individuals.Muscle efficiency is detected much later in life whereas facial pattern is predictable early in life.

The force exerted by the masticatory muscles is not a major environmental factor in controlling tooth eruption and not an etiological factor for most patients with deep bite or open bite.

Occlusal Biting Forces

Molar biting force generated in long faced individuals is 50 - 80 pounds compared to 150 - 200 pounds in short-faced individuals. The difference is due to the muscle strength. Larger gonial angle and a lowered maxilla results in lowered mechanical advantage of the muscles.

Soft Tissue Stretch

The long face morphology in children with the habit of mouth breathing may also result from the effects of soft tissue stretching that commonly occur when these individuals overextend their heads to compensate for impaired nasal respiration [16].

Oral Habits

Oral habits such as 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 non-nutritive sucking habits are often not limited to the vertical plane, but may also affect the transverse dimension manifesting as posterior cross-bites [40]. Thomaz and colleagues used 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 years [41].

Variations in the long face morphology have so far been discussed in terms of skeletal growth imbalances and mandibular rotations, although there still remains a great deal of uncertainty as to what causes or “triggers” these growth patterns [42]. The multiplicity of growth theories suggests a complex multifactorial etiology that involves genetic, environmental and epigenetic regulation.

Clinical Features

Examination of the affected individual’s extraoral features reveals a ‘mask like facies’. Assessment of the face in the frontal aspect reveals the upper third usually within normal limits, middle third reveals a narrow nose, narrow alar bases, and depressed nasolabial areas and the lower third commonly reveals excessive exposure of maxillary anterior teeth, poor upper-lip-to-tooth relationship, large internarial distance(resting lip separation >4 mm, judgment must be made with soft tissues at rest, not in a smile), long lower third of the face and inordinate exposure of the maxillary teeth and gingiva upon smiling. A tendency towards anterior open bite; however, one third of long face patients have normal or excessive overbite, and only one in six has 4 mm or more open bite. Anterior open bites are only found in a limited proportion of individuals with the long face morphology [43]. Fields and colleagues recognized this common misconception and pointed out that “not all long faced patients have open-bites and not all open-bite patients are long face [44]. The reduced prevalence of anterior open-bites in long face individuals can be attributed to the dentoalveolar compensatory mechanisms, which are capable of masking the underlying skeletal pattern in a large proportion of individuals [45]. An increased craniovertebral angle is a finding in most of the patients.

A tendency towards mandibular deficiency and Class II malocclusion, although the anteroposterior relationship can be anything from severe Class II to mild Class III.A tendency toward a narrow maxilla and posterior crossbite is a finding in about half the patients. Facial retrognathism, for example, gradually increases with facial divergence and mandibular plane angle [5]. Other features (such as a dolichocephalic cranium, narrow nasal apertures, small temporal fossa, underdeveloped mandibular processes, narrow and long mandibular symphysis, reduced chin prominence, and large teeth) have also been reported in some individuals with the long face pattern[3].

While excessive vertical facial growth can often be recognized clinically, several cephalometric traits are commonly used to classify the underlying vertical skeletal pattern as normal (normodivergent), short (hypodivergent), or long (hyperdivergent). The term “long face syndrome” depicts only the vertical component of the three dimensional problem which exists in these patients.

Cephalometric Features

Rotation of the palatal plane down posteriorly (i.e. the maxilla has descended posteriorly more than anteriorly). This is shown clearly by the inclination of the palatal plane to the other horizontal reference planes. The linear distance from the cranial base to posterior landmarks (e.g., PNS) usually is increased. Excessive eruption of maxillary posterior teeth (ie. the distance from the palatal plane to the cusps of the upper teeth is increased) is observed. Increased gonial angle is observed. Rotation of the mandible downward and backward leading to an increased mandibular plane angle. To a large extent, this is secondary to the maxillary rotation and elongation of the maxillary molars, but the mandibular ramus often is short. Excessive eruption of maxillary and mandibular incisors occurs in partial compensation for the jaw rotation. Even patients who have anterior open bite have this finding, but it is greatest in those with a deep bite.

Fields *et al*., demonstrated that three cephalometric criteria in combination are necessary to quantify the condition-increased mandibular plane angle, increased total anterior face height and decreased percentage of upper versus lower face height. If a patient has all three, he or she can be considered to have a long face deformity [44].

