

Surgical and Nonsurgical Techniques in Orthodontics

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ABSTRACT

Orthognathic surgery can be extremely useful in management of patients with complex malocclusions. It can benefit the patients by treating the esthetic and functional deformities. The collaboration between orthodontists and oral surgeons is crucial in obtaining optimal results for such complicated cases. The timing of the treatment and the age of the patient at the time of treatment play an important role in determining the type of treatment. This review discusses the different types of malocclusions in which the patient can be treated with conventional mechanics if presented during growing period and surgical management if presented after the growth is completed. Furthermore, the review describes the recent introduction of mini-screws and the non-surgical methods that can be used to treat complex malocclusions for adult patients.

Keywords: growth, collaboration, mini-screws, orthognathic surgery, surgical orthodontics.

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I. INTRODUCTION

The relationship between orthodontists and oral surgeons is critical for management of complex malocclusions [1]. The earliest ostectomy of mandible was shown by Dr. Blair (oral surgeon) and Dr. Angle (orthodontist) in 1898 in a patient with prognathic mandible [2]. Since the first ostectomy, there have been significant changes in the way surgery and orthodontics is performed. But one thing still holds true and that is the collaboration between orthodontist and oral surgeon is vital for a successful outcome [3]. This review will provide a broad overview of treatment of different malocclusion surgically. Furthermore, the advances in orthodontics with mini-screws have made it possible to treat certain cases non-surgically. This review will also describe such advances in detail.

II. POSTERIOR TRANSVERSE DIMENSION

The posterior transverse discrepancy needs to be classified in terms of maxillary or mandibular deformity and in terms of dental or skeletal deformity [4]. This can be performed with the help of clinical examination, mounted and articulate orthodontic models and radiographs [5]. The transverse dimension in a surgical patient is evaluated by moving the mandible and maxilla in ideal position during mock model surgery. For example, in a patient with Class II malocclusion, the mandible is advanced to match the maxilla and then the transverse discrepancy between maxilla and mandible is assessed [6]. Mandibular arch is typically considered the diagnostic arch and the dimensions of maxilla are compared to the mandibular arch to identify the transverse discrepancy [7]. The transverse discrepancy in maxilla is evaluated by comparing the buccal cusps of

maxillary molars to the lingual cusps. In addition, the maxillary arch width between first molars and canines is compared to the mandibular arch width between first molars and canines. In such patients with narrow posterior transverse dimension of maxilla, the age plays an important role in the treatment. In children who are growing with Cervical vertebrae staging of 1-2, maxillary expansion can be performed with rapid maxillary expansion appliance (RME) [8]. In patients who are older (adult patients), surgically assisted rapid palatal expansion (SARPE) or a multipiece LeFort osteotomy is used to expand the maxilla [9]. Nowadays, with the help of mini-screws such patients can be treated non-surgically. Mini-screws can be used in patients who are in late adolescents or adults beyond CVS stage of 3 and mini-screw assisted rapid palatal expansion appliances (MARPE) are designed for maxillary expansion [10]. MARPE appliances have been a revolutionary change in the orthodontic treatment as patients who earlier had to undergo surgery can now be treated without undergoing surgery. This is a significant advance in that it saves the patients from having to undergo general anesthesia, postsurgical complications and morbidity associated with surgery. With surgery, the maxillary expansion can be performed unilaterally by making incisions on only one side of maxilla and allowing it to expand more [11]. With the advances in orthodontics, now with U-MARPE appliance, maxillary arch expansion can be done unilaterally without surgery [12]. With the surgical option of expansion, there is usually accompanying maxillary molar buccal tipping similar to RME and MARPE. With all three options, RME, SARPE, and MARPE, there is accompanying molar extrusion [13]. This information is crucial for treatment planning of cases as the vertical dimension may change based on the amount of extrusion of molars.

III. VERTICAL AND SAGITTAL SKELETAL DIMENSION

The relationship between the maxilla and mandible in the sagittal dimension is represented by the angle ANB which is formed between A point, B point, and Nasion (N) point [14]. The ANB angle is formed by the difference between SNA and SNB angle. A negative ANB angle indicates skeletal Class III relationship. However, the angles SNA and SNB need to be evaluated to identify the etiology of the class III malocclusion. In a patient with Class III malocclusion and prognathic mandible, the ANB will be negative and the SNB will be high [15]. In patients with Class III malocclusion and retrognathic maxilla, the ANB angle will be negative, and SNA will be low [16]. In such patients depending on the age at which they present for treatment, the management plan shall be different. For younger patients with CVS staging of 1 and 2, the maxillary protraction with facemask or protraction headgear can be used for correction of maxillary deficiency [17]. But if the patients are older, surgery needs to be performed to correct the malocclusion. LeFort advancement surgery can be performed to move the maxilla forward and correct the Class III malocclusion [18]. Sometimes the LeFort advancement surgery will be combined with mandibular setback surgery in patients with a combination of maxillary deficiency and mandibular prognathism. With the introduction of mini-screws in orthodontics, such patients can now be treated non-surgically with skeletal anchorage when indicated. The mini-screws can be inserted in the patient's maxilla and mandibular symphyseal region [19]. Class III intermaxillary elastics are then engaged on the mini-screws for maxillary protraction and achieve Class I molar relationship [19]. This non-surgical method presents an alternative to surgery for patients who are in beyond CVS3 and cannot be treated by facemask alone.

The relationship between maxilla and mandible in vertical dimension is represented by the mandibular plane angle (Go-Gn to SN) angle, Frankfort mandibular plane angle (FMA) and posterior facial height to anterior facial height ratio [20]. Additionally, the measurements of palatal plane to Sella-Nasion (SN) plane, gonial angle, lower anterior facial height can also be used to determine the vertical relationship between maxilla and mandible. In patients with anterior open bite, the etiology can be dental, skeletal, or a combination of two [21]. Patients with skeletal open bite usually present with a complex malocclusion with increased mandibular plane angle and hyperdivergent skeletal pattern. These patients when present at an early age can be treated with high-pull headgear to prevent the eruption of maxillary molars and prevent worsening of open bite [22]. If these patients present when they are adult then they need to undergo surgery with LeFort maxillary impaction to move the maxilla upward and allow the counterclockwise rotation of mandible for the closure of anterior open bite. With the help of mini-screws now there is another option available for such patients and that is the intrusion of posterior teeth to correct the anterior open bite. Mini-screws can be inserted in the palatal region of maxilla and then forces are applied from the mini-screws to intrude the maxillary posterior teeth [23]. This allows the mandible to rotate counterclockwise and allows the closure of anterior open bite.

IV. CONCLUSION

Orthognathic surgery is a helpful tool that can correct severe esthetic and functioning deformities and can change and improve the lives for the patients. However, it requires an extensive presurgical orthodontic phase, a surgery involving general anesthesia, and postsurgical orthodontic rehabilitation. It can also add to the cost and morbidity due to postsurgical complications. Depending on when the patient presents for treatment, the malocclusions can be treated differently. Until now, if the patients present for treatment with complex malocclusions after peak growth in late adolescents or adults, they can only be treated by surgery. Nowadays with the help of mini-screws, patients with complex malocclusions can be treated by non-surgical methods to esthetic and functional stability.

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