Orthognathic Surgery

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Introduction

Orthognathic surgery requires a well-orchestrated combination of surgery and orthodontics in order to optimally treat dento-facial deformities. Dento-facial deformities result from growth modifications seen in either the maxilla or mandible, in a single dimension or multiple dimensions during development. The overall objective of treatment is to achieve proper, stable class I occlusion and to improve soft tissue aesthetics. In addition to aesthetic concerns, important functional considerations play a role in orthognathic surgical planning. Issues with mastication, lip incompetence, speech difficulties, spitting, oral hygiene, or TMJ function must all be considered. The psychosocial impact of dento-facial deformities is harder to define or quantify; however, the patient's confidence and satisfaction with appearance should be part of the discussion held with their surgeon. Recent advances in preoperative planning, including virtual surgical planning, can guide treatment and improve efficiency. The three osteotomies discussed in this chapter include the Le Fort I type osteotomy, the bilateral sagittal split osteotomy of the mandible, and the osseous genioplasty, which will address most dento-facial deformities.

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Patient Evaluation

Evaluation of a new patient should begin with general medical history in addition to dental history. The patient's psychosocial history, including social support system, plays a role in their ability to be compliant postoperatively and to cope with the stress of surgery.

The surgeon will work closely with the patient's orthodontist in defining the deformity and establishing a treatment plan. In examination of the patient, the surgeon can quickly establish whether the patient has an Angle class I, II, or III deformity. It is vital to evaluate not only the occlusion but also the facial skeleton. For example, differentiating between mandibular excess versus maxillary deficiency, or a combination of both, is necessary for treatment planning (Fig. 29.1). Paranasal flattening or malar flattening can indicate a deficient maxilla, for example. Additional evaluation of the tongue is necessary in the setting of mandibular excess. A large tongue with evidence of indentations from the teeth should serve as a warning sign that a bilateral sagittal split osteotomy with a mandibular setback may crowd the airway. In this setting, a Le Fort I osteotomy with maxillary advancement

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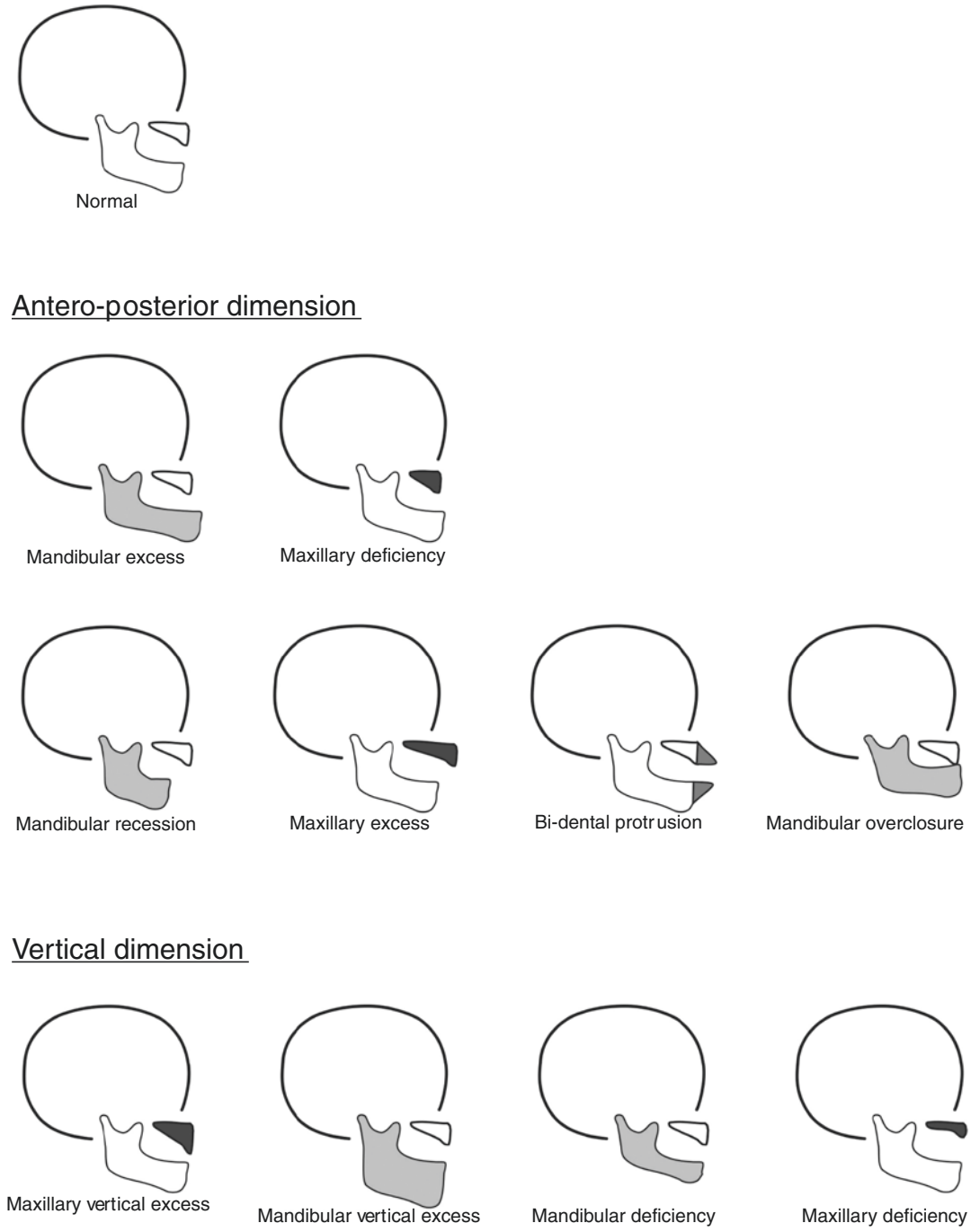

Fig. 29.1 Deformity of the facial skeleton in the anteroposterior dimension and vertical dimension

may be the better solution to correct the deformity.

Radiographic studies are integral to evaluating the patient and preoperative planning. Panorex and AP and lateral cephalometrics allow for evaluation of dentition and facial skeletal relationships.

The sagittal cephalometric analysis will give us vital information, including the following. The relationship of the maxilla to the skull base is identified by the angle between the sella, nasion, and point A (Fig. 29.2). The relationship of the mandible to the skull base is identified by the angle between the sella, nasion, and point B (Fig. 29.3). The relationship of the maxilla to the mandible or the angle between point A, nasion, and point B can then be determined (Fig. 29.4). The position of the maxillary incisors to the bony base of the maxilla, or the angle between axis of the maxillary central incisor to the point A, nasion perpendicular can also be defined (Fig. 29.5). The position of the mandibular incisors to the bony base of the mandible (angle between the axis of the mandibular central incisor to the mandibular plane angle) can also be identified (Fig. 29.6).

The vertical cephalometric analysis provides the upper facial height (UFH) nasion to anterior nasal spine (ANS), in addition to the lower facial height (LFH) (ANS to menton) allowing the ratio of the UFH to LFH to be identified (Fig. 29.7). The vertical cephalometric analysis also allows

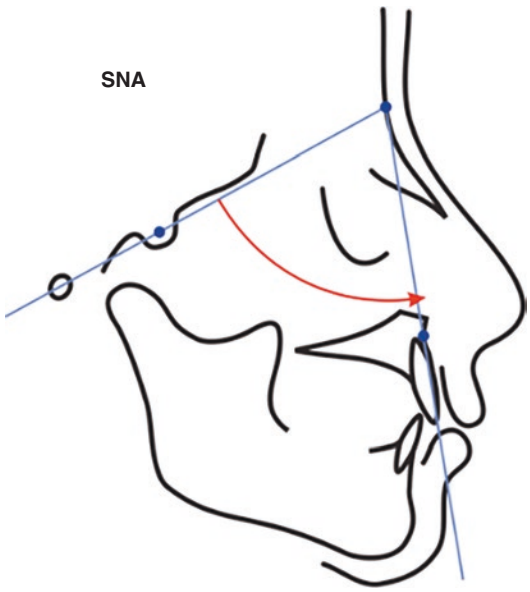

Fig. 29.2 The angle between Sella–Nasion–A point (SNA) indicates the horizontal position of the maxilla relative to the cranial base

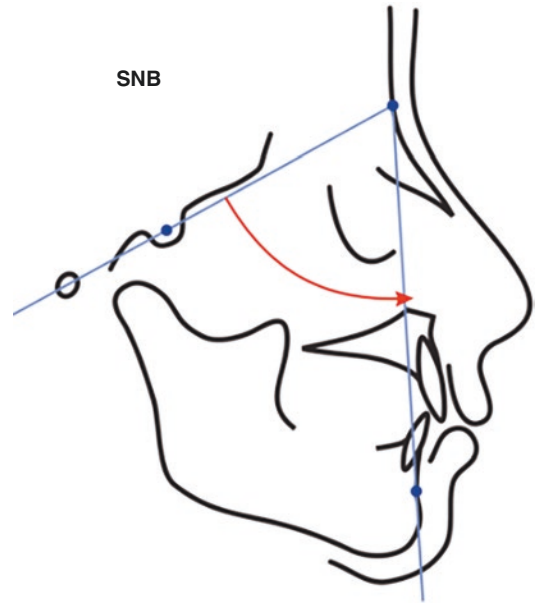

Fig. 29.3 The angle between Sella–Nasion–B point (SNB) indicates the horizontal position of the mandible relative to the cranial base

