ORTHOGNATHIC SURGERY

Orthognathic surgery or surgical orthodontics is the surgical correction of skeletal anomalies or malformations involving the mandible or the maxilla. orthognathic surgery is performed in conjunction with orthodontics so that the teeth are in proper position after surgery.

OBJECTIVES OF ORTHOGNATHIC SURGERY

- Correction of maxillofacial aesthetic
- Correction of dental aesthetic
- Achieve good functional occlusion
- Stability after treatment

INDICATIONS OF ORTHOGNATHIC SURGERY

Orthognathic surgery is indicated for patients whose orthodontic problems are so severe that neither growth modification nor camouflage offers a solution, and surgery to realign the jaws or reposition the dentoalveolar segments is the only possible treatment. Surgery alone is not a substitute solution for those patients; instead, it must be properly coordinated with orthodontics and other dental disciplines to achieve good overall results.

Dramatic progress in recent years has made it possible for combined treatment to correct many severe problems that simply were untreatable only a few years ago.

MAXILLARY ANOMALIES REQUIRE ORTHOGNATHIC SURGERY

1. Maxillary base may be anteriorly placed (Prognathic) or being large in all dimensions. Maxillary excess may cause either protrusion of the upper jaw or elongation of the face with downward displacement of the mandible. In vertical maxillary excess, the disfigurement causes a "long-face syndrome" with accompanying distortion of facial features.



2. Maxillary Retrognathism occurs when maxillary base being posteriorly placed or too small in all dimensions. In the latter condition, also called maxillary hypoplasia, the growth of the maxilla does not match that of the lower jaw. In this condition there is a collapse of the normal mid-face supporting structures. In addition to causing difficulties with eating and speech, this deficiency may be associated with anomalies of the supporting structures of the nose and cheeks. Partial obstruction of the nasal passages may be present. Hence, reconstruction of the nasal and malar tissues may be intimately related to the treatment for maxillary deficiency.



3. Maxillary asymmetry may occur when the maxillary base positioned laterally or when there is asymmetric length and width of the maxilla as in hemifacial microsomia.



MANDIBULAR BASE ANOMALIES

1. Mandibular prognathism could either be that the mandible is too large in all dimensions or the base of the body is positioned anteriorly. Excess mandibular bone causes protrusion of the lower jaw beyond the normal alignment with the upper jaw; with a resultant Class III malocclusion. This can prevent effective biting and chewing of food and predispose to periodontal disease. Temporomandibular joint function and speech may be impaired. In addition there may be chin hyperplasia or malposition which will require correction.

2. Mandibular Retrognathism could be as a result of the mandible being too small in all dimensions or the base of the body being positioned posteriorly Sleep may be impaired due to a retruded or deficient lower jaw. A deficiency of bone supporting the chin is recognised.

3. Mandibular asymmetry. The two halves of the base of the mandible have unequal dimensions. This may be seen in patients with hemimandibular hyperplasia, hemimandibular hypertrophy. Both halves of the base of the mandible may have equal dimensions but may be shifted to one.



ABNORMALITIES OF THE CHIN

The chin should be evaluated separately from the mandible. The chin prominence includes both bone and soft tissue that may require separate surgical management.

Macrogenia

The chin is too large in all dimensions. An anteriorly placed normal sized chin prominence (antegenia) will also give a macrogenic appearance.

Microgenia

The chin is small in all dimensions. A normal sized chin, placed posteriorly (retrogenia) should be distinguished from microgenia.



ABNORMALITIES OF THE ALVEOLAR PROCESSES

The alveolar process abnormalities should be assessed independent of the anomalies of the bases of the mandible and maxilla. The alveolar processes may be abnormal either in size, i.e. macro/micro or in position, i.e. retro/ ante. In addition they may be either too high or too low.

Other abnormalities which require surgical correction include long face and short face syndromes and open bite (apertognathism) cases.

