



Criteria for Orthognathic Surgery

**The American Association of
Oral and Maxillofacial Surgeons
9700 W. Bryn Mawr
Rosemont, IL 60018
(847) 678-6200**

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 available literature and the expert opinions of clinicians with considerable experience in this discipline. They express the consensus opinion of the American Association of Oral and Maxillofacial Surgeons and were developed in light of the federal government’s definition of medical necessity as stated in their Medicare/Medicaid guidelines.

The ultimate judgement regarding the appropriateness of any specific procedure must be made by the individual surgeon in light of the circumstances presented by each patient. The definitive guide to the management of patients with facial skeletal deformities can be found in the *AAOMS Parameters of Care for Oral and Maxillofacial Surgery*.

Definition – Orthognathic surgery is the surgical correction of abnormalities of the mandible, maxilla, or both. The underlying abnormality may be present at birth or may become evident as the patient grows and develops or may be the result of traumatic injuries. The severity of these deformities precludes adequate treatment through dental treatment alone.

Goals of Treatment – The overall goal of treatment is to improve function through correction of the underlying skeletal deformity.

Background – There is convincing evidence of the relationship between facial skeletal abnormalities and malocclusions, including Class II, Class III and openbite deformities. A strong correlation has been demonstrated between the state of a patient’s occlusion and his or her chewing efficiency.

Studies have shown that patients with skeletal malocclusions suffer from a variety of functional impairments including diminished bite forces, restricted mandibular excursions and abnormal chewing patterns.

While the reasons for facial skeletal deficiencies are not fully understood, 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 variety of functional parameters. The medical appropriateness of these procedures is further supported by the fact that the military healthcare system recognizes the need for and benefits of orthognathic surgery.

Classification – The classification and analysis of facial skeletal deformities is complex and involves discrepancies in all planes of space. The measurement of these discrepancies must take into account dental compensations for the underlying skeletal deformity.

Indications – Given the relationship between facial skeletal deformities and masticatory dysfunction, as well as the limitations of non-surgical therapies to correct these discrepancies, orthognathic surgery should be considered medically appropriate in the following circumstances. These indications relate verifiable clinical measurements to significant facial skeletal deformities.

Maxillary and/or mandibular facial skeletal deformities associated with masticatory malocclusion.

A. Anteroposterior discrepancies

1. Maxillary/Mandibular incisor relationship: overjet of 5mm or more, or a 0 to a negative value (norm 2mm).
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.

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. The following is a brief review of some of these conditions.

Facial Skeletal Discrepancies Associated with Documented Obstructive 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.

One specific type of respiratory dysfunction is obstructive sleep apnea (OSA). Defined as periodic cessation of breathing during sleep, patients with OSA may have associated findings such as hypertension and cardiac arrhythmias. While this condition is multifactorial, published studies report 95% of patients with obstructive sleep apnea benefit from orthognathic surgery, specifically bimaxillary advancement. OSA patients with underlying facial skeletal deformities also benefit from orthognathic surgery to correct this deformity and reconstruct the upper airway.

Before surgery, 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. It is evident that, 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% of patients show improvement of pre-operative 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 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, work force 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 the 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.

The following references provide support for the recommendations and statements above. 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.

REFERENCES

Masticatory Function:

The Effects of Orthognathic Surgery on Mandibular Range of Motion.
Aragon SB; Van Sickles JE
J Oral Maxillofac Surg 1985;43:938-43.

Preparation, Perceptions, and Problems: A Long-Term Follow-Up Study Orthognathic Surgery.
Cunningham SJ; Crean SJ; Hunt NP; Harris M
Int J Adult Orthodon Orthognath Surg 1996;11 ():41-7.

Mandibular Border Movements and Masticatory Patterns Before and After Orthognathic Surgery.
Ehmer U; Broll P
Int J Adult Orthodon Orthognath Surg 1992;7:153-9.

Bite Forces Before and After Surgical Correction of Mandibular Prognathism.
Ellis E III; Throckmorton GS; Sinn DP
J Oral Maxillofac Surg 1966;54:176.

