Surgeons:
Clinical Practice Guidelines
for Oral and Maxillofacial Surgery
(AAOMS ParCare 2017)

Surgical Correction of Maxillofacial Skeletal Deformities

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J Oral Maxillofac Surg

This section is 1 of 11 clinical sections included in AAOMS PARCARE 2017, which is viewed as a living document applicable
to the practice of oral and maxillofacial surgery. It will be updated
at designated intervals to reflect new information concerning the
practice of oral and maxillofacial surgery.
INTRODUCTION

The surgical correction of maxillofacial skeletal deformities includes the reconstructive procedures that correct deformities of the maxilla, mandible, facial skeleton, and associated soft tissue structures. The etiology of maxillofacial skeletal deformities may be congenital, developmental, or acquired. Deformities may be evident at birth or may manifest during subsequent growth and development, creating functional, degenerative, cosmetic, and/or psychosocial problems. The timing of corrective surgery can be critical and may occur during or after completion of growth. Radiographic evaluation prior to and following treatment is critical but should be used judiciously as clinically indicated. With advancing technology, integrated computer and radiographic techniques can be an integral part of planning and treatment. Orthodontic consultation and treatment in conjunction with surgical correction are frequently necessary and highly favorable in most cases. Treatment planning can involve single or multiple separate, staged surgical and nonsurgical treatments. The temporal order for orthodontic and surgical intervention may take place at any time during treatment. Earlier surgical intervention with a “surgery first” approach can be considered when it will benefit the patient and may have specific advantages over a more traditional “orthodontics first” treatment sequence. Other nonsurgical specialties (eg, speech therapy, sleep medicine, psychology, prosthodontics) may also be helpful or necessary for completion of treatment in more complicated cases. The principal goal for surgical correction of the maxillofacial skeletal deformity is to create or restore normal form, function, and health, while minimizing potential negative short-term and long-term sequelae.

Procedures used for the correction of maxillofacial skeletal deformities may also be necessary to correct obstructive sleep apnea (OSA). It is recognized that obstructive sleep apnea due to upper airway obstruction can effectively be corrected with maxillomandibular advancement procedures, whether or not traditional cephalometric landmarks and analysis diagnose a specific maxillofacial skeletal abnormality.

Cosmetic alterations may result after the treatment of maxillofacial surgical deformities. Treatment planning for the correction of maxillofacial skeletal deformities normally entails basic cosmetic tenets and guidelines to maximize patient outcomes both functionally and esthetically. The parameters for the correction of cosmetic deformities are included in the Facial Cosmetic Surgery chapter.

Congenital, developmental, and acquired abnormalities of the temporomandibular joint can result in functional alterations, distortion, and/or disfigurement of the mandible, maxilla, and related structures. Distortion and disfigurement of the maxillofacial skeleton can also cause temporomandibular joint problems. Surgical correction of the maxillofacial skeletal structures may include surgical and nonsurgical treatment of the temporomandibular joint. Parameters for management of temporomandibular joint pathology are included in the Temporomandibular Joint Surgery chapter.

Cleft lip and palate and/or craniofacial deformities often occur in conjunction with other maxillofacial skeletal deformities and are not independent of each other. Recognition and treatment of these associated cleft and craniofacial deformities may influence or change treatment guidelines for maxillofacial skeleton deformities. Parameters for management of cleft lip/palate and craniofacial deformities are included in the Cleft and Craniofacial Surgery chapter.

These parameters were prepared with the recognition that there is more than one approach to treating specific deformities of the maxillofacial skeleton. Each patient may require an individualized treatment based on a number of contributing factors. Consequently, flexibility has been incorporated into this document to allow the practitioner to select the most appropriate treatment option in each case. Newer diagnostic and surgical adjuvants, including computed tomography (CT), 3-dimensional modeling, computer aided surgical simulation (CASS), virtual surgical planning (VSP) and CT-generated surgical guides may be indicated to reduce surgical risk and improve outcomes. This is particularly true in more severe deformities and/or developmental anomalies with abnormal anatomical variants requiring complicated surgical maneuvers. In addition, navigational and endoscopic surgical techniques are rapidly evolving and may offer an advantage over traditional surgical techniques in selected instances. The future application of robotic surgery may even develop into a useful surgical tool for the treatment of maxillofacial skeletal deformities and adjunctive procedures. Surgically assisted osteogenic orthodontics (SAOO) is also a promising treatment modality comprised of techniques such as selective alveolar corticotomies, grafting, and temporary anchorage devices (TAD). These combined procedures, when clinically indicated, are potential outpatient treatment options in the preparation and correction of maxillomandibular skeletal deformities. Advantages may include lower morbidity, early recovery, decreased duration of orthodontic therapy and presurgical orthodontic decompensation via a temporary phase of accelerated tooth movement known as regional accelerator phenomenon (RAP). Future changes in the treatment of maxillofacial skeletal
deformities, resulting from new research findings and evolving technologic developments, will undoubtedly extend the capabilities for treatment and enable an even higher quality of patient care.

The surgical correction of maxillofacial skeletal deformities requires clear mutual understanding, by both surgeon and patient, of stated treatment objectives and expectations regarding the proposed treatment and expected outcome, recognizing that different treatment modalities for the same deformity may not only be acceptable but may also present different risks, benefits, and outcomes.

GENERAL CRITERIA, PARAMETERS, AND CONSIDERATIONS FOR SURGICAL CORRECTION OF MAXILLOFACIAL SKELETAL DEFORMITIES

INFORMED CONSENT: All surgery must be preceded by the patient's or legal guardian’s consent, unless an emergent situation dictates otherwise. Emergent circumstances should be documented in the patient’s record. Informed consent is obtained after the patient or the legal guardian has been informed of the indications for the procedure(s), the goals of treatment, the known benefits and risks of the procedure(s), the factors that may affect the risk, the treatment options, and the favorable outcomes.

PERIOPERATIVE ANTIBIOTIC THERAPY: In certain circumstances, the use of antimicrobial rinses and systemic antibiotics may be indicated to prevent infections related to surgery. The decision to employ prophylactic perioperative antibiotics is at the discretion of the treating surgeon and should be based on the patient’s clinical condition as well as other comorbidities which may be present.

