

Australian Society
of Orthodontists



University of Sydney



Orthognathic Surgery & Orthodontics

*Creating **Brighter** Futures*

Orthognathic Surgery & Orthodontics

Introduction

Conventional orthodontic treatment can involve dental movement, growth modification and camouflage to correct malocclusions and improve facial aesthetics. Orthognathic surgery is a treatment option that can be used in conjunction with orthodontic treatment if the malocclusion has a skeletal component that significantly compromises the treatment result. Surgery is used to realign the jaws and/or reposition the dentoalveolar segments.

Dentofacial deformity may be severe enough to compromise jaw function and social interaction. For example impaired mastication, swallowing and speech can be associated with severe Class II, Class III and long face/open-bite deformities. Facial aesthetics can influence many aspects of our lives. Recent data shows between one third and one half of the patients referred to the University of Carolina Dentofacial Clinic have levels of psychological distress high enough to predict continuing problems in interpersonal relationships and significantly affect overall quality of life. (Proffit et al 2007)

Orthognathic surgery is not a substitute for orthodontic treatment. It must be comprehensively coordinated with orthodontic and other dental treatment to achieve optimum dentofacial function and aesthetics. 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. (Proffit et al 2007)

Patient Selection Criteria

Dental referral of potential orthognathic surgery patients can significantly assist the treatment planning process. A patient who has been informed that surgery can be a treatment option will have time to embrace the concept of comprehensive treatment prior to subsequent specialist consultation and possibly foster a more receptive attitude than otherwise expected.

The following orthodontic problems and dentofacial deformities may benefit from orthognathic surgery:

1. Moderate to severe Class III malocclusions (maxillary retrusion and/or mandibular protrusion)
2. Open bite malocclusions particularly with lip incompetence and gummy smiles (vertical maxillary excess)
3. Severe non-growing deep bite malocclusions with reduced facial heights

4. Maxillary transverse deficiencies without the possibility of sutural expansion (generally girls above the age of 15yrs, and boys above 17 yrs should be considered)
5. Non-growing moderate to severe Class II malocclusions
6. Patients with severe chin deficiencies.
7. Cleft lip and palate and other syndromic patients.
8. Skeletal asymmetries, particularly mandibular asymmetry and canted occlusal planes.

Psychological Considerations

Generally speaking, most patients seeking an opinion regarding surgical correction are psychologically robust even though they may recognize their self-esteem will improve with such treatment. Studies have shown that 75-80% of orthognathic patients are seeking aesthetic improvement as well as improvement in function (Ostler and Kiyak 1991). Those who choose to proceed with surgery are generally self motivated and would be expected to cope with the physical and psychological difficulties encountered during treatment. About 90% of patients who undergo orthognathic surgery report satisfaction with the outcome. Over 80% say that knowing the outcome and difficulties they would proceed with the same treatment option and recommend such treatment to others (Ostler and Kiyak 1991).

It may be necessary, however, to pursue a more comprehensive psychological assessment for those patients who express unrealistic expectations, or are seeking treatment for inappropriate reasons such as coercion from others.

Surgical Treatment Planning

Final determination of the orthodontic/surgical treatment plan should ideally involve preliminary consultation with the orthodontist and maxillofacial surgeon followed by joint consultation and/or planning. In addition due consideration must be given to the referring dentist and other dental specialists regarding periodontal, endodontic and prosthetic requirements. The best results are achieved when the orthodontist, surgeon, and all the dental team, have a realistic knowledge of each other's skills and limitations.



Practical Surgery Use of Fluorides in Orthodontics

In conjunction with home-use fluorides, which were discussed in the last Colgate Care Column, the appropriate use of professionally applied fluorides can provide additional anti-carries benefits to at-risk patients. Optimally, fluoride should be delivered frequently in low doses, in for example fluoridated water and toothpaste. In addition high concentration topical fluoride applied in the surgery increases the fluoride concentration on the tooth surface and in dental plaque where it inhibits demineralisation. Patients who receive the most benefit from such topical application are those that have one or more of the following: 1. Newly erupted teeth with porous enamel surfaces, 2. Moderate to high caries risk, 3. Areas of enamel demineralisation producing white spot lesions. Orthodontic patients may fit into any or all of these three categories.

