Modified Le Fort III Osteotomy: Different Applications

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Received: 10 May 2016 / Accepted: 24 May 2017 / Published online: 12 June 2017
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Abstract

Summary Based on the new concepts of the modified Le Fort III osteotomy (MLFIII), Three variations of this technique are implemented: (A) the modified osteotomy Le Fort III Champy (1980) technique to be described with the use of surgical guides, and subciliary approach or an *transconjunctival* approach. Excellent technique for horizontal advancement no further to 6 mm, without requiring any type of graft.. (B) The modified Le Fort III osteotomy in “Z”: to solve horizontal (posterior anterior) problems of more than 6 mm without bone grafting. It is itself a modification of the technique described by Champy. (C) The modified Le Fort III osteotomy ascending: modified the original technique described by Bell and Epker with interpositional grafts, was modified by the called ascendant, making it higher in cases where the patient has an acceptable nasal bridge, but exorbitism the lateral wall of the orbit. Le Fort III osteotomy combined with a Le Fort I osteotomy and a front implant.

Method As pointed out in Part I for the modified oblique Le Fort III osteotomy, methods for the design of the osteotomy Le Fort III property will depend on the requirements of individual patients, and this has led us to design specific techniques for the deformity.

Results Patients have a right projection of the middle third, and protection of the eyeball.

Conclusions The techniques presented for the advancement of the middle third have excellent results with the ability to be tailored to each patient deformity.

Keywords Osteotomy · Champy · Ascending · Le Fort III

Introduction

There are so many dentofacial deformities that convey a high degree of difficulty considering the surgical correction. No one is the same, and therefore, the use of different techniques, modifications or creation of new ones is necessary. On other words “customize technique”.

Talking about correction of midface deformities based on the new concepts of the modified Le Fort III osteotomy (MLFIII) [1–3], there are three variations for the technique that can be implemented:

- A. The modified osteotomy Le Fort III Champy (1980) [4] technique to be described with the use of surgical guides, and subciliary approach or an *transconjunctival approach*. Excellent technique for horizontal advancement no further to 6 mm, without requiring any type of bone graft.
- B. The modified Le Fort III osteotomy in “Z”: to solve horizontal (posterior anterior) problems of more than 6 mm without bone grafting.
- C. The ascending modified Le Fort III osteotomy: modification of the original technique described by Bell [5], for cases where the patient has an acceptable nasal bridge, but exorbitism.

Modified Osteotomy Le Fort III Champy

In 1980 Champy talk about intermediary osteotomies by definition are those between Le Fort types I and III. Allowing simultaneous correction of occlusion functions

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and morphologic anomalies of the midface. The deformities are considered from many points of view: sagittal, lateral, or frontal displacement; too large or too small a midface. It is necessary to study the profile, the relative proportion of the cheeks, nasal pyramid and the chin; and the total facial appearance. For Champy technique [4], it will take into account the maxillo-malar hypoplasia, the projection of the occluded upper eyelid and skin hypoplasia discrepancy of the inferior orbital rim, measured with a tangential vertical line to the eyelid. There are patients that the discrepancy of the globe is 2–6 mm, but, without the presence of a vertical maxillary excess (only with maxillo-malar hypoplasia), the technique of choice will be Champy (Fig. 1).

Surgical Technique

All modified Le Fort III osteotomy can be made through three external approaches they are: coronal for the ascending technique, subciliary/*transconjunctival approach* and maxillary vestibular approach [6]. The advantage of transconjunctival incisions is that it can be extended by a lateral canthotomy and is more aesthetic due to lack of a cutaneous scarring.

The procedure is initiated with infiltration of anaesthesia with vasoconstrictor agent in the conjunctiva lower fornix and the area of the lateral canthotomy. The lateral canthotomy is done with a pointed scissor is inserted horizontally into the outer lid angle laterally so that the instrument contacts the underlying bone of the lateral orbital rim (approximately 10 mm). The lateral palpebral fissure is cut horizontally including the skin, the orbicularis oculi muscle and the conjunctiva. Then the transconjunctival incision is performed in a lateromedial direction. The lower eyelid is everted with Desmarres separator and supporting separator orbit or malleable on the inferior orbital rim in order to retract the lower fatty compartment