DEALING WITH NEUROLOGIC DEFECITS: Injuries to the terminal branches of the trigeminal nerve (eg, lingual, inferior alveolar, long buccal nerves), as well as the facial nerve, are known risks of oral and maxillofacial surgery. It should be noted that the presence of a pathologic craniomaxillofacial condition, dentoskeletal or craniofacial abnormality, or traumatic craniomaxillofacial injury may result in nerve injury prior to surgical management. In addition, the use of local anesthesia (eg, mandibular block) may increase the risk of nerve injury. Most nerve injuries resolve spontaneously, but some do not, and these may require consideration for non-surgical and/or surgical intervention. Microneurosurgical repair should be considered when the disability is of concern to the patient, and there is clinical evidence of moderate, severe, or complete neurosensory impairment of various areas of the orofacial region (eg, lips, chin, tongue); paresis or paralysis of facial muscles; loss, decreased, or abnormal taste sensation; or neuropathic pain of peripheral origin. Surgical repair should incorporate specialized microsurgical techniques (eg, operating magnification, nerve grafting), when indicated. Also see the Reconstructive Surgery chapter.

USE OF IMAGING MODALITIES: Imaging modalities may include panoramic radiograph, periapical and/or occlusal radiographs, maxillary and/or mandibular radiographs, computed tomography, cone beam computed tomography, positron emission tomography, positron emission tomography/computed tomography, and magnetic resonance imaging. In determining studies to be performed for imaging purposes, principles of ALARA (as low as reasonably achievable) should be followed.

DOCUMENTATION: The AAOMS ParCare 2017 includes documentation of objective findings, diagnoses, and patient management interventions. The ultimate judgment regarding the appropriateness of any specific procedure must be made by the individual surgeon in light of the circumstances presented by each patient. Understandably, there may be good clinical reasons to deviate from these parameters. When a surgeon chooses to deviate from an applicable parameter based on the circumstances of a particular patient, he/she is well advised to note the reason for the procedure followed in the patient’s record. Moreover, it should be understood that adherence to the parameters does not guarantee a favorable outcome.

COMPREHENSIVE CARE: Comprehensive care in the surgical correction of maxillofacial skeletal deformities usually includes orthodontic therapy. In cases where orthodontics is not included, adequate documentation is recommended. Other comprehensive care may include any necessary evaluations or interventions for medical, dental, psychological, speech, or airway concerns before surgery.
GENERAL INDICATIONS FOR THERAPY FOR SURGICAL CORRECTION OF MAXILLOFACIAL SKELETAL DEFORMITIES:

A. Physical evidence of musculoskeletal, dento-osseous, and/or soft tissue deformity
B. Imaging evidence of musculoskeletal, dento-osseous, and/or soft tissue deformity
   1. Deviation from cephalometric norms
   2. Other imaging disclosure of abnormality
C. Malocclusion that cannot be reasonably corrected by a nonsurgical means (e.g., unstable or traumatic occlusion, compromised aesthetics, protracted treatment time)
D. Speech pathology
E. Masticatory and swallowing abnormalities
F. Incomplete correction or unstable result of previous treatment
G. Dental and/or periodontal pathology
H. Social and psychological impairment
I. Associated temporomandibular joint disorders
J. Associated muscular disorder (surgical correction may be useful when reversible occlusal alteration demonstrates relief of symptoms)
K. Sleep disordered breathing

GENERAL THERAPEUTIC GOALS FOR SURGICAL CORRECTION OF MAXILLOFACIAL SKELETAL DEFORMITIES:

A. Improved musculoskeletal, dento-osseous, and/or soft tissue relationships
B. Improved masticatory and swallowing
C. Improved occlusion
D. Improved quality of speech
E. Enhanced stability of orthodontic result
F. Improved dental and periodontal health
G. Improved social and psychological well-being
H. Improved associated temporomandibular joint and/or muscular disorders
I. Limited period of disability
J. Improved airway, including improvement of signs and symptoms of sleep disordered breathing

GENERAL FACTORS AFFECTING RISK DURING SURGICAL CORRECTION OF MAXILLOFACIAL SKELETAL DEFORMITIES:

A. Degree of patient and/or family understanding of the origin and natural course of the condition or disorder and therapeutic goals and acceptance of proposed treatment
B. Presence of coexisting major systemic disease (e.g., disease that increases a patient's American Society of Anesthesiologists classification to II, III, or IV), as detailed in the Patient Assessment chapter
C. Age of patient
D. Active and/or disproportionate maxillofacial growth
E. Presence and severity of temporomandibular joint and/or muscular disorders
F. Severity of maxillofacial skeletal deformity (e.g., severe hemifacial microsomia syndromes, distorted or unusual anatomy, malocclusions with large occlusal discrepancies (generally >1 cm))
G. Presence and severity of acquired maxillary and/or mandibular skeletal, dento-osseous, or soft tissue deformities (e.g., secondary to facial trauma, compromised dentoalveolar health, previous surgical treatment)
H. Presence of parafunctional habits (e.g., bruxism, clenching, tongue thrusting, finger sucking)
I. Presence of local or systemic conditions that may interfere with the normal healing process and subsequent tissue homeostasis (e.g., previously irradiated tissue, diabetes mellitus, chronic renal disease, liver disease, blood disorder, steroid therapy, contraceptive medication, immunosuppression, malnutrition)
J. Presence of behavioral, psychological, neurologic, and/or psychiatric disorders, including habits (eg, substance abuse, including tobacco and alcohol), seizure disorders, self-mutilation that may affect surgery, healing, and/or response to therapy
K. Degree of patient’s and/or family’s cooperation and/or compliance
L. Regulatory and/or third-party decisions concerning access to care, indicated therapy, drugs, devices, and/or materials
M. Presence of sleep disordered breathing, including obstructive sleep apnea, upper airway resistance syndrome, and the potential for obstructive sleep apnea (recognizing that patients with borderline airway issues can be pushed into frank obstructive sleep apnea with an imprudent treatment plan)
N. Subsequent operative surgery to correct suboptimal results from prior maxillofacial skeletal surgery
O. Subsequent operative surgery due to prior planned/staged maxillofacial skeletal surgery
P. Maxillofacial skeletal surgery after prior adjunctive hard and soft tissue surgery (eg, pharyngeal flap, cleft repair, distraction osteogenesis)
Q. Correction of traumatic deformities
R. Preoperative deformity, condition, and/or temporomandibular joint disease complicating the establishment of a secure airway for surgery (eg, significant retrognathia, temporomandibular joint hypomobility/ankylosis, macroGLOSSia, scleroderma)

GENERAL FAVORABLE THERAPEUTIC OUTCOMES FOR SURGICAL CORRECTION OF MAXILLOFACIAL SKELETAL DEFORMITIES:
A. Long-term improvement in the musculoskeletal, dento-osseous, and/or soft tissue relationships
B. Improved masticatory and swallowing function
C. Improved speech
D. Stable functional occlusion
E. Satisfactory temporomandibular function
F. Satisfactory range of motion
G. Stable orthodontic result
H. Improved dental and periodontal health
I. Improved social and psychological well-being
J. Uncompromised facial aesthetics
K. Stable surgical result
L. Satisfactory surgical wound healing
M. Limited period of disability
N. Patient (family) acceptance of procedure and understanding of options and outcomes
O. Improvement or elimination of OSA

