

Surgical Orthodontics

Dr. Aishwarya Sonawane¹; Dr. Chetan Patil²; Dr. Pradeep Kawale³
 Dr. Pradeep Kumar⁴; Dr. Snehal Bhalerao⁵; Dr. Ben Joshua⁶; Dr. Aameer Parkar⁷
 Yogita Dental College and Hospital

Abstract:- Dentofacial orthopedists serve as guardians of facial development, capable of influencing the differential growth of craniofacial structures through growth modulation techniques, guiding them towards favorable outcomes. In cases where facial growth is complete in adult patients presenting with significant skeletal discrepancies, surgical repositioning of the jaws becomes the primary solution, a realm addressed by surgical orthodontics. The 'envelope of discrepancy' visually encapsulates current concepts regarding the extent of change achievable through different treatment modalities. Maxillomandibular surgeries encompass various procedures aimed at addressing these issues. Diagnosis and treatment planning are pivotal in surgical orthodontics, with cephalometric prediction tracing and mock surgery playing crucial roles in preoperative planning.

Keywords:- Surgical Orthodontics, Envelope of Discrepancy, Prediction Tracing, Mock Surgery.

I. INTRODUCTION

Surgical orthodontics combines orthodontic and oral/maxillofacial surgery to address musculoskeletal, dento-osseous, and soft tissue deformities of the jaws. It's suitable for patients with severe skeletal or dentoalveolar issues beyond correction with orthodontics alone and whose growth is complete. This approach offers new treatment options and diagnostic challenges, requiring the clinician to grasp and apply various treatment concepts for optimal esthetics, function, and stability.^{1,2}

Over the last 25 years, orthognathic surgery has advanced significantly due to rapid progress in surgical technology. This has broadened treatment options beyond traditional orthodontic camouflage methods. Previously, dentofacial deformities often relied solely on camouflage techniques, leading to suboptimal aesthetic results and instability. Correction of severe malocclusions with jaw discrepancies typically involves growth modification, orthodontic camouflage, or orthognathic surgery combined with orthodontic treatment to reposition the jaws and dental segments.^{1,2}

II. ENVELOPE OF DISCREPANCY

Proffit and Ackerman introduced the envelope of discrepancy concept to illustrate the potential changes achievable through different treatment methods. This diagram simplifies the relationship between three basic treatment options for skeletal discrepancies. The inner circle

represents the limitations of orthodontic camouflage alone, the middle envelope depicts the boundaries of combined orthodontic treatment and growth modification, and the outer envelope shows the limits of surgical correction.⁵

