Orthognathic (Corrective Jaw) Surgery

Mohammed A. Al-Muharraki
MBChB (Dnd.), BDS (Dnd.), MDS (Dnd.), MCh (RCSI), MRCS (RCS), FRCS (Plast.)
Consultant Maxillofacial Surgeon
Royal Medical Services, Bahrain Defence Force, KINGDOM OF BAHRAIN

Introduction
- Ortho (orthos – straight) gnathic (gnathos – jaw)
- Facial disproportion (dento-facial deformity)
- 20% of population
- MDT approach: orthodontist, OMFS, restorative dentist, hygienists, psychologist/psychiatrist, technician, anaesthetist
- Aetiology: anomalous facial development is complex & multi-factorial
  - Extremes of variation in normal development
  - Associated with recognisable syndromes

Orthognathic Surgery
The correction of functional and aesthetic consequences of severe dentofacial deformity through a combination of orthodontic, surgical and possible, restorative dentistry

Simply its a surgical procedure that changes the position of the jaws

Why Surgery?
- Severe Class III skeletal pattern
- Severe Class II skeletal pattern
- Long face syndrome / Anterior open bite
- Facial Asymmetries
- Craniofacial anomalies, e.g. Cleft lip and palate
Orthodontic Indications

1. Aesthetics
2. Function
3. Stability

Patient Factors

1. Age and Sex – influence the amount of growth remaining
2. Race – influence profile considerations
3. Medical History – contraindications for surgery
4. Psychological – patients perception of the problem

Frontal Assessment

- Assessment of Facial Thirds
  - Symmetry
  - Vertical proportions (e.g., facial 1/3s)
  - Mid-line in relation to maxilla, mandible, nose, and chin
- Chin
- Scleral Exposure
  - Normally the lower border of the iris should lie behind the upper border of the lower lid
  - Scleral exposure indicates maxillary hypoplasia
- Alar Base Width
- Upper Lip / Incisor Relationship
Lip / Incisor Relations
- Normal upper lip length
  - Males: 22 +/- 2mm
  - Females: 20 +/- 2mm
- Normal upper incisor exposure
  - 2-4mm at rest
  - Gingival margin on smiling

Profile Assessment
- Vertical facial proportions
- Relative protrusion of maxilla and mandible
- Nasolabial angle
- Nasal tip elevation
- Chin throat angle

Intra Oral Examination
- Periodontal and restorative state
- Extent and location of crowding
- Upper and lower incisor inclination
- Amount of labial bone
- All other aspects of routine orthodontic assessment

Radiographic Assessment
- DPT
  - General dental status
  - Position of third molars
  - TMJ pathology
  - Root resorption
- Lateral Ceph
  - Assessment of position of maxilla and mandible relative to cranial base
  - Assessment of tooth positions relative to the maxilla and mandible
- PA Ceph
  - Asymmetry cases
The greater the ANB difference, the greater the possibility of orthognathic surgery.

E-line the lower lip should lie 2mm anterior and upper lip 1mm posterior to the line.

Questions to be Asked...

- Is this a face that needs change?
- Is there a reasonable possibility of producing a functional, aesthetic and stable result by orthodontics only?
- Is the Maxilla or mandible or both that need surgical movement?

Procedure

Initial Consultation
- Discuss broad outline, give information leaflets etc., ask for questions

2nd consultation
- Answer questions, reiterate broad outline, patient writes to confirm wish to proceed

Record Collection
- Formulate detailed plan

Joint Clinic Consultation
- Agree preliminary plan and explain to patient, patient writes to confirm wish to proceed. Consent, arrange third molar removal

Pre-surgical Orthodontics

Presurgical Orthodontic Management

- Dental decompensations
- Leveling of the arches
- Alignment within the arch
- Coordination of the arches

‘Level’ and ‘Align’ the Dental Arches

Orthodontic Decompensation

Moving the incisors and molars to their normal inclination relative to their skeletal bases.

In a severe skeletal discrepancy, the dentition often maintain some occlusal contact, compensating in their positions for the skeletal problem.
Why Pre-Surgical Orthodontics (Decompensate)?

