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Venezuelan Protocol for the Correction of Midface Deficiency by Le Fort III Osteotomy in Patients with Cleft Lip and Palate

Hector H[1], Rodney H[1], Alarcón N[1] and Muñoz R[1,2]*

[1]*Department of Oral and Maxillofacial Surgery, University of Carabobo Maxillofacial Residency Program, Dr. Ángel Larralde University Hospital, Venezuela*

[2]*Department of Craniofacial Surgery, Palmer Children's Hospital, Maryland, USA*

Abstract

Purpose: 1. To establish the indications for advancement by Le Fort III osteotomy in patients with class III DFD due to true middle third deficiency and sequelae of cleft lip and palate. 2. To describe the technique of advancement by Le Fort III osteotomy in patients with class III DFD due to true middle third deficiency and sequelae of cleft lip and palate. 3. To analyze the functional and esthetic results of Le Fort III osteotomy advancement in patients with class III DFD due to true middle third deficiency and sequelae of cleft lip and palate.

Materials and Methods: A retrospective study of cases diagnosed with class III DFD due to cleft lip and palate that underwent surgical correction at the Dr. Ángel Larralde University Hospital in Valencia, Carabobo, Venezuela from 2016 to the present year, without distinction of gender and age, was carried out. Describing the protocol currently used in our country for the correction of such deformity, evaluating aesthetic changes, and functional and psychosocial pre and postoperative results in each patient. For this research, the combination of the bibliographic theoretical references will be used in its theoretical context, as well as the data from the medical history and the necessary studies to achieve the definitive diagnosis. Conjugated with the necessary surgical phases for the orthognathic correction of patients with class III DFD due to true deficiency of the middle third and sequelae of cleft lip and palate with the advancement of a Le Fort III osteotomy.

Population and Sample: Being a case study, the sample is represented by three individuals, which will have the specific characteristics required for the treatment to be performed, such as a patient with true middle third deficiency treated under the corrective and reconstructive protocol for patients with complete cleft lip and palate that is applied in our postgraduate program. The patient was asked for informed consent.

Inclusion Criteria: 1) True middle-third deficiency due to cleft lip and palate. 2) Complete cleft lip and palate. 3) Chronology of treatment of cleft lip and palate patients, correctly and timely applied within our training program. 4) Preserved hypernasality.

Exclusion Criteria: 1) Systemic pathology that contraindicates orthognathic reconstructive surgery. 2) Patients improperly managed under the cleft lip and palate treatment protocol. 3) High probability of increased velopharyngeal incompetence.

Results: The exposition of each case of the unit of analysis developed in the research is presented.

Conclusion: The objectives set out at the beginning of this research were achieved since the diagnostic elements that led to deciding the surgical management through LF III osteotomy for the correction of midface deficiency in patients with cleft lip and palate were described, based on the clinical and imaging evaluation, the interdisciplinary consultation and the general health status of the patient, complemented by the experience of the surgical team. Likewise, the surgical procedures used in the surgical resolution of the patients are discussed, detailing with the support of photographic images the steps executed during the surgical approach and the surgical procedures planned in them.

Keywords: Monobloc; Osteogenic distraction; Le Fort III; Crouzon syndrome; Facial bipartition; Median fasciotomy

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Correspondence:
Hector Herrera, Department of Oral and Maxillofacial Surgery, University of Carabobo Maxillofacial Residency Program, Dr. Ángel Larralde University Hospital, Naguanagua, Carabobo, Venezuela,
E-mail: hrcp.20@gmail.com

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Introduction

The estimated incidence of Cleft Lip and Palate (CLP) in some South American countries is very high, being approximately 1 in 450 live newborns [1-8] and in the USA it is 1 to 2 per 1,000 births or approximately 1 in 700 live births, the approximate cost of rehabilitation of a child born with CLP is estimated at approximately 100 thousand dollars. The rate of occurrence of infants born with cleft lip and/or palate is influenced by race and gender, being slightly less frequent in Caucasians and blacks [8-20]. It is genetic in one-third of the cases, but in the remaining two-thirds it is a multifactorial isolated event. If one parent has a cleft lip, the risk of having a child with the same pathology is 2%. If two healthy parents have a cleft child, they have a 5% risk of having another child with this deformity [20-23].

The overall incidence of maxillofacial clefts has been proposed to be between 1:500 and 1:700 births, although in recent years due to birth control and genetic counseling, the incidence of these clefts has decreased. The care of a child born with CLP begins with the primary surgical repair of the lip, followed by the palate, and continues through defined and appropriate stages of adolescence, at which time public financiation is usually suspended. The burden assumed by the patient and his family in terms of indirect costs such as absence from work and school, should not be underestimated [2]. In our country child patients born with CLP are subjected to primary surgeries to close them but unfortunately, in most cases, there is not the multidisciplinary rehabilitation approach they deserve, so they are often patients who are marginalized because of their physical appearance, becoming not only a medical-dental problem but also a sociocultural problem that affects both the individual suffering from the pathology as well as their families and people close to them, The culminating point of the surgeries to which they undergo throughout their lives is the orthognathic surgery which will give them definitive results that solve the aesthetic and mainly functional problem, thus improving their quality of life. The present work intends to evaluate aesthetic, functional, and psychosocial changes by recording pre and postoperative results in each patient treated with Le Fort III osteotomy, specifically in patients with middle-third deficiency due to cleft lip and palate. Establishing that the different anomalies and procedures are considered part of the subspecialty called craniofacial surgery, in this study we want to establish that with proper planning and precise anatomical knowledge, this surgical procedure can be performed without complications and the need for complex postoperative care; achieving in these patients in a single surgical act the desired functional and aesthetic improvement. This will be established through the description of three clinical cases with a diagnosis of class III DFD, with sequelae of CLP treated at the Oral and Maxillofacial Surgery Service of the University Hospital "Dr. Ángel Larralde" located in Bárbula, Carabobo State, Venezuela [23-36].