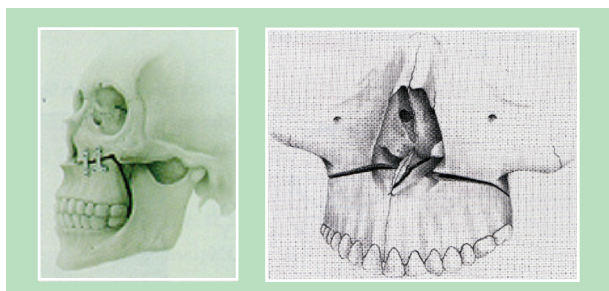
The products available for surgery use include varnishes, gels and foams. Fluoride varnish is the highest concentration fluoride product available with 22,600 ppm. It should be applied directly to at-risk tooth surfaces, for example adjacent to orthodontic brackets, or where white spot lesions are developing. Clinical trials suggest that multiple applications of varnish to such at-risk smooth surfaces may achieve a 75% reduction in the caries rate. Once the varnish sets the fluoride is released slowly minimising toxic effects and making it suitable for children less than 10 years of age¹. However caution is needed in the total dose applied in this under 10 year group.

Fluoride gels/foams (5000 - 12,300 ppm) can also be applied as spot applications to dried tooth surfaces but are more commonly applied 6- or 12-monthly using trays that are retained in the mouth for 4 minutes. A prophy is not required unless thick plaque deposits are present, and the patient should not eat or drink for 30 mins following the application. This method is most appropriate where there are multiple newly erupted teeth or widespread demineralisation, but only in children over 10 years of age¹.

Reference: 1. ARCPOH. The use of fluorides in Australia: guidelines. ADJ 2006; 51(2): 195-199

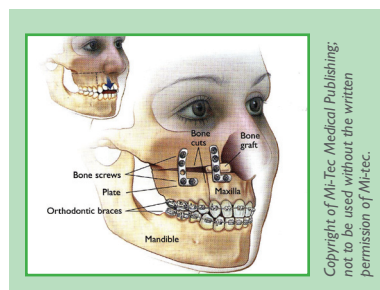
Orthognathic Surgery Procedures

1. Le Fort I Osteotomy



Maxillary surgery in the form of a Le Fort I osteotomy has become the principal form of maxillary surgery. As illustrated the surgical cuts entirely disarticulate the maxilla from the skull allowing it to be moved in all directions. The Le Fort I procedure can be used to correct:

1. Antero-Posterior discrepancies - for example Class II maxillary protrusions and Class III maxillary retrusions.
2. Vertical discrepancies - for example Vertical Maxillary Excess (VME) with open bites and gummy smiles, or skeletal deep bites with little or no incisor display.

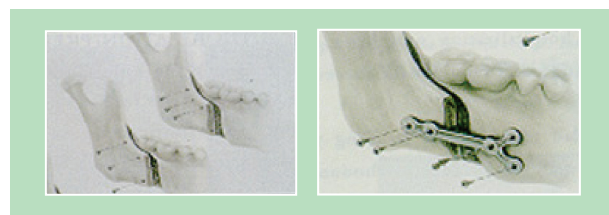


Segmental Le Fort I osteotomy to close an anterior open bite.

3. Transverse discrepancies - for example maxillary deficiencies with posterior lingual crossbites.
4. Asymmetries producing canted occlusal planes.
5. All of the above may be in combination with mandibular surgery and this is called bimaxillary surgery.

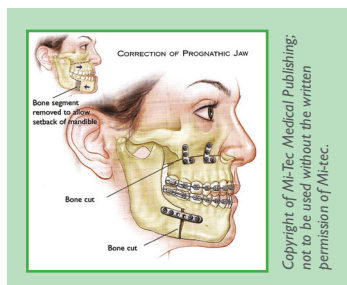
2. Bilateral Sagittal Split Osteotomy (BSSO) – Mandibular Surgery

Mandibular surgery with the Bilateral Sagittal Split surgical technique is the most commonly used mandibular osteotomy. It involves cuts on both sides of the mandible distal to the second molars and results in the mandible separating into three pieces, two posteriorly with the condyles and one anterior section.



This form of surgery may be used to correct:

1. Antero-Posterior discrepancies - for example Class II mandibular retrusions and Class III mandibular protrusions.
2. Vertical discrepancies associated with antero-posterior discrepancies - for example vertical deficiencies usually with deep bites.
3. Asymmetry - for example condylar hyperplasias and hypoplasias, or hemifacial microsomias.

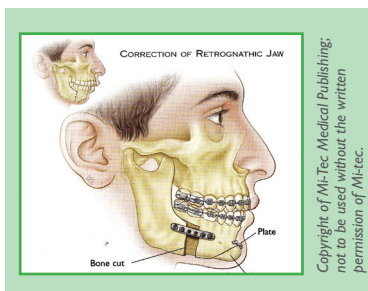


Correction of a Class III skeletal malocclusion may involve a maxillary advancement and mandibular setback.

