

Surgical orthodontic correction of mandibular laterognathism

Harpreet Singh, Dhirendra Srivastava¹, Pranav Kapoor and Poonam Sharma

ABSTRACT

This case report describes the successful treatment of a patient with mandibular laterognathism and associated facial asymmetry with combined surgical orthodontic approach. After 7 months of presurgical orthodontic treatment, intraoral vertical ramus osteotomy, and straightening genioplasty were performed as two step surgeries to reposition the deviated mandible and chin, respectively. The total active treatment period was 14 months. After surgical orthodontic treatment, significant improvement in occlusion, masticatory function, and facial appearance was discernible. Posttreatment records at 3 years showed stable results with good occlusion.

Key words: Facial asymmetry, genioplasty, intraoral vertical ramus osteotomy, laterognathism, temporomandibular joint

INTRODUCTION

Facial asymmetry is one of the most difficult and challenging dentofacial deformities to correct in orthodontics. Skeletal asymmetry is often caused by age-related adaptive remodeling changes in the temporomandibular joint (TMJ) and thus commonly observed in mandible which forms the skeletal support for soft tissues of the lower face.^[1-3] Conversely, since the maxilla provides minimal soft tissue support, most maxillary asymmetry usually develops secondary to asymmetric mandibular growth.^[4] Isolated excessive unilateral anteroposterior mandibular growth or anteroposterior maxillary deficiency, or a combination of the two usually result in the development of asymmetrical Class III dentofacial deformities.^[5] Studies have shown that the presence of temporomandibular disorder (TMD) symptoms, such as joint sounds and pain, and articular disk displacement is higher in patients exhibiting

mandibular asymmetry.^[6,7] Optimal correction of such asymmetries requires an interdisciplinary approach involving cooperation and skills of both orthodontist and oral surgeon right from the onset of planning through the completion of treatment and retention.

This article describes a case of asymmetrical dentofacial deformity due to mandibular laterognathism with unilateral crossbite treated by a combination of two-stage orthognathic surgery and orthodontic therapy.

CASE REPORT

Diagnosis and Etiology

A 19-year-old adult male reported to the Department of Orthodontics and Dentofacial Orthopedics for correction of his facial asymmetry. The noticeable progressively worsening asymmetry since last 6 years and accompanying masticatory insufficiency was the chief concern of the patient. He did not give any history of injury to his head or jaw. Frontal facial photographs demonstrated severe facial asymmetry with mandibular deviation toward the left side [Figure 1a-d]. TMJ pop (which was not a reciprocal click) on opening was evidently detectable on the left side without

Departments of Orthodontics and Dentofacial Orthopedics and 'Oral and Cranio-Maxillofacial Surgery, ESIC Dental College and Hospital, Rohini, New Delhi, India

Address for correspondence: Dr. Harpreet Singh, Department of Orthodontics and Dentofacial Orthopedics, ESIC Dental College and Hospital, Sector 15, Rohini, New Delhi - 110 085, India.
E-mail: drhpreet_mamc04@yahoo.co.in

Access this article online	
Quick Response Code:	Website: www.jorthodsci.org
	DOI: 10.4103/2278-0203.179420

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Singh H, Srivastava D, Kapoor P, Sharma P. Surgical orthodontic correction of mandibular laterognathism. J Orthodont Sci 2016;5:74-80.

any other symptoms typically associated with pathologic temporomandibular disease. On mouth opening, a lateral deviation of the mandible to the left was observed. The maximum interincisal opening was 38 mm.

Intraorally, the patient presented with anterior crossbite involving the maxillary right central incisor to the left lateral incisor with poor occlusion [Figure 1e-g]. The patient had permanent dentition with missing upper left second premolar. The molar relationship was Class III on the right and Class I on the left side. The maxillary dental midline was coincident with the labial frenum during smiling; however, when compared with the facial midline, a deviation of approximately 1 mm toward the left was observed. The mandibular dental midline was shifted toward the left by 4.5 mm when compared with the maxillary dental midline. Cephalometric analysis revealed a skeletal Class III jaw base relationship (ANB - 2°; Wits appraisal - 9 mm). The maxillary incisors were slightly retroclined (U1 to SN, 98°) whereas mandibular incisors had normal inclinations (IMPA, 89°) [Figure 2 and Table 1].

Posteroanterior (PA) cephalometric radiograph revealed mandibular asymmetry with chin deviation to the left side [Figure 3]. PA head film tracing showed approximately 7.5 mm deviation of the mandible toward left and 4.5 mm midline discrepancy [Figure 4].



