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## REVIEW ARTICLE

# SURGICAL–ORTHODONTIC TREATMENT OF SKELETAL CLASS III MALOCCLUSION: A REVIEW

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**ABSTRACT**

The prevelance of class III maloclussion is 4.2% at most. According to the Angle classification, class III malocclusionis defined as the lower molar mesially positionedrelative to the upper molar with no specifications in regardsto the line of occlusion. Nevertheless, as withall Angle's classification of malocclusion, class III malocclusioncomprises several skeletal and dental componentsthat may differ from the concept of normality. It can be characterized by presenting a mandibularskeletal protrusion, amaxillary skeletal retrusion, a combination of both, or noanteroposterior skeletal imbalances. Bone discrepancy may have an unfavorable impact on esthetics, which is frequently aggravated by the presence of accentuated facial asymmetries. This type of malocclusion is usually treated with association of Orthodontics and orthognathic surgery for correction of occlusion and facial esthetics.



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## INTRODUCTION

The correction of dento-facial deformity often requires combined surgical and orthodontic therapy. Poor facial appearance and functional difficulties are the motivating factors for seeking treatment in patients with Class III skeletal anomalies. (Paraschivescu, 2011) Angle in 1889 defined class III molar as relation with the mesiobuccal cusp of the maxillary first permanent molar occluding in the inter dental space between the mandibular first and second molars. Tweed divided class III into pseudo class III malocclusions and true class III malocclusions. The true class III malocclusion shows a genetic trend toward extreme upward and backward condylar growth, anterior cross bite, open bite and dolicofacial pattern. (Bench *et al.,* 1978) The true class III malocclusion may also be called skeletal due to the involvement of skeletal structure, caused by maxillary retrusion, mandibular protrusion or a combination of both. The skeletal class III malocclusion is characterized by mandibular prognathism, maxillary deficiency or both. Clinically these patients exhibit a concave facial profile, a retrusivenasomaxillary area and a prominent lower third face. The lower lip is often protruded relative to the upper lip. (Figueiredo *et al.,* 2008) Maxillary deficiency is the most frequent etiological factor for class III malocclusion. (Bergamo *et al.,* 2011) Bone discrepancy may have an unfavorable impact on esthetics, which is frequently aggravated by the presence of accentuated facial asymmetries, functional problems, temporomandibular disorders, or psychosocial handicaps. (Radha *et al.,* 2010) The choice of treatment of skeletal class III malocclusion depends on the diagnosis, facial pattern, age, patient compliance and the severity of the malocclusion (Figueiredo, 2007).

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### Treatment options for skeletal class III

There are three main treatment options for skeletal class III malocclusion: growth modification, dentolaveolar compensation (orthodontic camouflage) and orthognathic surgery. (Rabie and Wong, 2008) Class III skeletal problems are treated with a combination of orthodontic and orthopedic mechanics in growing individuals whereas, correction of the Class III malocclusion usually requires complex surgical procedures during adulthood for optimal aesthetic and functional results (SzuhanekandParaschivescu, 2011). The goals of combined surgical and orthodontic treatment are improved facial and dental aesthetics, functional, balanced and stable occlusion and patient satisfaction (Liao *et al.,* 2010). Camouflage orthodontic treatment may be performed in patients with a mild skeletal Class III discrepancy and no remaining growth by extracting lower premolars, second molars, incisors, or using mini-implants. However, in patients with a severe skeletal discrepancy or continuous mandibular growth, it is necessary to consider a combined surgical/orthodontic approach. (Baik, 2007) The use of orthodontic camouflage to treat skeletal class III malocclusion

requires the professional evaluation of the patient's face, and if facial esthetics is found to be an issue, orthodontic treatment alone is unlikely to succeed. (Brunharo, 2013)

**Surgical Treatment for correction of skeletal class III malocclusion**

Orthognathic surgery involves the surgical correction of the components of the facial skeleton to restore the proper anatomical and functional relationship in patients with dentofacial skeletal abnormalities. (Laura, 2013)

**Pre-surgical Phase**

Accurate treatment planning for surgical jaw movements involves comprehensive records including:

- Clinical examination.
- Photographs.
- Radiographs.
- Study models.