Occlusal and Functional Conditions After Surgical Correction of Anterior Openbite Deformities.
Hoppenrijs TJ; van der Linden FPK; Freihofer HP; Van't Hof MA; Tuinzing DB; Voorsmit RA;
Stoelinga PJ

Int J Adult Orthodon Orthognath Surg 1996;11(1):29-39.

The Influence of Orthognathic Surgery on Occlusal Force in Patients with Vertical Facial Deformities.

Hunt NP; Cunningham SJ

Int J Oral Maxillofac Surg 1997;26:87.

Changes in Activity of the Temporal, Masseter and Lip Muscles after Surgical Correction of Mandibular Prognathism.

Ingervall B; Ridell A; Thilander B

Int J Oral Surg 1979;8:290.

Effect of Mandibular Setback on Occlusal Force.

Kim YG; Oh SH

J Oral Maxillofac Surg 1997;55:121-126.

Changes in Masticatory Function After Surgical Treatment of Mandibular Prognathism. Cineradiographic Study of Bolus Position.

Lundberg M; Nord PG; Astrand P

Acta Odont Scand 1974;32:39.

Long-Term Stability of Two-Jaw Surgery for Treatment of Mandibular Deficiency and Vertical Maxillary Excess.

Miguel JA; Turvey TA; Phillips C; Proffit WR

Int J Adult Orthodon Orthognath Surg 1995;10(4):235-45.

The Effect of Orthognathic Surgery on Occlusal Force.

Proffit WR; Turvey TA; Fields HW

J Oral Maxillofac Surg 1989;47:457.

Functional Outcomes Following Orthognathic Surgery.

Throckmorton, G

Selected Readings in Oral and Maxillofacial Surgery, Vol. 4, No. 8.

Improvement of Maximum Occlusal Forces After Orthognathic Surgery.

Throckmorton GS; Busching PH; Ellis E III

J Oral Maxillofac Surg 1966;54:1080

Functional Characteristics of Retrognathic Patients Before and After Mandibular Advancement Surgery.

Throckmorton GS; Ellis E III; Sinn DP

J Oral Maxillofac Surg 1995;53:898

Evaluation of Masticatory Function Following Orthognathic Surgical Correction of Mandibular Prognathism.

Shiratsuchi Y; Kouno K; Tashiro H
J Craniomaxillofac Surg 1991;19:299.

Functional and Morphological Alterations After Anterior and/or Inferior Repositioning of the Maxilla.

Song HC; Throckmorton GS; Ellis E III
J Oral Maxillofac Surg 1967;26:87.

Comparison of habitual Masticatory Cycles and Muscle Activity Before and After Orthognathic Surgery.

Youseff RE; Throckmorton S; Ellis E III
J Oral Maxillofac Surg 1997;55:699.

Functional and Morphological Changes Following Combined Maxillary Intrusion and Mandibular Advancement Surgery.

Zarrinkelk HM; Throckmorton GS; Ellis E III
J Oral Maxillofac Surg 1996;54:828.

Functional and Morphological Alterations Secondary to Superior Repositioning of the Maxilla.

Zarrinkelk HM; Throckmorton GS; Ellis E III
J Oral Maxillofac Surg 1995;53:1258.

Temporomandibular Joint:

The TMJ Performance and Behavior in Patients More Than Six Years After Le Fort I Osteotomy.

de Mol van Otterloo JJ; Tuinzing DB; Greebe RB; et al
J Craniomaxillofac Surg 1991;19:217-22.

Jaw Function, Skeletal Malocclusion, and TMD Disorders.

Grierman et al
Oral and Maxillofacial Surgery Clinics of North America, 251-270.

Temporomandibular Joint Symptoms in Orthognathic Surgery.

Kerstens HCJ; Tuinzing DB; VanderKwast WAM
J Craniomaxillofac Surg 1989;5:215-18.

Incidence of Temporomandibular Symptoms in Patients with Major Skeletal Malocclusions: A Survey of Oral and Maxillofacial Training Programs.

