Clinical Paper

American Association of Oral and Maxillofacial Surgeons

# Criteria for Orthognathic Surgery

## Preface

The following statements are intended to summarize the indications for orthognathic surgery. These criteria are based on a thorough review of the world literature and a consensus of the governing body of the American Association of Oral and Maxillofacial Surgeons.

The parameters outlined in this document are meant as general guidelines, or threshold numbers that may substantiate the clinical indications for orthognathic surgery, as opposed to absolute criteria. For example, those not falling into the two or more standard deviations from published norms for facial skeletal discrepancies may still legitimately require surgery. Among other clinical findings, clarification and documentation of compensated incisor tooth position versus uncompensated position – even to estimate incisor discrepancy with orthodontic decompensation – may be necessary to support medical necessity.

The ultimate judgment regarding the appropriateness of any specific procedure must be made by the individual surgeon taking into consideration the constellation medical and physical conditions presented by each patient.

AAOMS's definitive guide to the management of patients with facial skeletal deformities can be found in *Parameters of Care: AAOMS Clinical Practice Guidelines for Oral and Maxillofacial Surgery (AAOMS ParCare),* Seventh Edition, 2023.

## Definition

Orthognathic surgery is the surgical correction of skeletal abnormalities of the mandible, maxilla or both. The underlying abnormality may be congenital (intrinsic), present at birth. These abnormalities may be recognized at birth or may not become obvious until the individual grows and develops. The dysmorphology may be extrinsic, the result of traumatic injuries or secondary to systemic diseases. Often, the severity of these deformities necessitates surgical correction in combination with other rehabilitative services, including no surgical therapies.

## Primary Goal of Treatment

The primary goal of treatment is to improve form and function through correction of the underlying skeletal deformity.

## Consequential Outcomes of Treatment

As a direct effect of the resultant skeletal movements, changes in the soft-tissue drape overlying the facial skeleton may be realized. The soft-tissue changes are inherent to the procedure and must be considered in the surgical work-up and are not considered the primary goal of surgery.

## Background

There is a direct correlation between facial skeletal abnormalities, malocclusion and masticatory function, for example:

1. Class II and Class III dental arch relationships
2. Transverse arch discrepancies
3. Bolton discrepancy
4. Vertical maxillary excess
5. Maxillary and mandibular asymmetry
6. Apertognathias

Scientific studies have shown that many patients with skeletal deformities suffer from a variety of functional impairments including, but not limited to, malocclusions, diminished bite forces, restricted mandibular excursions, swallowing difficulties, qualitative speech disorders, abnormal chewing patterns and temporomandibular disorders. While the etiology of facial skeletal deficiencies is multifactorial, it is known that patients with these deformities have pathologic alteration in their muscle fibers when compared to those with normal facial skeletons. Electromyography further demonstrates significant differences between these two groups of patients. Clinical experience and the literature have demonstrated that, when indicated, orthognathic

surgery leads to improvement in a spectrum of functional impairments. The medical appropriateness of these procedures is well-documented in the world literature.

## Classification

The classification and analysis of dentofacial skeletal deformities is complex and involves discrepancies in all planes of space.

However, they can generally be classified as follows:

Congenital anomalies (for example)

1. Cleft lip and palate
2. Dentofacial skeletal deformities: mandibular hyper or hypoplasia, maxillary hyper or hypoplasia, apertognathia, facial asymmetry, maxillary and mandibular transverse discrepancies
3. Craniofacial microsomia
4. Dysmorphic syndromes, such as Noonan and Treacher Collins
5. Pierre Robin sequence
6. Chromosomal anomalies, including 22q11.2 deletion syndrome

Acquired anomalies

1. Traumatic facial skeletal injuries
2. Cysts and tumors of the jaws
3. Obstructive sleep apnea
4. Temporomandibular joint disorders resulting in skeletal malocclusion
5. Rheumatoid arthritis
6. Degenerative arthritis
7. Condylar atrophy
8. Growth disturbances
9. Condylar hyperplasia

## Indications

Given the relationship between facial skeletal deformities and masticatory dysfunction as well as the limitations of non-surgical therapies to correct these discrepancies, the measurement of these discrepancies must consider dental compensations relating to the malocclusion and the underlying skeletal deformity. Orthognathic surgery may be indicated and considered medically appropriate in the following circumstances:

A. Anteroposterior discrepancies: established norm=2mm
   1. Maxillary/mandibular incisor relationship
      a. Horizontal overjet of +5mm or more
      b. Horizontal overjet of zero to a negative value
   2. Maxillary/mandibular anteroposterior molar relationship discrepancy of 4mm or more (norm 0 to 1mm)
   3. These values represent two or more standard deviation from published norms

