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Orthognathic surgery in Growing patients-A review

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Abstract:
Management of dentofacial deformities in a growing patient presents a unique and challenging problem for orthodontists and surgeons. They are reluctant to recommend a surgical treatment option for growing patients with severe developmental jaw abnormalities because of their age. Early orthognathic surgery may be warranted in situations where function and psychological well-being could be negatively affected. To correct developmental jaw abnormalities, definite surgical procedures can be performed during growth with predictable results. This review article discusses the treatment of growing patients with developmental jaw abnormalities who seek orthodontic treatment.

Key Word*: Growing patients, Dentofacial deformities; Orthognathic surgery*.

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I. Introduction

For correction of a skeletal deformity, the surgical procedures required may affect postsurgical growth and dentofacial development. Facial growth may continue or be arrested postoperatively and negate the benefits of surgery performed, resulting in treatment outcomes less than ideal. Individual patient characteristics, the type of deformity, and the indications for early surgical intervention are some of the factors that helps in treating many cases during growth. A thorough understanding of facial growth patterns and the effects of surgery on growth is essential, and each case needs to be evaluated individually. Surgery is often undertaken with the expectation that additional treatment after the completion of growth is required.

Questions typically arise relating to the suitable temporal order for surgery in growing patients and also the attainable effects of such surgery on ensuant facial growth. Approximately 98% of facial growth is sometimes complete in girls by age 15 years and in boys by age 17–18 years (Broadbent et al 1975; van der Linden 1986). Some growing patients with dentofacial deformities exhibit proportionate growth between the upper jaw and lower jaw. However, others exhibit disproportionate growth with progressive worsening of the deformity. The surgical procedures needed to correct these deformities could affect later facial growth and dentofacial development. Thus, each surgical procedure and growth factor might impact the standard of the result.

II. Diagnostic considerations for early surgery

General considerations:

Facial appearance is crucial in a child's growth and development. Aesthetics play a significant role in deciding social relationships. Orthognathic surgery is commonly performed for useful and aesthetic reasons; however, once performed, growth might hold necessary psychosocial implications for a few younger patients whereas teen patients with dentofacial deformities are typically perceived as less engaging by their friends and others. Delaying orthognathic surgery till growth is complete or selecting non-surgical treatments (e.g. myofunctional medical aid, or dentistry and dental camouflage) might not forever be acceptable choices. In some cases, they might be damaging to the patient's self-image and adversely affect a child's social development or probably exacerbate issues associated with occlusion, TMJ operation and dysfunction, speech, airway, and therefore the psychosocial part.

Jaw growth considerations:

Determination of rate and vector is often difficult because the jaws grow in all 3 dimensions whereas grow disturbances will occur in one or additional dimensions. An understanding of facial growth tendencies of the precise anatomical facial varieties provides necessary information regarding resultant growth. Evaluation of the patient's medical and case history, as well as serial clinical and picture radiographic examinations, are useful to spot growth imbalances of the jaw structures. Comparison of serial lateral and posteroanterior (PA) cephalometric radiographs, and the dental models are often useful in growth assessment relative to skeletal and occlusal changes. Specialized radiography (e.g. CT scans, MRI, nuclear scintigraphy) may be indicated in

certain cases, particularly for the identification of TMJ pathology. Hand-wrist films may be useful in determining the growth potential in some patients; however they aren't typically useful for skeletal category III patients, especially those with condylar dysplasia. The consequences of orthognathic surgery on resultant facial growth and development also require understanding; so, the timing of surgery will minimize adverse effects on jaw growth.