Although the cases are similar, they do not have the same needs and requirements, so the surgical plans are different. The purpose is to demonstrate the protocol currently used in the country and the esthetic changes at the level of bone and soft tissues; and functional changes.

Materials and Methods

A retrospective study of cases diagnosed with class III DFD due to cleft lip and palate that underwent surgical correction at the Dr. Ángel Larralde University Hospital in Valencia, Carabobo, Venezuela from 2016 to the present year, without distinction of gender and age, was carried out. Describing the protocol currently used in our country for the correction of such deformity, evaluating aesthetic changes, and functional and psychosocial pre- and post-operative results in each patient. For this research, the combination of the bibliographic theoretical references will be used in its theoretical context, as well as the data from the medical history and the necessary studies to achieve the definitive diagnosis. Conjugated with the necessary surgical phases for the orthognathic correction of patients with class III DFD due to true deficiency of the middle third and sequelae of cleft lip and palate with the advancement of a Le Fort III osteotomy. The patient was asked for informed consent. Within the inclusion criteria of this research, the following were taken into account: 1) True middle third deficiency due to cleft lip and palate. 2) Complete cleft lip and palate. 3) Chronology of treatment of cleft lip and palate patients, correctly and timely applied within our training program. 4) Preserved hypernasality. Within the exclusion criteria of this research: 1) Systemic pathology that contraindicates orthognathic reconstructive surgery. 2) Patients improperly managed under the cleft lip and palate treatment protocol. 3) High probability of increased velopharyngeal incompetence. The data collection method was a retrospective revision of the medical clinical archives and individual clinical cases as well as photographic records for each patient that underwent surgery at Dr. Ángel Larralde hospital adscript to Carabobo University. Ethical approval by the Ethical Committee of the institution was given for this investigation, we declare that we had read the Helsinki Declaration and followed its guidelines in this investigation as well.

Body

The insufficiency can be attributed to 4 structural-based etiological groups: 1) Unrepaired clefts, such as the submucous form of cleft palate, congenital short palate; an anatomical structural interference, such as hypertrophic tonsils or distortion of the posterior pillar. 2) Post-surgical insufficiencies, such as post-tonsillectomy or after palatoplasty, pharyngoplasty or pharyngeal flaps complicated by functional communications. 3) Those produced by ablation as in tumors or trauma. Incompetence, on the other hand, involves a neuromuscular etiology: a) Primary motor-neuromotor control, congenital (myotonia, cerebral palsy, etc.) or acquired as in closed brain trauma, cerebrovascular accidents, or progressive diseases. b) Associative motor programming, such as apraxia of language. In the insufficiency, which is the most common secondary damage in cleft lip and palate, direct or indirect methods are used for its evaluation of physical, auditory, acoustic, or visual graphic recording or modern imaging. Among the direct ones are: Static lateral radiographs, lateral cine video radiography, multi-imaging-fluoroscopy, ultrasound, oral endoscopy, nasoendoscopy (rigid or flexible), electromyography; among the indirect ones, the clinical evaluation of air leakage with a mirror (vapor will be marked) or in a candle or with cotton, rudimentary systems but still used with relative ease; the judgment of the listener and recording-analysis; or methods that are not very applicable in many of our hospitals, such as spectrography, computerized sound analysis, accelerometry, pressure-flow measurements, and phototransduction [15].

Most of the methods are limited in their application because of the costs and availability in cleft lip and palate centers, but above all, because they are very difficult to apply in preschool children, which is precisely when the clinician needs to make crucial decisions regarding the future of the function of the velum. For some, the most

useful but expensive methods are videofluoroscopic multi-imaging with views in three planes, lateral, frontal, and submentovertex; they consider essential the study with contrast media such as barium; and also accompany them with nasoendoscopy, among which the flexible one is easier to use in younger children. Pigott, Dalston, and Warren believe that both methods are complementary to each other, being more qualitative the information of nasoendoscopy and more quantitative that of videofluoroscopy but even so, the clinical appreciation by the group of experts not lost its value and, in the comparisons, there is little difference in the advantages of one or the other methods [13]. Argamaso, in New York uses these methods for the selection of the surgical intervention; he considers that it is possible to determine whether the lateral walls are mobile or not to make discriminated and more functional techniques regarding wide or narrow pharyngeal flaps, "obstructive" or not. Grabb points out: The extreme difference in the evaluation in different language groups, the intimate ignorance of these experts and other specialists involved, in the techniques used, so that most of the time this parameter does not discriminate the quality of the procedure, and the different long-term results obtained with the same technique by different surgeons [37-40].

Maxillary hypoplasia

Maxillofacial growth is a synchronous activity of different intimate processes depending on the embryological origin of its components that can be described as desmoplastic (at the sutures) or endochondral osteogenesis. The former can be guided by muscular function while the latter is more subject to endogenous factors; this initial formation begins as early as the seventh and eighth embryonic weeks and can be seen throughout the base of the skull as stated by Stark. In desmoplastic osteogenesis, it can be influenced if the function is restored, but little can be done to influence endochondral growth; for Jóos [41] there are two very important portions of the cranial base that affect maxillofacial growth: a) The ethmoid that will guide the vertical and sagittal growth of the face. b) The ala-orbital-temporalis (sphenoidal) area that will define the sagittal, vertical, and transversal position of the articular fossa, which will support the mobile unit of the lower jaw and its functional matrix.