GENERAL KNOWN RISKS AND COMPLICATIONS FOR SURGICAL CORRECTION OF MAXILLOFACIAL SKELETAL DEFORMITIES:
A. Unplanned admission to intensive care unit after elective surgery
B. Unplanned intubation for longer than 12 hours after surgery
C. Reintubation or tracheostomy after surgery
D. Use of parenteral drugs and/or fluids for longer than 72 hours after elective surgery
E. Failure to ambulate within 48 hours of elective surgery
F. Failure to begin or maintain adequate nutritional intake following surgery
G. Facial and/or trigeminal nerve dysfunction after surgery
H. Facial fracture during or after surgery
I. Unplanned Caldwell-Luc, bronchoscopy, or other exploratory procedures associated with surgery
J. Dental injury during surgery
K. Soft tissue and/or osseous periodontal injury
L. Ocular and orbital injury during surgery
M. Repeat oral and/or maxillofacial surgery
N. Core temperature of greater than 101 °F 72 hours after elective surgery
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O. Postsurgical radiograph indicating presence of foreign body
P. Surgical anesthesia risks and complications
Q. Unplanned transfusion(s) of blood or blood components during or after surgery
R. Readmission for complications or incomplete management of problems during previous hospitalization
S. Respiratory and/or cardiac arrest
T. Impaired dental occlusion
U. Impaired airway or worsening of sleep disordered breathing
V. Impaired social and psychological well-being
W. Deterioration of facial appearance
X. Onset or exacerbation of temporomandibular disorders
Y. Clinically significant neurologic deficit
Z. Failure of bone to heal (eg, delayed or nonunion)
AA. Damage or loss of teeth, bone, and/or soft tissue
BB. Dental pathology requiring treatment
CC. Infection (eg, acute or chronic)
DD. Unplanned need for removal of fixation devices
EE. Hemorrhage (may include unplanned blood transfusion)
FF. Pain
GG. Restricted mandibular range of motion
HH. Skeletal relapse and/or unstable surgical result
II. Onset of parafunctional habits
JJ. Prolonged period of disability
KK. Delayed wound healing
LL. Scar
MM. Excess or deficiency of anticipate growth after surgery
NN. Growth disturbance
OO. Death

SPECIAL CONSIDERATIONS FOR THE SURGICAL CORRECTION OF PEDIATRIC MAXILLOFACIAL SKELETAL DEFORMITIES

The Oral and Maxillofacial Surgeon performing orthognathic surgery in children must make a special effort to ensure that the parent/guardian and the child (depending on age) understand the indications, risks and benefits, and the change in appearance that will accompany the correction of maxillofacial skeletal deformities. The relationship between the child patient and the parents may complicate the patient-physician relationship. It is important for the surgeon to develop a relationship with the child and the family to understand their concerns and expectations. Psychological consultation may be required.

The principles of management of maxillofacial skeletal deformities in children are similar to those for adults. The major difference is related to determining the proper timing for surgery. The patient’s age, stage of development, growth history, and the nature of the deformity and its consequences to the child must be considered when establishing the timing and sequencing of treatment. For example, the rate of growth in height, in the years immediately preceding an evaluation, is helpful in judging where a child is on the growth curve. Information on the height of siblings and parents may be helpful. For females, the time of onset of menses is very informative. Most females stop growing approximately 2.5 to 3 years after beginning menstruation. The hand-wrist radiograph may be helpful because skeletal maturity in normal jaw growth correlates with closure of the radial and ulnar epiphyses. Correlative indices based on cervical vertebral maturation have been developed. Bone scanning and serial cephalometric radiographs, along with clinical examinations, photographs, and models, can provide additional information concerning growth, particularly with abnormal or disproportionate growth and cases of delayed pubertal onset. Facial growth, whether normal or abnormal, is not entirely predictable even with the best technology. Newer approaches to surgical orthodontic sequencing include the advent of a “surgery first” protocol that has been shown to significantly shorten total treatment time (orthodontics and surgery) for those patients determined to benefit from this approach. Other desirable advantages of the surgery first protocol for the pediatric or young adult patient may include early improvement in facial esthetics, dental function, speech and swallowing...
The nature of the deformity and an understanding of the growth pattern of the maxillofacial skeleton also help
the Oral and Maxillofacial Surgeon make a decision on timing of surgery. For example, surgery for mandibular
prognathism generally is delayed until the patient reaches skeletal maturity and mandibular growth has ceased.
Similarly, surgery for class III malocclusion secondary to maxillary hypoplasia may be delayed to avoid relapse
secondary to subsequent mandibular growth. Examples of reasons for exceptions include the management of sleep
disordered breathing, psychological issues secondary to severe facial deformities, associated condylar procedures
for relapse. It is clear that active facial growth has a sufficient degree of variability necessitating that decisions
correction of classic osteotomies. Surgeons should consider these limitations and must have a clear rationale for
the use of distraction osteogenesis in place of immediate surgical repositioning for correction of a given
distraction osteogenesis at the LeFort III level to correct upper third facial deficiencies exclusive of the occlusion.
If a malocclusion remains stable in the context of proportionate maxillomandibular growth, surgical correction
may be appropriate before the completion of active growth. In the case of vertical maxillary excess, surgery can
be undertaken after the permanent canines and second molars have erupted because there is little vertical growth
of the maxilla after these developmental milestones. In the case of mandibular retrognathism, correction can often
be performed during growth. If the jaw grows after correction, it will be in a direction that counters the tendency
for relapse. It is clear that active facial growth has a sufficient degree of variability necessitating that decisions
correct deformity particularly in the pediatric patient. Virtual surgical planning (VSP) can illustrate the
multidimensional correction required at both the skeletal and dental level, provide preoperative insight into the
distraction osteogenesis techniques. Mandibular retrusion and maxillary protraction utilizing temporary anchorage
devices (TAD) such as screw retained plating systems and miniscrews may be considered as a more conservative,
cost efficient, and less morbid treatment alternative for developing skeletal class III malocclusion in pre-and early
adolescents. Examples would include the development of obstructive sleep apnea due to severe mandibular or
midface hypoplasia. Speech abnormalities, especially obligate articulation errors, may occasionally be treated in
this developing population. Severe lip incompetence, sialorrhea, and significant masticatory problems resulting
from a skeletal deformity may also indicate a need for surgery before the completion of growth (also see the Cleft
and Craniofacial Surgery chapter). Because there are many valid reasons for a particular treatment that falls
outside accepted norms, treatment planning that significantly deviates from standard accepted guidelines should
be clearly documented and should include documentation of appropriate multidisciplinary consultation.