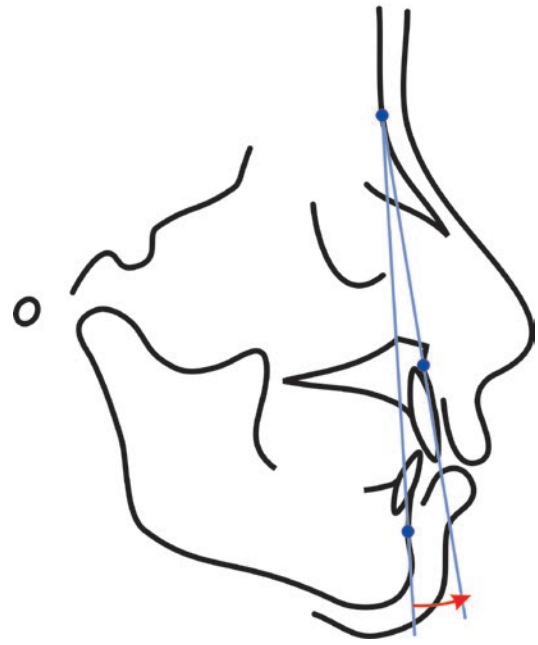

Fig. 29.4 The relative position of the maxilla to the mandible is measured by the angle between A point–Nasion–B point (ANB). An angle measuring >5° Class II, maxillary excess or retrognathic mandible. An angle measuring <1° Class III, deficient maxilla or prognathic mandible

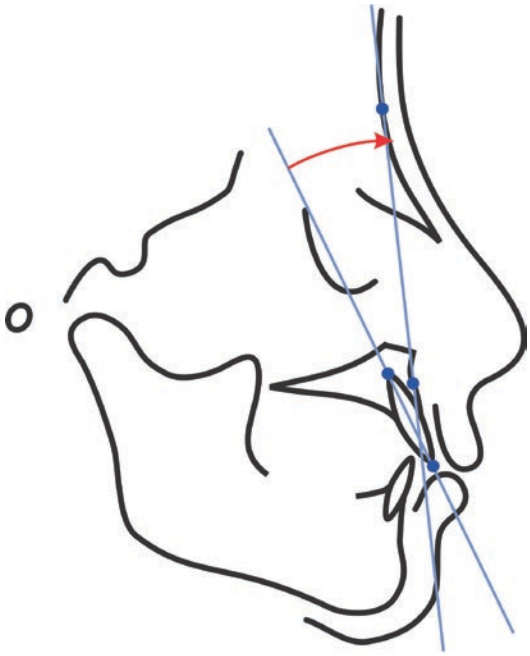

Fig. 29.5 The position of the maxillary incisors to the bony base of the maxilla (angle between axis of the maxillary central incisor to the point A, nasion perpendicular)

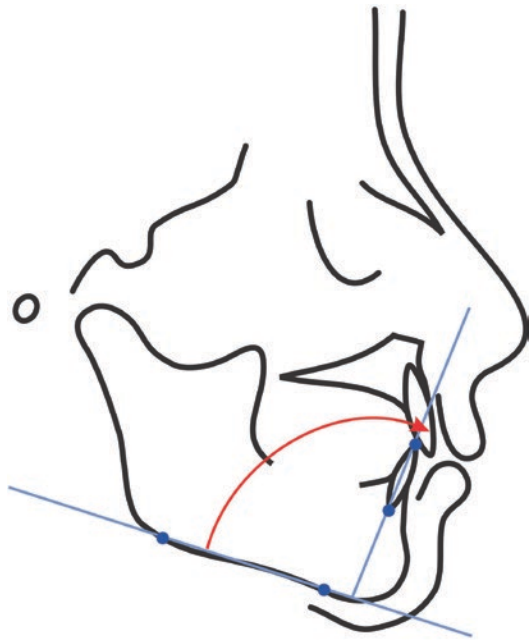

Fig. 29.6 The position of the mandibular incisors to the bony base of the mandible (angle between the axis of the mandibular central incisor to the mandibular plane angle)

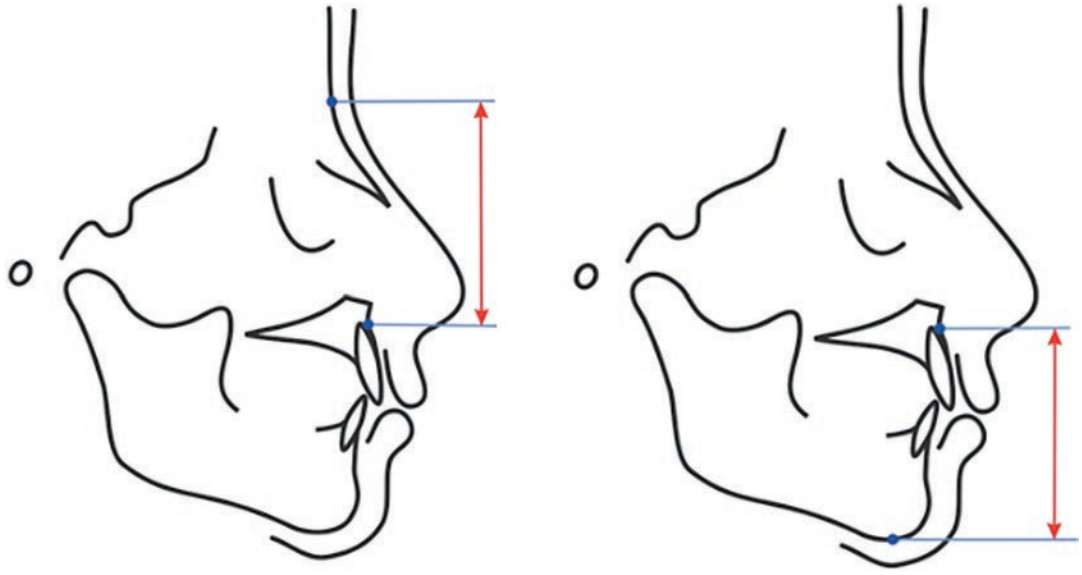

Fig. 29.7 Upper facial height, UFH (nasion to anterior nasal spine (ANS)), the lower facial height, LFH (ANS to menton) allows for comparing the ratio of UFH to LFH

for measurement of the symphysial height (mandible incisor tip to menton) (Fig. 29.8).

The above measurements are then compared to the normal range, as a picture of the abnormal dento-facial deformity emerges. For example, one can then decipher whether a class III abnormality is due to a maxillary deficiency or a mandibular excess.

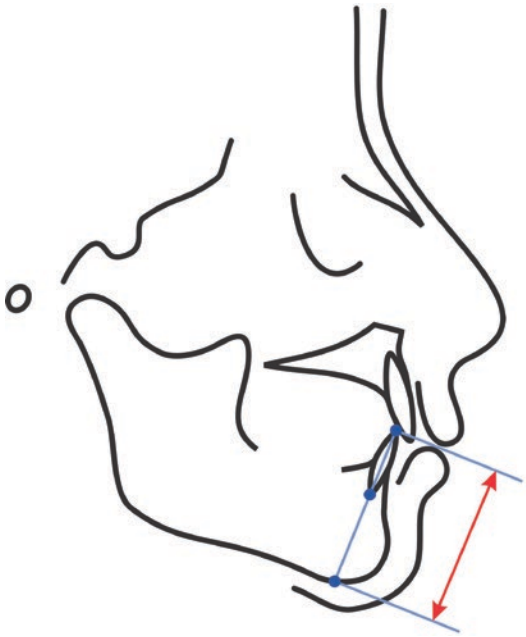

Fig. 29.8 Symphysial height (mandible incisor tip to menton)

Virtual Surgical Preoperative Planning

One of the most progressive areas of advancement in regard to orthognathic surgery has been the addition of virtual surgical planning. Using computer-aided design/computer-aided manufacturing (CAD/CAM) to formulate proposed osteotomies and bony movements, as well as to fabricate splints, has proven to save time and provide a less costly alternative to standard planning techniques [1, 2]. Additionally, differences in three-dimensional measurements between virtual surgical planning and postoperative results have been shown to have minimal significant deviation, proving that virtual surgical planning and CAD/CAM-fabricated splints produce accurate and reliable surgical outcomes [3–6]. The growing popularity of virtual surgical planning does shift the task of preoperative planning from the hands of the clinicians to the computer technicians, presenting an interesting paradigm shift. However, given the decrease in time for preoperative splint planning, fabrication time, and proven accuracy, virtual surgical planning has proven very useful in treating these patients [7] (Figs. 29.9, and 29.10).

Virtual surgical planning will take on an even greater role as the soft tissue predictions become more reliable. One can imagine planning to an ideal aesthetic soft tissue profile and then work-

Fig. 29.9 Preoperative images of Class III malocclusion secondary to mandibular excess