TMJ considerations:

Two-thirds of all TMJ pathologies begin during the teenage, significantly during the pubertal growth phase. If the TMJs aren't healthy and stable, orthognathic surgical results could also be unstable with resultant magnified TMJ dysfunction, pain, and relapse of the surgical and orthodontic results. Therefore, it is vital to evaluate the TMJs in growing patients before any contemplated surgical intervention clinically, radiographically, and with MRI when indicated. Common TMJ disorder seen in orthognathic surgery patients is a displaced articular disc, which might be known clinically by the presence of clicking; patients may have displaced TMJ discs but exhibit no clicking in conditions like anterior disc displacement without reduction; medial, lateral, and posterior disc displacements; certain pathologies that cause thickening of the bilaminar tissues; or previous treatment with growth appliances. It has been documented that post-surgical complications will occur once orthognathic surgery (especially anticlockwise rotation with jaw advancement) is performed like initiation or magnified TMJ pain, headaches, myofascial pain, skeletal and occlusal instability, process resorption, etc.

Habitual considerations:

Children and teenagers with dentofacial deformities may have associated habits such as thumb sucking, tongue thrusting, etc. The tongue is an important factor in jaw growth and development, usually reaching its approximate size by the age of 8years. An evaluation includes clinical and functional assessments relative to interference with speech, mastication, airway, and treatment stability. Microglossia can cause underdevelopment of the jaws with lingual collapse of the dentoalveolar structures. Surgical reduction of the tongue size for proper posture and correction of movements before surgery may be considered when indicated to improve treatment outcomes. It is not uncommon to encounter habitual posturing of the mandible anteriorly with hyperextension of the head in class II cases as a secondary response to open the constricted oropharyngeal airway obstruction or intentional response to improve unfavorable aesthetics, thus causing a significant centric relation-centric occlusion shift.

In growing patients with skeletal class II relations, a triad of associated factors could also be present:

(1) TMJ pathology;

(2) Nasal airway obstruction (hypertrophied turbinates, abnormality, etc.) and

(3) Constricted bodily cavity airway (hypertrophied bodily cavity adenoids and tonsils, retruded mandibular posteriorly displacing the tongue and lip, etc.) creating the potential for preventative sleep disorder in these young patients.

For these patients, additional evaluations might include polysomnography, TMJ analysis, 3D airway analysis, etc.

III. Deformities and Treatment modalities

MANDIBULAR DEFORMITIES AND TREATMENT MODALITIES:

Mandibular Hypoplasia: It is a retruded position leading to a class II skeletal relationship with either a standard or a deficient mandibular growth rate.

Mandibular Hyperplasia: It is a protrusive mandibular position leading to class III skeletal and occlusal relationships. This condition could also be at first seen with traditional growth or with accelerated mandibular growth rates.

There are primarily 3 choices concerning the timing of surgery:

Option 1 defer surgery till growth is complete. This could need delaying surgery till patients are in their middle to late twenties. Consequently, they will have issues with mastication, speech, esthetic disfigurement, pain, and psychosocial stigmas related to a severe facial deformity. In addition, the magnitude of the deformity, if allowed to become manifested by this delay in treatment, might preclude a perfect result later.

Option 2 is to perform surgery to posteriorly position the mandible throughout growth, with overcorrection of the jawbone. Growth may be expected to continue after surgery and extra surgery may be necessary if the overcorrection is insufficient or excessive. If this variable is chosen, the operation ought to be performed when the bulk of maxillary growth is complete (girls, 14 years; boys, 17 years) to facilitate the estimation of overcorrection

Option 3 surgically eliminate additional growth with a high condylectomy and at the same time correct the maxillary deformity. Other option is to consider high condylectomy as stage one surgery, followed by orthognathic surgery at a later time. The high condylectomy removes active growth centers, and hence prevents additional growth.

TREATMENT MODALITIES:

Inverted "L" osteotomy: The inverted "L" surgical procedure (ILO) will be used to advance the mandible and vertically lengthen the ramus, however, it needs bone or artificial bone for affixation to manage the point orientation of the proximal phase and to fill the bony voids between segments. The employment of rigid fixation is usually recommended.