It is now clear that the majority of the growth disturbances that contribute to the long face morphology occur below the maxillary plane [1, 5, 9, 45, 48]. In general, the hyperdivergent pattern results from a combination of dentoalveolar and skeletal features. A number of cephalometric variables that represent these areas have therefore been associated with the long face morphology, including a reduced posterior facial height, greater total facial height, and larger lower anterior facial height, gonial angle, and mandibular plane angle [1, 46, 47, 49]. One recent study shows that long faces were predominantly due to increased lower face height [50]. One of the main limitations of the studies discussed is their confinement to the open-bite variant of the long face morphology.

Morphology And Growth Patterns

The relative size of the mandible is significantly smaller in growing children with a hyperdivergent pattern than in those with either the normodivergent or hypodivergent morphologies [51]. The shape of the mandible is also more variable in those with greater skeletal divergence, and differs from normodivergent individuals at the gonial angle, alveolar process, posterior ramus border, and mandibular plane. Recent studies have shown that the hyperdivergent pattern is associated with thin cortical bone plates which may lead to mini-implant failure especially in maxillary buccal alveolar segments [52].

Treatment

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.

The etiology must always be treated first

In case of nasal polyps being the cause of nasal obstruction, adequate medications must be initiated.
In case of a deviated nasal septum, early interventional management at birth appears to be a safe procedure and may prevent future need for septoplasty surgery later [53].

In case of enlarged adenoids, adenoidectomy must be carried out as soon as identified as the major cause to airway obstruction. The surgery is best carried out as soon as identified in children to prevent further impediments in the facial growth. It is carried out as a one day out-patient procedure soon after which the child can return home, and fully recover in a week's time.

These being the most common causes, once treated will allow a patent airway to function and further intervention can be carried out depending on the age of the patient.

Preadolescents with Growth Potential

The primary objective of treatment in a growing child with a long face problem, must be to restrain and control the excessive vertical growth of the maxilla, particularly in the posterior region thereby preventing downward and backward rotation of the mandible.

The long face growth pattern is hard to modify, and it persists until late in the teens; therefore treatment must continue over many years.

The two methods for impeding excessive vertical growth are

1) High-pull headgear to a complete or partial maxillary fixed appliance
2) Functional appliance that incorporates bite blocks between the teeth

High-Pull Headgear to a Complete or Partial Maxillary Fixed Appliance

A headgear effectively holds the maxillary sutural growth and vertical dentoalveolar development.
The force must be directed through center of resistance of thedentomaxillary complex.

Its direction should be such that a more intrusive component of the force is produced than a distally directed one. Restriction of the vertical maxillary growth, masks the normal vertical mandibular growth through mandibular rotation. A force which is not through the center of resistance would tend to rotate the dentomaxillary complex during growth. A headgear must be worn for a minimum of 14 hours a day. Intrusion of upto 3mm has been observed with this. Disadvantage of using a headgear is difficulty in obtaining a pure vertical component of force and that only the molars experience the intrusive force. Biomechanical constraints also offer a disadvantage in its usage.

Vertical Pull Chin Cup

This appliance is placed as forward as possible exerting a force of 16 ounce and to be worn for a minimum of 12 hours. Extraction of four premolar will have to follow its usage. The appliance may be augmented with mandibular bite blocks. Pearson has used the vertical chin cup in the mixed and permanent dentition to reduce the mandibular plane angle and limit increases in anterior facial height [54].

A case treated with a vertical-pull chin cup in conjunction with a Kloehn cervical headgear showed significant dental and skeletal alterations; upper molar eruption and descent of the maxilla were inhibited while mandibular growth was redirected toward a more horizontal direction. Treatment success was attributed to the increase in posterior facial height.

Chin cups have also been used during active rapid palatal expansion therapy to minimize the vertical displacement of the maxilla and control the opening of the mandibular plane angle. Importantly, the vertical chin cup is the only appliance shown to effectively alter mandibular shape by increasing posterior heights, redirecting condylar growth, and decreasing gonial angulation.

Posterior bite blocks

Posterior bite blocks have been shown to effectively modify vertical skeletal patterns in animal models and humans. McNamara concluded that the maxillary complex was most affected by posterior bite blocks, although changes have been reported to occur throughout the craniofacial complex [55].

Active Vertical Corrector

Dellinger gave this appliance which was nothing but an energized bite block. It consists of upper and lower posterior bite planes with one or two samarium cobalt magnets sealed in a stainless steel capsule. The method of action is reciprocal intrusion of the maxillary and mandibular teeth, due to repelling force of the magnet.Force exerted is 700 g of force per magnetic unit. One or two magnets per distal quadrant are used, depending on the force required. It provides for better constancy of force and greater rapidity of tooth movement. Suggested duration of wear is a minimum of 12 hours per day for 4-6 months. Disadvantages include poor patient compliance due to the size of the magnets. Intrusion achieved was not greater than that achieved with ordinary bite blocks. Repelling force of the magnet causes inconvenience [56].Dellinger's active vertical corrector, with repelling magnets embedded in bite blocks and acrylic shields to prevent lateral jaw deviations, is used in conjunction with a vertical chin cup [57, 58].