3. Genioplasty - Chin Advancement, Reduction or Recontouring

Genioplasties are largely cosmetic procedures which may be used to correct large or small chins, vertically and/or horizontally, as well as asymmetric chins. In some cases the malocclusion can be resolved orthodontically, however a residual skeletal discrepancy may compromise facial aesthetics. An example of this is where orthodontic treatment may successfully correct a Class II malocclusion but the chin remains retrusive.

A genioplasty may also be used to supplement other osteotomies in order to avoid excessive surgical movements. For example, a Class II mandibular retrusion may be surgically corrected by a conservative mandibular advancement supplemented by a genioplasty to aesthetically improve the chin position rather than risking a larger and potentially unstable mandibular advancement.



In this example, a patient with a Class II mandibular retrusion was treated with a BSSO mandibular advancement procedure and a genioplasty.

4. Surgically Assisted Rapid Maxillary Expansion

Rapid Maxillary Expansion (RME) is commonly used in younger patients for the correction of a maxillary transverse deficiency and is nearly always successful when used before mid-palatal sutural closure. However treatment options for widening the maxilla in older or adult patients following sutural closure are limited to Surgically Assisted Rapid Maxillary Expansion (SARME), or surgical expansion using a segmental Le Fort I osteotomy. Stability of the expansion is improved when the SARME option is used. The patient is required to have an expander appliance placed prior to surgery. The surgical cuts are less extensive but similar to a Le Fort I procedure, without the down-fracture but including a mid-palatal split, and aim to release the bony areas which resist the lateral expansion of the maxilla. The patient is instructed to start using the expansion device 5-7 days after surgery, expanding on average 0.5mm per day. This procedure is a form of distraction osteogenesis, which will be discussed below.

A SARME procedure is often used for example as phase I surgery for skeletal Class III patients to correct maxillary constriction prior to orthodontic decompensation and bimaxillary surgery to correct the sagittal skeletal dysplasia. Stability of the expansion following such a two phase surgical treatment plan is greater than if the expansion was carried out in a single phase segmental surgical treatment.



a. Pre SARME

b. Post SARME



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5. Distraction Osteogenesis

Distraction osteogenesis was introduced by the Russian surgeon Ilizarov (1988) to lengthen long bones by performing an osteotomy or corticotomy followed by prolonged, progressive and gradual distraction of the two bony segments. During this period bone is laid down between the two bone segments and gradually ossifies. The ideal rate of distraction is approximately 1mm per day. Surgically assisted rapid maxillary expansion is a form of distraction osteogenesis. Distraction osteogenesis has also been utilized to advance and/or widen the mandible in patients with severe mandibular micrognathia where surgical lengthening or widening is limited by the difficulty in obtaining adequate soft tissue coverage.

Stabilizing the Jaws After the Surgery

Maintaining the jaws in the desired position after the osteotomy cuts involves fixation of the bony segments. Fixation techniques have changed over the last two decades, from intermaxillary wire fixation, "having your jaws wired together", to rigid internal fixation.

Rigid internal fixation has become the gold standard showing improved surgical stability over intermaxillary wire fixation (Dolce 2000). Metal plates, predominantly made from titanium, held in position by screws are used to hold the bony segments together rigidly while bony healing takes place. The plates are permanent fixtures and are not usually removed once healing takes place. Recently biodegradable plates and screws have been developed (Turvey et al 2002, 2006).

Stability of Surgical Movements

Some procedures such as mandibular and maxillary advancements have proven to be very stable, others less so. "Relapse" can occur within the first year post-surgery and relates to post-surgical healing, post-treatment orthodontics and short term physiological adaptation.

Post-treatment changes over the long term, 1 to 5yrs post-surgery, relate to long term adaptation for some patients and to post-treatment growth. For example while moving the maxilla up (impacting) is a stable procedure within the first year post-surgery, some small changes can be anticipated in the long term due to the small amounts of long term downward growth of the maxilla (Proffit et al 2007).

Some procedures have shown a higher relapse potential and patients should be warned regarding these surgical movements. Potential relapse is factored into treatment planning and surgical procedures and patients should have realistic expectations as to the limitations of these surgical movements. Surgical movements with increased relapse potential include major movements beyond 10mm in any direction, maxillary expansion and vertical elongation of the maxilla.

Conclusion

This edition of Brighter Futures has covered various surgical treatment options used in conjunction with orthodontic treatment to resolve skeletal discrepancies contributing to a malocclusion. Surgical fixation and stability have also been discussed. Part 2 of Orthognathic Surgery and Orthodontics, in the 2008-2 edition of Brighter Futures, will elaborate on clinical implications and complications, orthodontic requirements and show some cases.

References available on request

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