The presence of developing teeth, the relative positions of anatomical landmarks, and the character of young
bone requires the modification of adult orthognathic surgical techniques for use in the pediatric patient. For
example, internal fixation methods will also have to be modified to account for these differences, and the
postoperative management may also require alteration.

Distraction osteogenesis is a useful technique in the pediatric population and may overcome many anatomical
challenges encountered with classic osteotomies and fixation techniques. Distraction techniques, however, impose
a significant additional burden on a child and family beyond that encountered with classic osteotomies.
Distraction osteogenesis is a more expensive technique due to the additional cost of the distraction devices and the
second operation required for their removal. Additional patient visits are also required compared with classic
techniques. Furthermore, distraction cannot predictably achieve the same precise 3-dimensional anatomical
correction of classic osteotomies. Surgeons should consider these limitations and must have a clear rationale for
the use of distraction osteogenesis in place of immediate surgical repositioning for correction of a given
distortion. Due to the added advantages of lower costs and morbidity, fast recovery, and decreased duration of
orthodontic therapy and decompenation, surgically assisted osteogenic orthodontics (SAOO) may be considered
as a treatment option when clinically indicated.

Computer aided surgical simulation (CASS) can greatly enhance the efficiency and accuracy of dentofacial
defority correction in the virtual plan to the operating room. VSP can be utilized to fabricate anatomic
templates, jigs, and cutting guides to aid in the transfer of the virtual plan to the operating room to elevate
efficiency, accuracy, and patient outcomes.

Advances in computer-assisted surgery, including computed tomography (CT) scans, laser surface scans, 3-
dimensional photography, 3-dimensional diagnostics, and 3-dimensional treatment planning, along with surgical
simulation, rapid prototyping for surgical guide fabrication, and intraoperative navigational techniques, are
rapidly evolving and may offer an advantage over traditional surgical techniques in selected cases.
SPECIAL CONSIDERATIONS FOR THE GERIATRIC PATIENT

With advances in the diagnosis and treatment of medical and dental disease, the geriatric population requires more advanced oral and maxillofacial surgical care. Increased lifespans have resulted in a larger geriatric population with multifaceted dental and oral needs. Surgical care is safer, more predictable and continues to evolve, although the consequences of aging may dictate modifications of traditional protocols for treatment. As a result of improved health and longer lifespans, the goals of dental rehabilitation are evolving with more focus on maintenance of an active lifestyle with an emphasis on function and esthetics.

Traditional removable dental prosthetics are no longer the only or best option available to the geriatric patient with advanced dental disease. Patients with moderate to severe bone loss can create or exacerbate skeletal discrepancies making dental and oral rehabilitation challenging without surgical correction. Orthodontics, even in a compromised periodontium is often indicated, and may require adjunctive surgery or more traditional dentofacial skeletal correction. Intricate implant supported fixed and removable prosthetics can provide the geriatric patient with improved mastication, esthetics, speech, and oral function, but advanced dental restoration of the geriatric patient without correction of dentofacial deformities can result in compromised outcomes, poor function or early failure of dental reconstruction.

Esthetic surgery in the geriatric patient often requires correction of dentofacial deformities with traditional or adjunctive procedures to restore facial proportions and volume. Obstructive sleep apnea is more common in the geriatric population and surgical correction is often indicated to correct anatomical deficiencies of the airway. Temporomandibular joint replacement due to advanced autoimmune or degenerative joint disease may require simultaneous dentofacial skeletal correction. Treatment for head and neck cancer can result in poor dental function requiring correction of congenital or acquired deformities with traditional or adjunctive procedures. Computer aided surgical simulation (CASS), virtual surgical planning (VSP) and a “surgery first” approach have an obvious benefit in the geriatric population and may be the treatment approach of choice for many patients, particularly as technology continues to advance.

MANDIBULAR PROGNATHISM/HYPERPLASIA

I. Indications for Therapy for Mandibular Prognathism/Hyperplasia

May include one or more of the following:

A. One or more indications for therapy, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Bilateral condylar hyperplasia

II. Specific Therapeutic Goals for Mandibular Prognathism/Hyperplasia

The goal of therapy is to restore form and/or function. However, risk factors and potential complications may preclude complete restoration of form and/or function.

A. One or more therapeutic goals, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

III. Specific Factors Affecting Risk for Mandibular Prognathism/Hyperplasia

Factors that increase risk and the potential for known complications:

A. Presence of one or more general factors affecting risk, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Existing or recently removed impacted mandibular third molars
C. Presence of sleep disordered breathing preoperatively
D. Active pathologic growth process
IV. Indicated Therapeutic Parameters for Mandibular Prognathism/Hyperplasia

The presurgical evaluation includes, at a minimum, a history and physical examination and diagnostic records, including a panoramic radiograph, cephalometric analysis, photographic documentation, and dental model assessment. CT scanning and computer-assisted surgical techniques, including 3-dimensional modeling, computational planning, and rapid prototyping of surgical guides, may be indicated in select cases. Also see the Patient Assessment chapter.

Navigational surgical techniques may also be indicated in select cases based on the surgical deformity, proposed procedures, surgeon experience and preference, and potential for an improved outcome.

The following procedures for the management of mandibular prognathism are not listed in order of preference:

A. Sagittal split ramus osteotomy
B. Vertical oblique ramus osteotomy (eg, intraoral, extraoral, endoscopic)
C. Supplemental procedures
   1. Le Fort I maxillary osteotomy
   2. Mandibular symphysis vertical osteotomy
   3. Subapical or body osteotomy/ostectomy
   4. Grafting procedures (eg, autogenous, allogeneic bone, alloplasts, bone morphogenetic protein)
   5. Genioplasty
   6. Contour augmentation and/or reduction
   7. Coronoidectomy and/or coronoidectomy
   8. High condylectomy (in severe cases demonstrating continuous abnormal growth)
   9. Alveolar bone grafting in preparation for orthodontic movement
  10. Surgically assisted orthodontic movement (includes skeletal anchorage devices, corticotomies)
  11. Partial glossectomy
  12. Dental extractions (includes third molar removal)
  13. Speech and swallowing therapy
D. Instructions for posttreatment care and follow-up

V. Outcome Assessment Indices for Mandibular Prognathism/Hyperplasia

Indices are used by the specialty to assess aggregate outcomes of care. Outcomes are assessed through clinical evaluation and may include an imaging evaluation.