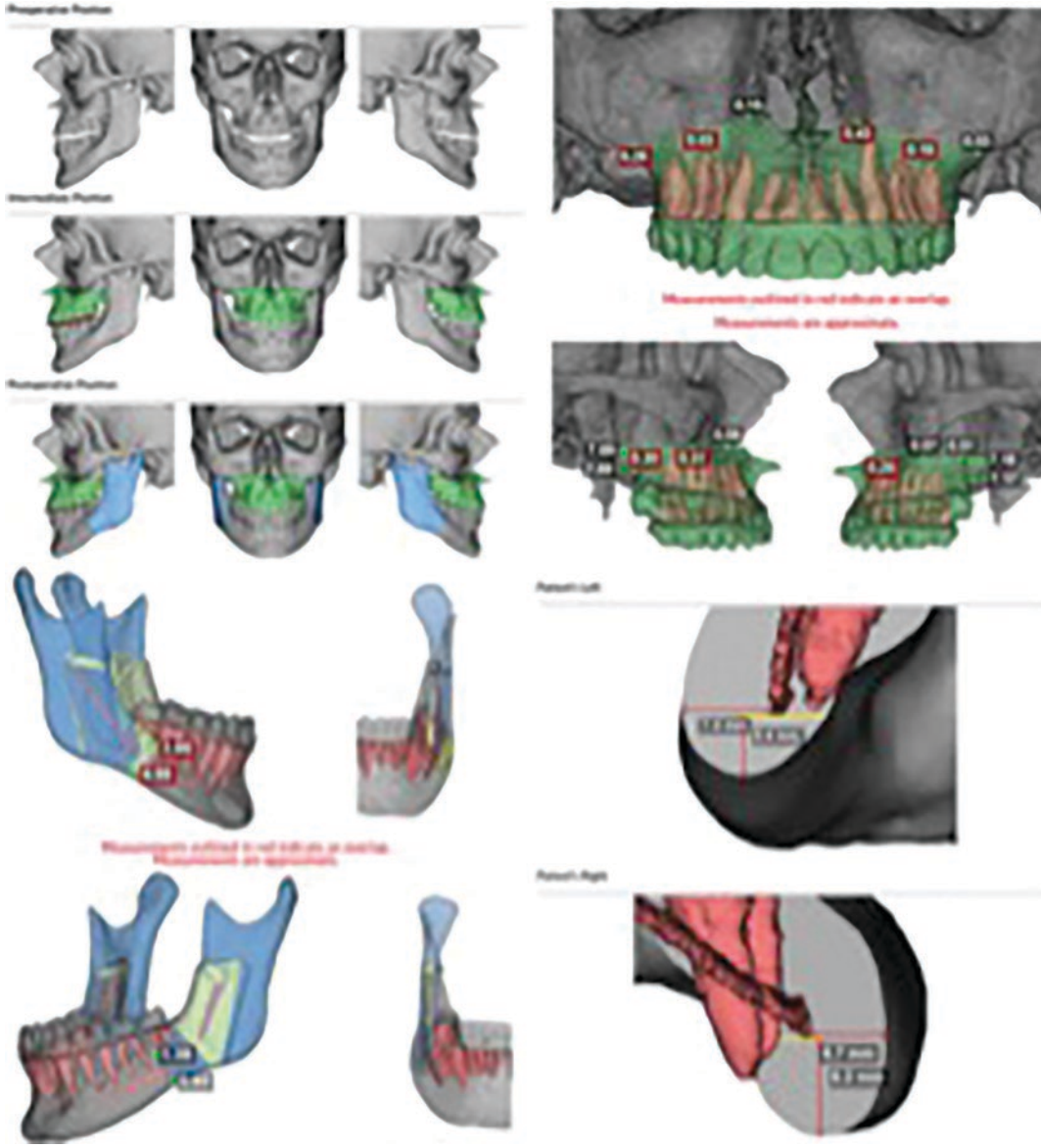

Fig. 29.10 CAD/CAM 3D imaging allows for planned osteotomies and movement. Note mapping of the tooth roots and course of inferior alveolar nerve to avoid injury

ing backwards to see what needs to be altered in the skeletal framework in order to achieve that profile.

Sequence and Timing

Appropriate timing of orthognathic surgery relies on accurate determination of skeletal maturity in the patient. Radiographic evaluation of the distal radius is a well-established method of determining skeletal maturity [8]. However, this requires additional imaging for this purpose. Alternatively, skeletal maturity and peak in mandibular growth can be detected based on the analysis of the second, third, and fourth cervical vertebrae visible in cephalogram typically obtained for preoperative planning [9]. This has been proven to be a reliable method for determining skeletal maturity, and does not require additional imaging for the patient [10].

Patients may undergo orthognathic surgical treatment either prior to their orthodontics or following orthodontic correction [11]. In majority of cases, it is preferred to correct any dental compensations prior to orthognathic surgery. However, teeth are more mobile after surgery, and therefore performing some postoperative orthodontic corrections is becoming more common. Timing of third molar extraction is also a consideration when planning surgery. Extraction prior to surgery should be performed to allow several months of bone healing. Concurrent extraction of third molars can be performed at the time of bilateral sagittal split osteotomy without any increased rate of complications [12].

Some controversy exists in regard to doing the maxilla or mandible first. Sequencing is based on preoperative planning and model surgery with creation of an intermediate splint. If only one jaw is being repositioned, a final splint can be fabricated to establish occlusion. In the case of both maxillary and mandibular repositioning, an intermediate splint is used and can be fashioned to allow for movement of the maxilla or the mandible first, depending on surgeon preference. Many surgeons perform the mandibular corticotomies first followed by the Le Fort I osteotomies and repositioning, before returning to convert the mandibular corticotomies to osteotomies and repositioning the mandible. This allows for easy exposure to visualize the mandible to perform the corticotomies without concern for altering the position of a previously plated maxilla during exposure. Returning to complete the osteotomies requires less wide mouth opening for exposure and less likelihood of unintentional malposition of the maxilla [13]. However, given the added time and lack of issues with malposition of the maxilla with mandibular exposure, the author prefers to complete the Le Fort I osteotomy and maxilla repositioning followed by the mandibular osteotomies and repositioning.

Soft Tissue Consideration

While the goal of orthognathic surgery is a harmony between stable occlusion and aesthetics, ultimately, aesthetics should not be sacrificed for occlusion [14]. However, understanding the expected affect that modifications to the bony skeleton will have on the soft tissue is vital. In the case of maxillary advancement, the nasal tip has been shown to advance 30% and the upper lip is expected to shorten 10–20%. With mandibular setback, the soft tissue of the chin is expected to move 90–100% of the setback, the lower lip moves only slightly, and an increase in neck fullness is expected. The accuracy of CAD/CAM soft tissue predictions in response to bony movements is improving, but it cannot be considered reliable in all cases [15].

Normative data for all orthognathic soft measurements is largely based on North American Caucasians and do not reflect ideal bony and soft tissue ideals of most population groups. Evaluating a patient's soft tissue profile and aesthetic goals should be the starting point for orthognathic surgical planning. Ultimately, we should be able to reliably predict an "ideal" soft tissue profile and work backwards to see what bony movement is needed to achieve this aesthetic goal.

Le Fort I Osteotomy

Tips

- Ensure that the occlusal splits fit before surgery.
- Ensure you have an adequate cuff of soft tissue above the teeth. This makes closure easier and improves perfusion of the maxilla.
- Make sure the pterygomaxillary disjunction osteotome is positioned just behind the maxillary tuberosity and not too high.
- Do not use any force greater that your thumb pressure to complete the osteotomy. Use Smith spreaders gently along the osteotomy lines to identify where the osteotomy needs to be completed. This is often posteriorly. Use the disjunction osteotome to protect the maxillary artery as you complete the osteotomy either with a fine osteotome

or a piezo saw, which is what the author prefers.
- Remember to trim the caudal septum and even the inferior turbinates, if needed, when performing a maxillary impaction.
- Always place an alar base cinch suture before closing the soft tissue.

Le Fort I osteotomy, performed either as a single piece or with segmental osteotomies, allows for a variety of adjustments to be made to the maxilla. In the anterior-posterior direction, the maxilla can be advanced as a single piece or in multiple pieces, depending on other needed adjustments. In order to set back the maxilla, segmental osteotomy is usually necessary. The height of the mid-face can be increased by down-grafting the maxilla [16], or decreased with intrusion of the maxillary segment. Width can also be adjusted with the use of segmental osteotomy to increase the width, and tooth extraction is often necessary to achieve a decrease in width. Additionally, the position of the upper lip, nasal tip, columella labial angle, and alar base can be altered with a Le Fort I osteotomy.

In the operating room the patient is placed in a supine position on the operating table. General anesthesia is induced and a nasotracheal tube is placed to secure the airway. The tube is sutured through the caudal nasal cartilaginous septum using a silk suture to ensure placement of the tube does not become disrupted during surgery. The tube is then taped to the forehead and operating table using flexible foam tape with foam padding to protect the skin of the forehead. Care must be taken to avoid pressure injury to the nasal ala (Fig. 29.11).

Measurements are then made to determine the vertical distance from the medial canthus to the maxillary arch wire on the central incisors, lateral incisors, and canines bilaterally. These measurements are referenced later when evaluating the vertical position of the maxilla.

Local anesthetic in the form of 1% lidocaine with epinephrine 1:100,000 is then infiltrated into the surgical area. The patient is then prepped and draped to include the forehead superiorly and clavicle inferiorly.

Fig. 29.11 Le Fort I: Nasotracheal intubation with airway secured through the cartilaginous septum and the scalp to avoid distortion or pressure on the nasal ala

Careful placement of the intra-oral upper buccal sulcus incision is vital to allow both adequate exposure and ease of closure. A cuff of detached mucosa at least 5 mm in length should be left when designing the incision. Special consideration in bilateral cleft patients is needed to protect the blood supply to the gingiva in the midline, and therefore the mucosa in the midline is left intact, effectively making two separate incisions lateral to the midline.

Dissection is then carried down to the periosteum with electrocautery. Adequate exposure of the maxilla can be achieved using a periosteal elevator, taking care to identify and avoid injury to the infraorbital nerve. A curved elevator allows for elevation of the nasal mucosa from the pyriform aperture and anterior nasal spine (Fig. 29.12).

