Lec. 10 &11 Orthodontics and orthognathic surgery

Orthognathic surgery is surgery aimed at correcting dentofacial deformity. A dentofacial deformity is a deviation from normal facial proportions and dental relationships that is severe enough to be handicapping to a patient. The patient can be handicapped in two possible ways: jaw function, or aesthetics. It is estimated that 2–3 per cent of the population has a dentofacial deformity, for correction of a dentofacial deformity, a combined orthodontic and surgical approach is required. Successful treatment requires close interdisciplinary work involving a number of specialists

Indications

The presence of a skeletal discrepancy does not automatically mean that a patient requires surgical intervention. When faced with a skeletal discrepancy the clinician has three choices:

- Growth modification
- Orthodontic camouflage
- Combined orthodontics and orthognathic surgery

Growth modification is only possible in growing patients. Once growth is complete, the only non-surgical option is orthodontic camouflage. This means moving the teeth into the correct dental relationships, but accepting the skeletal discrepancy but there is a danger of compromising facial aesthetics. In these cases, a combined surgical approach may be required.

Clinical examples of cases when orthognathic surgery is commonly used include:

- Severe Class II skeletal malocclusions.
- Severe Class III skeletal malocclusions
- Severe vertical disproportions leading to anterior open bite or a severely increased overbite
- Skeletal asymmetries

Orthognathic surgery to correct these discrepancies can involve a range of surgical movements, which achieve repositioning of the maxilla or mandible within the facial skeleton.

The process of combined orthodontic surgical treatment

- ***Presurgical*** orthodontics to correct abnormal tooth position and prepare the patient for surgery;
- ***Surgery*** to correct the jaw position; and
- ***Postsurgical*** orthodontic treatment to detail tooth position prior to removal of the fixed appliances.

The orthodontist plays a predominant role in preparing a patient for orthognathic surgery. Once it is felt that the teeth are in a position to allow the required surgical movements to take place, the patient returns to the joint clinic and orthodontist and surgeon definitively plan the necessary surgical movements.

Pre-surgical orthodontics

There are four aims of pre-surgical orthodontics:

- Alignment and levelling
- Co-ordination (ensuring arches will be compatible with each other after surgery)
- Decompensation
- Creation of space for osteotomy cuts if segmental surgery is required. Extractions may be required to relieve crowding, level arches and allow correction of the inclination of the incisors (decompensation). The pre-surgical orthodontics is undertaken with fixed appliances to allow the correct anterior–posterior and vertical positioning of the incisors. This allows the surgical movements to take place. The fixed appliances also act as a method of intra-operative intermaxillary fixation and a means of attaching the intermaxillary elastics used post-operatively.

The advantage of this approach is that it offers a more predictable surgical phase and more accurate planning immediately pre-surgery.

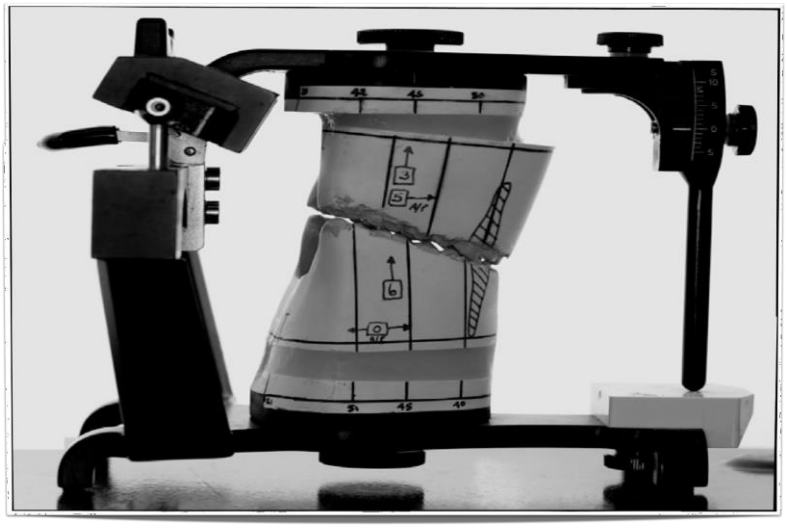
Preparing for surgery

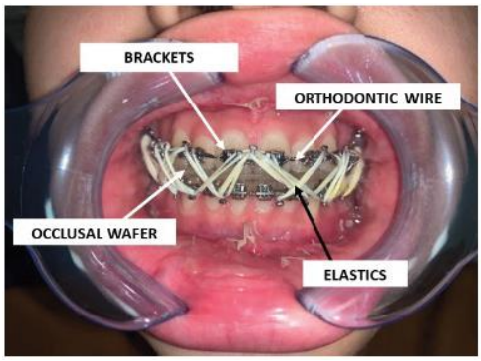
Pre-surgical orthodontics takes about 12–18 months, depending on the complexity of the case. At the end of this stage a new set of records are taken – impressions, photos, radiographs – to check the pre-surgical movements have been achieved and to modify or confirm the surgical plan.