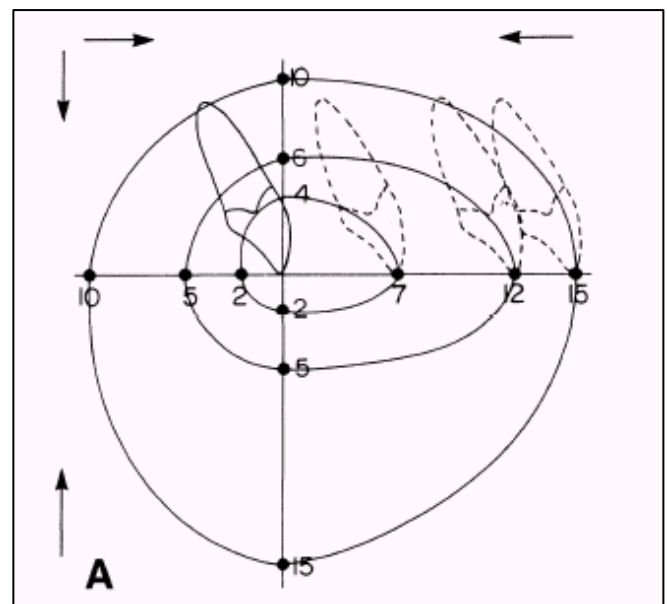


Fig 1 Envelope of Discrepancy; Maxilla

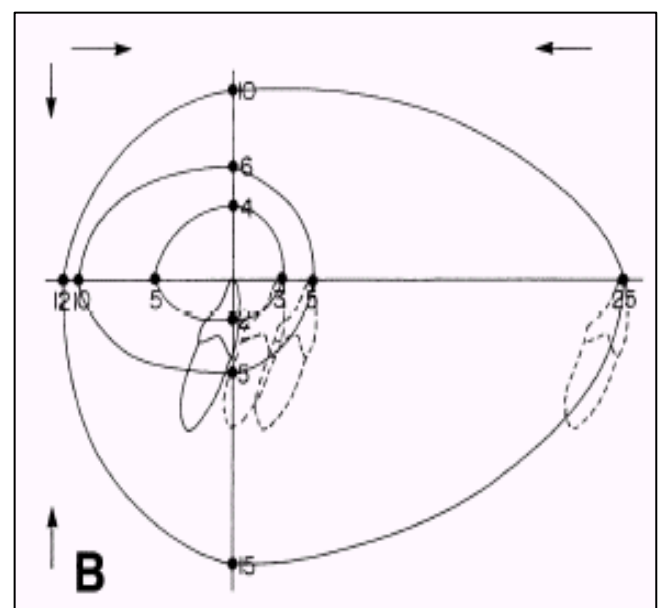


Fig 2 Envelope of Discrepancy; Mandible

The envelopes of discrepancy, showing the amount of change in the anteroposterior and vertical planes of space that could be expected from orthodontic tooth movement alone (the inner envelope), orthodontic tooth movement combined with growth modification (the middle envelope), and orthognathic surgery (the outer envelope). The possibilities of treatment are not symmetric with regard to the three planes of space. For example, treatment for growth modification is more effective in mandibular deficiency than in mandibular excess.⁵

➤ *Indications for Surgical-Orthodontic Treatment*

- Adults with severe malocclusion
- Adults with severe skeletal discrepancies
- Patients with dentofacial deformities and syndromes, including cleft lip and palate
- Syndromes featuring facial asymmetries like Pierre Robin syndrome, Treacher-Collins syndrome, Apert syndrome, Parry-Romberg syndrome, Goldenhar syndrome, hemifacial hypertrophy, and unilateral ankylosis
- Syndromes characterized by midface deficiencies such as craniosynostoses, Apert syndrome, Crouzon syndrome, Pfeiffer syndrome, Binder syndrome, achondroplasia dwarfism, and cleidocranial dysplasia
- Syndromes involving mandibular deformities including Pierre Robin syndrome, Treacher-Collins syndrome, Goldenhar syndrome (hemifacial microsomia), and mandibular prognathism observed in Gorlin-Goltz syndrome, achondroplasia, and Klinefelter syndrome.^{2,4,5,8}

➤ *Diagnosis and Treatment Planning*

The diagnosis and treatment planning and execution of treatment comprises four phases

- *Phase I*
Includes assembling the database, synthesizing the problem list, diagnosis and team conference.
- *Phase ii*
Includes developing interdisciplinary problem list with dentofacial problems in order of priority, and possible solutions, which forms the tentative treatment plan. A patient parent doctor team conference is arranged to discuss the tentative treatment plan with the patient and the family and definitive plan is arrived.
- *Phase iii*
Includes the preparatory phase (Restorative, endodontic, periodontic), the definitive orthodontic-surgical treatment and continuous team monitoring, re-evaluation, interaction, and modification of the therapy.
- *Phase iv*
Maintenance phase.^{4,5}