Figure 1: (a) Pretreatment frontal photograph illustrating facial asymmetry. (b) Pretreatment left profile view depicting mandibular prognathism. (c) Pretreatment posed smile photograph depicting smile asymmetry. (d) Submental view photograph illustrating mandibular asymmetry. (e) Pretreatment intraoral-frontal view showing left anterior crossbite with 4.5 mm dental midline discrepancy towards left side. (f) Pretreatment intraoral right lateral view. (g) Pretreatment intraoral left lateral view showing buccal crossbite

Panoramic radiographic evaluation revealed increased right ramal height and mandibular right body length. He was missing his maxillary left second premolar and all his third molars [Figure 5].

In accordance with literature studies, a combination of hereditary and environmental factors appeared to be the etiological factors of severe facial asymmetry.^[8]

A technetium-99m methylene diphosphonate bone scan revealed mildly increased osteoblastic activity of the right mandibular condyle. However, clinical and radiographic evaluation over a period of 1 year did not reveal any further clinically significant increase in the asymmetry [Figure 6].

Electromyographic monitoring showed that the activities of the masseter and anterior temporalis were lower during

Table 1: Cephalometric measurements

Measurement	Pretreatment	Posttreatment
SNA (°)	77	78
N-A (II HP) (mm)	-7	-4.5
SNB (°)	79	75
N-B (II HP) (mm)	-9	-13
N-Pg (II HP) (mm)	-11	-15
ANB (°)	-2	3
Wits (mm)	-9	-2
SN-MP (°)	35	39
FH-MP (°)	30	35
LFH (ANS-Me/N-Me) (%)	54.7	55
U1 to SN (°)	98	100
U1 to NA (°)	21	22
IMPA (°)	89	89.5
L1 to NB (°)	20	25
Upper lip protrusion (mm)	3.5	3
Lower lip protrusion (mm)	7	3.5
Chin prominence in relation to mandibular dental base (mm)	-11	-15
Maxillary basal length (mm)	57	55
Mandibular basal length (mm)	84	76



Figure 2: Pretreatment lateral cephalogram showing Class III skeletal pattern



Figure 3: Pretreatment posteroanterior cephalometric radiograph of the patient

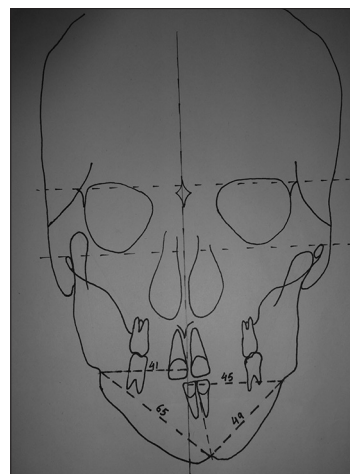


Figure 4: Pretreatment posteroanterior headfilm tracing showing frontal facial (mandibular) asymmetry



Figure 5: Pretreatment orthopantomogram documenting normal morphology of mandibular condyle

unilateral chewing on the right side than on the left side [Figure 7a and b].

Based on the essential and supplementary diagnostic aids, the patient was diagnosed as having an asymmetric dentofacial deformity with mandibular and chin asymmetry, severe midline deviation, and left unilateral anterior crossbite with associated click in left TMJ.

Treatment Plan

In order to address the chief complaints of the patient, i.e., facial asymmetry, orthognathic surgery was unavoidable. Fabrication of mandibular splint was contemplated as the first step which would help in reduction of TMD symptoms and serve as a diagnostic aid. Both the mandibular setback procedures, sagittal split ramus osteotomy (SSRO) and intraoral vertical ramus osteotomy (IVRO) have been employed widely for correction of asymmetric dentofacial deformities; but IVRO provides a greater likelihood of symptom relief in TMDs.^[9] Hence, IVRO was selected for correction of severe skeletal asymmetry and improvement of TMD symptoms. Presurgical orthodontic treatment was planned to eliminate compensations of the teeth in maxillary and mandibular arches while taking into account the postsurgical position of upper incisor and



Figure 6: Technetium-99m methylene diphosphonate bone scan revealing clinically nonsignificant differential uptake of radioisotope in both right and left mandibular condyles

observing the anatomic limits of the symphysis. Furthermore, genioplasty was also proposed as an adjunct surgery for correction of deviated chin.