Vertical ramus osteotomy: It is more commonly used for moving the submaxilla posteriorly to correct mandibular prognathism than for mandibular advancement. It is for mandibular advancement and vertical lengthening of the mandible and will need bone affixation to manage the point orientation of the proximal phase and fill bony voids. The amount of mandibular advancement and vertical lengthening is restricted by the temporalis attachment and interference of the coronoid processes on the zygoma. Thus, for larger movements, a coronoidectomy is also required or ideally revert to alternative surgical choices. Rigid fixation will be the choice for VRO. Without fixation, condylar position control is also inexact and may result in post-surgical occlusion. The ILO and VRO are usually performed on patients of just virtually any age. Rigid fixation should be applied cautiously to avoid injury to developing teeth in younger patients

High condylectomy: Surgically removing 3–5 millimeters of the condylar head can predictably stop anteroposterior and vertical growth of the mandible by removing the active growth center within the condyle. TMJ function after surgery will be expected to stay traditional if the condylar head is fitly recontoured and the articular disk is repositioned and stable in an exceedingly traditional anatomical relationship between the condylar head and articular fossa. This procedure is usually postponed till the traditional jaw and articulator growth area unit is nearer to completion.

ANTERIOR MANDIBULAR DENTOALVEOLAR DEFORMITIES:

It is excessive, deficient, or uneven growth of the dentoalveolar structures. The condition may be due to overdevelopment or underdevelopment of alveolar bone, dental ankylosis, anodontia, premature tooth loss, congenital anomaly, congenital anomaly, habitual factors, or biological science. The mandibular growth rate must not be stricken by correction of those deformities unless adjacent teeth are damaged, which can lead to dental-osseous ankylosis, a condition that may impair resultant vertical alveolar growth. With orthodontics, the roots of the teeth adjacent to the vertical surgical process will be diverged to make extra space to facilitate the surgical process and reduce the potential for root injury.

TREATMENT MODALITY:

Anterior and posterior mandibular subapical osteotomies. The anterior and posterior mandibular subapical osteotomies involve 2 vertical interdental osteotomies joined inferiorly by a horizontal surgical process 4–5 metric linear units below the tooth apices. The section is placed within the desired position and stabilized, ideally with rigid fixation. Preoperative orthodontic treatment is needed to make adequate space between the roots of the adjacent teeth to securely complete the interdental osteotomies and reduce potential injury to the tooth roots. To avoid harm to the roots of developing teeth, which might lead to ankylosis and alveolar growth impairment, the surgical procedure ought to be postponed till the eruption of adjacent teeth is complete (i.e., once the patient is over age 12 years).

MANDIBULAR BODY DEFORMITIES:

It is excessive, deficient, or uneven development of the mandibular body. Correction of those deformities throughout growth should not affect mandibular growth unless adjacent teeth are ankylosed or the developing teeth are damaged, resulting in dental osseous pathology, which can lead to impaired vertical alveolar growth.

TREATMENT MODALITY:

Mandibular body osteotomy:

The procedure involves one or a lot of osteotomies, extending the total vertical height of the mandibular body. These osteotomies are usually performed between adjacent teeth. Care should be taken to maintain the integrity of the inferior alveolar and mental nerves. It is suggested that this procedure be postponed until after the age of 12 years to attenuate the chance of injury to the developing dental structures.

CHIN DEFORMITIES:

Deformities of the chin include macrogenia, microgenia, or uneven development. It will occur in all 3 planes of spaces and affect the height, width, and anteroposterior dimensions of the anterior mandible. The treatment for macrogenia might involve bony recontouring or spatial reorientation of the chin with surgical techniques. Microgenia likewise be treated by altering chin position with osteotomies or with a graft, using bone, artificial bone substitutes, or alloplastic implants. In younger patients, there is an associated inherent risk of injury to

developing teeth and to the inferior alveolar and mental nerves that closely approximate the inferior border of the mandible. Augmentation genioplasty with alloplastic implants that do not cause resorption of the underlying bone might be performed at an earlier age, can be considered.

TREATMENT MODALITIES:

Osseous genioplasty:

Various techniques are available for altering the size of the chin by osteotomies, as well as horizontal surgery. Bone segments may be fixed with wires, bone screws, or bone plates, and will need bone or artificial bone attachment, as within the case of vertical lengthening. These procedures have no result on facial growth, except affecting appositional bone growth at pogonion, or if developing dental structures are scraped, which can result in dentoalveolar pathology and attenuate vertical alveolar growth. The patient should be at a level of dental-osseous development (i.e., 12 years), which will minimize the chance of injury to underlying teeth and neurovascular structures.