Intrusion of the posterior teeth, mandibular autorotation, and reductions in anterior height have been shown after 4 to 7 months of treatment. Dellinger has also reported good long-term stability for five treated cases.

Functional Appliance with Bite Blocks

The functional appliance opposes the vertical maxillary development, by stretching the musculature and other facial soft tissues to create a reactive force, which then is applied to the occlusal surfaces of the upper and lower teeth via bite blocks.

A functional appliance with bite blocks can control the vertical position of the maxillary and mandibular teeth if the patient cooperates well (i.e. if the appliance is worn 14 to 16 hours per day), and skeletal effects can be observed.

Combination of Functional Appliance with Posterior Bite Blocks and Headgear

The combination of headgear and a functional appliance, in a cooperative child, can produce a significant improvement in long face growth during the mixed dentition years.

In a mandibular-deficient patient, it would be advantageous to advance the mandible when the functional appliance impression was taken, whereas in a patient with a normal-size mandible and a largely vertical problem, the blocks would be positioned without any mandibular advancement.

Produces force direction near the estimated center of resistance of the maxilla

Frankel IV is also used along with vertical pull chin cup for extra vertical force. Rarely is it possible to decrease the mandibular plane during orthodontic treatment, but at least further downward-backward rotation during treatment can be controlled.

Extractions and Space Closure Mechanics

Extraction therapy for hyperdivergent patients is predicated on the belief that molars moved mesially out of the occlusal wedge will increase mandibular autorotation, decrease anterior facial height, and reduce open-bite malocclusions.

Mechanics of space closure

In such cases extrusion of the posterior teeth must be avoided. Class II or Class III elastics must be avoided which extrude the posterior teeth. Normal horizontal chains or coil springs used, while the teeth are engaged on a light wire do not apply defined moment to force ratio, resulting in tipping of the teeth into the extraction site.

Rapid Maxillary Expansion

As the maxilla and the dentition tend to rotate in a fan shaped fashion, there is an extrusive component in the posterior region, which is not favorable in a long face.

Bonded expansion is preferred as it will prevent the buccal tipping of the posteriors which brings the lingual cusps down. The occlusal coverage can provide a platform for the masticatory muscles to provide an intrusive force. Occlusal stops should be provided, if the second molars are not included in the bonding.

Possible treatment approaches in the order of their clinical effectiveness as given by Proffit are

High pull head gear to molars>High pull head gear to maxillary splint>Functional appliances with bite blocks>High pull head gear to functional appliance with bite blocks.

Adolescents with Questionable Growth Potential

Anterior open bite in adolescents (or adults) often can be corrected with orthodontic treatment. Ideally, this would be accomplished by intruding the posterior teeth, but that is almost impossible without surgery. It has been claimed that a multiloop edgewise appliance as proposed by Young H.Kim, in conjunction with anterior vertical elastics, can produce posterior intrusion and therefore a true correction of the skeletal problem [58].

Double Edgewise brackets with .018 slots and preferably an auxiliary vertical slot, are used for the appliance setup. The last molars are fitted with .018 × .025 tubes. A vertical slot in an edgewise bracket can be used for an auxilliary mechanism during the early stages of tooth alignment. The wire size is only .016 × .022”.Tipback bends are incorporated into the archwire, according to the required degree of correction of axial inclination. The greater the inclination of the molars, the greater the angle required for the tipback bends. The series of tipback bends is begun at the first bicuspid and progresses posteriorly to the last molar. Typical tipbacks are 3° to 5° on each tooth.

The completed maxillary multiloop edgewise appliance should show a marked curve of Spee, and the mandibular arch a marked reverse curve.

For some patients, a combination of orthodontics and surgical repositioning of the chin is an alternative to the more extensive surgery needed to superiorly reposition the maxilla.

For the more severe long face problems, surgery in the middle to late teens (after the adolescent growth spurt) is quite feasible. Although excessive vertical growth of the maxilla is a characteristic part of the deformity pattern, the best evidence is that continued growth after adolescence does not lead to relapse.

Adults with Little or No Growth Potential

For long face patients with no prospect for successful growth modification, there is no real alternative to surgery.