Laskin DM; Ryan WA; Green CS
J Oral Maxillofac Surg 1986;61:537.

Temporomandibular Joint Function and Morphology, Observations on the Spector of Normalcy.
O'Ryan F; Epker BN
Oral Surg Oral Med Oral Path 1984;58:272.

Malocclusion Associated with Temporomandibular Joint Changes in Young Adults at Autopsy.
Solberg WK; Bibb CA; Nordstrom BB; et al
Am J of Orthodon 1986;89:326.

Temporomandibular Disorders and Dentofacial Skeletal Deformities.
Tucker MR; Thomas PM
Selected Readings in Oral and Maxillofacial Surgery, Vol 4, No 5.

Temporomandibular Pain and Dysfunction in the Orthodontic Surgical Patient: Rationale for Evaluation and Treatment Sequencing.
Tucker MR; Thomas PM
Int J Adult Orthodon Orthognath Surg 1986;1:11.

Major Maxillomandibular Malrelations and Temporomandibular Joint Pain Dysfunction.
Upton LG; Scott RF; Haward JR
J Prosthetic Dent 1984;51:686.

Prevalence and Variance of Temporomandibular Joint Dysfunction in Orthognathic Surgery Patients.
White CS; Dolwick MF
Int J Adult Orthodon Orthognath Surg 1992;7:7.

Psychological:

Psychological Aspects of Facial Form
Lucker GW, et al
The Center of Human Growth and Development, The University of Michigan, 1981.

Expectations of Patients From Orthognathic Surgery.
Olsen RE; Laskin DM
J Oral Maxillofac Surg 1980;38:283-285.

Psychosocial Ramifications of Facial Change in Relation to Orthodontic Treatment and Orthognathic Surgery.
Ouelette TL
J Oral Maxillofac Surgery 1978;36:787-790.

Respiratory:

Surgical Maxillofacial Treatment of Obstructive Sleep Apnea.
Hochban W; Conradt R; Bradenburg U; Heitmann J; Peter JH
Plast Reconstr Surg 1997 Mar;99(3):619-26; discussion: 627-8.

Airway Changes After Le Fort III Osteotomy in Craniosynostosis Syndromes.
Ishii K; Kaloust S; Ousterhout DK; Vagervik K
J Craniofac Surg 1996 Sep;7(5):363-370; discussion: 371.

Management of Obstructive Sleep Apnea.
Johns RJ; Sandler NA; Braun TW
Selected Readings in Oral and Maxillofacial Surgery, Vol 5, No 8.

Downs Syndrome: Identification and Surgical Management of Obstructive Sleep Apnea.
Lefavre JF; Cohen SR; Burstein FD; Simms C; Scott PH; Montgomery GL; Graham L; Kattos AV; Plast Reconstr Surg 1997 Mar;99(3):629-37.

Speech:

Speech and Swallowing Changes Associated with Sagittal Osteotomy: A Report of Four Subjects.
Bruce FA; Hanson ML
Int J Orofacial Myology 1992;13:1-6.

Effects of Orthognathic Surgery on Speech: A Prospective Study
Dalston RM; Vig PS
Am J Orthod 1986 Oct;86(4):291-8.

Speech Production Before and After Orthognathic Surgery: A Review.
Ruscillo DM; Tekeli ME; VanSickles JE
Oral Surgery 1985;50:10-14.

The Effects of Orthognathic Surgery on Speech Production.
Ruscillo DM; Tekeli ME; Jakomis T; Cool L; VanSickles JE
Am J Orthod 1986;89:237-41.

Correction of Open Bite Deformity: A Study of Tongue Function, Speech Changes and Stability.
Turvey TA; Journot V; Epker BN
J Oral Maxillofac Surg 1976;4:93-101.

Velopharyngeal Function and Hearing Before and After Orthognathic Surgery.
Vallino LD
J Oral Maxillofac Surg 1990 Dec;48(12):1274-81.

Articulation Before and After Facial Osteotomy.
Witzel MA; Ross RB; Munro IR
J Oral Maxillofac Surg 1980;8:195-202.