Here we observe the conjunction of the maxillary central structures that will be affected by the deficit of the nosological entity and the subsequent intervention to correct the defect. This impact on the chondrocranium alters the proportionality of growth and this also happens in cleft lip and palate, as in craniofacial syndromes like the Goldenhar, Crouzon, etc., type. Jóos [42-46] raises the possibility of using Delaire's [5] Tele Radiographic Cephalometric Analysis method to determine the effect on the cranial base in the anterior and posterior angles to relate it to the tendency of the dentoalveolar angle if it is class I, II, or III. He concludes that in 60 adult cleft patients treated in the same way (lip: Millard technique, and palate with the Campbell-Widmaier technique and late osteoplasty), the great majority of cases (48 patients) showed a primary alteration in the cranial base and class III relationship.

At the beginning of the 80s, W. Grabb [14,19,20] noted that most of the groups used primary correction techniques that sought to reconstruct the palate for phonetic and masticatory functional well-being but that the scientifically confirmed facts, even if scarce, suggested the alteration in growth and that it was necessary to establish longitudinal studies sufficiently wide to be able to establish the least harmful; so he initiated comparative studies between venorrhaphy or staphylorrhaphy (Schweckendiek, Rosenthal, etc. type), the Von Langenbeck (with or without Cronin or Millard nasal flaps), retroposition palatorrhaphy (Veau-Wardill, Pushback type) and staphylorrhaphy or velorraphy with primary pharyngeal flap, the technique still without extensive reports but for Grabb, the best subjectively, followed by the Von Langenbeck in terms of being the least harmful to growth. Obviously, in all of them, multidisciplinary work is supposed to take care of dental arches and their stability. The sequelae will also be related to factors such as poor oral hygiene, poor early dental care, late initiation of the restorative scheme whatever it is, and especially the inexperienced, unplanned, and traumatic surgical management of the palate, things to which many of our children in the third world are subjected, so Trigos and Ortiz-Monasterio, have suggested, early total surgery resolution. In urban centers with well-trained teams, a sequential comprehensive approach is justified [16].

The search for the correction of functional and esthetic problems in the secondary form leads to the use of the following methods: a) Maxillary orthopedics, late and early, whose objectives are to prevent the collapse of the arches, stabilize and balance the premaxilla and favor occlusal contact as this way the necessary stimulus for osteogenesis is maintained; it uses plates in a passive, active or alternated form from birth to mixed dentition. It performs the movement of the bone base, not teeth [40]. b) Orthodontics, whose objective is the correct dentoalveolar position and therefore requires permanent teeth, stable and useful as anchors, due to the type of appliance and age in which it acts; it is used from the mixed dentition to the adult period; it is part of the rational approach in late orthognathic surgery. It seeks to improve occlusion, oral esthetics, arch position, and dental alignment necessary for effective results in surgical movements and facilitates prosthetic reconstruction in segments [47-87]. c) Maxillofacial and orthognathic surgery that attempts to reposition all or parts of the jaws with a view to aesthetics and function; the most common in cleft lip and palate are the advances of the middle third, maxillary (Le Fort I type) or nasal maxilla (Le Fort II type or its quadrangular variety of Kufner): pseudoprognathism is also frequent due to simple discrepancy and rotation of the maxilla, for which it is possible to obtain very acceptable results by intervening the lower jaw with retro osseous osteotomies.

In previous experiences of 200 cases of orthognathic surgery published in Colombia, the group of congenital anomalies was 10.5% (18 cases of the total); and this data persists in the total of the casuistry from 1982 to 2005). Advances of the upper jaw in cases of cleft lip and palate are not only more complex but also the results are more uncertain or subject to a certain degree of recurrence or reinstatement of the incompetence of the velum. There are reports of increased hypernasality due to increased pharyngeal breadth and anterior traction of the velum as documented by [26,59] Schwartz, Witzel and Munro, and Schendel Oeslchlaeger. Wolford and Epker.

Several factors are added to make this so marked: scar contracture of the palatine velum, pharyngeal and pillar muscle fibrosis, intra-vein or muscular scars, paranasal sinus dysfunction, infection, septal distortion, and malposition. For Freihofer Jr. [64,65] the unacceptable results are 2:1, between fissured and normal patients. The preconditions for surgery in these patients should be optimal in terms of dental status, preparation of rigid and stable appliances of excellent design, and permanent follow-up; segmental surgery is preferred in many cases, and restorative prosthesis, if the state of the bone bases is less than acceptable, at the end of growth (after 18 years

of age). Otherwise, the orthognathic study and planning determine if maxillary advancement, mandibular retrusion, or simultaneously combined surgeries are to be performed.

Technique for maxillary advancement by Le Fort III osteotomy (LFIII)

The exact design of the midface advancement osteotomy is limited only by the surgeon's capabilities, knowledge, and skills and should be determined by the aesthetic needs of the patient [9,13,12].