Treatment Progress

Following a 6 weeks period of wear of mandibular disclusion splint, and associated reduction of discomfort as reported by the patient, presurgical orthodontics in both arches was initiated with 0.022" × 0.025" preadjusted edgewise appliances (MBT prescription). Positive control of torque within the buccal segments was achieved using a removable lingual arch. Alignment and leveling were commenced with improved superelastic continuous archwires (0.016" NiTi followed by 0.019 × 0.025" NiTi archwire). Final presurgical records were obtained 3 weeks after the placement of final stabilizing archwires (0.019 × 0.025" SS and 0.021 × 0.025" SS) [Figure 8]. Arbitrary facebow mounting [Figure 9] was employed to locate the jaw anatomically within the anatomic adjustable articulator in a satisfactory manner. Immediate presurgical model surgery was performed on articulator mounted casts in centric

relation which aided in recording and documenting any discrepancy between the jaw relations at the initial contact of the teeth and at the patient's habitual occlusion [Figure 10]. Model surgery also provided easy visualization of the magnitude of medial/lateral discrepancies existing between condylar and dentoalveolar segments. After 7 months of presurgical orthodontic treatment, asymmetric transverse rotation of the mandible by bilateral IVRO was performed according to the Epker method.^[10] In postsurgery, the healing period was uneventful. Maxillomandibular fixation was maintained for 3 weeks [Figure 11] and on release, jaw physiotherapy, which is a combination of isometric and isotonic exercises, was employed for 7–10 days. The patient was given a ruler on which presurgical interincisal opening was marked. He was advised to perform vigorous exercises in front of the mirror for 5 min at least thrice daily which involved forceful opening of the mouth to the maximal distance, followed by holding the jaw open for a few seconds before closing. Afterward, the patient was instructed to maximally protrude the mandible and then place the teeth back into proper occlusion with firm biting. With this regimen, the preoperative extent of mandibular movements was achieved within 12 days.

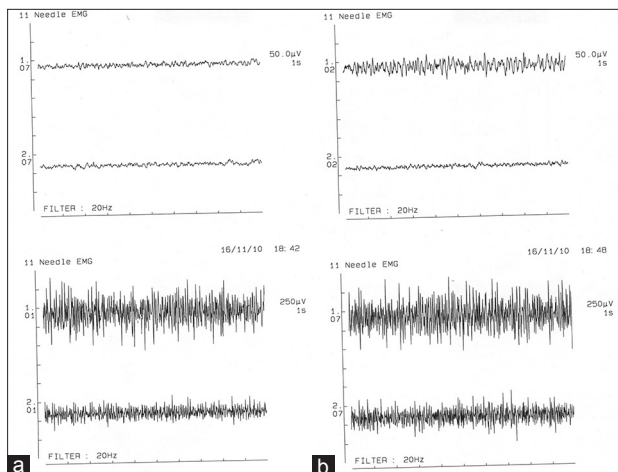


Figure 7: (a) Electromyogram of right anterior temporalis and right masseter muscle in resting and contracted state. (b) Electromyogram of left anterior temporalis and left masseter muscle showing increased activity in both resting and contracted state

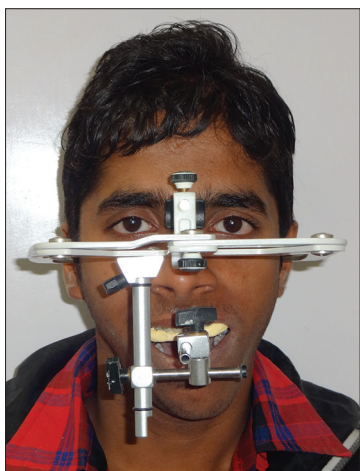


Figure 9: Arbitrary facebow record for the patient

Postsurgical orthodontic treatment was commenced 6 weeks following surgery when the patient had attained full range of movements (with a mouth opening of 48 mm) and had returned to a normal diet. Stabilizing archwires were removed at the first postsurgical orthodontic visit, and fixed appliances and archwires were checked for damage and repaired as necessary. Full-time light vertical 3/8" elastics worn on Kobayashi hooks (modified ligature ties) were used in conjunction with sectional anterior 0.019 × 0.025" TMA wire in upper arch and continuous 0.016" SS wire in the lower arch. Elimination of residual marginal ridge discrepancies was accomplished by placing small vertical bends in the lower arch wire at the second postsurgical appointment. By the third postsurgical appointment, well settled occlusion was obtained, and elastics were worn intermittently only during night for 3 weeks [Figure 12]. After debonding, maxillary and mandibular circumferential retainers were delivered.