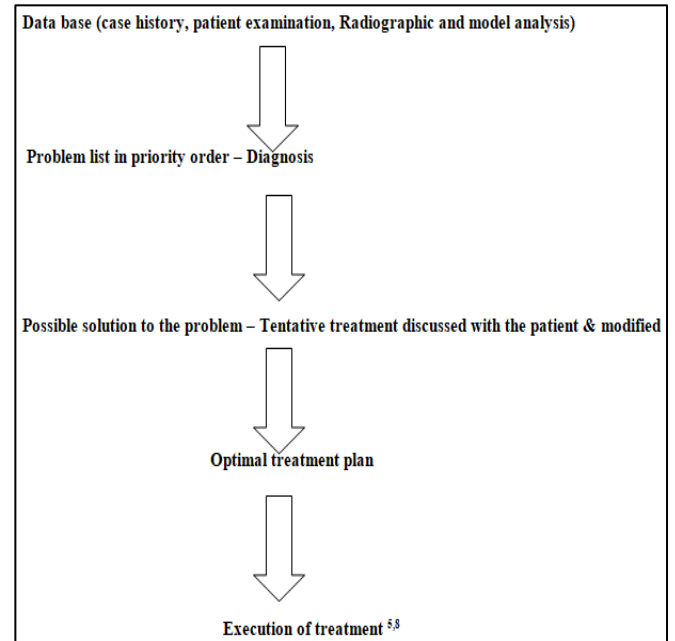


Fig 3 Diagnosis and Treatment Planning

III. VARIOUS SURGICAL OPTIONS

➤ *Midface Surgeries*

- *Posterior Repositioning*
- *Superior Repositioning*
- *Maxillary Advancement Surgeries*
- ✓ *Lefort I*
- ✓ *High level Lefort I*
- ✓ *Lefort II*
- ✓ *Lefort II*
- *Inferior Repositioning*
- *Maxillary Anterior Segmental Osteotomy:*
- *Single Tooth Osteotomy*
- *Posterior Segmental Osteotomy*
- *Interdental Corticotomy*
- *Zygomatic Osteotomy*
- *Horse Shoe Osteotomy*

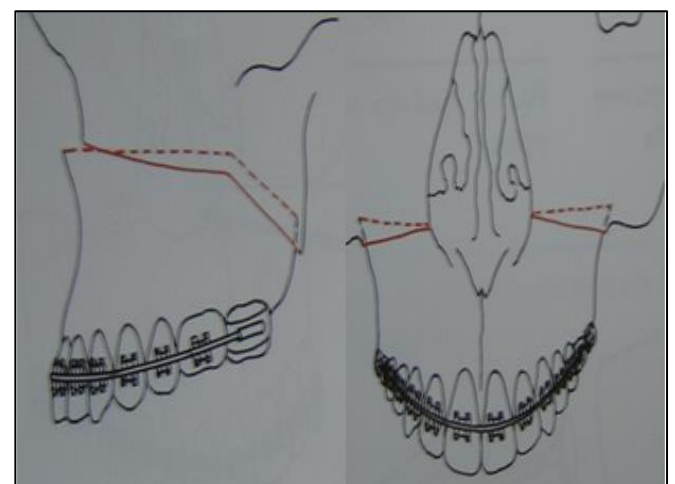


Fig 4 Maxillary Superior Repositioning

➤ *Mandibular Surgeries*

• *Ramus Procedures*

- ✓ Condylotomy (subcondylar osteotomy)
- ✓ Condylectomy
- ✓ Sagittal split osteotomy
- ✓ Vertical subsigmoid osteotomy
- ✓ Inverted L osteotomy
- ✓ C or arching osteotomy
- ✓ Post condylar grafts