The osteotomy is then designed by first marking with pencil the horizontal cut starting from the pyriform aperture and extending posteriorly above the teeth roots, posteriorly to the pterygomaxillary junction, and laterally just inferior to the infraorbital nerve. Where a maxillary advancement and simultaneous downgraft is planned, the horizontal osteotomy can be angled superiorly passing just under the infraorbital nerve. A vertical component then carries the osteotomy inferiorly before the posterior horizontal osteotomy is completed above the roots of the

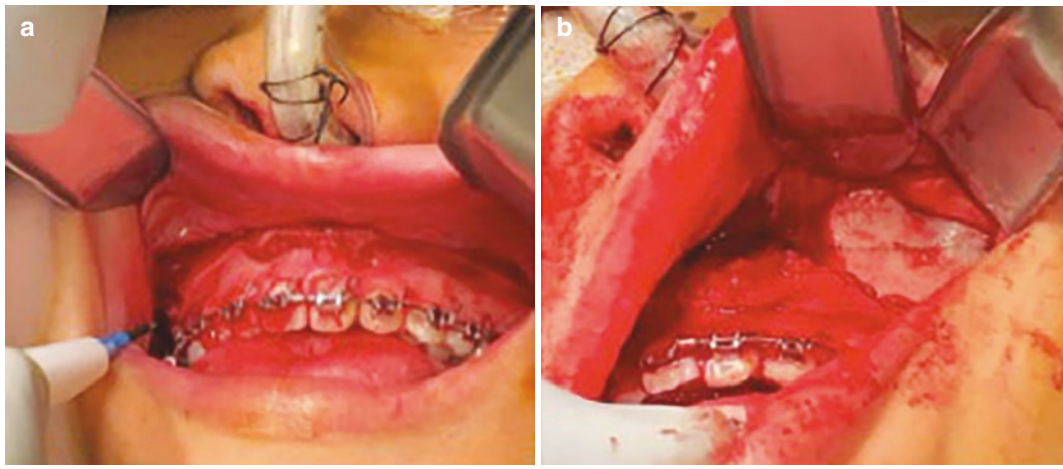

Fig. 29.12 Le Fort I. (**a**) The incisions is made above the attached gingiva, leaving a cuff of at least 5 mm of unattached gingiva for closure. (**b**) Subperiosteal dissection is completed to expose and protect the infraorbital nerve

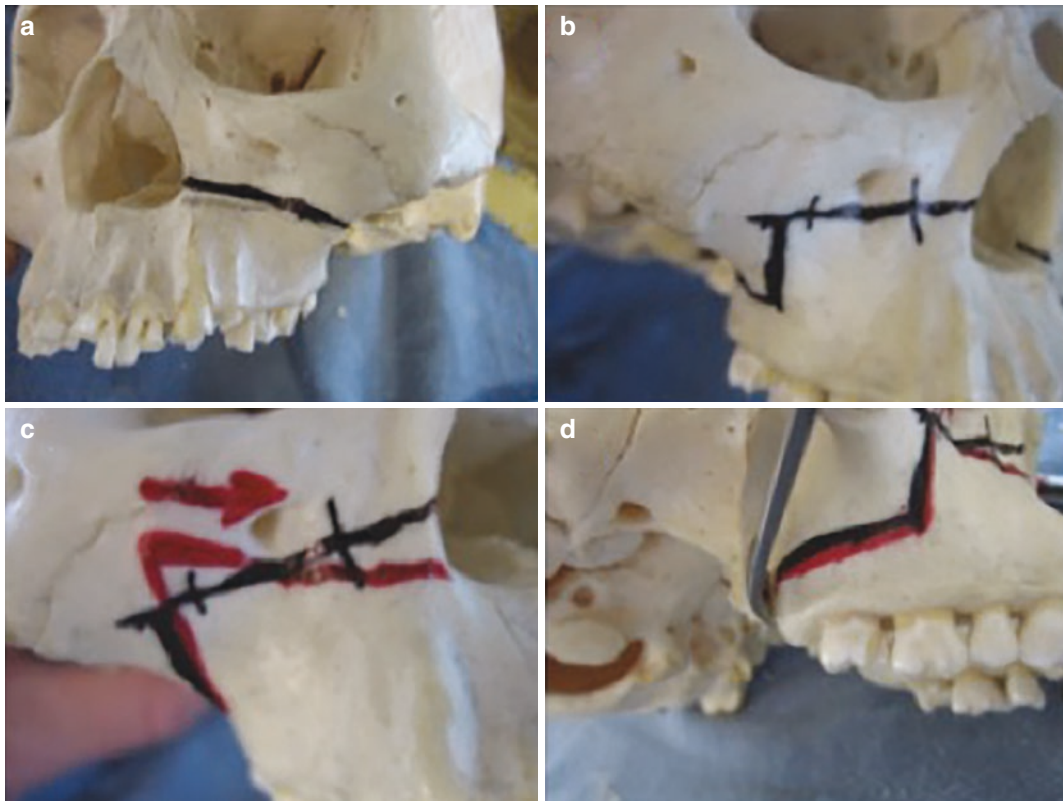

Fig. 29.13 Le Fort I. (**a**, **b**) Design of the osteotomy taking into account the tooth roots and infraorbital nerve. (**c**, **d**) Modification of the horizontal osteotomy angled to allow for advancement and down grafting of the maxilla without bone graft

posterior molars. This allows for advancement and down grafting of the maxilla without requiring bone graft to achieve bony contact after movement (Fig. 29.13).

Traditionally, osteotomies are performed using an oscillating saw. However, the author prefers using a piezoelectric saw which seems to be more precise, causes less severe nerve damage, and has less postoperative swelling and discomfort [17–20].

A curved osteotome is used to complete the osteotomy in the pterygomaxillary recess, separating the pterygoid plate from the maxillary tuberosity. Care must be taken to protect the area behind the maxillary tuberosity when completing the osteotomies to prevent damage to the maxillary artery and venous plexus in the area (Fig. 29.14). Palpating with a finger behind the maxillary tuberosity allows for confirmation of separation and control while performing the pterygomaxillary disjunction. A guarded osteotome is used to separate the septum and vomer from the maxilla. Straight osteotomes or a piezo saw are also used to complete osteotomies along the lateral nasal wall bilaterally (Fig. 29.15). Down fracture is completed with digital pressure only in a controlled manner, with minimal force applied to the base of the pyriform aperture. Maxillary disimpaction forceps are used for soft tissue mobilization only, and not for down fracture, to avoid skull base injury or unfavorable fractures. In the setting of intrusions, the septum and turbinates are trimmed to avoid buckling of the septum and deviation of the nose.

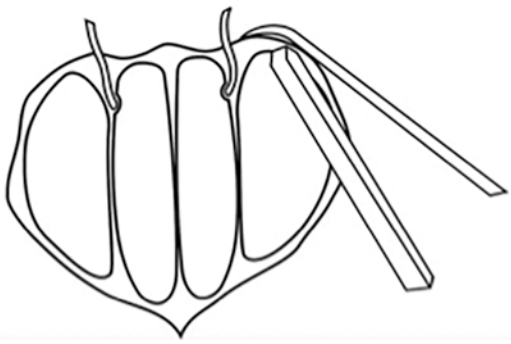

Fig. 29.14 Le Fort I. Curved osteotome used to complete the osteotomy in the pterygomaxillary recess, separating the pterygoid plate from the maxillary tuberosity while protecting blood supply

Once the maxilla is freely mobile and soft tissue has been adequately freed to allow for movement, the position of the maxilla is then adjusted according to preoperatively planned movements. At this point, interdental and palatal osteotomies can be performed if a multi-segmented adjustment is indicated.

The new occlusion is established using the prefabricated splint, which is held in place using elastic bands between the upper and lower surgical hooks. Once occlusion is confirmed in the splint, the maxillary–mandibular complex is adjusted as a unit. The complex rotates on an arc determined by the rotation the condyles in the glenoid fossa. The vertical measurements from the medial canthus to the maxillary arch wires obtained at the start of the operation are used to confirm the desired vertical height. This is crucial to achieving the ideal relationship or show of the upper incisors to the upper lip. The maxilla is then plated in the desired position using the appropriate plates to achieve stability (Fig. 29.16). Following plating, the maxillary-mandibular fixation is removed, and occlusion is verified by assuring that the condyle is in the fossa and that the mandibular teeth swing easily into the splint. If this is not the case, the plates should be removed and adjusted until the planned occlusion is achieved.

In the case of maxillary advancements and impactions, the base of the nasal ala widens, and an alar base cinch suture is placed to prevent this. The soft tissue is then closed with a running absorbable suture. A mucosal V-Y advancement of the upper lip in the midline will ensure adequate lip length.

Necrosis of the bony segment is a rare complication, but is most commonly seen in the central maxillary bony segment in patients with bilateral cleft lip and palate [21, 22]. Taking care to leave midline mucosa intact when performing the upper buccal sulcus incision is important in order to best preserve the blood supply to the central maxillary bony segment. In addition to the alar cinch suture, it is important to trim the inferior septum when impacting the maxilla. Failure to do so will distort the septum and nasal tip [23].