A. Favorable therapeutic outcomes
   1. General favorable therapeutic outcomes, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Known risks and complications associated with therapy
   1. Presence of a general known risk and/or complication, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

MANDIBULAR RETROGNATHISM/HYPOPLASIA

I. Indications for Therapy for Mandibular Retrognathism/Hypoplasia

May include one or more of the following:

A. Presence of one or more indications for therapy, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Associated developmental, pathologic, or acquired condylar disorders (eg, ankylosis, idiopathic condylar
resorption)

C. Associated airway obstruction (eg, obstructive sleep apnea or upper airway resistance syndrome, when confirmed by appropriate sleep studies as part of a multidisciplinary approach to treatment)

II. Specific Therapeutic Goals for Mandibular Retrognathism/Hypoplasia

The goal of therapy is to restore form and/or function. However, risk factors and potential complications may preclude complete restoration of form and/or function.

A. Presence of one or more general therapeutic goals, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

B. Correction of airway obstruction and signs and symptoms of obstructive sleep apnea

III. Specific Factors Affecting Risk for Mandibular Retrognathism/Hypoplasia

A. Presence of one or more general factors affecting risk, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

B. Presence of or recent removal of impacted mandibular third molar

IV. Indicated Therapeutic Parameters for Mandibular Retrognathism/Hypoplasia

The presurgical evaluation includes, at a minimum, a history and physical examination and diagnostic records, including a panoramic radiograph, cephalometric analysis, photographic documentation, and dental model assessment. CT scanning and computer-assisted surgical techniques, including 3-dimensional modeling, computational planning, and rapid prototyping of surgical guides, may be indicated in selected cases. Also see the Patient Assessment chapter.

Navigational surgical techniques may also be indicated in select cases based on the surgical deformity, proposed procedures, surgeon experience and preference, and potential for improved outcomes.

The following procedures for the management of mandibular retrognathism are not listed in order of preference:

A. Sagittal split ramus osteotomy with rigid fixation

B. Inverted "L" osteotomy with bone grafting and rigid fixation

C. Supplemental procedures
   1. Le Fort I maxillary osteotomy
   2. Mandibular symphysis vertical osteotomy
   3. Grafting procedures (eg, autogenous, allogeneic bone, alloplasts)
   4. Subapical or alveolar osteotomies
   5. Genioplasty
   6. Contour augmentation and/or reduction (augmentation with prosthesis, bone graft, or osteoplasty)
   7. Myotomy
   8. Hyoid suspension
   9. Genial tubercle advancement
   10. Reconstruction (condyle/mandible)
   11. Alveolar bone grafting in preparation for orthodontic movement
   12. Surgically assisted orthodontic movement (includes skeletal anchorage devices and corticotomies)
   13. Dental extractions (includes third molar removal)
   14. Pharmaceutical management to minimize temporomandibular instability

D. Distraction osteogenesis both for mandibular widening and lengthening

E. Instructions for posttreatment care and follow-up

V. Outcome Assessment Indices for Mandibular Retrognathism/Hypoplasia

Indices are used by the specialty to assess aggregate outcomes of care. Outcomes are assessed through clinical evaluation and may include an imaging evaluation.

A. Favorable therapeutic outcomes
1. Presence of general favorable therapeutic outcomes, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
2. Improved airway (OSA patients)

B. Known risks and complications associated with therapy
1. Presence of general known risks and/or complications, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
2. Unimproved airway
3. Altered growth
4. Degenerative condylar disease (idiopathic condylar resorption, rheumatoid arthritis)

MANDIBULAR ASYMMETRY

Mandibular asymmetry may result from congenital, developmental, or acquired condylar anomalies. It may be manifested as hyperplasia with overgrowth or hypoplasia with deficiency and may also be present without apparent condylar involvement.

The condition may be isolated to the transverse plane or demonstrate transverse, sagittal, and vertical skeletal deformity.

I. Indications for Therapy for Mandibular Asymmetry

May include one or more of the following:

A. Presence of one or more indications for therapy, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Associated developmental, pathologic, or acquired condylar disorders affecting mandibular symmetry
C. Vertical and/or horizontal asymmetry of the ramus and/or body of the mandible

II. Specific Therapeutic Goals for Mandibular Asymmetry

The goal of therapy is to restore form and/or function. However, risk factors, soft tissue abnormalities, severe skeletal deformities, and potential complications may preclude complete restoration of form and/or function.

A. Presence of one or more general therapeutic goals, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

III. Specific Factors Affecting Risk for Mandibular Asymmetry

Severity factors that increase risk and the potential for known complications:

A. Presence of one or more of the general factors affecting risk, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Severity of mandibular condylar deformity
C. Etiology of condylar deformity (eg, tumor, idiopathic condylar resorption, ankylosis)
D. Associated soft tissue asymmetry
E. Severity of mandibular asymmetry
F. Lack of functional condylar articulation

IV. Indicated Therapeutic Parameters for Mandibular Asymmetry

The presurgical evaluation includes, at a minimum, a history and physical examination and diagnostic records, including a panoramic radiograph, cephalometric analysis, photographic documentation, and dental model assessment. CT scanning and computer-assisted surgical techniques, including 3-dimensional modeling, computational planning, and rapid prototyping of surgical guides, may be indicated in select cases. Also see the Patient Assessment chapter.
Navigational surgical techniques may also be indicated in select cases based on the surgical deformity and proposed procedures, surgeon experience and preference, and potential for improved outcomes.

The following procedures for the management of mandibular asymmetry are not listed in order of preference:

A. Sagittal split ramus osteotomy, vertical ramus osteotomy, inverted "L" osteotomy
B. Le Fort I osteotomy with or without segmentalization
C. Partial or complete condylectomy
D. Supplemental procedures
   1. Mandibular symphysis vertical osteotomy
   2. Grafting procedures (eg, autogenous, allogeneic bone, alloplasts)
   3. Genioplasty
   4. Contour augmentation and/or reduction, including soft tissue augmentation (eg, fat grafting and soft tissue flaps)
   5. Temporomandibular joint surgery including total joint replacement
   6. Genial tubercle advancement
   7. Alveolar bone grafting in preparation for orthodontic movement
   8. Surgically assisted orthodontic movement (includes skeletal anchorage devices and corticotomies)
   9. Dental extractions (includes third molar removal)
   10. Pharmaceutical management to minimize temporomandibular instability
E. Distraction osteogenesis
F. Soft tissue grafts or flaps (eg, microvascular transfer of adipofascial flap for soft tissue augmentation)
G. Instructions for posttreatment care and follow-up

V. Outcome Assessment Indices for Mandibular Asymmetry

Indices are used by the specialty to assess aggregate outcomes of care. Outcomes are assessed through clinical evaluation and may include an imaging evaluation.