• *Body Procedures*

• *Anterior to mental foramen*

- ✓ Step osteotomy
- ✓ Midline symphyseal osteotomy

• *Posterior to Mental Foramen*

- ✓ Y – osteotomy
- ✓ Rectangular osteotomy
- ✓ Inverted V osteotomy

• *Subapical Procedures*

- ✓ Anterior
- ✓ Posterior
- ✓ Total
- ✓ Genioplasty

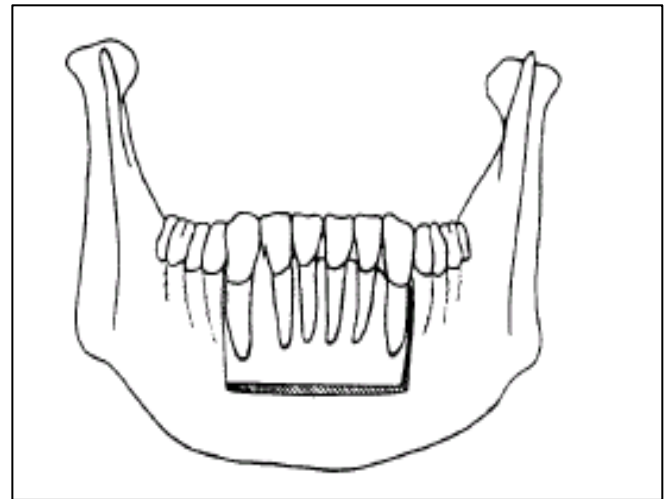


Fig 7 Subapical Osteotomy

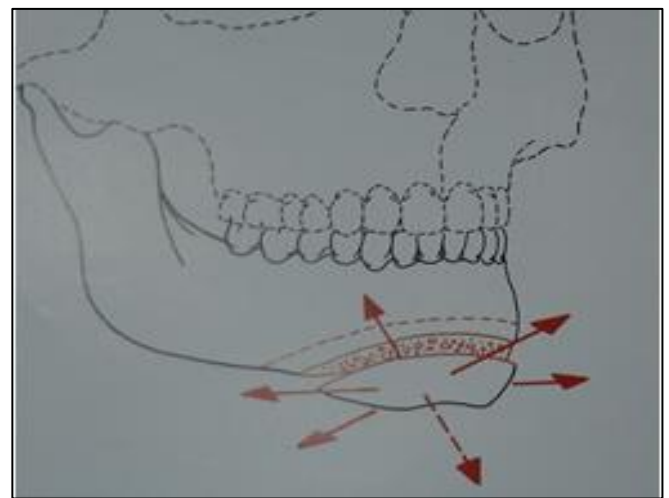


Fig 8 Genioplasty

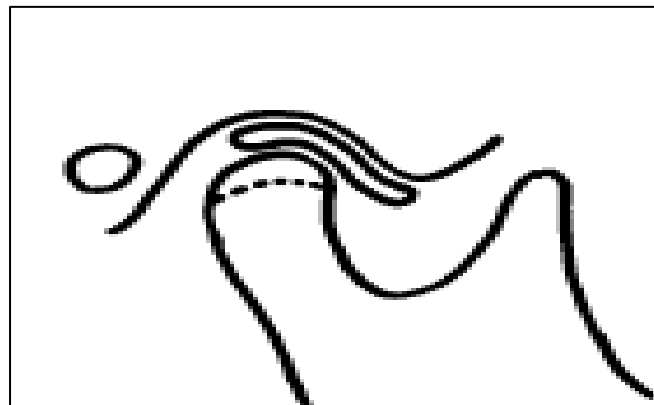


Fig 5 Condylectomy

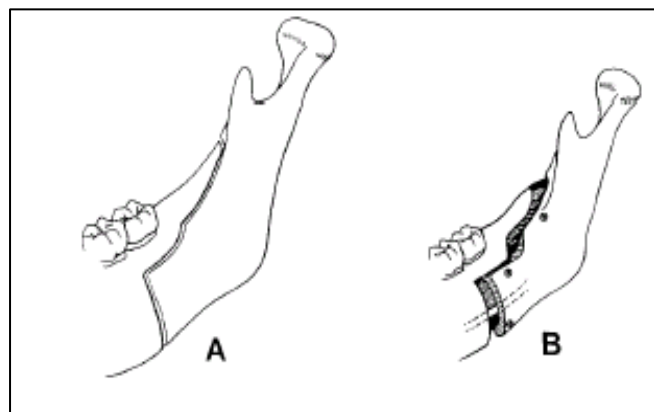


Fig 6 Mandibular Bsso

➤ *Esthetic Changes Accompanying Surgical Orthodontics*
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➤ *Esthetic Changes Accompanying Maxillary Superior Repositioning*