B. Vertical discrepancies
   1. Presence of a vertical facial skeletal deformity, which is two or more standard deviations from published norms for accepted skeletal landmarks
   2. Open bite
      a. No vertical overlap of anterior teeth
      b. Unilateral or bilateral posterior open bite greater than 2mm
   3. Deep overbite with impingement or irritation of buccal or lingual soft tissues of the opposing arch
   4. Supraeruption of a dentoalveolar segment due to lack of occlusion

C. Transverse discrepancies
   1. Presence of a transverse skeletal discrepancy, which is two or more standard deviations from published norms
   2. Total bilateral maxillary palatal cusp to mandibular fossa discrepancy of 4mm or greater, or a unilateral discrepancy of 3mm or greater, given normal axial inclination of the posterior teeth

D. Asymmetries
   1. Anteroposterior, transverse or lateral asymmetries greater than 3mm with concomitant occlusal asymmetry

These indications relate verifiable clinical measurements to significant facial skeletal deformities, maxillary and/or mandibular facial skeletal deformities associated with masticatory malocclusion. In addition to the above conditions, orthognathic surgery may be indicated in cases where there are specific documented signs of dysfunction. These may include conditions involving airway dysfunction, such as sleep apnea, temporomandibular joint disorders, psychosocial disorders and speech impairments. The following is a brief review of some of these conditions.

Refer to the attachments at the end of this document:

1. Form titled "Criteria for Orthognathic Surgery" created for use to summarize the data on a single form. Consider submitting the completed form to payers for orthognathic surgery prior to authorization.
2. Form titled "Orthognathic Surgery Clinical Evaluation" created to help gather information to document the orthognathic criteria.
3. Form titled: "Orthognathic Surgical Planning" created to quantify movement in preparation for orthognathic surgery.

## Facial Skeletal Discrepancies Associated with Documented Sleep Apnea, Airway Defects and Soft-tissue Discrepancies

Breathing patterns, craniofacial growth and skeletal alteration are known to be closely related. Intervention with orthopedic and/or surgical means on selected patients has been shown to decrease airway resistance and improve breathing. For example, studies demonstrate that patients with vertical hyperplasia of the maxilla have an associated increase in nasal resistance, as do patients with maxillary hypoplasia with or without clefts. Following orthognathic surgery, such patients routinely demonstrate decreases in nasal airway resistance and improved respiration.

Obstructive sleep apnea (OSA) is a specific type of respiratory dysfunction. Defined as periodic cessation of breathing during sleep, patients with OSA may have such associated findings as hypertension and cardiac arrhythmias. While this condition is multifactorial, a significant number of patients with obstructive sleep apnea have underlying facial skeletal deformities and benefit from orthognathic surgery.

Prior to surgical treatment, such patients should be properly evaluated to determine the cause and site of their disorder with appropriate non-surgical treatment attempted when indicated.

## Facial Skeletal Discrepancies Associated with Documented Temporomandibular Joint Pathology

It is generally accepted that temporomandibular joint (TMJ) dysfunction may have a variety of causes. In some patients, skeletal malocclusion and TMJ dysfunction may be correlated. While some types of malocclusion have been more commonly implicated, a variety of deformities have been reported to be associated with TMJ symptoms. The rationale for proceeding with surgery to correct skeletal-dental deformities is based on common reports of significant improvement in joint and muscle symptoms after a variety of orthognathic procedures. The literature reports that approximately 80 percent of patients show improvement of preoperative symptoms after orthognathic surgery. Prior to performing an orthognathic procedure on such patients, non-surgical therapies should be attempted, including those procedures and treatments that mimic the effects of occlusal alteration.

## Facial Skeletal Discrepancies Associated with Congenital and Extrinsic Anomalies

Congenital and extrinsic abnormalities give rise to the full spectrum of deformities that affect the facial skeleton. They potentially have a profound effect on the patient's self-image, masticatory function, nutritional intake, speech articulation and socialization. Often, they are compounded by a host of medical comorbidities. It is essential to address many of these conditions through a medical home or team approach of which the craniofacial surgeon is a key participant. Addressing the craniofacial deformities frequently requires multiple surgical procedures from shortly after birth into adulthood. Without these required procedures, the patient is destined to a less-than-optimal quality of life.

For example, patients with cleft lip and palate may undergo surgical correction of the lip as an infant followed by closure of the palate as a young child. As the patient continues to grow and mature, the jaw-size discrepancy

can become worse, negatively impacting form and function. Orthognathic surgery will correct the jaw growth deformity and allow for much-improved function.