Augmentation genioplasty with alloplastic:

Alloplasts that are tested not to cause bone resorption may be placed in patients as early as age 8 or 9 provided. They can be fixed to the bone without causing damage to underlying dental or neurovascular structures. It is best to wait till the patient is a minimum of 12 years before inserting an associate alloplastic chin implant to attenuate the chance of injury to underlying teeth and neurovascular structures.

MAXILLARY DEFORMITIES AND TREATMENT MODALITIES:

Maxillary Hypoplasia:

It is a deficient maxillary development and might occur in one or more of the three maxillary growth vectors including in anteroposterior (AP), transverse, and/or vertical dimensions. Jaw deformity typically gets worse throughout growth. With deficient growth potential, traditional growth cannot be expected after surgery. Correction of AP or vertical deficiencies throughout growth can lead to the recurrence of class III skeletal and occlusal relationship because the mandible continues to grow normally. Earlier surgery to advance, elongate vertically, and/or increase the transverse width of the maxilla may be indicated if significant functional, esthetic, and psychosocial impairments exist

Maxillary Hyperplasia:

Maxillary dysplasia will occur within the horizontal or vertical vector and uncommonly within the transverse direction. Horizontal dysplasia (maxillary protrusion) is defined as excessive forward growth of the upper jawbone that may lead to class II skeletal and occlusal relationship. This condition presents typically early in life and may or may not get worse with growth. Vertical jaw dysplasia (vertical jaw excess), is defined as excessive vertical growth of the upper jawbone and may or may not embrace to associate anterior open bite deformity. It's usually seen in patients with nasal airway obstruction. This deformity may be corrected throughout growth. However, vertical jaw growth may be expected to continue postoperatively at an identical rate as before surgery.

TREATMENT MODALITIES:

Le Fort I maxillary osteotomy:

It inhibits more anterior growth of the maxilla when performed in growing patients. Vertical maxillary dentoalveolar growth can continue postoperatively at an equivalent rate as before surgery. Patients with vertical jaw dysplasia can expect postsurgical vertical jaw growth to continue at an equivalent accelerated rate as before surgery till the cessation of growth. In patients with normal growth, the maxillomandibular complex will grow with a downward and backward vector; however, the occlusion ought to stay stable. The utilization of rigid fixation and acceptable attachment with either porous block hydroxyapatite or autogenous bone maximize the stability and quality of the surgical outcome for all kinds of jaw osteotomies.

Maxillary dentoalveolar (horseshoe) osteotomy:

The nasal septum remains attached to the palate, and the dentoalveolar structures alone are mobilized. Therefore, AP jaw growth may not be restrained as it is with the LeFort I surgery. This procedure might supply the simplest potential for continued anterior jaw growth after surgery. The maxillary dentoalveolar surgery is technically far more difficult to perform, notably in patients with jaw dysplasia. In maxillary vertical dysplasia, if done at an earlier age (i.e., 12 years in girls and 14 years in boys), there's a chance of excessive vertical jaw rate recreating a vertical jaw excess after surgery, even though to a lesser extent

DOUBLE JAW SURGERY:

Surgical repositioning of the upper and lower jaw one operation is performed throughout growth with certain and harmonious growth after surgery. The LeFort I surgery can inhibit more anterior jaw growth while permitting vertical jaw growth to continue. In cases involving mandibular prognathism secondary to active condylar dysplasia, surgery involving high condylectomy can arrest the pathologic growth and may be combined with maxillary and mandibular osteotomies with certain results, regardless of the rate of jaw growth.

The high condylectomies ought to be performed first and the articular disk repositioned over the remaining condylar head, followed by routine double jaw surgery. Once properly performed, high condylectomies prevent more anterior growth of the lower jaw. With normal or deficient jaw growth, the jaws and occlusion should stay in balance. With the presence of vertical jaw excess, the vectors of facial growth are downward and backward.