History

Conventional Le Fort III osteotomy, due to the growing success and experience achieved with LF I osteotomy, in the 50s, surgical techniques to deal with hypoplastic midface and craniofacial malformations, such as those observed in patients with Cleidocranial Dysostosis Syndromes (CCD), were again taken up and developed. In this sense, the studies of H. Gillies [68] were opening new paths. In 1941, as a military surgeon, Gillies resolved his first LF III fracture with malunion [43]. Nine years after his first attempt, he pioneered an LF III osteotomy in a patient with oxycephaly [66]. The indication for this procedure was marked prognathism and exophthalmos. He mobilized the entire midface, achieved rigid fixation with intermaxillary wiring, and maintained it for 5 weeks. Although the operation was successful and aesthetically beneficial, difficulties in recovery and management of the resulting scars for the time, in the nasomaxillary region and frontomalar junctions, coupled with damage to the lacrimal apparatus were observed.

Paul Tessier [117], a French plastic surgeon, operated on 35 patients with different cleidocranial dysostosis syndromes and standardized procedures for the surgical treatment of many types of deformities [88-94]. His objectives were: to restore a normal facial projection and reestablish a normal occlusion; to increase the vertical dimensions of the face; and to correct exorbitism. He stated that the reasons indications for craniofacial surgery could be functional, morphological, or psychological. In addition to these techniques and recommendations, he also formulated several caveats after he encountered complications [94-118].

Surgical technique

The LF III osteotomy is performed following the exposure of the frontomalar suture, lateral orbital region, nasion, zygomatic arch, and body. The anterior surface incision of the maxillary antrum can be approached through the gingivobuccal sulcus. Osteotomies are performed, following the desired design described by Tessier, then the frontozygomatic suture, bilateral orbital floor, and nasal proper bones are exposed using a reciprocating saw, and osteotomes are separated to separate the vomer and ethmoid from the cranial base at the midline. The pterygomaxillary junction is separated in the common way in which it is performed when doing LF I, by the circumvestibular approach. Placement of a protective acrylic palatal plate is performed with notches for the active tips of the Rowe forceps, which are then used to mobilize the Le Fort III segment. The maxillary acrylic plate is used to prevent unwanted fractures of the maxilla. Mobilization of the midface is a lengthy procedure, leading to a high degree of morbidity and blood loss. Surgeons have sought less invasive techniques to limit morbidity. The need for further advancement has made it necessary to combine the technique with bone distraction, eliminating the need for immediate advancement, graft harvesting, and immediate internal stabilization. Schulten et al. [119] describe the conjoint use of internal and external distractors, called the 'push-pull technique', to better control the distraction process, force, and vectors. In their experience, the use of both types of distractors allows for segmental mastery and desired results, with the disadvantages of costly operative time and the need for another operative time for the removal of the attachments. Ueki et al. [120-132] performed this technique in a patient with Crouzon syndrome using both a Rigid External Distractor (RED) and Hyrax screw system expansion in the maxilla [95]. Respect the complications related to LF III osteotomy, minor and major complications have been reported with traditional LF III osteotomy [25,27,33,62]. Minor complications include infraorbital nerve neuropraxia, ptosis, strabismus, partial anosmia, and zygoma fracture during mobilization, partial exposure of the nasal bone graft, and localized infections of the surgical site. Major complications include respiratory distress requiring preoperative tracheostomy, development of gastric stress ulcer, ventriculoatrial shunt infection, generalized infection, subgaleal hematoma, cerebrospinal fluid leakage and fistula, and visual loss after retrobulbar hemorrhage. In one case report, lethal intracranial arterial bleeding was described after a skull base fracture due to intraoperative maneuvers [57].

Esthetic changes with the maxillary advancement

With maxillary advancement, the soft tissue response in cleft patients is more favorable than the soft tissue response in non-cleft patient groups. Studies by Kawauchi et al. compared the effects of 5 mm maxillary advancement on the soft tissue of cleft and non-cleft patients. The difference in soft tissue change between the two groups is mostly the result of significant scarring and fibrosis in repaired cleft lips. This results in less thinning of the upper lip in the cleft group. The nasal tip is advanced more forward in the cleft group; this is a result of the preexisting lack of support in the noses of cleft patients. With the increased support of the alar bases, the nasal tip advances more than in the non-fissure group [23]. On the other hand, Wolford Larry M [26] in 2008 indicates that orthognathic surgery can also be performed during growth in cleft patients when the mandate is psychological and/or functional concerns. Careful case selection is imperative, and the surgeon should be aware of the following post-surgical outcomes when performing orthognathic surgery on patients with clefts during development: a) Expect the absence of maxillary AP growth after surgery. Postoperative maxillary growth becomes predominantly vertical. b) Patients with preoperative proportional growth will exhibit disproportionate postsurgical growth with skeletal and occlusal Class III as a result of altered maxillary growth. c) Surgery can be performed at an early age with the understanding that it may need to be repeated after growth is complete.

Pharyngeal veil insufficiency and maxillary advancement

Maxillary advancement generally increases the anterior-posterior dimension of the nasopharynx, resulting in the increased distance for soft palate movement during velopharyngeal closure. Most patients have a sufficient compensatory reserve to ensure normal velopharyngeal closure. Persistent hypernasality followed by maxillary advancement in the non-fissured population is extremely rare but may occur when there are accompanying defects such as an occult submucosal cleft, muscle disorders (e.g., myotonia), or other abnormalities [9].

Non-cleft patients without preexisting speech disorders rarely benefit from a speech evaluation, but patients with repaired cleft palate are at risk for pharyngeal velar insufficiency, and preoperative evaluation may be of great value. The compensatory ability of a patient with cleft followed by maxillary advancement may be impaired as

a result of scarring, shortening of the hard and soft palate, relative enlargement of the nasopharyngeal fundus, improperly positioned musculature, muscle atrophy, and perhaps an already extended compensatory system [9].