Planning Surgical-Orthodontic Treatment

Superior Repositioning Of Maxilla

Total or segmental maxillary osteotomy is performed. Moving up the maxilla causes the mandible to rotate around the horizontal condylar axis and move up with it leading the chin to move upward and forward. It must be kept in mind to not elevate the anterior maxilla to maintain an esthetic smile arch.

Mandibular Surgery

In case of anterior open bite mandibular surgery must be performed to bring the mandible forward and upward with a ramus osteotomy. It is mainly implied for cases where problem is largely with the mandible which is rarely the case

Superior Repositioning Of The Chin

A mandibular lower border osteotomy is performed in case of a retruded chin which is an adjunct to either of the surgical possibilities but never a primary option.

Surgical Approach

The guideline for choosing between maxillary and mandibular surgery is quite clear: In patients whose facial height should be reduced, maxillary surgery is the primary procedure. A mandibular ramus osteotomy is recommended only as a secondary procedure, after the maxilla has been repositioned vertically.

Superior Repositioning Of Maxilla

Maxilla is the focus of surgical treatment in long face patients for two major reasons: The maxilla nearly always has excessive vertical development. Neither normal jaw and lip function nor good esthetics can be achieved without correcting the maxillary deformity for most patients and moving the maxilla up produces a stable surgical correction.

In patients with a normal mandible that has been rotated downward and backward, superior repositioning of the maxilla to correct the vertical discrepancy also corrects the anteroposterior problem because the mandible rotates at the horizontal condylar axis. During the maxillary surgery, with the maxilla in the down fractured position, dentoalveolar segments can be created readily.

The usual indication for two segments created by a parasagittal osteotomy, is to allow the maxilla to be widened as it is moved superiorly. Three segments, two posterior and one anterior, usually are employed to correct a vertical step in the arch, typically by moving the posterior segments up more than the anterior.

The canines can be in either the anterior or posterior segments, depending on their initial position. A major reason for segmenting the maxilla is to expand it transversely.

Problems with the stability of transverse expansion have led some surgeons to recommend two-stage surgical treatment when a long face patient needs both vertical repositioning and expansion of the maxilla.

The first stage is surgically assisted palatal expansion to widen the maxilla during the presurgical orthodontics, and then a LeFort I osteotomy is done to reposition it in one piece [5].

But better clinical success with the two-stage surgery has not been demonstrated, and the increased morbidity and cost of two surgical procedures rather than one cannot be justified [6].

Hence one-stage surgery with segmentation when needed is recommended.

Mandibular Surgery

If the mandible is both small and rotated, a ramus osteotomy for further advancement is needed in addition to superior repositioning of the maxilla. In patients with a large but rotated mandible, correcting the vertical position of the maxilla causes the mandible to rotate into a prognathic position, and a ramus osteotomy to shorten it is required.

Superior Repositioning Of the Chin

Many long face patients have excessive eruption of the lower incisors (i.e., the distance from the incisal edge to the chin is too great).

In addition, the incisors tend to be flared forward, which produces poor chin-lip balance. Both of these problems can be addressed with a mandibular lower border osteotomy. The bony cuts are angled up anteriorly, allowing the chin to be moved up and forward, and a wedge of bone is removed from above the chin if further vertical shortening is needed.

In summary, the surgical approach to long face patients almost always includes a LeFort I osteotomy to superiorly reposition the maxilla.

Maxillary segments, mandibular ramus osteotomy to advance or set back the mandible, and lower border osteotomy to reposition the chin are added as required to the individual cases.

Orthodontic Approach with Presurgical Orthodontics

The orthodontist must know the general surgical plan and two things quite specifically; whether the maxilla will be kept in one piece or segmented and whether chin-lip balance is to be achieved by orthodontically repositioning the incisors or by lower border osteotomy.

As a general rule, it is preferable to level the lower arch before surgery. A long face patient with severe anterior open bite often has an extreme curve of spee in the upper arch, to the point that vertical steps exist in the arch which are usually distal to the canines, but they may occur between the lateral incisors and canines.

The more severe the steps, the more advantageous it is to segment the maxilla during the surgery and level the arch by repositioning the dentoalveolar segments rather than by moving the teeth orthodontically. When surgical segments are planned, the orthodontist's role is to level presurgically within the segments but not across the osteotomy sites and to make sure that there is enough space between the roots of the involved teeth to allow interdental osteotomies.

Expansion of a narrow maxillary arch can be carried out either by dental expansion (arch wires only) or by orthopaedic expansion of the midpalatal suture (jackscrew appliance or equivalent)or with segmental expansion.