CLEFT PALATE CONSIDERATIONS:

The facial growth potential in newborns with congenital defects is relatively normal. Multiple constructive maxillofacial surgical procedures, to repair these clefts may result in impaired jaw growth and development. Wolford et al demonstrated that in cleft patients with jaw dysplasia LeFort I osteotomy be used to correcting the dentofacial deformity and graft the alveolar cleft. However, transversal dysplasia will result in anterior and posterior occlusal crossbites. Orthognathic surgery could be performed on growing cleft patients if mandated by psychological and/or useful considerations. Careful case selection is imperative, and the surgeons should be cognizant of postsurgical outcomes. Cleft patients with disproportionate presurgical growth exhibit disproportionate postsurgical growth that develops into class III skeletal and occlusal relationships. The presence of a posterior pharyngeal flap creates a greater decrease in anterior maxillary growth and a significant increase in vertical growth. Most cleft patients are best served to perform orthognathic surgery after facial growth is complete. These patients ought to be treated with surgical over-correction in the anteroposterior and transverse dimensions. Patients who are still in the mixed dentition phase should be operated on carefully, specifically avoiding injury to developing permanent tooth buds. In younger patients, deliberation for distraction osteogenesis could also be acceptable.

IV. Conclusion

Surgical treatment in pediatric and adolescent patients with dentofacial deformities may be considered because of the functional, aesthetics, and psychosocial factors. A good understanding of facial growth, available treatment options, and the effects of surgery on postoperative growth patterns will help clinicians to improve treatment outcomes in these patients.

References

[1]. Mehra P, Wolford LM. Early orthognathic surgery: Considerations for surgical management. Orthognathic Surgery: Principles, Planning, and Practice. 2016:347-60.
[2]. Capelli Junior J, Almeida RC. Orthosurgical treatment of patients in the growth period: At what cost? Dental Press Journal of Orthodontics. 2012; 17(1):159-77.
[3]. Villegas C, Oberti G, Jimenez IV, Franchi LO, Baccetti TI. Early orthognathic surgery in growing Class III patients. J Clin Orthod. 2010; 44(11):651-4.
[4]. Huang CS, Ross RB. Surgical advancement of the retrognathic mandible in growing children. American J Orthod. 1982 Aug 1;82(2):89-103.
[5]. Mojdehi M, Buschang PH, English JD, Wolford LM. Postsurgical growth changes in the mandible of adolescents with vertical maxillary excess growth pattern. Am J Orthod Dentofacial Orthop. 2001; 119(2):106-16.
[6]. Wolford LM, Karras SC, Mehra P. Considerations for orthognathic surgery during growth, part 2: maxillary deformities. Am J Orthod Dentofacial Orthop. 2001; 119(2):102-5.
[7]. Wolford LM, Karras SC, Mehra P. Considerations for orthognathic surgery during growth, part 1: mandibular deformities. Am J Orthod Dentofacial Orthop. 2001; 119(2):95-101.
[8]. Precious DS, McFadden LR, Fitch SJ. Orthognathic surgery for children: Analysis of 88 consecutive cases. International journal of oral surgery. 1985; 14(6):466-71.
[9]. Washburn MC, Schendel SA, Epker BN. Superior repositioning of the maxilla during growth. Journal of Oral and Maxillofacial Surgery. 1982; 40(3):142-9.
[10]. Mogavero FJ, Buschang PH, Wolford LM. Orthognathic surgery effects on maxillary growth in patients with vertical maxillary excess. Am J Orthod Dentofacial Orthop. 1997; 111(3):288-96.
[11]. Wolford LM, Schendel SA, Epker BN. Surgical-orthodontic correction of a mandibular deficiency in growing children: Long term treatment results. Journal of maxillofacial surgery. 1979 Jan 1; 7:61-72.
[12]. Wolford LM, Rodrigues DB. Orthognathic surgery considerations in the young patient and effects on facial growth. Handbook of growth and growth monitoring in health and disease, 2012. Springer, New York, NY.