Modified osteotomy Le Fort III Champy

Fig. 1 Modified osteotomy Le Fort III Champy

Fig. 2 Transconjunctival approach

and delimiting bony structures will have a direct view of the rim and to identify the position of the lower tarsal plate through the conjunctiva. Next, the periorbita is incised parallel but just posterior to the infraorbital rim. Once the infraorbital rim is exposed, the periorbital dissection can be performed in the usual fashion (Fig. 2). The incisions are extended as far medially as necessary. With the dissection towards the infraorbital rim, as soon as the bony surface is exposed to the desired extent, the periosteum or periorbita is incised and dissected over the anterior maxilla or into the orbital cavity in the usual fashion. Only the dissection of the orbital floor will be made, 6–7 mm before the lower orbital fissure and the lateral wall. Zygoma dissection is not performed by this approach neither of the pyramidal portion of the maxilla, to avoid damaging the thin skin of the lower eyelid, preventing possible laceration.

An conventional maxillary vestibular approach incision is made from 1st half upper right molar to left, prior to “v” incision at the maxillary labial frenum. The incision is carried down through the mucosa, submucosa, underlying facial muscles and periosteum onto the bare bony surface. Sharp periosteal elevators are used to strip the soft tissues in the subperiosteal plane. The upper region of the middle third is dissected until the middle extern portion of the zygomatic arch dissection is carried to the orbital rim

Fig. 3 Pterygoid guide

Fig. 4 Osteotomy of the entire base of the zygoma

dissection bonding with the transconjunctival approach respecting the inferior orbital nerve.

The pterygomaxillary fossa dissection must be careful and gentle, with complete subperiosteal dissection and with a sharpened dissector, with 5 or 6 mm in diameter, as well as aiding yourself with soaked gauzes wrapped around the dissector [2].

Finally conventional dissection of the nasal floor like for a Le Fort I, first release the periosteum of the lower internal wall of the maxilla and then anterior portion of the pyriform, only from this point enter with the dissector parallel to the septum, in contact with the nasal floor, making lever with the instrument, to make posterior dissection of periosteum of the nasal floor; this it's recommend to release the nasal mucosa and periosteum, without causing tears.

The osteotomy will be divided into two events, the intraoral and extraoral (floor of orbit and zygoma).

Intraoral Osteotomy

It starts to separate the pterygoid process. To achieve the osteotomy of the fossa, first, a curved Tessier osteotome is used to separate the pterygoids from the maxilla. Then the cut is made on the most visible part of the tuberosity using an oscillating 12 mm saw, angled at 105° up to the hidden face of the pterygomaxillary buttress. After this event, the pterygoid guide is placed (Fig. 3), and then a 7 mm saw at 105° is placed instead, avoiding damage to the soft tissues, and the osteotomy is performed behind the buttress ending a few millimetres from the inferior orbital fissure (3–5 mm). The guide is removed, and gauze packed with hydrogen peroxide is produced as equally osteotomy of the contralateral side.

Prior tomography and stereolithography analysis the distance of the lateral wall is measured, proceed with osteotomy of the lateral wall of the nasal fossa, from the posterior palatine foramen to the pyriform, the osteotomy is made with ultrasonic bone cutting system preferably

Fig. 5 Short reciprocating saw with inclination to 45°

Fig. 6 Osteotomy from the pyramidal process

“Q” tip, in which is remove the stem protector and introduced to the measure taken previously, osteotomy will end 5 mm before reaching the pyriform (not take

Fig. 7 Pre-post pictures, in tomography you can see de osteointegration of the cut

Fig. 8 “Z” osteotomy and guide

osteotomy up the pyriform). The same will be made at the contralateral side. Finally septum osteotomy is done just as in the Le Fort type I.

Extraoral Osteotomy

Proceed to work on the orbital floor, through the transconjunctival approach, and place the orbitozygomatic guide for the osteotomy, anterior osteotomy comes down from the pyramidal process of the maxilla to pyriform. The osteotomy of the orbital floor is made with the “Q” tip, going slightly without any pressure at the infraorbital canal. All the parts come together, fighting the infraorbital canal; osteotomy is directed towards the medial orbital rim 6 mm before lacrimal sac, and the guide descends towards the pyriform obliquely.