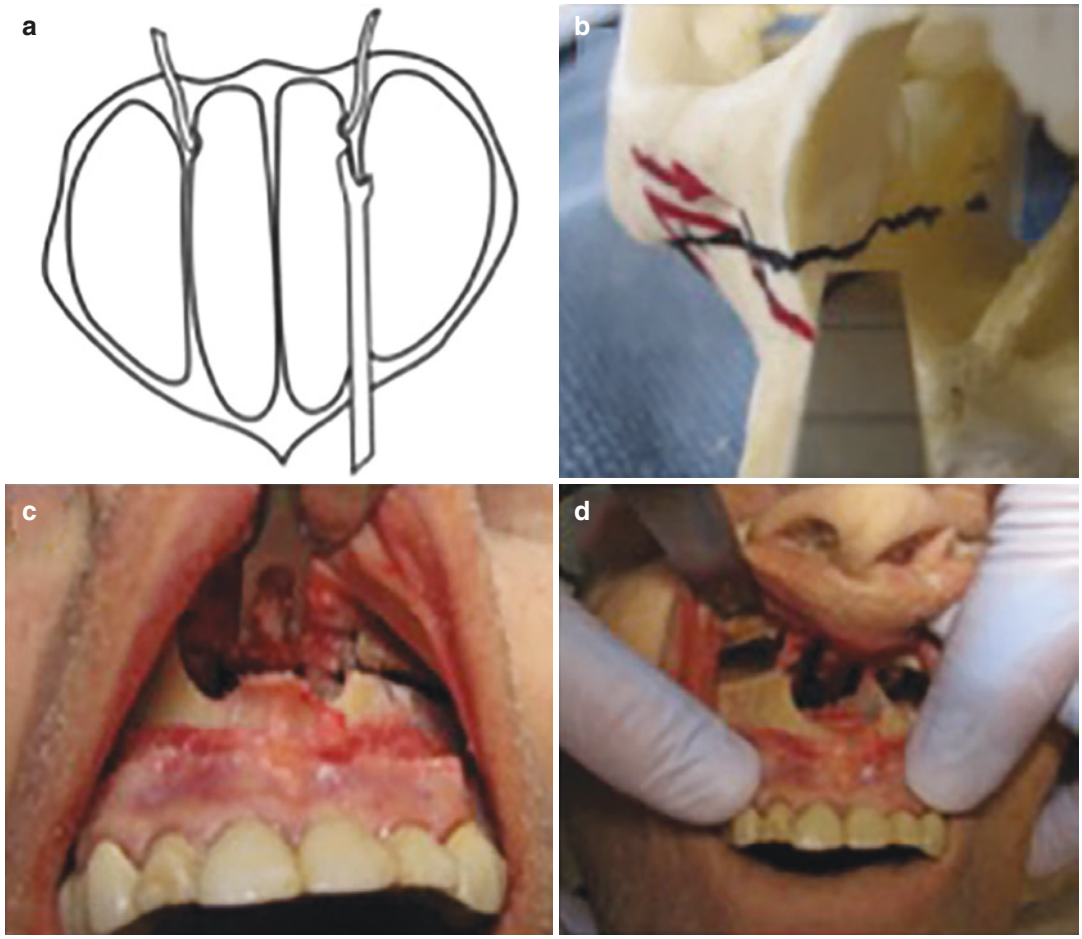

Fig. 29.15 Le Fort I. (**a**, **b**). Straight, guarded osteotome used to complete osteotomies along the lateral nasal wall bilaterally. (**c**) Guarded osteotome for separation of septum. (**d**) Down fracture with digital pressure only

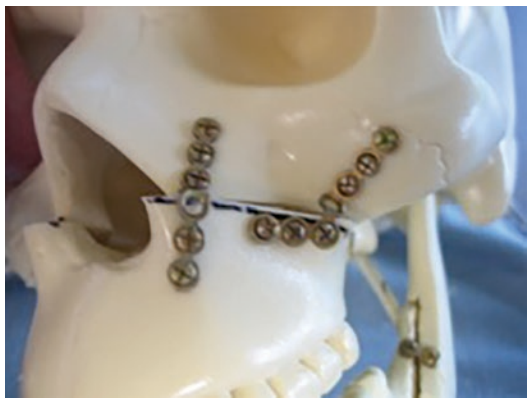

Fig. 29.16 Le Fort I: Plating of the maxilla along the nasomaxillary and zygomaticomaxillary buttress

Sagittal Split Ramus Osteotomy

Tips

- Placing the mucosal incision a little farther medially than conventional wisdom suggests makes the medal dissection easier.
- Make sure you are above the lingula by visualizing the inferior alveolar nerve before performing the medial osteotomy.
- Carry the medial corticotomy posteriorly to the depression posterior to the lingula.

- Make sure your osteotomies have gone through the full thickness of the cortex.
- Ensure that you have completed the osteotomy through the full thickness of the lower border of the mandible anteriorly. Use a channel retractor to protect the soft tissue when doing this.
- Place a large fiber handle osteotome in osteotomy cut along the external oblique ridge and give it one or two sharp blows with a mallet to commence the split. This is a very effective maneuver when all the initial osteotomies have been completed.
- Check that the inferior alveolar nerve is in the distal segment as you complete the split. It may be necessary to dissect the nerve free from the lateral wall of the proximal segment of the mandible with an osteotome to achieve this.
- Make sure the condyle is seated in the glenoid. Tell you assistant to "push the chin toward the occiput" while the rigid fixation is secured.
- Check the occlusion after fixation by removing the elastic bands. If the teeth do not fit into the splint with minimal pressure, remove fixation to correct the position.
- Pre-op planning and communication with your orthodontist is key.
- Additional changes to the nasal morphology can be observed in the case of inadequate reduction of the nasal septum, resulting in nasal deviation. Once again, care must be taken to reduce the septum in the setting of maxillary impaction to prevent deviation.

Sagittal split ramus osteotomy (SSRO) of the mandible allows for adjustments in the anterior-posterior dimension, including advancement and set-back of the mandible. The height and width cannot be adjusted as they can with a Le Fort I osteotomy. However, asymmetries affecting the occlusal cant can be adjusted to level the occlusal plane.

Local anesthetic in the form of 1% lidocaine with epinephrine 1:100,000 is infiltrated into the surgical field. The incision is made along the mandibular ramus from the level of the lingual, passing laterally along the extern al oblique ridge to the level of the first molar. The author makes the ramus incision more medial than is commonly described. It makes the medial dissection above the lingula easier and allows for better visualization of the inferior alveolar nerve. An adequate cuff of tissue must be left along the gingiva for closure. Dissection in a subperiosteal plane exposes the anterior ramus and lateral boarder of the mandible. Dissection of the ramus requires elevating the lower fibrous attachment of the temporalis upward toward the coronoid. The medial dissection in a subperiosteal plane is performed above the level of the occlusion. The lingula should be identified, and the inferior alveolar nerve must be visualized as in enters the foramen above the lingula (Fig. 29.17).

The horizontal osteotomy along the medial border of the ramus is made first above and posterior to the mandibular foramen. The nerve is visualized, and location confirmed prior to making the medial osteotomy. Piezo saw or Linderman burr is used to make this horizontal osteotomy through the cortex, approximately half the thickness of the bone. It is important to carry this osteotomy into depression behind the lingula. It is not necessary to carry the osteotomy all the way to the posterior edge of the ramus (Fig. 29.18).

The osteotomy then continues just medial to the external oblique ridge of the mandible downward and forward to the level of the first molar (Fig. 29.19). The lateral osteotomy is made vertically from the upper osteotomy down to the inferior border of the mandible through the cortical bone. The osteotomy must then be completed across the full thickness of the inferior border of the mandible to ensure a successful split of the mandible (Fig. 29.20). The author uses a piezo saw for all of these osteotomies. The split of the mandible is completed using osteotomes angled toward the lateral cortex to protect the nerve. The

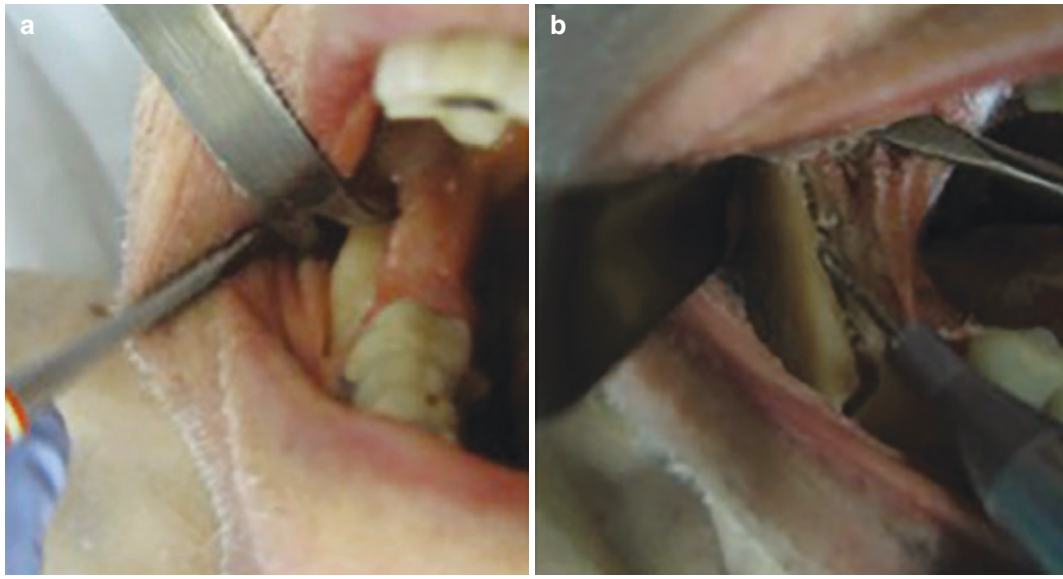

Fig. 29.17 Bilateral sagittal split osteotomy of the mandible. (**a**) Incision lateral to the attached gingiva. Exposure in the subperiosteal plane. (**b**) Osteotomy performed along the oblique ridge

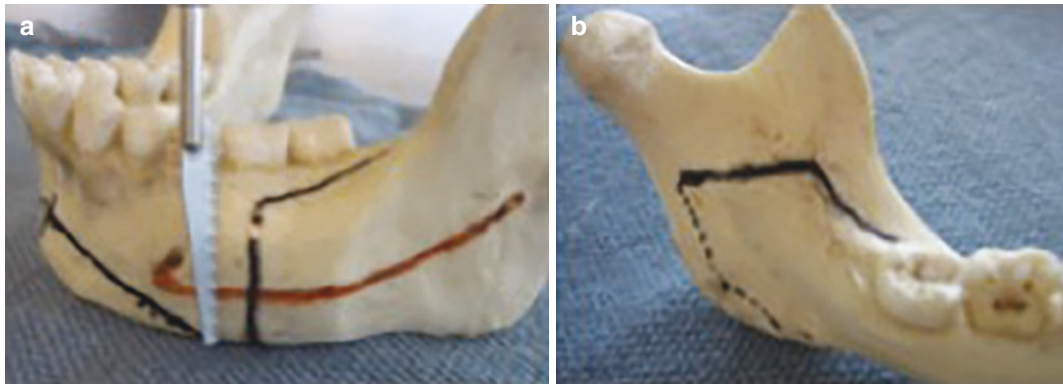

Fig. 29.18 Bilateral sagittal split osteotomy of the mandible. (**a**) Design of the osteotomy taking into account the location of the inferior alveolar nerve. (**b**) Horizontal osteotomy along medial ramus

nerve is visualized after the split, and care is taken to leave the nerve within the medial segment (Fig. 29.21). Some degree of decreased sensation in the lower lip is almost inevitable in these cases; visualizing and protecting the nerve minimizes the damage [24].