Post-IVRO, frontal facial esthetics showed significant improvement [Figure 13]. With the patient's consent, genioplasty to reposition deviated chin was also performed during a second operation, in order to maximize facial esthetics.

TREATMENT RESULTS

The combination of orthodontic-orthognathic treatment approach helped establish a favorable occlusal result with good



Figure 8: Stage intraoral frontal view showing decompensation accomplished by presurgical orthodontics



Figure 10: Articulator mounted casts with interposed surgical splint

interdigitation while restoring facial symmetry to acceptable esthetic and functional levels [Figure 14a-g]. There was clinically significant reduction in TMJ clicking sounds, suggesting an improvement in the TMD symptoms. Anterior crossbite was corrected, and buccolingual inclination of left maxillary and mandibular buccal segments improved after treatment. The patient also reported significant improvement in masticatory efficiency.

The posttreatment lateral cephalometric analysis demonstrated favorable skeletal changes (ANB, 3°; Wits appraisal, - 2 mm) and a slight increase in mandibular plane angle (SN-MP, 39°). The maxillary incisor inclinations improved (U1 to SN, 100°) and inclinations of mandibular incisors remained stable (IMPA, 89.5°) [Figure 15 and Table 1].

Posttreatment PA cephalogram [Figure 16] showed significant improvement of facial asymmetry and the PA head film tracing revealed corrected mandibular and chin midline in relation to true facial midline [Figure 17]. The posttreatment panoramic radiograph revealed acceptable root parallelism with no significant apical root resorption or alveolar bone loss [Figure 18].

At the 3-year follow-up, patient exhibited stable occlusion and well maintained acceptable facial profile without obvious



Figure 11: Postsurgical orthopantomogram documenting intraoral vertical ramus osteotomy cuts and maxillomandibular fixation

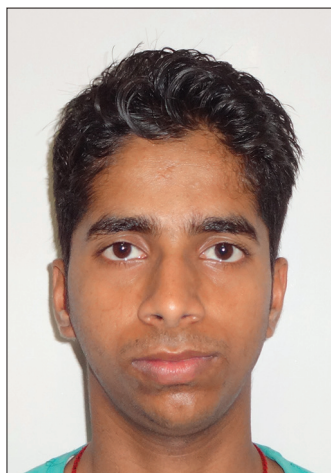


Figure 13: Photograph illustrating improved frontal facial esthetics after intraoral vertical ramus osteotomy

relapse, despite maturational changes that would have occurred with time [Figure 19a and b].

DISCUSSION

The presence of facial asymmetry may have a significant adverse impact on the patients' orofacial, nutritional, esthetic, and psychosocial development.^[11] Since only a clinically demonstrable correction in asymmetry would satisfy the patient's expectations, concerns, and expectations of such patients must be taken into consideration during formulation of a treatment plan.^[12,13] Meticulous clinical and radiographic

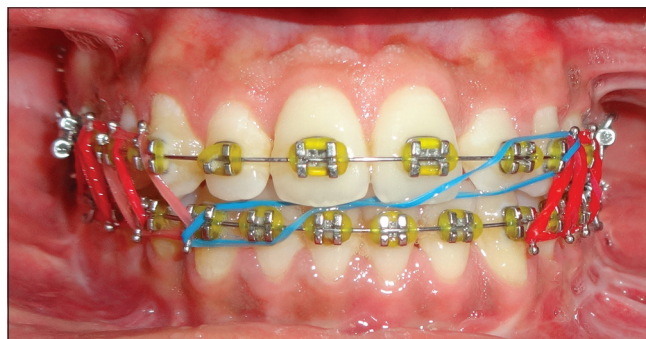


Figure 12: Treatment progress photograph showing elastic conduct during postsurgical orthodontic phase



Figure 14: (a) Post treatment frontal view showing correction of deviated chin after genioplasty. (b) Posttreatment photograph depicting good esthetic profile. (c) Posttreatment posed smile photograph showing smile symmetry. (d) Posttreatment submental view showing mandibular and chin symmetry. (e) Posttreatment intraoral frontal view showing corrected anterior crossbite and coincident midlines. (f) Posttreatment right lateral view showing good occlusion. (g) Posttreatment intraoral left lateral view depicting corrected buccal crossbite



Figure 15: Posttreatment lateral cephalogram showing correction of mandibular prognathism