These records are used to plan in detail the surgical movements required to correct the malocclusion and simulate their effect on the soft tissue facial profile. These predictions can be carried out manually or with the aid of computer software

Study models are produced which can be used for model surgery to mimic the surgical plan. Model surgery is undertaken to verify that the planned surgical moves are appropriate, and to allow construction of intermaxillary wafers. These acrylic wafers

are used during surgery to help the surgeon position the jaws correctly. A face-bow recording is required to mount the models on a semi-adjustable articulator, for single jaw maxillary procedures and bimaxillary procedures.





Common surgical procedures

Only a brief overview of some of the more popular surgical techniques is included here. Additional information is available in references

Maxillary procedures

- Le Fort I osteotomy

The entire maxilla can be moved in anteroposterior, vertical or transverse directions as a single unit with a Le Fort I osteotomy. These movements can be carried out using a single vector, or with a combination to produce differential changes in position.

The maxilla can be moved forwards or upwards by anything up to 10 mm and these movements are generally stable; backwards repositioning is also possible, but the changes that can be achieved are less, at around 5 mm. Inferior repositioning of the maxilla is notoriously unstable and generally avoided.

- Le Fort II

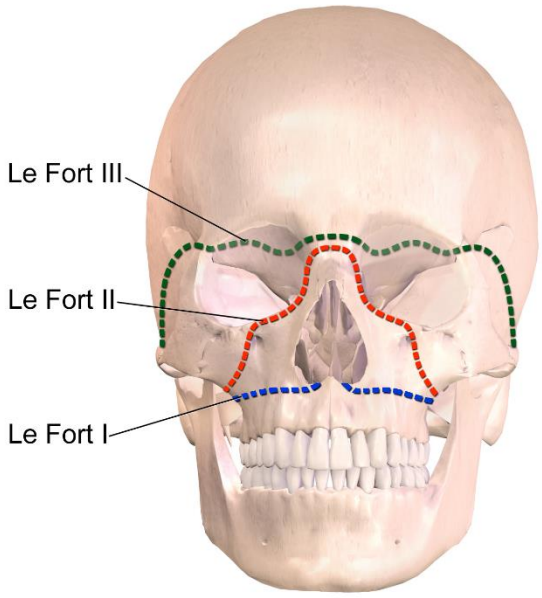
This is employed to achieve mid-face advancement. The surgery is more extensive than for a Le Fort I and therefore carries more risks.

- Le Fort III

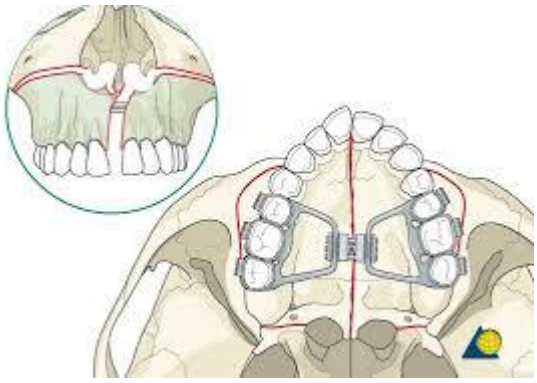
This usually necessitates the raising of a bicoronal flap for access and is commonly used in the management of craniofacial anomalies.

- Surgical Assisted Rapid Palatal Expansion (SARPE)

It involves the use of corticotomies, and the use of a rapid palatal expander that is used to rapidly widen the upper arch. The advantage of the technique is that it enlarges the maxilla transversely, expanding the upper arch considerably more than can be achieved with orthodontic appliances alone. The disadvantage is that an additional surgical intervention is required.



Three Types of Le Fort Osteotomy



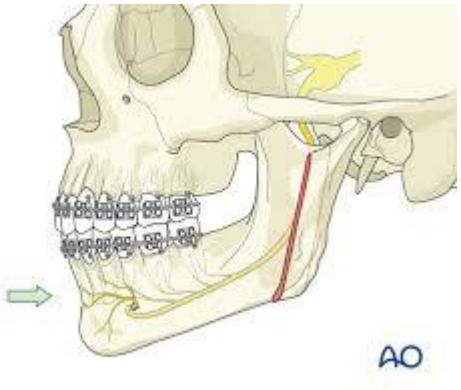
Mandibular procedures

- Ramus procedures

The most commonly used ramus techniques are the following.

- Sagittal split osteotomy. This procedure can be used to advance or push back the mandible or to correct mild asymmetry. The bony cut extends obliquely from above the lingula, across the retromolar region, and vertically down the buccal plate to the lower border. The main complication is damage to the inferior alveolar nerve.