When the mandible is being set back, the medial pterygoid muscle and stylomandibular ligament must be released from their medial attachments. The correct occlusion and appropriate bony position is aided by placing the teeth in the prefabricated splint and placing elastic bands between the surgical hooks on the mandibular and maxillary orthodontic wires. Bony fixation is achieved with bicortical screws through transbuccal trocar access, or with lateral buccal plates and monocortical screws. The condyles must be seated during fixation. To ensure this, the elastic bands are removed and the occlusion checked before the elastic bands are replaced. If the occlusion is not correct, the rigid fixation is removed, and the process is repeated (Figs. 29.22, and 29.23).

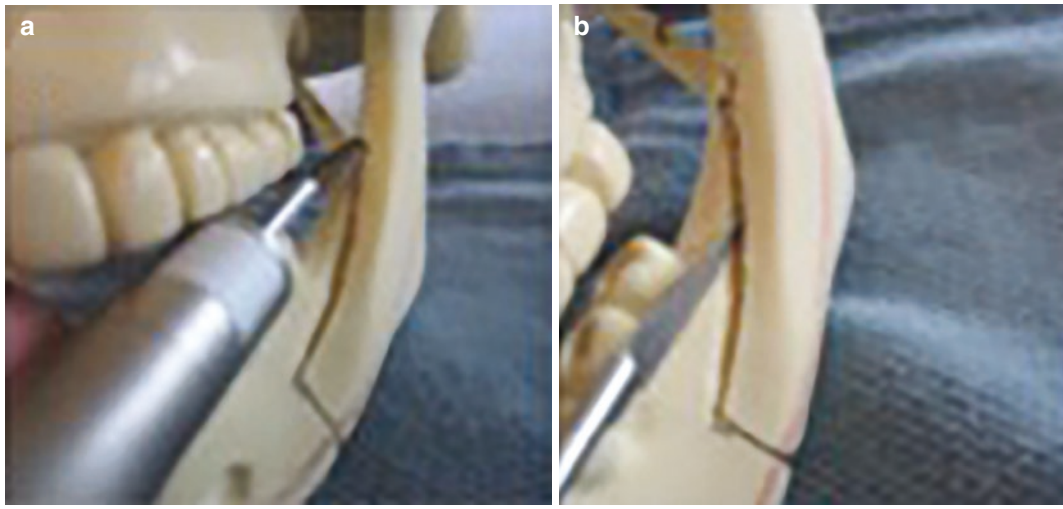

Fig. 29.19 Bilateral sagittal split osteotomy of the mandible. (**a**, **b**) Oscillating saw used to complete osteotomy allow oblique ridge

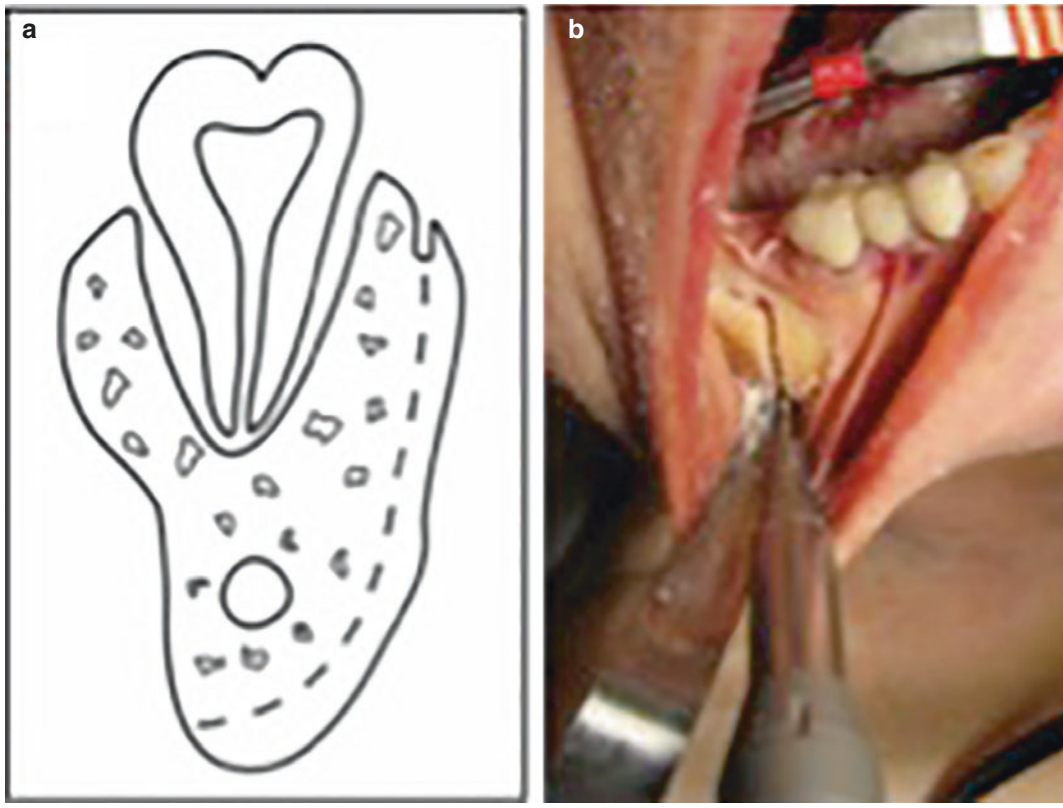

Fig. 29.20 Bilateral sagittal split osteotomy of the mandible. (**a**) Angle of osteotomy through cancellous bone to protect nerve. (**b**) Completion of vertical osteotomy along inferior border of mandible

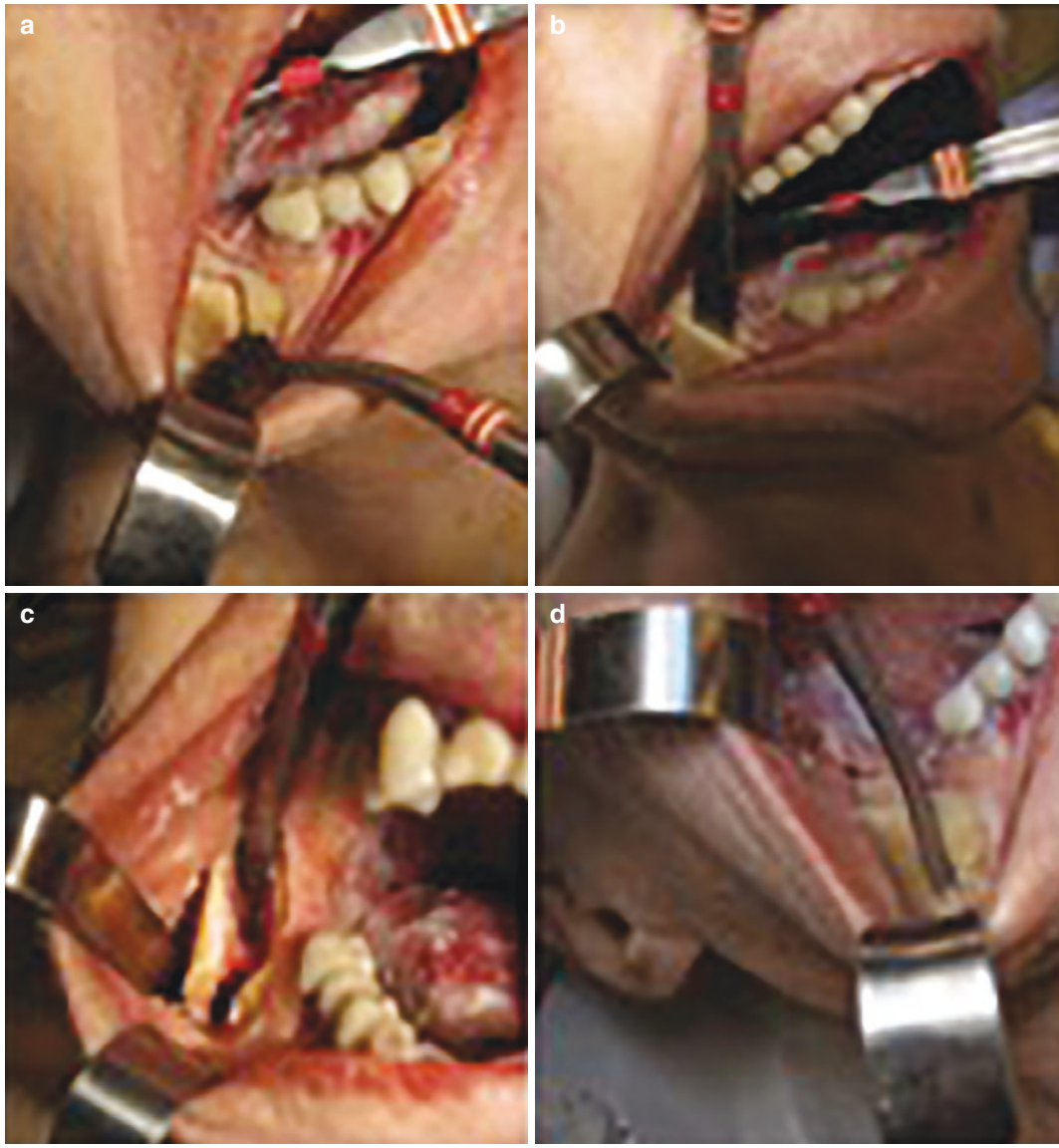

Fig. 29.21 Bilateral sagittal split osteotomy of the mandible. (**a**, **d**) Completion of osteotomy along inferior border with straight osteotome. (**b**) Straight osteotome used to complete osteotomy along body of mandible. (**c**) Visualization of the nerve during split