The more severe the narrow maxilla and the older the patient, the better the decision to expand surgically. If the patient is young enough to open the suture orthopedically, presurgical expansion with a jackscrew appliance is acceptable.

Final Presurgical Planning

Complete records- panoramic and lateral cephalometric radiographs, other radiographs if indicated (e.g. periapical radiographs in areas where interdental osteotomy for segmental surgery is planned), facial and intraoral photographs, and dental casts- are required immediately before surgery. A facebow transfer to a semiadjustable articulator is necessary for the maxillary surgery. The first step is a cephalometric prediction. From this, the measurements that are necessary for model surgery are taken, and the casts are repositioned on the articulator. There are two critical elements in the planning at this stage; how far the maxilla is moved up and if there would be residual overjet with a straight vertical movement of the maxilla, whether the maxilla is moved forward or back to correct overjet or the mandible is lengthened or shortened by ramus osteotomy.

As a general rule, it is better to leave approximately 4 mm of lip separation in the younger patients, perhaps even more in those over age 30. Incisor display is a youthful characteristic, and decreasing it makes an individual look older.

Generally, exposing 30% to 40% of the clinical crown of the maxillary incisor beneath the lip is esthetically pleasing, whereas completely covering it is not. Because the upper lip covers the upper incisors more and more with advancing age, decreasing the amount of exposure of the incisors may be undesirable as the patient gets older even if it looks good initially. Rotation of the anterior maxilla down as the posterior goes up, to establish the best exposure of the teeth, may be needed for optimum esthetics.

Often the maxilla should be advanced somewhat to obtain the best lip support and esthetics. Almost never should it be retracted. It is much better to accept the need to do two-jaw surgery to obtain a good result than to significantly compromise esthetics to keep the surgery within one jaw.

If there is any doubt about the need for both LeFort I and mandibular surgery as the plan for treatment is being developed, the orthodontist and surgeon should discuss the possible need for two-jaw surgery with the patient.

The final step in the presurgical planning is preparation of the splint or splints. If two-jaw surgery is planned, it is helpful to have an intermediate splint that fits the result of the first (maxillary) stage of surgery as well as a final one.

Surgery

When the maxilla has been freed so that it can be repositioned, the mandible is fixed to the maxilla with maxillomandibular wires and the intervening occlusal splint. Widening a narrow maxilla is easily accomplished after the maxilla is downfractured. Parasagittal cuts extended through a midline osteotomy between the maxillary central incisors allow transverse expansion of 5 to 8 mm in the molar region without compromising the soft tissue pedicle on the palate, which maintains blood supply to the segments.

Additional expansion is often difficult and may require carefully planned incisions in palatal mucosa. Once the dentoalveolar segments have been positioned laterally and into the occlusal splint, an auxiliary arch wire (36 or 40 mil steel) prepared before surgery and inserted into the headgear tubes on first molar bands helps stabilize the segments.

Post-Surgical Orthodontics

The splint should not be removed until the patient is ready to have the stabilizing arch wires removed so that finishing orthodontics can proceed. With maxillary surgery only and rapid intermaxillary fixation, orthodontic treatment sometimes can resume at 3 weeks postsurgery. With two-jaw surgery, a longer healing time seems prudent, even with the use of rapid intermaxillary fixation.

When the stabilizing wires are removed, they should be replaced at the same appointment with working arch wires and light vertical elastics.

It takes at least 6 months following surgery for the maxillary dentoalveolar segments to stabilize transversely, so they must be held in their expanded position during the finishing orthodontics. The easiest way to do this is to use a heavy labial auxiliary wire in the headgear tubes along with the light working arch wires.

An alternative for maintaining width is a transpalatal lingual arch, which has the significant advantage of excellent torque control.

A lingual arch cannot be in place at surgery before the segments are moved, and it is difficult to place one in the operating room at the conclusion of the surgical procedure. A labial auxiliary is best until the time of splint removal.

Postsurgical orthodontics for long face patients often is accomplished quickly. The teeth usually fit quite well when the patient returns from surgery, and it is only necessary to settle them into position before going to retainers.

CONCLUSION

Management of long face syndrome has always been a challenge to the clinician. It has a multivariate etiology with both genetic and environmental factors associated. Timely diagnosis of the etiology and its treatment can allow normal growth to occur in children. Different ages require different modalities of treatment based on the severity and etiology. Hence, a correct diagnosis can cause about 50 % of the treatment to be successful.

Conflict of Interest

None

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