Schendel et al. 1997 [54] investigated the static pharyngeal velum mechanism before and after surgery in cleft and non-cleft groups using lateral cephalograms. The results in non-fissured patients showed stretching of the soft palate by 50% of the amount that the maxilla advanced in the posterior nasal spine area. In cleft patients, the soft palate lengthened by only 40% of the amount of maxillary advancement. In addition, it was determined that if the pharyngeal fundus was divided by the length of the soft palate, a radius greater than 1.0 indicates possible pharyngeal velar incompetence. Thus, predictions of associated changes occurring in the soft palate and the likelihood of velopharyngeal incompetence may be possible. However, variants such as Passavant adaptive capacity, adenoid tissue, and variations in soft palate movement make predictions less reliable. An evaluation of speech adaptability, nasal resonance, and static and dynamic function (phonetic cephalogram, quine fluoroscopy, nasopharyngoscopy) may help identify velopharyngeal insufficiency that would otherwise not be apparent and may be indicative of potential hypernasal speech followed by surgery. If velopharyngeal insufficiency occurs, a pharyngeal flap, palatoplasty, pharyngeal wall augmentation, or prosthesis may be necessary to correct the problem. One should wait 6 to 12 months before deciding on one of these surgical treatments as very often speech compensations occur that later result in normal speech without treatment, and flap procedures before the maxilla have completely healed can lead to recurrence [13].

Results

The results of the surgical technique applied are shown. The following is the exposition of the cases of the unit of analysis that was developed in the research.

Case 1

Current disease: This is a 27-year-old female patient who started her current disease from intrauterine life when she developed Crouzon syndrome associated with cleft lip and palate. She is currently evaluated by a specialist in orthodontics, who refers her to the Oral and Maxillofacial Surgery Service "Dr. Atilio Perdomo" of the University Hospital "Dr. Ángel Larralde", Bárbula, Carabobo State, for evaluation of dentofacial deformity and surgical resolution.

Clinical examination: Frontal vision shows 5 mm hypertelorism, grade 3 exophthalmos, severe bilateral zygomatic hypoplasia, true middle third deficiency, scarring of the upper lip, and septum deviation with alar deformity. In Figure 1, a concave profile, closed nasolabial angle, middle third deficiency, and open nasofrontal angle are observed in Figure 2, 3. Intraoral examination shows an occlusal discrepancy of 8 mm, maxillary midline deviation of 5 mm, and sequelae of palatal cleft and alveolar cleft Figure 4.

Imaging evaluation: Conventional radiographic and Cone-Beam Tomography were requested; with which was possible to corroborate diagnoses and the real location of the bony points for the different metric tracings for the necessary analysis for the surgical planning. Figure 5, 6. Through which the diagnosis was Crouzon syndrome associated with stage III cleft lip and palate without resolution and class III dentofacial deformity.

Surgical planning: After preoperative paraclinical examinations and assessment by the Internal Medicine and Anesthesiology Departments of the University Hospital "Dr. Angel Larralde", which allowed verifying systemic counter-indications that would not allow the surgical procedure to be performed.

The surgical procedure was planned as follows:

1. Genioplasty of 6 mm advancement and 4 mm descent.
2. Le Fort III osteotomy for advancement by distraction osteogenesis 10 mm.
3. Palate distraction 13 mm.

Postoperative evaluation: The patient was hospitalized for 21 days, with no evidence of bleeding or postoperative complications, or edema according to the procedure, after 7 days the patient started the distraction process and daily controls during the first month. At 21 days postoperatively, there was evidence of normal tissue healing, with no esthetic or functional alteration. The imaging showed the osteotomies, osteosynthesis, and distraction devices in position according to the planning, and relevant esthetic changes in the projection of the middle third were observed (Figures 7-10).

Case 2

Current disease: This is a 17-year-old male patient who refers the onset of a current disease from the early stages of intrauterine development presenting CLP, being treated by our Oral and Maxillofacial Surgery Service "Dr. Atilio Perdomo" of the University Hospital "Dr. Angel Larralde", Bárbula, Carabobo State since birth under the surgical protocol.

Clinical examination: In the frontal view, severe bilateral

Figure 1: Frontal view analysis: 5 mm hypertelorism is evidenced, grade 3 exophthalmos (Calculated by oculo-orbital index, normally 70%), severe bilateral zygomatic hypoplasia, true deficiency of the middle third, scarring sequelae on the upper lip and septo-deviation with deformity of the alar cartilage in three planes. Lateral view: a concave, hyper-divergent profile is observed, an open nasofrontal angle, a closed nasolabial angle due to lack of projection of the nasal tip, and deficiency of the middle third. ¾ view: A lack of malar projection is evident.

Figure 2: Intraoral view analysis: An anterior open bite is observed, as well as a bilateral class III canine relationship, maxillary midline deviation of 5 mm, and negative overjet of 8 mm.

Figure 3: Posteroanterior, panoramic, and lateral cephalic radiograph analysis.

Figure 4: CT scan preoperative analysis.