• *Front Face :*

- ✓ Widens alar bases
- ✓ Reduces exposure of maxillary anterior teeth
- ✓ Reduces interlabial distance
- ✓ Reduces lower third face vertically
- ✓ Shortens distance from upper lip stomion to menton
- ✓ Decreases distance from subnasale to mucocutaneous junction of lower lip

• *Profile:*

- ✓ Accentuates para nasal areas
- ✓ Elevates nasal tip
- ✓ Reduces interlabial distance
- ✓ Increases chin prominence
- ✓ Reduces lower third face vertically.

➤ *Esthetic Changes Accompanying Maxillary Inferior Repositioning*

- *Front Face :*
- ✓ Lengthens lower third face vertically
- ✓ Increases distance from subnasale to upper lip stomion
- ✓ Increases distance from subnasale to mucocutaneous junction of lower lip vermilion

- *Profile:*

- ✓ Reduces chin prominence
- ✓ Increases upper lip prominence
- ✓ Decreases lower lip prominence.
- ✓ Decreases acute nasolabial angle

➤ *Esthetic Changes Accompanying Total Maxillary Advancement*

- *Front Face:*

- ✓ Widens alar bases
- ✓ Increases prominence of upper lip
- ✓ Increases exposure of upper lip vermilion
- ✓ Reduces chin prominence

- *Profile:*

- ✓ Accentuates paranasal areas
- ✓ Reduces prominence of nose elevates nasal tip
- ✓ Elevates nasal tip
- ✓ Accentuates upper lip
- ✓ Deaccentuates chin

➤ *Esthetic Changes Accompanying Mandibular Setback*

- *Front Face:*

- ✓ Decreases chin prominence
- ✓ Increases exposure of upper lip vermilion
- ✓ Decreases lower third face height
- ✓ Increases squareness of face

- *Profile:*

- ✓ Reduces chin prominence
- ✓ Reduces lower lip eversion
- ✓ Shortens neck chin line
- ✓ Increases paranasal fullness

➤ *Esthetic Changes Accompanying Mandibular Advancement*

- *Front Face:*

- ✓ Variable increase in lower third face height
- ✓ Reduces lower lip eversion
- ✓ Reduces prominent labiomental fold

➤ *Cephalometric Prediction Tracing*^{3,9}

The basic reasons for doing predictions are:

- To accurately assess the profile esthetic results which will result from the proposed surgery,
- To consider the desirability of simultaneous adjunctive procedures such as genioplasty, suprahyoid myotomy, etc.,
- To help determine the sequencing of surgery and orthodontics (i.e., if the surgery is done first will it be more difficult or easier to do the indicated orthodontics),
- To help decide what type of orthodontics might best be employed (i.e., extraction versus non-extraction) and
- To determine the anchorage requirements should extraction treatment be chosen.

➤ *Prediction Tracing for Mandibular Surgeries*

- Trace the Stable Structures.
- Add Skeletal Portion Changed by Surgery
- New A-Po Line.
- Placing the Teeth
- Tracing the New Lip Contours

➤ *Cephalometric Prediction for Maxillary Superior Repositioning*^{3,9}

- Trace the Stable Structures
- Determination of Ideal Vertical Position for the Upper Incisor
- Autorotation of the Mandible
- Genioplasty Determination
- Placement of Teeth In Ideal Positions
- Nasal Outline
- Upper Lip outline
- Lower Lip outline
- Chin outline

➤ *Cephalometric Prediction Tracing for Combined Maxillary and Mandibular Cases*^{3,9}

- Trace the Stable Structures
- Determine the Ideal Vertical Position for the Upper Incisor
- Autorotation of the Occlusal Plane
- Mandibular Movement
- Completing the Tracing

IV. MOCK SURGERY

➤ *Aims of Model Surgery*²

- To locate the problem areas preoperatively.
- To determine the feasible surgical plan.
- To determine the direction of movement of dento-osseous segments.
- To view the osteotomy sites directly.
- To obtain the measurements of osteotomies.
- To reduce the operating time for desired occlusal results.