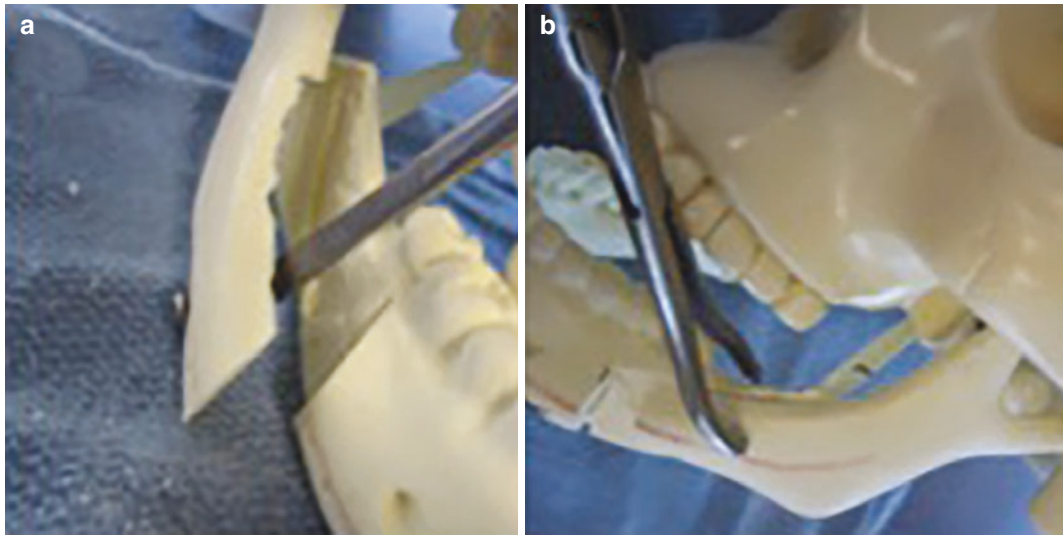

Fig. 29.22 Bilateral sagittal split osteotomy of the mandible. (**a**) Confirm mobility of proximal and distal segments of the split. (**b**) Secure movement for fixation

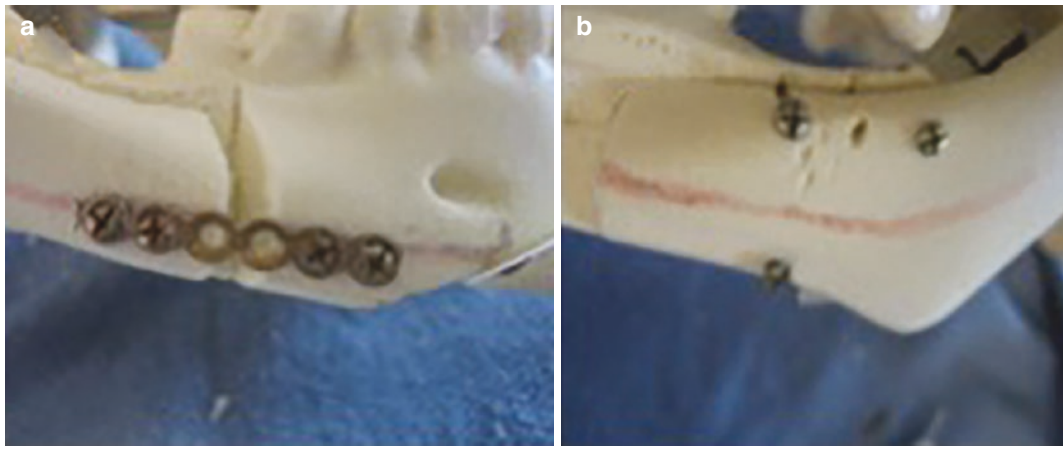

Fig. 29.23 Bilateral sagittal split osteotomy of the mandible. (**a**) Fixation of mandible with plates and monocortical screws. (**b**) Fixation with bicortical screws

Genioplasty

Tips

- Leave an adequate cuff of mucosa and muscle for closure.
- Do not "over-dissect" soft tissue and muscle over the chin.
- Visualize the mental nerve and protect it. Remember the nerve lies up to 5 mm below the mental foramen.
- Ensure your osteotomy line is below the tooth roots.
- Minimize a visual "step-off" on the inferior border of the mandible by carrying the osteotomy further posteriorly.

Evaluation of the chin position is important when considering overall facial appearance and harmony. Deformities of the chin can exist separately from deformities of the mandible. Genioplasty can be performed to address a need for advancement or setback in the anterior/posterior plane in addition to adjusting the height or width of the chin as needed. Asymmetries of the chin can also be addressed when performing a genioplasty by adjusting for sagittal or horizontal deformities.

An intra-oral incision in the buccal sulcus is made, leaving a generous cuff of mucosa and mentalis muscle to facilitate closure. A subperiosteal dissection allows sufficient exposure of the proposed osteotomy. An effort should be made to avoid over-dissecting the soft tissue and muscle over the chin, in order to prevent soft tissue descent and a "witches chin" deformity. The mental nerve should be visualized and protected before performing the osteotomy.

The osteotomy is then designed, taking into consideration the tooth roots with the canine length measuring 30 mm, as well as the course of the mental nerve as it travels inferior and distal to the foramen prior to exiting the bone (Fig. 29.24). The midline of the chin is then marked using a saw. The osteotomy is then performed using a piezo, an oscillating, or a sagittal saw.

Fixation of the bony segment can be achieved with prefabricated plates or using tricortical screws. Again, care must be taken to avoid damage to tooth roots when placing screws for fixation. The mentalis muscle should be re-approximated as a separate layer to avoid soft tissue ptosis, and the mucosal incision is then closed as a separate layer (Fig. 29.25).

Clinical Cases

Case 1

A 20-year-old male with a history of a bilateral cleft lip and palate underwent an 8 mm advancement and 4 mm downgraft to achieve this result (Figs. 29.26 and 29.27) with a stable class I occlusion.

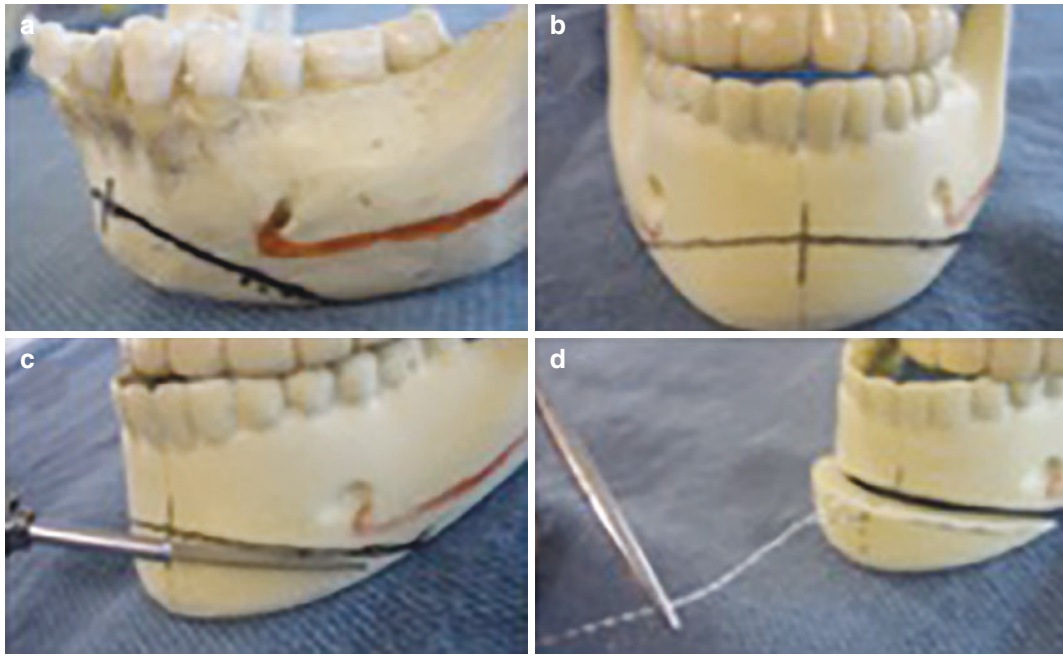

Fig. 29.24 Genioplasty. (**a**) Design of osteotomy taking into account the course of the mental nerve. (**b**) Osteotomy design, midline marked. (**c**) Oscillating saw used for osteotomy. (**d**) Wire placed following completion of osteotomy to assist with manipulation and fixation

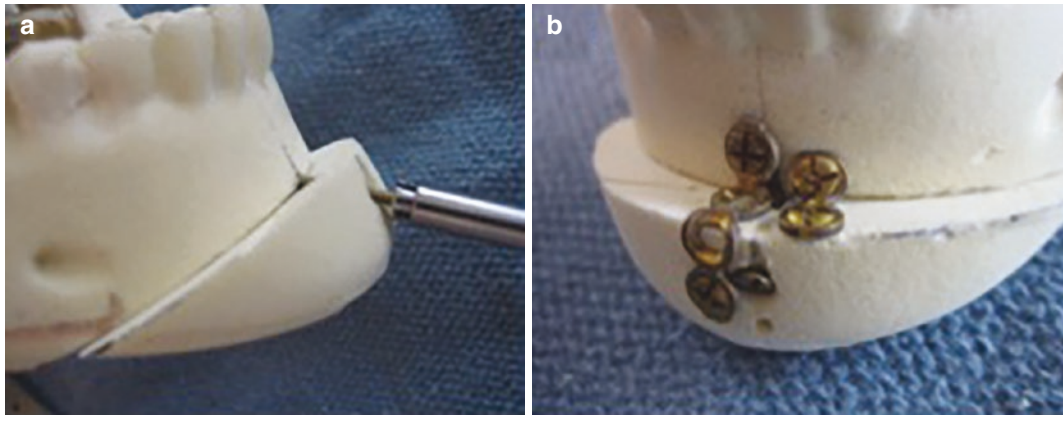

Fig. 29.25 Genioplasty. (**a**) Fixation after advancement with screw. (**b**) Fixation with customized bent plate