A. Favorable therapeutic outcomes
   1. General favorable therapeutic outcomes, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Known risks and complications associated with therapy
   1. Presence of a general known risk and/or complication, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
   2. Soft tissue response to hard/soft tissue augmentation or reduction
   3. Continued facial asymmetry

MAXILLARY HYPERPLASIA

Maxillary hyperplasia consists of three component subsets: vertical, horizontal, and transverse. Items listed under this condition are applicable to all subsets of this condition unless otherwise designated.

I. Indications for Therapy for Maxillary Hyperplasia

May include one or more of the following:

A. Presence of one or more indications for therapy, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Airway obstruction (eg, sleep disordered breathing, nasal airway obstruction)
C. Associated soft tissue deformities (eg, lip incompetence)

II. Specific Therapeutic Goals for Maxillary Hyperplasia
The goal of therapy is to restore form and/or function. However, risk factors and potential complications may preclude complete restoration of form and/or function.

A. Presence of a general therapeutic goal, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

III. Specific Factors Affecting Risk for Maxillary Hyperplasia

Severity factors that increase risk and the potential for known complications:

A. Presence of a general factor affecting risk as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

B. Presence of or recent removal of impacted maxillary third molars

IV. Indicated Therapeutic Parameters for Maxillary Hyperplasia

The presurgical evaluation includes, at a minimum, a history and physical examination and diagnostic records, including a panoramic radiograph, cephalometric analysis, photographic documentation, and dental model assessment. CT scanning and computer-assisted surgical techniques, including 3-dimensional modeling, computational planning, and rapid prototyping of surgical guides, may be indicated in select cases. Also see the Patient Assessment chapter.

Navigational surgical techniques may also be indicated in select cases based on the surgical deformity and proposed procedures, surgeon experience and preference, and potential for improved outcomes.

The following procedures for the management of maxillary hyperplasia are not listed in order of preference:

A. Segmental maxillary alveolar osteotomies

B. Le Fort I osteotomy with or without segmentalization

C. Supplemental procedures
   1. Grafting procedures (eg, autogenous, allogeneic bone, alloplasts)
   2. Contour augmentation and/or reduction
   3. Septorhinoplasty
   4. Turbinoplasty and/or turbinectomy
   5. Genioplasty
   6. Mandibular osteotomy
   7. Dental extractions (includes third molar removal)
   8. Soft tissue procedures (eg, V-Y closure, nasal cinch, buccal fat removal)
   9. Biopsy or debridement and removal of maxillary sinus pathology (eg, mucous retention cyst, mucocele, polyp)
   10. Palatal or alveolar cleft repair with/without bone grafting
   11. Surgically assisted orthodontic movement (includes skeletal anchorage devices and corticotomies
   12. Malar osteotomies/augmentation

D. Instructions for posttreatment care and follow-up

V. Outcome Assessment Indices for Maxillary Hyperplasia

Indices are used by the specialty to assess aggregate outcomes of care. Outcomes are assessed through clinical evaluation and may include an imaging evaluation.

A. Favorable therapeutic outcomes
   1. General favorable therapeutic outcomes, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
   2. Improved airway

B. Known risks and complications associated with therapy
   1. Presence of a general known risk and/or complication, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal
MAXILLARY HYPOPLASIA

Maxillary hypoplasia consists of three component subsets: vertical, horizontal, and transverse. Items listed under this condition are applicable to all subsets of this condition unless otherwise designated. Also see the Cleft and Craniofacial Surgery chapter.

I. Indications for Therapy for Maxillary Hypoplasia

May include one or more of the following:

A. Presence of one or more indications for therapy, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

B. Transverse maxillary discrepancies not amenable to orthodontic correction

C. Obstructive sleep apnea, upper airway resistance syndrome

D. Airway obstruction (eg, nasal airway)

E. Exorbitism with risk of exposure keratopathy (LeFort III level)

F. Posttraumatic

II. Specific Therapeutic Goals for Maxillary Hypoplasia

The goal of therapy is to restore form and/or function. However, risk factors and potential complications may preclude complete restoration of form and/or function.

A. Presence of a general therapeutic goal, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

B. Improved airway

III. Specific Factors Affecting Risk for Maxillary Hypoplasia

Severity factors that increase risk and the potential for known complications:

A. Presence of a general factor affecting risk, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

B. Severity of maxillary deformity

C. Presence of or recent removal of impacted maxillary third molars

D. Presence of cleft palate or prior palatal surgery (eg, uvulopalatopharyngoplasty)

IV. Indicated Therapeutic Parameters for Maxillary Hypoplasia

The presurgical evaluation includes, at a minimum, a history and physical examination and diagnostic records, including a panoramic radiograph, cephalometric analysis, photographic documentation, and dental model assessment. CT scanning and computer-assisted surgical techniques, including 3-dimensional modeling, computational planning, and rapid prototyping of surgical guides, may be indicated in select cases. Also see the Patient Assessment chapter.

Navigational surgical techniques may also be indicated in select cases based on the surgical deformity and proposed procedures, surgeon experience and preference, and potential for improved outcomes.

The following procedures for the management of maxillary hypoplasia are not listed in order of preference:
A. Segmental maxillary alveolar osteotomies
B. Le Fort I, II, or III osteotomy with or without segmentalization (quadrangular and Kufner modifications)
C. Distraction osteogenesis
D. Supplemental procedures
   1. Grafting procedures (e.g., autogenous, allogeneic bone, alloplasts)
   2. Contour augmentation and/or reduction
   3. Malar osteotomies/augmentation
   4. Septorhinoplasty
   5. Turbinoplasty and/or turbinectomy
   6. Genioplasty
   7. Mandibular osteotomy
   8. Dental extractions (includes third molar removal)
   9. Soft tissue procedures (e.g., V-Y closure, nasal cinch, buccal fat removal)
   10. Biopsy or debridement and removal of maxillary sinus pathology (e.g., mucous retention cyst, mucocele, polyp)
   11. Palatal or alveolar cleft repair with/without bone grafting
   12. Surgically assisted orthodontic movement (includes skeletal anchorage devices and corticotomies)
   13. Instructions for posttreatment care and follow-up

V. Outcome Assessment Indices for Maxillary Hypoplasia

Indices are used by the specialty to assess aggregate outcomes of care. Outcomes are assessed through clinical evaluation and may include an imaging evaluation.