- To maximise surgical movements
- To increase stability of the surgical movements
- Improve gingival health in Class III patients

Post Surgical Orthodontics

- Close residual spaces
- Improve occlusal interdigitation
- Finishing and artistic positioning
- Transition to retention phase
- Excursive to improve range of movement

Surgical Aspect

- Coordinate the Arches: Maxillary arch expansion either using rapid maxillary expansion or Surgically assisted expansion

Treatment Objectives

1. Function: functional occlusion aiming to achieve normal overbite/overjet & transverse relationship
2. Aesthetics: normalise facial balance in 3D
3. Long-term stability
4. TMJDS
5. Mouth opening
6. Sleep apnoea
7. Traumatic occlusion and dental health
Surgical Treatment Planning

- **Check list:** essential information for planning
  - Class I/II/III
  - Skeletal base relationship
  - Maxilla AP - hypoplastic/normal
  - Vertical Maxillary Excess (VME)
  - Upper incisor show at rest & smiling
  - Centre lines - upper dental/lower dental/chin point
  - Overjet/overbite
  - Occlusal cant
  - Naso-labial angle
  - Upper lip length
  - Alar base width

Surgical Treatment Planning

- **Pattern Recognition:** common examples
  - **Class III:** Maxillary hypoplasia & mandibular prognathism with an average facial height and no open bite • orthodontic decomposition, maxillary advancement and mandibular setback
  - **Class II Div 2:** Mandibular retrognathia, deep overbite, and VMD • orthodontic conversion to CIID maintaining curve of Spee, mandibular advancement to ’3-point landing’ establishing a CI increasing LAFH
  - **Class II:** Long face (VME), retrogenia, AOB • orthodontics, maxillary impaction (posterior > anterior), mandibular auto-rotation (+/- advancement)

Definitive Surgical Planning

- **Determine the final position to place upper incisor tip in 3D:**
  - **Vertical:** degree of VME? Upper incisor show?
  - **AP:** position of maxilla? Naso-labial angle? Degree of lip support?
  - **Lateral:** upper centre line to facial mid-line? Lateral vs. Rotational movement?

Definitive Surgical Planning

- **Determine position of the posterior maxilla:**
  - **Vertical:** can be the same as anterior, if maintaining occlusal plane but if AOB then differential
  - **AP & rotation:** must equal incisor tip
  - **Lateral width discrepancies:** SARPE, maxillary widening, mandibular narrowing
Definitive Surgical Planning

- Mandibular positioning:
  - Deliver to class I
  - Consider lower centre line to facial midline/dental midline
- Chin:
  - Consider AP, vertical, lateral need for genioplasty
  - It will be influenced by changing occlusion

Soft Tissue Considerations

- Nasal tip relative to A point
  - 1:3 in LeFort I (1:2 LFII, 1:1 LFIII)
- Upper lip
  - 80% of advancement, 50% of setback, 10-40% of impaction, 50% of down grafting
- Lower lip
  - 85% of advancement, 60% of set-back
- Chin:
  - Pogonion moves consistently in a 1:1

Maxillary Procedures

- Based on Le Fort (Rene, French surgeon 1869 – 1951) fracture lines
- Le Fort I most popular
- Total maxillary osteotomy through lateral wall of maxilla, lateral wall of nose & nasal septum
- Once mobilised can be moved in any dimension
- Segmentalization to correct width, occlusal plane, dento-alveolar discrepancies

Maxillary Procedures

- Le Fort I
  - Sulcus incision
  - Zygomatic buttress, IO nerve, piriform aperture & pterygo-palatine fissure
  - Floor of the nose
  - Bone cuts: from posterior aspect of zygomatic buttress (5mm above teeth) → lateral wall of sinus → base of piriform aperture
  - Division of lateral nasal walls, nasal septum from crest, pterygo-maxillary dysjunction
  - Down #, mobilisation, trimming of interferences
Maxillary Procedures
- Le Fort I variants
  - Le Fort I with mid-line expansion – midline or U-shaped or ‘horseshoe’
  - Surgically assisted rapid palatal expansion (SARPE)
  - Stepped Le Fort I
- Segmental Maxillary Procedures

Mandibular Procedures
- Bilateral Sagittal Split Osteotomy (BSSO)
  - 1957 Trauner & Obwegeser ➔ 1961 Dal Pont
  - ➔ 1968 Hunsuck ➔ 1977 Epker
  - Utilizes natural cleavage plane
  - Advancement & setback
  - Correct rotations (asymmetric adjustments)
  - Close small open bites