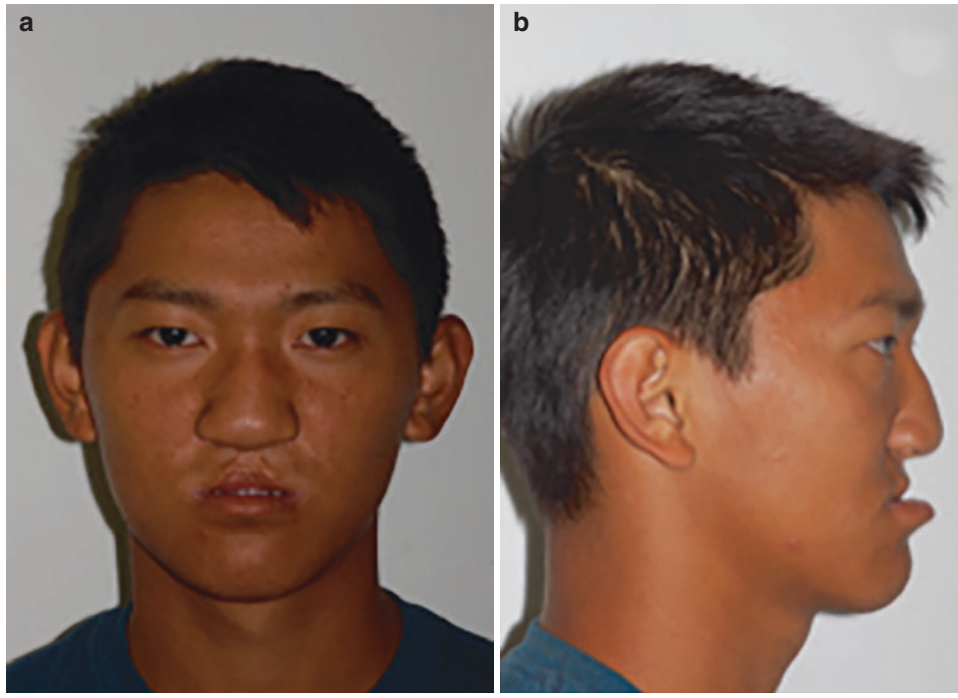

Fig. 29.26 Clinical case 1. (**a**, **b**) Patient with history of bilateral cleft lip and palate with Class III malocclusion and maxillary hypoplasia preoperatively. (C, D) Postoperative photos show status post Le Fort I osteotomy and maxillary advancement

Fig. 29.26 (continued)

Fig. 29.27 (**a**, **b**) Same patient as Fig. 29.26 with history of bilateral cleft lip and palate with Class III malocclusion and maxillary hypoplasia pre-operatively. (**c**, **d**) Postoperative Class I occlusion status post Le Fort I osteotomy and maxillary advancement

Case 2

A 21-year-old male with a severe Class III dentofacial deformity due to a combination of maxillary deficiency and mandibular excess (Fig. 29.28). The surgical plan included a 10 mm Le Fort I advancement with a 4 mm downgraft and a 2.5 mm mandibular setback with a BSSO. Planning to get the maximal movement

Fig. 29.28 Clinical case 2. (**a**, **b**) Patient with Class III malocclusion related to a combination of maxillary deficiency and mandibular excess, preoperative photos. (**c**, **d**) Postoperative photos following a Le Fort I osteotomy and maxillary advancement and bilateral sagittal split osteotomy with mandibular setback

with the maxilla gives a good aesthetic outcome by advancing the midfacial and paranasal soft tissue. The downgraft lengthens the foreshortened midface, and by autorotating the mandible, decreases prognathism. The extent of the mandibular setback is also reduced. In this case it only required a 2.5 mm setback.

This case illustrates an important principle. Where possible, you should expand the facial skeleton. Conventional wisdom would have suggested that a greater setback of the mandible with the BSSO would be appropriate. Doing so would have resulted in a fuller submental soft tissue profile, which is undesirable. He would also not have had the same improvement in the midface soft tissue profile.

Case 3

An 18-year-old male with another severe Class III dentofacial deformity due to a combination of maxillary deficiency and mandibular excess in both horizontal and vertical dimensions. The patient had a 9 mm Le Fort I advancement and 3 mm downgraft, together with a 6 mm BSSO setback. He also had a genioplasty with a 2 mm height reduction and 4 mm setback (Figs. 29.29 and 29.30).

Fig. 29.29 Clinical case 3. (**a**, **b**) Patient with history of Class III malocclusion and both maxillary hypoplasia and prognathic mandible, preoperatively. (**c**, **d**) Postoperative photos status post Le Fort I osteotomy and maxillary advancement, bilateral sagittal split osteotomy and mandibular setback, and reduction genioplasty

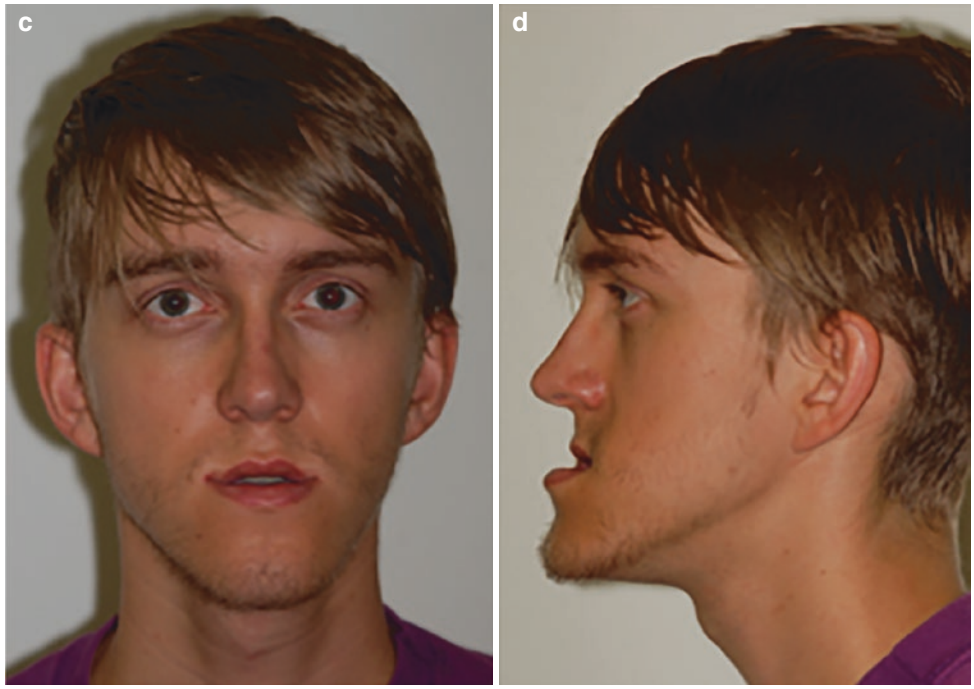

Fig. 29.29 (continued)

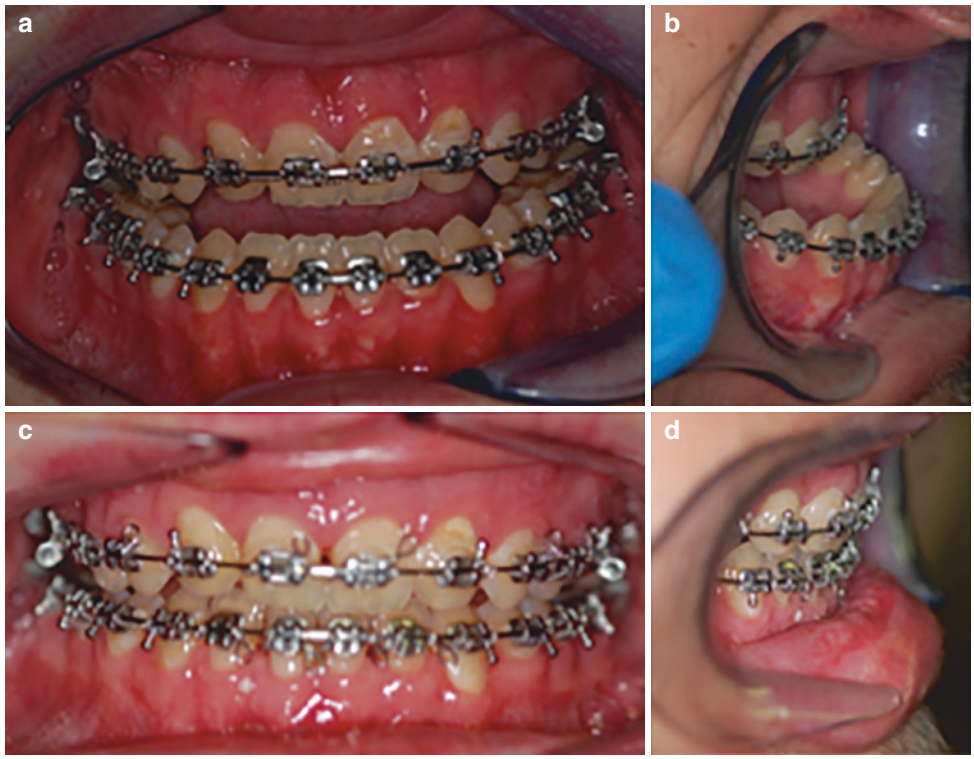

Fig. 29.30 (**a**, **b**) Occlusal views of patient in Fig. 29.29 with history of Class III malocclusion and both maxillary hypoplasia and prognathic mandible, preoperatively. (**c**, **d**) Postoperative photos status post Le Fort I osteotomy and maxillary advancement, bilateral sagittal split osteotomy and mandibular setback, and reduction genioplasty

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