A. Favorable therapeutic outcomes
   1. General favorable therapeutic outcomes, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
   2. Improved airway

B. Known risks and complications associated with therapy
   1. Presence of a general known risk and/or complication, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
   2. Impaired nasal and/or sinus function
   3. Unfavored nasal changes, including nasal tip overrotation, alar base widening, septal deviation
   4. Epiphora

SKELETAL OPEN BITE (APERTOGNATHIA)

Skeletal open bite can be developmental or acquired, as well as secondary to local factors influencing tooth eruption and dentoalveolar growth. The condition may be isolated to the vertical dimension in one or both jaws, may be seen in conjunction with sagittal and transverse problems, and may occur anteriorly or posteriorly, both unilaterally or bilaterally.

I. Indications for Therapy for Skeletal Open Bite (Apertognathia)

May include one or more of the following:

A. Presence of one or more indications for therapy, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Associated developmental, pathologic, or acquired condylar disorders resulting in open bite (e.g., ankylosis, idiopathic condylar resorption, osteochondroma, rheumatoid arthritis)
C. Associated soft tissue deformities (e.g., lip incompetence)
D. Dry mouth
E. Mouth breathing gingivitis
II. Specific Therapeutic Goals for Skeletal Open Bite (Apertognathia)

The goal of therapy is to restore form and/or function. However, risk factors and potential complications may preclude complete restoration of form and/or function.

A. Presence of a general therapeutic goal, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Improvement in lip incompetence

III. Specific Factors Affecting Risk for Skeletal Open Bite (Apertognathia)

Severity factors that increase risk and the potential for known complications:

A. Presence of a general factor affecting risk, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. Severity of open bite
C. Presence and severity of localized conditions (e.g., tongue posture, tongue size, mode of respiration as it influences jaw posture)
D. Active condylar disease (e.g., rheumatoid arthritis, idiopathic condylar resorption)

IV. Indicated Therapeutic Parameters for Skeletal Open Bite (Apertognathia)

The presurgical evaluation includes, at a minimum, a history and physical examination and diagnostic records, including a panoramic radiograph, cephalometric analysis, photographic documentation, and dental model assessment. CT scanning and computer-assisted surgical techniques, including 3-dimensional modeling, computational planning, and rapid prototyping of surgical guides, may be indicated in select cases. Also see the Patient Assessment chapter.

Navigational surgical techniques may also be indicated in select cases based on the surgical deformity and proposed procedures, surgeon experience and preference, and potential for improved outcomes.

The following procedures for the management of skeletal open bite are not listed in order of preference:

A. Le Fort I osteotomy with or without segmentalization
B. Segmental maxillary alveolar osteotomies
C. Sagittal split ramus osteotomy with rigid fixation
D. Inverted "L" osteotomy with bone grafting and rigid fixation
E. Vertical ramus osteotomies in conjunction with mandibular setback procedures
F. Supplemental procedures
   1. Grafting procedures (e.g., autogenous, allogeneic bone, alloplasts)
   2. Septorhinoplasty
   3. Partial glossectomy
   4. Distraction osteogenesis
   5. Speech therapy
   6. Turbinoplasty and/or turbinectomy
   7. Reconstruction (condyle/mandible), including autogenous or alloplastic total joint reconstruction
   8. Dental extractions (includes third molar removal)
   9. Soft tissue procedures (e.g., V-Y closure, nasal cinch, buccal fat removal)
   10. Biopsy or debridement and removal of maxillary sinus pathology (e.g., mucous retention cyst, mucocèle, polyp)
   11. Palatal or alveolar cleft repair with/without bone grafting
   12. Surgically assisted orthodontic movement (includes skeletal anchorage devices and corticotomies)
   13. Pharmaceutical management to minimize temporomandibular instability

V. Outcome Assessment Indices for Skeletal Open Bite (Apertognathia)

Indices are used by the specialty to assess aggregate outcomes of care. Outcomes are assessed through clinical evaluation and may include an imaging evaluation.
A. Favorable therapeutic outcomes
   1. General favorable therapeutic outcomes, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
   2. Improved airway

B. Known risks and complications associated with therapy
   1. Presence of a general known risk and/or complication, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

SPECIAL CONSIDERATIONS FOR SLEEP DISORDERED BREATHING

Surgical correction of maxillofacial skeletal deformities is often indicated for the treatment of sleep-disordered breathing, which includes most commonly obstructive sleep apnea (OSA) and upper airway resistance syndrome. Untreated, the disorder can increase the risk of cardiovascular disease, cerebrovascular disease, diabetes, and other metabolic and endocrine dysfunctions. It may also increase the risk for work-related injuries and motor vehicle collisions and may exacerbate psychiatric conditions. In the pediatric population, sleep disordered breathing can have a profound impact on a child’s achievement of developmental milestones and quality of life. Neuropsychological manifestations predominate with behavioral and attention deficit issues, and learning disabilities being frequent complaints. In severe cases, sleep apnea may result in failure to thrive. A thorough history with screening questionnaires and diagnostic evaluation including polysomnography, radiography, and clinical evaluation, can be essential for diagnosing obstructive sleep apnea and subtler forms of sleep-disordered breathing so that an appropriate treatment plan be developed.

Maxillomandibular advancement procedures demonstrate well-documented success in the treatment of obstructive sleep apnea. Consideration for a surgery first approach in the patient with OSA may be appropriate, especially in those individuals intolerant to CPAP and other forms of non-surgical therapeutic mechanisms. Ancillary/adjunctive procedures, such as hyoid suspension, genioglossus advancement, tonsillectomy and/or adenoidectomy, uvulopalatopharyngoplasty, radiofrequency tongue base reduction, tracheostomy, and turbinectomy, can also provide relief and may be indicated for the treatment of obstructive sleep apnea in both children and adult patients. As with the surgical correction of maxillofacial skeletal deformities, proper patient assessment and informed consent is critical to maximizing results. It is important to note that for some patients with a history of OSA undergoing surgery for maxillofacial skeletal deformities, inpatient overnight observation with consideration given to intensive care monitoring, may be indicated.

OBSTRUCTIVE SLEEP APNEA (OSA)

I. Indications for Therapy for Obstructive Sleep Apnea

May include one or more of the following:

A. One or more indications for therapy, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
B. An elevated Respiratory Disturbance Index (RDI) or Apnea Hypopnea Index (AHI), as measured objectively by polysomnography (PSG)
C. Nocturnal hypoxia
D. Excessive daytime sleepiness (as measured by Epworth Sleepiness Scale)
E. Positive STOP-BANG sleep apnea questionnaire
F. Reduced quality of life
G. Cardio-pulmonary disease
H. Upper airway obstruction or collapse as documented by imaging of the upper airway
I. Maxillary or mandibular retrognathism (ie, hypoplasia)
II. Specific Therapeutic Goals for Obstructive Sleep Apnea

The goal of therapy is to restore form and/or function. However, risk factors and potential complications may preclude complete restoration of form and/or function.