Figure 16: Post treatment posteroanterior cephalogram

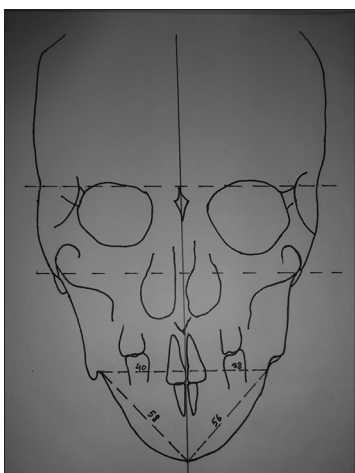


Figure 17: Post treatment posteroanterior headfilm tracing

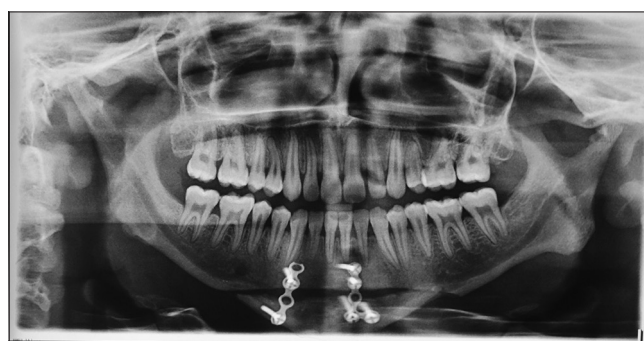


Figure 18: Post treatment panoramic radiograph

evaluation to identify and quantify facial asymmetry and to understand the dentoalveolar compensations associated with the various types of asymmetries is, therefore, indispensable.

Determination of underlying cause of asymmetry is necessary for the formulation of the appropriate treatment plan. True dental asymmetries are often treated orthodontically by means of asymmetric tooth-extraction sequences and asymmetric mechanics such as diagonal and midline elastics.^[14,15] Partial or complete resolution of discrepancy solely through orthodontic treatment is often dictated by the severity and nature of the skeletal asymmetry.^[16] However, skeletal asymmetries treated with orthodontics alone might dictate certain compromises in treatment outcome that need to be explained to the patient before initiating treatment.

Based on Obwegeser and Makek's classification of skeletal mandibular asymmetries,^[17] this case was diagnosed with hemimandibular elongation because of elongation of the mandibular right body in a horizontal plane and both right condyle and ramus in the vertical plane. Consequently, the deviation of the mandible to the left was observed.

Presurgical orthodontic treatment has a profound influence on front face esthetics in patients with facial asymmetry. The primary objective of the presurgical orthodontic treatment is to make the occlusal asymmetry equal in magnitude with that of the skeleton to enable maximize correction of facial esthetics and achieve stable results, thus precluding the need for unnecessary surgery in the maxilla.^[5] Determination of the extent of extreme variations in the magnitude of dental compensations is indispensable before initiating presurgical orthodontics. This can be done by guiding the patient's mandible laterally until the midpoint of the chin is coinciding with the true facial midline and then studying the occlusion in this position.^[5] Orthodontic decompensation of the teeth and dental arches was done to enable the required sagittal movement and the asymmetric correction of the mandible and chin in the surgical phase.

In patients with associated TMJ symptoms, use of a disclusion splint (fabricated on articulator mounted casts) for a few days, before making the retruded contact position record is beneficial as muscle spasm does not distort the condylar position.^[18]

Anatomic model surgery was performed as it the most invaluable means of identifying the millimetric movements required to correct an asymmetry in the lower third of the face.



Figure 19: (a) Three-year follow-up frontal facial photograph. (b) Three-year follow-up intraoral frontal view

Correction of mandibular asymmetry by IVRO facilitates a largely rotational move of one or both mandibular rami. IVRO is indicated for the side that moves in a posterior direction and is usually employed for correction of asymmetries of large magnitude (more than 8 mm) with associated TMD symptoms. Correction of severe asymmetries by SSRO may lead to lateral hump formation, whereby the proximal segments tend to flare, leading to poor bone contact, posterior mandibular asymmetry and a greater predisposition for peripheral condylar sag after placement of internal rigid fixation. The advantages of IVRO include short rehabilitation time (as it is faster and simpler operation) and lower risk of permanent inferior alveolar nerve injury when compared to SSRO.^[19]

Since this case demonstrated concurrent asymmetry of mandible and chin, additional correction of the chin midline was necessitated after the correction of the mandibular asymmetry and the dental midline. Anatomic model surgery enabled accurate determination of the three-dimensional change in the position of bony pogonion produced after mandibular osteotomy, and thus helped determine the necessity of its additional repositioning via genioplasty to place bony pogonion symmetrically with the facial midline.