PLANNING PROCEDURE IN SURGICAL ORTHODONTICS

- **Clinical examination**

This should include a general medical examination to rule out any systemic disorders e.g., acromegaly. Local oral examination should include overall dental health. Any pulpal or periodontal infections should be eradicated before surgery. The TMJ is assessed for any preexisting pathology, e.g. clicking, locking, tenderness, deviation, etc. Rule out any hormal imbalance especially pituitary hormones.

- **Socio-psychological evaluation**

Assessment of the patient's awareness of his/her dentofacial deformity and *expectation* from treatment should be done. This helps in determining the patient's motivation towards surgery. The patient's social status should also be evaluated.

- **Radiological examination**

A complete dental radiographic survey can be done with an orthopantomogram (OPG) to rule out a periapical or periodontal pathological condition. The X-ray will also aid in the determination of the stability of teeth in the supporting tissue and their ability to withstand the stresses of fixation devices and immobilization. Any impacted/embedded or ectopic teeth, which may come in the line of the osteotomy cut, should be preferably extracted 6 months prior to surgery. The position of the inferior dental canal and the anteroposterior width of the ramus is assessed when mandibular ramus osteotomy is planned. The flare of the rami is assessed on a submentovertex view when intraoral approach for ramus osteotomy is planned.

- **Photographs**

Preoperative photographs are necessary in order to have a record of the pretreatment profile. Morphometric measurements can also be done on these photographs. Frontal and lateral photographs are usually taken in a natural head positions.

- **Cephalometric evaluation**

This is essential for preoperative evaluation of all patients regardless of the type of deformity. Lateral cephalogram and/or anteroposterior cephalogram (in asymmetry cases) is most helpful in determining precisely the location of the deformity and in selecting the proper operative sites for surgical correction. Soft tissue outline on the cephalogram aids the treatment planning. A combination of commonly used landmarks and measurements determine the degree and location of dentoskeletal deformity. Different analyses were proposed to assess those cases.

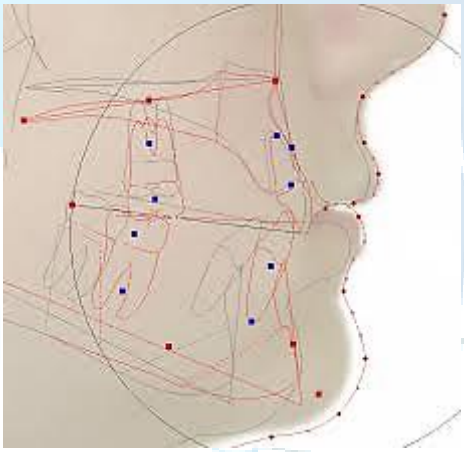
- **Study models**

Two sets of dental stone models are constructed from the patient's impressions. Bite registration is useful while mounting the models on an articulator. One set of study models are evaluated for intra-arch, inter-arch discrepancies and for occlusion. The study models are invaluable aids when assessing the feasibility of surgical correction as they provide a permanent three dimensional record of the dental and underlying skeletal structures. They also present the various permutations of movement area involved that will need to be explored to correct the presenting facial and jaw disharmony. A second articulated set is used as working models on which mock surgery is performed.

- **Prediction tracing**

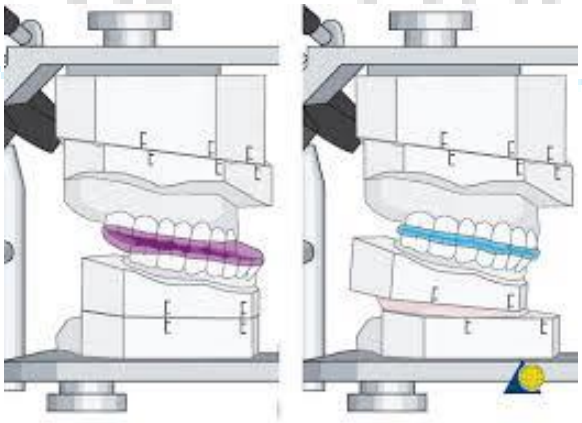
The postoperative profile of the patient can be predicted with some degree of accuracy by cephalometric means. This is called "prediction tracing".