A. One or more therapeutic goals as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

B. Reduce RDI and/or AHI

C. Reduce nocturnal hypoxia

D. Improve nocturnal esophageal pressure (Pes)

E. Improve esophageal pH

F. Reduce daytime sleepiness

G. Improve quality of life

H. Improve cardiovascular health

I. Reduce upper airway obstruction or collapse

J. Improve form and function of the upper airway by increasing upper airway space

K. Reduce snoring

L. Reduce or eliminate need for continuous positive pressure airway (CPAP) and/or tracheostomy

M. Improve cognitive and behavioral function and development

III. Specific Factors Affecting Risk for Obstructive Sleep Apnea

Factors that increase risk and the potential for known complications:

A. Presence of one or more general factors affecting risk, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities

B. Associated comorbid conditions including: obesity, cardio-pulmonary disease, hypertension, history of stroke, history of myocardial infarction, diabetes, neuromuscular disorders, metabolic disease

C. Drug and alcohol dependence

D. Presence and severity of localized conditions (eg, tongue posture, tongue size, periodontal disease, impacted teeth)

E. Temporomandibular joint (TMJ) and jaw deformities, (eg, ankylosis, Pierre Robin sequence, hemifacial microsomia)

F. TMJ pain and dysfunction

G. Cleft and craniofacial disorders

H. Family history of OSA

IV. Indicated Therapeutic Parameters for Obstructive Sleep Apnea

The presurgical evaluation includes, at a minimum, a history and physical examination. Lifestyle changes, such as losing weight, alcohol cessation before bed, and CPAP can result in clinical improvement. When specific anatomical conditions may exist, diagnostic records should be obtained and can include a panoramic radiograph, cephalometric analysis, photographic documentation, dental model assessment, polysomnography sleep study (with or without Pes), upper airway endoscopy, esophageal pH monitoring, or other studies. Computed tomography (CT) scanning and computer-assisted surgical techniques, including 3-dimensional modeling, computational planning, and rapid prototyping of surgical guides, may be indicated in select cases. Specialty consultations may be indicated to optimize treatment of comorbid conditions prior to surgical correction of OSA. Also see the Patient Assessment chapter.

Navigational surgical techniques may also be indicated in select cases based on the surgical deformity, proposed procedures, surgeon experience and preference, and potential for an improved outcome.

The following procedures for the management of obstructive sleep apnea are not listed in order of preference:
A. Maxillomandibular advancement (MMA) to improve form and function of the upper airway

B. Consideration of specific adjunctive surgical techniques to maximize stability of MMA, minimize neurosensory deficits and promote normal wound healing including:

1. Mandibular advancement
2. Maxillary and/or mandibular expansion
3. Chin advancement
4. Genial advancement
5. Hyoid (suprahypoid muscle complex) advancement
6. Uvulopalatophargoplasty (or variant)
7. Tracheostomy
8. Nasal septoplasty/polypectomy/turbinectomy
9. Tonsillectomy and adenoidectomy
10. Partial glossectomy (or variant)
11. Tongue suspension
12. Orthodontics
13. Prosthetics
14. Oral appliances
15. Diaphragmatic Stimulator

C. Consideration of specific postoperative management strategies to minimize wound healing problems, establish normal TMJ function, functional occlusion and promote recovery of mandibular mobility

D. Instructions for posttreatment care and follow-up

V. Outcome Assessment Indices for Obstructive Sleep Apnea

Indices are used by the specialty to assess aggregate outcomes of care. Outcomes are assessed through clinical evaluation and may include an imaging evaluation.

A. Favorable therapeutic outcomes

1. General favorable therapeutic outcomes, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
2. Reduction in OSA with reduction in AHI, RDI, as measured objectively by PSG
3. Routine postoperative course including uneventful wound healing
4. Imaging documentation of positive upper airway change, adequate bone healing and stability of MMA or adjunctive procedures
5. Establish and maintain functional occlusion and normal TMJ function
6. Minimal neurosensory dysfunction

B. Known risks and complications associated with therapy

1. Presence of a general known risk and/or complication, as listed in the section entitled General Criteria, Parameters, and Considerations for Surgical Correction of Maxillofacial Skeletal Deformities
2. Perioperative hypertension, cardiovascular events, respiratory and venous thromboembolic events
3. Persistent OSA requiring additional treatment such as CPAP or tracheostomy
4. Need for further upper airway surgery
5. Revision surgery

SELECTED REFERENCES – SURGICAL CORRECTION OF MAXILLOFACIAL SKELETAL DEFORMITIES

This list of selected references is intended only to acknowledge some of the sources of information drawn on in the preparation of this document. Citation of the reference material is not meant to imply endorsement of any statement contained in the reference material. The list is not an exhaustive compilation of information on the topic. Readers should consult other sources to obtain a complete bibliography.


Mandibular Prognathism/Hyperplasia


MANDIBULAR RETROGNATHISM/HYPOPLASIA


MANDIBULAR ASYMMETRY

285. Foushee DG, Moriarty JD, Simpson DM: Effects of mandibular orthognathic treatment on mucogingival


MAXILLARY HYPERPLASIA


Lee DY, Bailey LJ, Proffit WR: Soft tissue changes after superior repositioning of the maxilla with Le Fort I


359. Tung TC, Bendor-Samuel R, Chen YR: Surgical complications of the Le Fort I osteotomy—a retrospective review of 146 cases. Changgeng Yi Xue Za Zhi 18:102, 1995


363. White CS, Dolwick MF: Prevalence and variance of temporomandibular dysfunction in orthognathic surgery
MAXILLARY HYPOPLASIA


441. Throckmorton GS, Ellis E 3rd, Buschang PH: Improvement of maximum occlusal forces after orthognathic


SKELETAL OPEN BITE (APERTOGNATHIA)


OBSTRUCTIVE SLEEP APNEA


566. Sittitavornwong S, Waite PD, Shih AM, et al: Computational fluid dynamic analysis of the posterior airway...


579. Woodson BT: Non-pressure therapies for obstructive sleep apnea: surgery and oral appliances. Respir Care 55:1314, 2010


SURGICAL ORTHODONTICS


Dentofacial Orthop 146:594, 2014