- Vertical subsigmoid osteotomy. This is used for mandibular prognathism and involves a bone cut from the sigmoid notch to the lower border. This can be performed intra-orally using special instruments or extra-orally using standard instruments at the expense of a scar.



- Body osteotomy. Indications
  - Correction of prognathism due to an increased body length of mandible.
  - Unilateral correction of asymmetric mandible with or without ramus osteotomy of the opposite side.

This method provides good bony contacts between the proximal and distal segment. Damage to the inferior dental nerve is minimal and the reported long term stability is excellent.

- Genioplasty

  The tip of the chin can be moved in almost any direction, limited by sliding bony contact and the muscle pedicle. This technique may be used to supplement mandibular ramus surgery where there is a localized abnormality of the chin area in addition to the general mandibular position. It can also be usefully employed as an isolated operation, where it is used as a masking procedure, thus avoiding more complex treatment (for example, mild mandibular asymmetry).

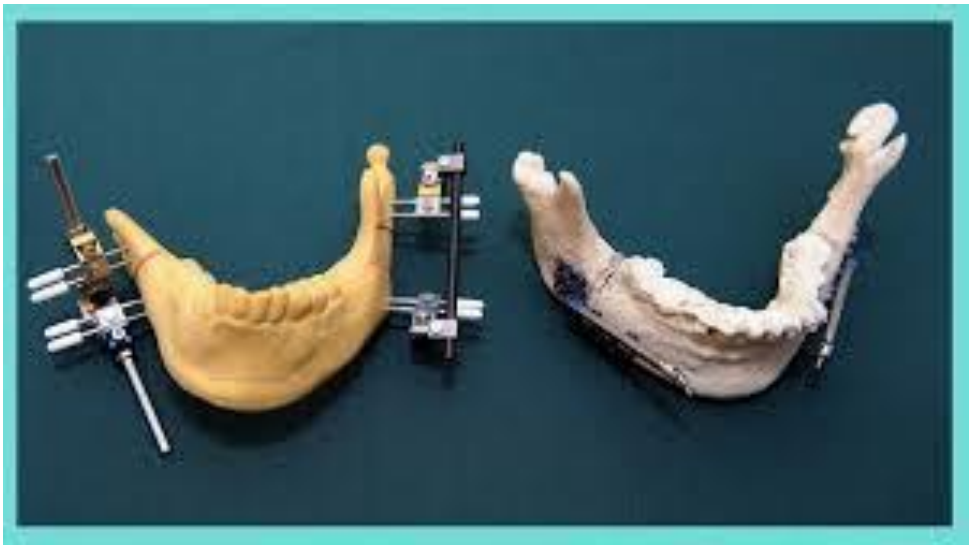
Bimaxillary surgery

Many patients require surgery to both jaws to correct the underlying skeletal discrepancy.

Distraction osteogenesis

This is a technique that involves osteomomy cuts followed by a slow mechanical separation of the bone fragments with an expandable device. It is a technique that was originally developed for lengthening limbs. It offers exciting potential for larger movements than can be achieved with traditional orthognathic surgery, and has been found to be useful in the treatment of patients with severe jaw deficiencies, particularly

those associated with craniofacial syndromes.
After the bone cuts, there is a latent period of 4–5 days before the bones are separated gradually by the mechanical device. The mechanical device is turned each day and the tension leads to the production of new bone, while allowing time for the soft tissues to adapt.



Post-surgical orthodontics

In the past, patients were placed in intermaxillary wires to fix the bony segments in place during healing. This meant the patient's upper and lower arches were tied together for 6 weeks. This is now rarely required due to the introduction of small bone plates that are used to fix the bony segments semi-rigidly in the maxilla and the use of plates and/or screws in the mandible. The surgery carries a number of risks, the exact nature of these risks depending on the procedure undertaken. These risks should be explained by the surgeon before any treatment is started as part of the informed consent process.

Future developments in orthognathic surgery: 3D surgical Simulation Cone beam computed tomography (CBCT) now allows the acquisition of detailed 3D images of the face in high resolution. Using this 'virtual' 3D information, software is being developed that could revolutionize the way that orthognathic planning and surgery is undertaken. In dentistry we are familiar with the use of CAD/CAM (computer-aided design/computer-aided manufacture) for the manufacture of complex 3-dimensional restorations. Computer-aided surgery (CAS) is now being introduced that will allow surgical planning and simulation using the information captured from CBCT.

References;

- **An introduction to orthodontics,** Laura Mitchell, 2013
- **Contemporary orthodontics**, Proffit, fifth edition, 2013.
- **Handbook of orthodontics,** Martyn and Andrew, second edition, 2016.