Mandibular Procedures
- Bilateral Sagittal Split Osteotomy (BSSO)
  - Sulcus straight incision/third molar incision
  - Lingual dissection to identify the lingula
  - Bone cuts: lingual cut ➔ external oblique ridge ➔ vertical buccal cut ➔ lower border cut
  - Fixation: plates or bi-cortical screws
Mandibular Procedures

- **Vertical Subsigmoid Osteotomy (VSS)** – simplest, less used after semi-rigid fixation (needs IMF post-operatively), no ID nerve damage, more stable than BSSO in set-backs, advocated in TMJDS patients, I/O + E/O
- **Inverted L Osteotomy** – in mandibular hypoplasia, 'bird-face' deformities
- **Total sub-apical Osteotomy**
- **Segmental Mandibular Osteotomies** e.g., Kohle’s
Complications

- Haemorrhage – pterygoid venous plexus, greater palatine nerve, naso-palatine vessels, maxillary artery
- Reduced by: LA, diathermy, hypotensive GA, table position, efficient surgery, anti-fibrinolytics, care in pterygo-maxillary dysjunction
- Management: diathermy/ligation, packing, haemostatic gauze, fixation, ligation of external carotid, angiography and embolization

Complications

- Unfavorable Osteotomy – unwanted patterns (most common in BSSO), ≤ 23%
- Predisposed by: thin ascending ramus, unfavorable bone texture, wisdom teeth, failure to divide lower border at buccal cut
- Undesirable fractures in maxillary osteotomies may propagate to base of the skull

Complications

- Nerve Damage –
  - ID nerve during BSSO, long-term varies from 3% - 25% (up to 85%)
  - Risk factors: age, lag-screws, BSS + genioplasty
  - Facial nerve VII damage rare (0.5% - 1%)
  - Labial gingival and anterior palatal mucosa
  - CN II, III, IV, VI, X and XII due to unfavorable fractures propagating up to the base of the skull

Complications

- Condylic Positioning –
  - Mal-occlusion will result
  - Upright vs. supine patient, paralyzed vs. unparalyzed patient
  - Notorious in:
    - Mandibular rotations: rotation of the condyle, winging of the proximal fragment, inability to get fragments to sit passively (excessive torquing)
    - Le Fort I impaction with interferences distracting the condyle causing an AOB on releasing IMF

Complications

- Tooth Damage –
  - Direct damage (bone cuts, screws) or due to ischemic changes
- Soft Tissue Changes –
  - Nasal changes – alar base widens, nasal tip upturned, naso-labial angle decreases (advancement)
  - Reduction of nasal septum (to prevent buckling), cinch sutures, V-Y closure

Stability

- Relapse/Migration
- Surgical/Orthodontic
- Careful planning building in relapse
- Hierarchy of stability (Proffit, Yurvey & Phillips)
  - Maxillary impaction ➔ mandibular advancement ➔ maxillary advancement with mandibular advancement ➔ maxillary impaction with mandibular setback ➔ mandibular setback ➔ increasing maxillary width ➔ inferior positioning of maxilla
**Stability**

- **Maxillary Surgery**
  - Impaction is the most stable, but stability decreases if combined with advancement
  - Larger moves (>8mm) are potentially unstable
  - Short period of IMF may aid stability
  - Inferior positioning of maxilla: relapse of 30-50%, mal or non-union common, must be accompanied by grafting
  - Surgical widening: very unstable, 6/52 support (acrylic plate or accessory bucco-labial arch wire), accompanied by grafting

- **Mandibular Surgery**
  - Degree of advancement/setback & fixation
  - BSSO relapses forward, VSS migrates posteriorly
  - Plates vs. screws – same results
  - For large advancement (>10mm), suspension wires 1/52
  - Larger moves in setback (>8mm) are also potentially unstable – pterygo-masseteric sling impingement (mitigated by Hunsuck modification)

**Stability**

- **Condylar Resorption**
  - 6 – 18 months post-surgery
  - 2-8% incidence
  - Clinically: Horizontal relapse with AOB, radiologically: flattening of condylar head with posterior shortening/angulation of neck
  - Risks: ♀ patients, CII, high FP-M plane angle, TMJDS, large mandibular advances (<10mm), counter clockwise rotations for AOB

- **Condylar Resorption**
  - Aetiology: increased pressure on posterior surface of the condylar head thereby increasing load on the TMJ stimulating resorption
  - Management: ‘self burn out’ then stabilize, an unloading splint, extra-capsular approach recommended, further corrective surgery confined to maxilla?

Thank You