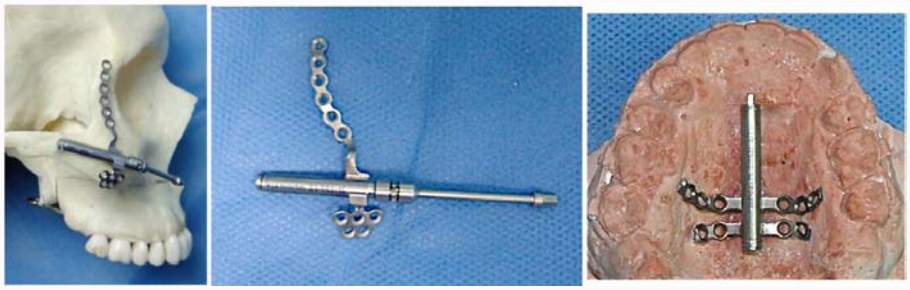

Figure 5: Preoperative adaptation of osteogenic distractors in the preoperative stereolithographic model, for advancement through OD of 10 mm and 13 mm palatal distraction using KLS Martin distractors (KLS Martin, USA).

zygomatic hypoplasia, true middle third deficiency, scar sequel in the upper lip, and septum deviation with alar deformity grade 4 can be observed. In the lateral view, a concave profile, closed nasolabial angle, middle third deficiency, and open nasofrontal angle can be observed Figure 8. The ¾ view shows severe bilateral zygomatic hypoplasia, a true middle-third deficiency. Intraoral examination shows an occlusal discrepancy of 8 mm, deviation of the maxillary midline of 5 mm, and sequel of palatal cleft and alveolar cleft (Figure 10). Imaging evaluation: Conventional radiographic and Cone-Beam Tomography were requested; with which was possible to corroborate diagnoses and the real location of the bony points for the different metric tracings for the necessary analysis for the surgical planning (Figure 11). Establishing the diagnosis of class III dentofacial deformity secondary to the sequel of bilateral CLP, associated with maxillary AP deficiency with maxillary asymmetry.

Surgical planning: After preoperative paraclinical examinations and assessment by the Internal Medicine and Anesthesiology Departments of the University Hospital "Dr. Angel Larralde", which allowed the verification of systemic counter-indications that would not allow the surgical procedure to be performed.

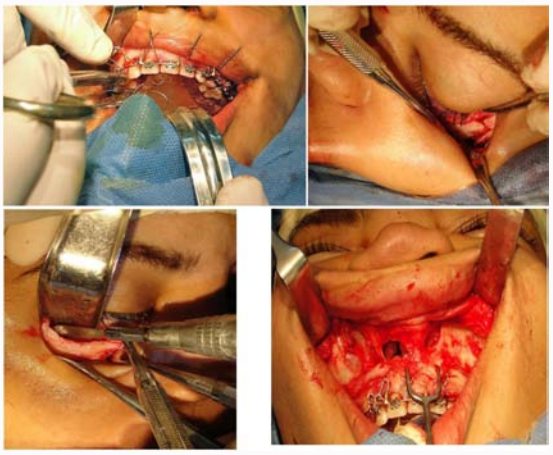

Figure 6: Le Fort III osteotomies transoperatory photographic record.

Figure 7: Septoplasty, the last osteotomy of Le fort III for division of the nasal septum, perpendicular lamina of the ethmoid, and the vomer, controlling with the surgeon's finger just at the level of the posterior nasal spine to control the osteotomy.

Figure 8: Craniofacial disjunction and Le fort III mobilization with Rowe Forceps.

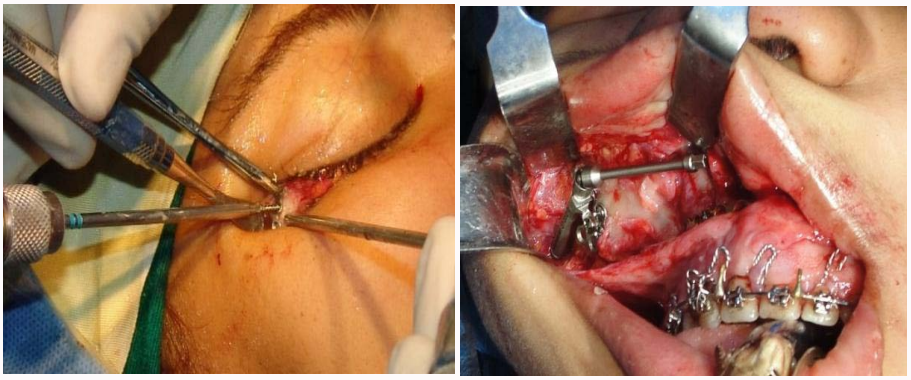

Figure 9: Osteogenic distractor fixation in frontozygomatic and zygomatic region.

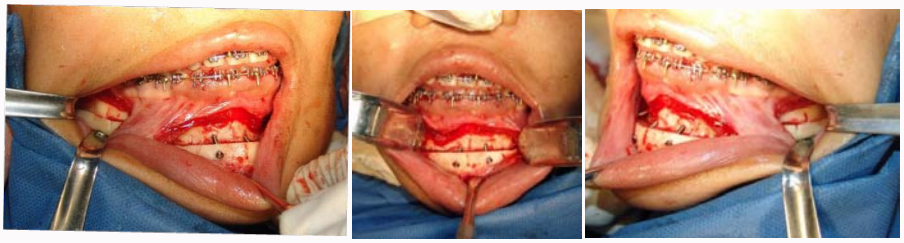

Figure 10: Total mandibular basal osteotomy, using tunneled circumvestibular approach.