These records allow consistent communication between the orthodontist, maxillofacial surgeon and other members of the dental team to formulate the Surgical Treatment Objectives (STO) or the Visual Treatment Objectives (VTO) (Kluczewska, 2008). Pre-surgical orthodontic treatment consists of three concurrent aspects: arch alignment, arch co-ordination and arch decompensation. (Jacobs and Sinclair, 1983) In most cases, incisor decompensation is achieved with fixed appliances, whereby the incisors are either proclined or retroclined so that the incisors are at the correct axial inclination to the maxillary or mandibular skeletal bases (Carlos *et al.,* 2009). In order to assess practical considerations and further predict results of the planned surgical approach Trivedi*et al.,* did the cephalometric prediction tracing both manually using the template method and with computer image prediction. (Trivedi *et al.,* 2014) The prediction tracing permits the surgeon to visualize the treatment objective, therefore allowing refinement of the original plan and ascertainment that the correct soft tissue profile will be obtained for maximum aesthetic value. (Stephen, 1997) The next step is cast prediction or model surgery and fabrication of occlusal splints for use at surgery. The surgical splint is a wafer of occlusal acrylic used during surgery to accurately reposition the maxilla and/or mandible. Once the surgeon has made the osteotomy cuts the splint is positioned over the patient's dentition and wired into place prior to placement of rigid fixation plates and screws securing the surgical jaw movements. (Kluczewska *et al.,* 2008)

**Surgical Phase**

Using the surgical orthodontic approach to treat skeletal class III malocclusion, the overall treatment goals could be attained, in spite of the risks inherent to the procedure. It could help in achieving correct static and functional occlusion and considerable improvement in facial esthetics.

**Le fort 1**

LeFort 1 osteotomy with horizontal advancement is used for the majority of patients to correct malocclusion. LeFort I osteotomy is used in combination with the bilateral sagittal split osteotomy (BSSO) in correcting the secondary maxillary effects seen in asymmetrical mandibular deformities. These asymmetries are usually attributed to unilateral mandibular condylar hyperplasia during active growth of the maxilla and mandible. The asymmetric overgrowth of the ipsilateral maxilla shifts the midline and slope of the maxillary plane. LeFort I is used to realign the maxilla with the facial midline, correct the cant, and allow for advancement.(Edward and Charles, 2013) In order to perform the surgical expansion of the maxillary arch, two options were presented: it could be done in a first stage, with a subtotal LeFort I osteotomy, and thereafter a 1-piece osteotomy would be performed for advancement; or, concomitantly with the advancement, segmentation of the maxilla in four pieces would provide expansion of the arch (Janson *et al.,* 2008).

**Bilateral Sagittal Split Osteotomy (BSSO)**

Mandibular surgery with the Bilateral Sagittal Split surgical technique is the most commonly used mandibular osteotomy.Indications for a bilateral sagittal split include horizontal mandibular excess, deficiency, and/or asymmetry. It is the most commonly performed procedure for mandibular advancement and can also be utilized for a mandibular setback of small to moderate magnitude. More than 7 to 8 mm of posterior repositioning of the mandible with a BSSO can be difficult, and consideration should be given to an inverted "L" osteotomy or intraoral vertical ramus osteotomy (IVRO) (Laura, 2013). BSSO 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 (Kluczewska *et al.,* 2008).

**Post-surgical (Finishing)**

Orthognathic surgery requires stable fixation for uneventful healing of osteotomized bony segments and optimal remodeling. Titanium plates and screws have been accepted as the gold standard for rigid fixation in orthognathic surgery.The use of bio absorbable devices has resolved several problems of titanium fixation, such as the need for a second operation and interference with radiological evaluation.The use of bio absorbable devices leads to predictable postoperative long-term skeletal stability, which appears to be similar to that provided by titanium devices. (Park, 2015) Ravi *et al.* recommended post -surgical orthodontics after a period of 4 weeks. Finishing and settling of occlusion is carried out using short elastics. Mild Class III elastics are maintained throughout this phase of treatment. The overall treatment duration is about 22 months approximately. Upper and lower Hawley's type of retainers is given with instructions to wear full time. (Ravi *et al.,* 2012)

**Complications**

Residual bleeding is one of the most common problems in the immediate post-operative phase also lack of sensibility for infra orbital or alveolar nerve are the most common complications that usually resolves in at least 6-12 months. Late complications may include major periodontal defects or

loss of the vascular supply to the teeth adjacent to the sectorial osteotomy site in segmented Le Fort I operations. (Cortese, 2012) Single-jaw procedure may lead to less stability, leading to skeletal relapse, than double-jaw procedure. Skeletal relapse after orthognathic surgery may be due to biological factors like lack of neuromuscular adaptation and condylar resorption, as well as factors related to the surgical procedures. (Al-Delayme *et al.,* 2013)

**The Hierarchy of Stability and Predictability**

Stability after surgical repositioning of the jaws depends on the direction of movement, the type of fixation and the surgical technique, largely in that order of importance. (Proffit, 2007)Despite some skeletal relapse after most surgical corrections, the anterior occlusion is generally stable. (Dowling *et al.,* 2005) During the first post-surgical year, patients treated for Class II/long face problems are more stable than those treated for Class III problems; from one to five years post-treatment, some patients in both groups experience skeletal change, but the Class III patients then are more stable than the Class II/long face patients. Fewer patients exhibit long-term changes in the dental occlusion than skeletal changes, because the dentition usually adapts to the skeletal change. (Proffit and Turvey, 2007)

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