- Find the existence of a possible tooth mass problem.
- Find the ideal site for interdental osteotomy.
- Ascertain the presence of transverse discrepancies.

➤ *Protocol for Mock Surgery*²

- Cut the model exactly similar to surgery
- Avoid apices or root surfaces of teeth during cutting
- Detect the problem areas-proximity of roots, bony interferences, etc.
- Observe and note the movement of dento-osseous segments-rotations-expansion
- Consider best aesthetics, functional requirement, axial inclination, vertical relationship, and maximum interdilatation.
- Consider difference in movements of bony segments of one side to the other side as in the case of facial asymmetry cases in superior positioning of maxilla

➤ *Postsurgical Objectives*²

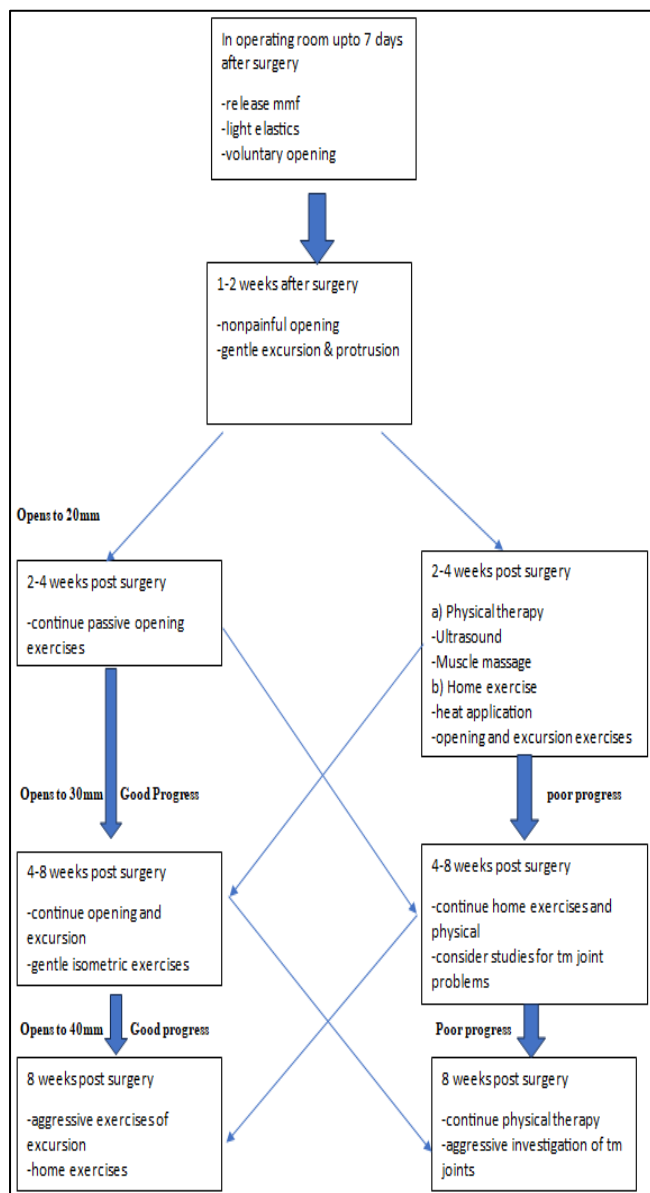


Fig 9 Postsurgical Objectives

V. CONCLUSION

- Inadequate orthodontics preparation can jeopardize the quality of the surgical result. A proper interaction between the Orthodontic and Surgical team is essential so that the best results are achieved.
- We should make a sincere effort to lay an enduring foundation for a robust and a lasting co-operation between the specialities for the sake of providing excellent care for our patients
- We should be open to criticisms and update ourselves. We should be careful not to get entangled in dogmatic philosophies

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