The lateral wall of floor will deepen by more than 1 cm, so it has to be perfectly released.

The osteotomy of the entire base of the zygoma (horizontal cut) (Fig. 4) is performed with 45° inclination with a short reciprocating saw and perpendicular to the guide (Fig. 5), in its widest dimension, shall protect the anterior temporal muscle; this osteotomy reach the side of orbit completing cut and attaching it to the horizontal osteotomy to form an angle of 90°.

The last step will be the descending osteotomy from the pyramidal process and will join the osteotomy of the lateral wall of the nasal floor (Fig. 6).

Craniofacial Disjunction

Palatine protector and Rowe forceps are placed. Using the assistant, head of the patient will remain securely fastened.

The movement will start with a slight cephalic traction (above), a force exerted greater than that required for a standard osteotomy Le Fort I is necessary, then caudal traction (below) for fracture, observing the osteotomy of both zygomas moves simultaneously; pendulum movements (cephalo-caudal) is perform until the operator feels

that the entire middle third moves up and down easily; after this movement forward tractions of the midface is made, until the soft palate muscles separated (Depending on the required advancement will be traction). Various movements are performed in all directions for approximately 3 min. Finally, the surgical occlusal template is placed; this template reproduces the upward and forward movement of the maxilla to set the Le fort with osteosynthesis. In Fig. 7 you can see pre–post pictures of patients with this osteotomy.

Modified Le Fort III Osteotomy in “Z”

Like the Champy technique, is used for a linear advancement of the middle third without unmodified the vertical dimension. This technique is designed for greater advancement of 6–11 mm without bone graft. You can apply the same approaches as in the prior technique (Champy); the difference is zygomatic osteotomy (Figs. 8, 9).

“Z” Osteotomy Marking

The width of the base of the frontal process of the zygoma is measured, and a straight line is marked in three quarters of the total width (approximately 10–15 mm not more). From this point, it will draw a line parallel to measure half the distance of the total width (about 5 mm), and then another horizontal line which ended in the bottom junction of the zygomaticotemporal suture is drawn (Fig. 8). Cut bone with a reciprocating saw in a 45° angulation.

Ascending Modified Le Fort III Osteotomy

The technique is a variant of the technique created by Bell 1980 [5], in which interposition grafts were placed in the portion of the zygomatic process below the

Fig. 9 Patient with hypoplasia anterior–posterior of the face how need 9 mm of advancement

frontozygomatic suture, where the osteotomy is brought to the vertical joint and horizontal orbital rim (Fig. 10).

This variant of the technique is especially designed for cases midface advancement conjunction with a custom-made frontal implant, without an intracranial osteotomy for frontal advance; the implant increases the superior orbital rim. It will be used in very specific and occasional cases, such as mild cases of non-syndromic cases or Crouzon syndrome where the orbital hypoplasia is not exclusively maxillo-malar, plus lateral hypoplasia of the lateral orbital rim in adult patients.

The technique requires three different approaches, like the two previous techniques subciliary/*transconjunctival approach* and intraoral extended maxillary vestibular approach and coronal approach (Fig. 11).

There are several alternatives for the design of the scalp incision.

The bow-like incision is traditional. Geometric patterns (zigzag, sawtooth, stepwise, stealth, or wavelike designs) may be used. There can be significant blood loss from the coronal incision at the beginning of surgery and during

closure. Several techniques may be used to limit blood loss. Start with saline solution infiltration to produce hydrodissection.

The incision is made to the depth of the pericranium, finishing at the level of the root of the zygomatic arch, which is palpable and extends across the temporal fossa to the posterior aspect of the zygomatic body. As soon as the yellow outline of the superficial temporal fat pad is visible shining through the superficial layer of temporalis fascia, an oblique incision through the fascia extending from the root of the zygomatic arch to the superior-posterior aspect of the lateral orbital rim is made. An additional exposure of the infratemporal fossa is required; the temporalis muscle is dissected from its bony attachments to reach the inferior orbital fissure on the superior-external portion, no more than 6 mm of dissection of the anterior temporal muscles.