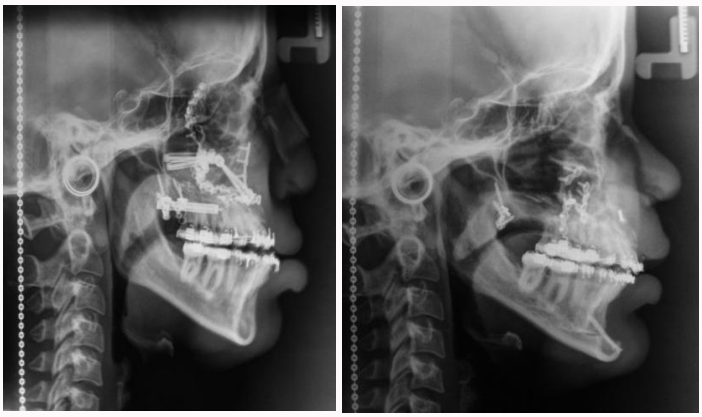

Figure 11: Radiographic control before and after OD for 10 mm of facial advance and 13 mm palatal distraction.

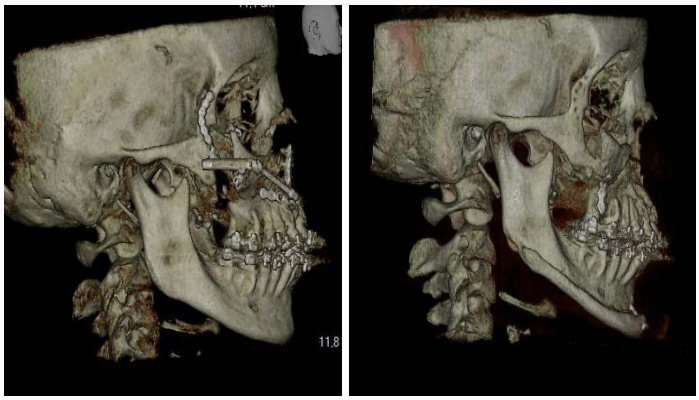

Figure 12: CT scan control pre- and post-palatine and facial distraction and mandibular basal total osteotomy.

Figure 13: Post-surgical, post-orthodontic, and aesthetic intraoral clinical changes.

Figure 14: Clinical changes in front and profile view pre- and post-surgery.

The surgical procedure was planned:

1. Anterior Subapical Osteotomy.

1.1. 34-44 Odontectomy.

1.2. Mandibular set back of 5 mm.

2. Le Fort III advancement osteotomy.

2.1. Maxillary midline correction.

Reconstructive Rhinoplasty

Postoperative evaluation: The patient was hospitalized for 48 h, with no evidence of bleeding or postoperative complications, or moderate edema, he was maintained and attended inter-daily controls for 15 days, then weekly for 2 months. The imaging showed the osteotomies and osteosynthesis in position according to the planning, and relevant aesthetic changes in the projection of the middle third were observed (Figures 12-14).

Case 3

Current disease: This is a 27-year-old male patient who refers the onset of the current disease from the early stages of intrauterine development presenting CLP, being treated by our Oral and Maxillofacial Surgery Service "Dr. Atilio Perdomo" of the University Hospital "Dr. Angel Larralde", Bárbula, Carabobo State since birth under the surgical protocol.

Clinical examination: In the frontal view, there is moderate bilateral zygomatic hypoplasia, true middle third deficiency, and scar sequel in the upper lip, and septum deviation with alar deformity grade 3 (Figure 15). In the lateral view, there is a concave profile, closed nasolabial angle, middle third deficiency, and open nasolabial angle (Figure 16). In the ¾ view, there is moderate bilateral zygomatic hypoplasia, true middle-third deficiency (Figure 17, 18). Intraoral examination showed an occlusal discrepancy of 14 mm, deviation of the maxillary midline 5 mm to the right, and sequel of palatal cleft and alveolar cleft.

Imaging evaluation: Conventional radiographic and Cone-Beam Tomography were requested; with which it is possible to corroborate diagnoses and the real location of the bony points for the different metric tracings for the necessary analysis for the surgical planning (Figures 19-21). Therefore, the diagnosis was established as follows: Class III dentofacial deformity secondary to sequelae of unilateral CLP, associated with maxillary AP deficiency and mandibular AP excesses with maxillary asymmetry.

Surgical planning: After preoperative paraclinical examinations and assessment by the Internal Medicine and Anesthesiology Departments of the University Hospital "Dr. Angel Larralde", this allowed the verification of systemic counter-indications that would not allow the surgical procedure to be performed.

The surgical procedure was planned:

1. Anterior Subapical Osteotomy and set back 7 mm.

1.1. 34-44 Odontectomy.

2. Le Fort III osteotomy for 6 mm advancement.

2.1. Maxillary midline correction.

2.2. Reconstructive rhinoplasty.

Postoperative evaluation: The patient was hospitalized for 72 h, with no evidence of bleeding or postoperative complications, moderate edema, and attended daily controls for 15 days, then weekly. The imaging showed the osteotomies and osteosynthesis position according to the planning, and relevant aesthetic changes in the projection of the middle third and functional were observed

Figure 15: In the front view, severe bilateral zygomatic hypoplasia, true deficiency of the middle third, scar sequelae on the upper lip, and septodeviation with grade 4 alar deformities can be seen. The lateral view shows a concave profile, closed nasolabial angle, deficiency of the middle third, and open nasofrontal angle. In ¾ views, severe bilateral zygomatic hypoplasia is observed, with true deficiency of the middle third.

Figure 16: Pre- and post-surgical intraoral and occlusal clinical changes.