Essentially, after knowing the location and severity of deformity, the osteotomy and the extent of movement of the osteotomized segment is determined. On anacetate tracing of the cephalogram, the osteotomized segment is cut out and moved as calculated. The soft tissue follow the movement of bone in a ratio determined by the type of movement and the technique performed. However, these soft tissue changes are only meant to be a guide for prediction tracings and are variable. These tissue changes are marked on the tracing to give the postoperative profile.



- **Model surgery**

Using prediction tracings, a surgical plan is decided and then the surgery is simulated on articulated working models. The models are cut and repositioned in the desirable position and the segments secured in their new position with sticky wax. The occlusion achieved is evaluated for stability and any modifications required noted. Splints are then constructed which are of immense help during surgery.



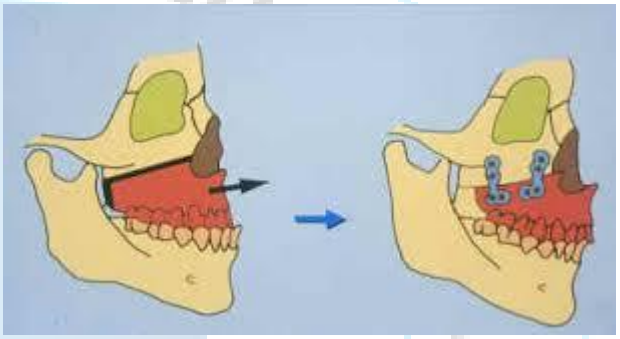
SURGICAL PROCEDURES

1. Anteroposterior correction

- **Maxillary Surgery**

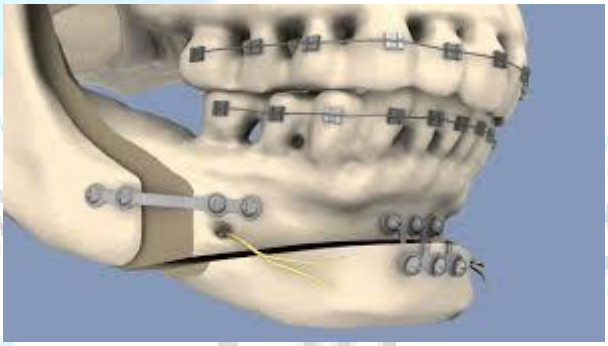
Advancement LeFort I downfracture and advancement is the preferred technique for maxillary retrognathism. The length of the vascular pedicle and soft tissue compliance limits the extent of anterior movement.

Retraction of a LeFort I segment is difficult because of the presence of the pterygomandibular plates and tuberosity. Therefore, anterior segmental osteotomy (Wassmund, Wunderer procedure or Cupar's technique) after extraction of a premolar on either side is most commonly performed in maxillary prognathism cases.



- **Mandibular surgery**

Advancement Bilateral Sagittal Split Osteotomy (BSSO) is currently the most preferred technique since it can be performed easily intraorally.



Inverted L-osteotomy and C-osteotomy are also procedures performed in the ramus for advancement of the mandible. The former can be performed intraorally whereas the C-osteotomy is done extraorally. Anterior segmental subapical osteotomy can be performed if the alveolar segment needs to be advanced without moving the chin-point.

Setback BSSO or oblique ramus osteotomy are usually performed for this backward movement of the mandible. If closure of bilateral edentulous spaces or narrowing of the arch is required, then a body *ostectomy* is performed where a segment of full-thickness bone is removed.

Anterior segmental subapical osteotomy and posterior movement of the dentoalveolar segment can be performed in case of mandibular excess with chin deficiency.

2. Vertical correction

- **Maxillary Surgery**

Both superior positioning (for long face correction) and inferior positioning (for short face correction) can be performed by LeFort I down-fracture technique. Inferior movements, however, is less stable and usually require insertion of bone graft or hydroxyapatite blocks between the segments in order to increase stability.