The ascending osteotomy, will be performed on the external face, of the lateral wall of the orbit, by the ultrasonic bone cut system; at all times protecting the eyeball with a malleable separator; osteotomy starts about 10 mm above the frontozygomatic suture (where the temporal fossa begins anteriorly) at a depth of 5–6 mm, without entering pterion (Fig. 12), (without making an intracranial communication damaging the dura). The osteotomy will descend, passing the zygomatic frontal suture, the cut it made behind, at the level of the lateral canthus without detaching it. From there the osteotomy will be directed to the anterior part of the inferior orbital fissure, where it binds with the orbital floor osteotomy previously described and the osteotomy of the pterygomaxillary fossa.

The osteotomy of the zygomatic arch is in the form of inverted “L”, from the zygoma upward joint with the horizontal part of the zygomatic arch, with a base length of 10 mm according to anatomical features of each patient and the vertical osteotomy, towards the lower edge of the zygoma. Grafts of the outer cortex of the parietal bone will be placed with 1.5 osteosynthesis fixing system (Fig. 13).

Ascending modified Le Fort III osteotomy

Fig. 10 Ascending modified Le Fort III osteotomy

Fig. 11 Coronal approach

Discussion

The methods of surgical treatment of the midface are diverse; when the osteotomy of the upper midface was described in 1950 by Gillies and Harrison, but this method was never widely accepted. In 1967 Tessier suggested a bone cut that resulted in a true separation of the skull and face allowing the correction of extensive facial and cranial deformities. Other authors have suggested other osteotomies, but no one has changed Tessier's basic principles.

Champy in 1980 presented a technique that make possible the move almost any facial structure in any desired direction to correct the deformed bone structure by moving bones rather than implanting bone graft or using

Fig. 12 Osteotomy starts about 10 mm above the frontozygomatic

prostheses. His conclusions were that transfacial osteotomy gives better aesthetic results; if the deformity is situated high on the midface, it is most logical to proceed with an intermediary transfacial osteotomy rather than with a Le Fort I osteotomy or a sagittal osteotomy of the ramus giving aesthetic results.

Champy technique is a versatile technique that can simultaneously correct cross-cutting issues. It is easy to implement and requires only placement stability of osteosynthesis in the zygoma. No need osteosynthesis at level of the pyramidal process of the maxilla would be a simple modification to the original technique; as the gap floor orbit is very prior to the orbital rim (6.5 mm maximum), no mesh reconstruction of the orbital floor is needed. It is a great technique to make the total correction of the deformity of the facial lower third.

“Z” Le Fort III osteotomy as mentioned above is used for maxillo-malar displacement of more of 6 mm without requiring grafts of up to 15 mm. It is a slightly more complex than the previous technique due to bevel to 45° from the long horizontal osteotomy that controls the default advance, to make the sliding fracture of the middle third without undesirable fracture; however, if it is required to

correct a problem maxillo-malar cross, it can be made by removing a fragment (“dal pont”) of the long horizontal osteotomy compared to contralateral side. If the postero-anterior displacement is greater than 8 mm, take reinforcing osteosynthesis at the pyramidal process maxillary and mesh for orbital reconstruction. Merely to advance linearly over 6 mm without requiring grafts, make this an excellent technique.

Ascendant Le Fort III osteotomy is a technique for very special cases, deficient lateral orbital rim, over the lower edge and presents a good nasal bridge or at least not very hypoplastic. This technique has to move forward from the lateral orbital rim temporary muscle so that there is a defect in the anterior temporal subsidence area caused by temporary muscle.

The three techniques are performed similarly, except the variant already mentioned, in all may be performed simultaneously osteotomy Le Fort I or segmental, plus complement of mandibular osteotomies if required in a single operating time.

In transversal problems, it may only impact more than one side to correct the deformity; however, if this requires lateral displacement, it could not be done, because

Fig. 13 Crouzon patient with ascending modified Le Fort III osteotomy

zygomatic projection would be greater from one side than the other.

Conclusions

The osteotomy success depends on the skill of the surgeon with the osteotomy without undesirable fractures during downfracture for a monoblock and breaking muscle tension which could cause negative traction (recurrences). The techniques presented have excellent results with adequate stability and the ability to be adapted to each patient deformities “osteotomy—à la carte”. No recurrences.

Compliance with Ethical Standards

Conflict of interest There are no conflict of interest from authors.

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