## Facial Skeletal Discrepancies Associated with Documented Psychological Disorders

Physical characteristics are likely the single-most important variables that determine self-esteem, behavior patterns and successful personal interactions. In addition to measurable improvements in masticatory function, studies demonstrate the beneficial effects on patients' self-image after surgical correction of facial skeletal deformities, with concomitant improvement in their psychosocial condition and, by extension, workforce productivity. Prior to surgical treatment designed primarily to improve psychological conditions, appropriate consultation should be obtained and non-surgical therapy attempted when reasonable.

## Facial Skeletal Discrepancies Associated with Documented Speech Impairments

Abnormal jaw relationships affect many of the structures involved in the production of speech, including the position of the lips, tongue and soft palate. Studies demonstrate that altered speech production may be associated with facial skeletal deformities, the most common impairment of which is a distortion within the sibilant sound class. Such studies also demonstrate the beneficial effects of orthognathic surgery on speech production, documenting improvement in a high percentage of patients after the correction of abnormal jaw relationships. In the age of information, the ability to accurately communicate with an articulate speech pattern is of great importance.

Prior to surgery, speech evaluation should be obtained to demonstrate the nature of the problem and to determine if improvement can be expected.

## References

The following references provide support for the previously mentioned recommendations and statements. It should be recognized that the literature on orthognathic surgery dates back to 1849. In light of the volume of this published material, the following listing is limited to but a few representative articles. Several of these articles make extensive references to supportive material and are recommended reading:

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Clinical Paper

## Criteria for Orthognathic Surgery for submission to insurance company for prior authorization

DATE _____ PATIENT NAME _____ COMPLETED BY DR. _____

**A. Anteroposterior Discrepancies**

1. Maxillary/Mandibular incisor relationship: overjet of 5mm or more, or a 0 to a negative value (norm 2mm).
   Response _____
2. Maxillary/Mandibular anteroposterior molar relationship discrepancy of 4mm or more (norm 0 to 1mm).
   Response _____
3. These values represent two or more standard deviations from published norms.
   Response _____

**B. Vertical Discrepancies**

1. Presence of a vertical facial skeletal deformity which is two or more standard deviations from published norms for accepted skeletal landmarks.
   Response _____
2. Open bite
   a. No vertical overlap of anterior teeth.
   b. Unilateral or bilateral posterior open bite greater than 2mm.
      Response _____
3. Deep overbite with impingement or irritation of buccal or lingual soft tissues of the opposing arch.
   Response _____
4. Supraeruption of a dentoalveolar segment due to lack of occlusion.
   Response _____

**C. Transverse Discrepancies**

1. Presence of a transverse skeletal discrepancy, which is two or more standard deviations from published norms.
   Response _____
2. Total bilateral maxillary palatal cusp to mandibular fossa discrepancy of 4mm or greater, or a unilateral discrepancy of 3mm or greater, given normal axial inclination of the posterior teeth.
   Response _____

**D. Asymmetries:** Anteroposterior, transverse or lateral asymmetries greater than 3mm with concomitant malocclusion.

Response _____

*In addition to the above conditions, orthognathic surgery may be indicated in cases where there are specific documented signs of dysfunction. These may include conditions involving airway dysfunction, such as sleep apnea, temporomandibular joint disorders, psychosocial disorders and/or speech impairments.

**There are occasions when planned movements do not meet the AAOMS published criteria. Therefore, the surgeon will provide evidence that the proposed surgical procedure(s) are indicated.

*** The above criteria, A–D, are obtained by clinical, radiographic and virtual planning data.

**E. Diagnosis:**

Maxilla: 1. _____ 2. _____

Mandible: 1. _____ 2. _____

Other condition: _____

Name:_____ Diagnosis:_____ Date:_____

## DENTAL FACIAL EVALUATION: FRONTAL VIEW

**Vertical Facial Evaluation**

Interlabial distance:_____mm (lip incompetence)

Lip tooth relationship:

*Repose (1.5-3.5mm tooth show):_____mm

*Smile (#7-10, 8-12mm tooth show):_____mm

_____mm gingival show

Upper lip length (_22+/-2,_20+/-2mm):____mm

Labiomental fold: Norm Deep Flat

**Nasal Evaluation**

Nasal airway:

*Cottle: Right ❒+ ❒ - left ❒ + ❒-

*Septum: ❒ deviated R L

*Turbinates: ❒ normal ❒ Large

Nasal evaluation:

*Tip: ❒ wnl *Dorsum: ❒wnl

* Nasolabial angle:_____

*Alar base (width):_____mm

❒narrow ❒WNL ❒wide

**Transverse Facial Evaluation**

Midlines relative to midsagittal plane.