- **Mandibular Surgery**

Shortening of vertically excessive mandible should be done by inferior border osteotomy and chin augmentation horizontally. Elongation of the lower facial height can be done with BSSO, which rotates the mandible down and forward.

3. Skeletal openbite correction (apertognathia)

Skeletal openbite is a difficult problem to treat. It is commonly occurs in long face individuals who have vertical maxillary excess and deficient mandible with short ramus height. Lower anterior teeth may be overerupted.

LeFort I down fracture and superior repositioning of the maxilla especially posteriorly best treat those patients (posterior impaction of the maxilla). The mandible will autorotate upward and forward, which brings the chin anteriorly. If further anterior placement of the chin is desired, an augmentation genioplasty is performed.

4. Genioplasty

The chin can be moved in all three planes after osteotomy or may be augmented by an onlay autograft or allograft. Genioplasty is done to improve the results of mandibular advancement or to correct asymmetry.

5. Distraction Osteogenesis

Distraction osteogenesis is based on manipulation of a healing bone, stretching an osteotomized area before calcification has occurred in order to generate the formation of additional bone and investing soft tissue. For correction of facial deformities, this has two significant advantages and one equally significant disadvantage.

The advantages of the distraction are:

(1) Large distances of movement are possible than with conventional orthognathic surgery.

(2) Deficient jaws can be increased in size at an earlier age.

The great disadvantage is that precise movements are not possible. With distraction, the mandible or maxilla can be moved forward, but there is no way to position the jaw or teeth in exactly a preplanned place, as can be done routinely with orthognathic procedures. This means that patients with *craniofacial syndromes* who are likely needed intervention at early ages and large distances of movement and for *whom precision in establishing* the posttreatment jaw relationship is not so critical are the prime candidates for distraction of the jaws.

ADJUNCTIVE SURGICAL PROCEDURES

- **Rhinoplasty**

The smile is framed by the chin below and the nose above. It may be necessary to change both structures to achieve optimal changes in facial appearance. Moving the maxilla up and/or forward can result in an unwanted rotation of the nasal tip upward.

Rhinoplasty usually is focused on the contour of the nasal dorsum, the shape of the nasal tip and the width of the alar base

- **Lip Procedures**

Instead of changing soft tissue contours indirectly with skeletal surgery, lip procedures directly augment or reduce the lips. Lip augmentation rarely accompanies orthognathic procedures. This is usually done to counteract the loss of lip fullness that accompanies aging.

THE ROLE OF ORTHODONTICS IN ORTHOGNATHIC SURGERY

- **Presurgical orthodontics**

The objective of presurgical treatment is to prepare the patient for surgery, placing the teeth relative to their own supporting bone without concern for the dental occlusion at that stage.

The amount of presurgical orthodontics can be quite variable, ranging from only appliance placement in a few months to 12 months.

The essential steps in presurgical orthodontics are to align the arches or arch segments and make them compatible, and to establish the anteroposterior and vertical position of the incisors. Both are necessary so that the teeth will not interfere with placing the jaws in the desired position.

The presurgical orthodontics involves:

1. Alignment of the dentition
2. Flattening of the curve of spee

When an accentuated curve of Spee is present in the lower arch, the decision to level by intrusion of incisors or extrusion of premolars must be based on the desired final face height.

3. Establishment of Incisor Position and Space Closure

The anteroposterior position of the incisors determines where the mandible will be placed relative to the maxilla at surgery, and therefore, is a critical element in planning treatment. This is often the major consideration in planning the closure of extraction sites.

4. Good arch coordination

The upper and lower arches should be coordinated so that the intermolar and intercanine distances of the upper jaw are larger than that of the lower jaw.

- **Postsurgical orthodontics**

Once a satisfactory range of motion is achieved and the surgeon is satisfied with the initial healing, the finishing stage of orthodontics can be started. With rigid fixation, this is at 2 to 4 weeks postsurgery. During the postsurgical orthodontic treatment,

intermaxillary elastic and rigid wires should be used until a solid occlusion is established. Correction of dental rotation, lateral openbite and space closure is the main objectives in this period.

All the best