CONCLUSIONS

The optimal stable esthetic result and improved functional outcome in the present case were achieved by transverse rotation of the mandible and straightening genioplasty in conjunction with meticulously planned presurgical and postsurgical orthodontic treatment.

Declaration of Patient Consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial Support and Sponsorship

Nil.

Conflicts of Interest

There are no conflicts of interest.

REFERENCES

- O'Byrn BL, Sadowsky C, Schneider B, BeGole EA. An evaluation of mandibular asymmetry in adults with unilateral posterior crossbite. *Am J Orthod Dentofacial Orthop* 1995;107:394-400.
- Pirttiniemi P, Kantomaa T, Lahtela P. Relationship between craniofacial and condyle path asymmetry in unilateral cross-bite patients. *Eur J Orthod* 1990;12:408-13.
- Kantomaa T. The shape of the glenoid fossa affects the growth of the mandible. *Eur J Orthod* 1988;10:249-54.
- Legan HL. Surgical correction of patients with asymmetries. *Semin Orthod* 1998;4:189-98.
- Epker BN, Stella JP, Fish LC. Asymmetric class III dentofacial deformities. In: Epker BN, Stella JP, Fish LC. *Dentofacial Deformities-Integrated Orthodontic and Surgical Correction*. 2nd ed., Vol. IV. St. Louis, MO: Mosby; 1999. p. 2162-228.
- Kobayashi T, Honma K, Izumi K, Hayashi T, Shingaki S, Nakajima T. Temporomandibular joint symptoms and disc displacement in patients with mandibular prognathism. *Br J Oral Maxillofac Surg* 1999;37:455-8.
- Ueki K, Nakagawa K, Takatsuka S, Shimada M, Marukawa K, Takazakura D, et al. Temporomandibular joint morphology and disc position in skeletal class III patients. *J Craniomaxillofac Surg* 2000;28:362-8.
- Melnik AK. A cephalometric study of mandibular asymmetry in a longitudinally followed sample of growing children. *Am J Orthod Dentofacial Orthop* 1992;101:355-66.
- Bell WH, Yamaguchi Y, Poor MR. Treatment of temporomandibular joint dysfunction by intraoral vertical ramus osteotomy. *Int J Adult Orthodon Orthognath Surg* 1990;5:9-27.
- Epker BN. Modifications in the sagittal osteotomy of the mandible. *J Oral Surg* 1977;35:157-9.
- Takeshita N, Ishida M, Watanabe H, Hashimoto T, Daimaruya T, Hasegawa M, et al. Improvement of asymmetric stomatognathic functions, unilateral crossbite, and facial esthetics in a patient with skeletal Class III malocclusion and mandibular asymmetry, treated with orthognathic surgery. *Am J Orthod Dentofacial Orthop* 2013;144:441-54.
- Tripathi T, Srivastava D, Rai P, Singh H. Asymmetric class III dentofacial deformities – Widening the horizon. *Orthodontics (Chic.)* 2012;13:e162-80.
- Costales LL, Guzmán VI. Severe prognathism and laterognathia, condilar hyperplasia with considerable facial asymmetry. *Rev Mex Ortod* 2014;2:134-40.
- Bishara SE, Burkey PS, Kharouf JG. Dental and facial asymmetries: A review. *Angle Orthod* 1994;64:89-98.
- Joondeph DR. Mysteries of asymmetries. *Am J Orthod Dentofacial Orthop* 2000;117:577-9.
- Tai K, Park JH, Ikeda K, Nishiyama A, Sato Y. Severe facial asymmetry and unilateral lingual crossbite treated with orthodontics and 2-jaw surgery: 5-year follow-up. *Am J Orthod Dentofacial Orthop* 2012;142:509-23.
- Obwegeser HL, Makek MS. Hemimandibular hyperplasia – Hemimandibular elongation. *J Maxillofac Surg* 1986;14: 183-208.
- Epker BN, Stella JP, Fish LC. Management of temporomandibular joint pathology in patients with dentofacial deformities. In: Epker BN, Stella JP, Fish LC. *Dentofacial Deformities-Integrated Orthodontic and Surgical Correction*. 2nd ed., Vol. IV. St. Louis, MO: Mosby; 1999. p. 2304-41.
- Fonseca RJ. *Oral and Maxillofacial Surgery-Orthognathic Surgery*. Vol. 2. Philadelphia, Penn: W.B. Saunders; 2000:297-323.