Facial midline (asymmetry): ❒wnl

Nasal dorsum midline: ❒ wnl

Dental midline:

*Upper: R_____C_____L_____

*Lower: R_____C_____L_____

Chin midline R_____C_____L_____

Occlusal Cant: ❒ none

**Facial Evaluation**

Midface: ❒ flat ❒ wnl ❒ prominent

* infraorbital soft tissue relative to globe:

❒posterior ❒in line ❒ anterior

Zygoma: ❒ wnl

Orbit:

*Eyelids: ❒ wnl

*Brow: ❒ wnl

Facial Proportions:

*Upper 1/3:

*Middle 1/3:

*Lower 1/3:

## LATERAL VIEW

**Profile Evaluation**

Facial Profile: Convex Concave Flat

Cervicomental angle: ❒ acute (< 90 degrees) ❒ obtuse (>90 degrees)

Glabella Vertical:

*Maxilla: ❒ deficient ❒ normal ❒ excessive

*Mandible: ❒ deficient ❒ normal ❒ excessive

## ORAL EXAM

Molar: I II III Canine: I II III

Curve of Wilson (molar tipping): NO YES

Curve of Spee: ❒ flat ❒ wnl ❒ excessive

H-Overjet:_____ mm V-Overbite:_____

mm Ant Open Bite: mm Post Cross Bite: NO

YES Missing teeth:

Third Molars: ❒ missing

Active Periodontal Disease: NO YES

Attached Gingiva: ❒ wnl Pathology: ❒ none

Airway Obstruction: NO YES Apnea: NO YES

## TMJ EXAM

Symptoms: NO YES:_____

_____

_____

Preauricular: NTP R_____L_____

Muscles: NTP R_____L_____

Click/Pop: NO YES

*Open: R_____L_____

*Close: R_____L_____

MIO:_____

ROM: L_____R_____Protrusive_____

Deviation: NO YES R_____L_____

Planned 3D surgical movements and soft-tissue modifications:

Name:_____ Diagnosis:_____ Surgery Date:_____

**A) Maxilla** ☐ No procedure ☐ Le Fort I osteotomy

1. Vertical impaction:
   - ☐ Posterior to correct open bite: ☐ RIGHT_____mm ☐ LEFT_____mm
   - ☐ Total impaction correct VME: ☐ RIGHT_____mm ☐ LEFT_____mm
2. Horizontal advancement (A-P):____mm anterior
3. Rotation for midline correction: ☐ RIGHT_____mm ☐ LEFT_____mm
4. Maxillary segmental surgery: ☐ NO ☐ YES: _____
   - ☐ Two piece-interdental osteotomies between: #_____& #_____
   - ➢ Is their adequate space between the teeth radiographically to perform the interdental osteotomies?

     NO YES
   - ☐ Three piece-interdental osteotomies between: #____& #_____ + #_____& #____
   - ➢ Is their adequate space between the teeth radiographically to perform the interdental osteotomies?

     NO YES
5. Horizontal osteotomy:
   - ☐ Conventional
   - ☐ High (for augmentation of midface deficiency)
     - ☐ Stepped with or without intermediate bone graft in the maxillary buttress. (For advancement of the maxilla greater than 5mm and for enhanced satiability and OSAS surgery).
6. Other considerations: _____

**B) Mandible** ☐ No procedure ☐ BSSO ☐ IVRO ☐ Other: _____

1. Horizontal: ☐ Advancement_____mm ☐ Setback_____mm
2. Rotation: ☐ RIGHT_____mm ☐ LEFT_____mm
3. Genioplasty: ☐ NO ☐ YES: _____
   - ☐ Advancement___mm ☐ Setback___mm
   - ☐ Vertical reduction____mm ☐ Right ☐ Left ☐ Bilateral
   - ☐ Vertical augmentation___mm ☐ Right ☐ Left ☐ Bilateral
   - ☐ Rotation_____mm ☐ Right ☐ Left
4. Other considerations _____

**C) Occlusion**

1. Enameloplasty: ☐ NO ☐ YES: _____
   - #
   - #
   - #
1. Extractions: ☐ NO ☐ YES: _____
   - #(s)

**D) Nasal**

1. Alar Cinch: ☐ NO ☐ YES: _____
2. Turbinectomy: ☐ NO ☐ YES: _____
3. Septoplasty: ☐ NO ☐ YES: _____

**E) Other considerations** _____