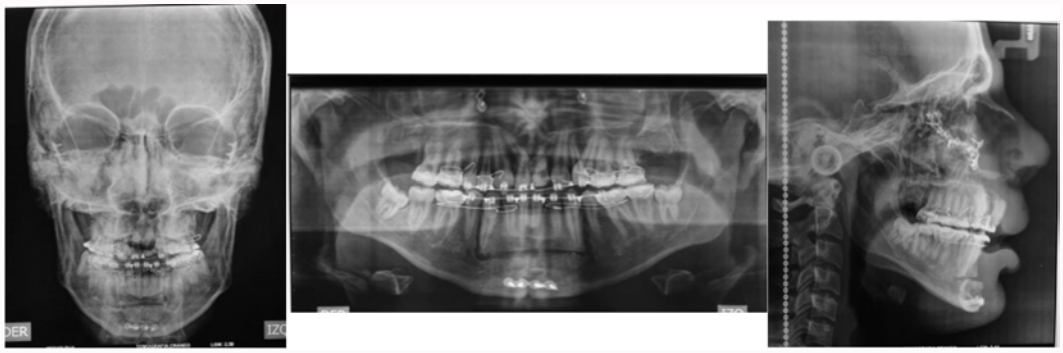

Figure 17: Post-surgical radiographic changes.

Figure 18: Facial clinical changes post-surgery in a frontal, profile, and ¾ views.

Figure 19: In the front view, moderate bilateral zygomatic hypoplasia, true deficiency of the middle third, scar sequelae on the upper lip, and septodeviation with grade 3 alar deformities can be observed. The lateral view shows a concave profile, closed nasolabial angle, deficiency of the middle third, and open nasofrontal angle. In ¾ views, moderate bilateral zygomatic hypoplasia is observed, with true deficiency of the middle third.

Figure 20: Pre- and post-surgery imagenologic radiographic and CT Scan control.

Figure 21: Pre- and post-surgical intraoral and occlusal clinical changes.

Figure 22: Pre- and post-surgical intraoral and occlusal clinical changes.

(Figures 20-23).

Discussion

It was in the 1950s that the virtues and benefits of increasing the use of the Le Fort III technique were realized. In 1941, as a military surgeon, Gillies resolved his first LF III fracture with malunion [43]. Nine years after his first attempt, he pioneered an LF III osteotomy in a patient with oxycephaly [66]. The indication for this procedure was framed in patients with prognathism and exophthalmos. Mobilization of the entire midface, rigid fixation achieved with intermaxillary wiring and maintained for 5 weeks. Although the operation was successful and aesthetically beneficial, the difficulties in recovery and management of the resulting scars in the nasomaxillary region and frontomalar junction, together with possible damage to the lacrimal apparatus were observed.

The etiology of craniofacial alterations and deformities, and with

Figure 23: Facial clinical changes post-surgery in a frontal, profile and ¾ views.

the advent of the technological evolution of diagnosis and the need to achieve the best results in the shortest possible surgical time; within the developmental alterations managed by maxillofacial surgeons trained in the management of craniofacial alterations, are patients with cleft lip and palate, who converge in being protocolized as longer and more expensive treatments. With these patients, the commitment and dedication of every surgeon are evident.

Knowing that these patients will undergo multiple interventions and multidisciplinary treatments by different specialists in the dental medical field, it is uncertain to establish only diagnostic criteria to perform the respective surgical planning in the orthognathic phase, which is not an isolated procedure from what is described in this research, which was proposed to reveal the esthetic and functional benefits of the correction of class III DDF with a true middle third deficiency in HLP patients, based on the experience in three cases with excellent results.

Paul Tessier [127], a French plastic surgeon, operated on 35 patients with different CDD syndromes and standardized procedures for the surgical treatment of many types of deformities [89-92,94]. His objectives were: to restore a normal facial projection and reestablish a normal occlusion; to increase the vertical dimensions of the face; and to correct exorbitism. He stated that the reasons indications for craniofacial surgery could be functional, morphological, or psychological. In addition to these techniques and recommendations, he also formulated several caveats after he encountered complications. Regarding the LF III osteotomy procedure, Tessier [128-135] describes three basic procedures in which the operative risk is minimized: the LF-III TESSIER I [89], LF III-TESSIER II [91], and LF III-TESSIER III [70,80]. These three types of osteotomies are similar and show only minor variations concerning the lateral wall of the orbital wall. In 1969, Obwegeser published a summary of various Le Fort fracture operations, including the combination of an LFIII and an LF I osteotomy in a single operation and a modified LF III technique excluding the nasal bones, the 'butterfly osteotomy' [9,69]. With the suggested techniques it became possible to correct upper and lower facial dysmorphism. Obwegeser suggested expanding transversely and simultaneously, to correct the dysmorphia. In 1971, CONVERSE [18] published another modification, the 'tripartite osteotomy', and a surgical technique that divides the entire midface into three segments: A central nasomaxillary segment and two orbitozygomatic segments, each in a separate sagittal and transversely fashion. All these modifications were aimed at giving more remodeling options and therefore better aesthetic results. Important research on combination osteotomies, along with bimaxillary corrections, was continued by Freihofer [28] among others.

In the cases presented in this research, we can demonstrate that this surgical technique allows us a wide range of attributes to achieve the best possible results, knowing that this technique was designed to achieve advances with the help of osteogenic Distraction Devices (DO). We must take into account that the achievements made in our patients are shared with mandibular movements of minimal expression and that in addition to the difficulty of the technique in surgical time, there was no increase in the same of having performed common procedures, managing the necessary surgical approaches, the evidence of scars is reduced and the most important thing in the two cases that DO was not used, it was evidenced that there was no increase in pharyngeal incompetence and velopharyngeal insufficiency.

Conclusion

Following the first specific objective of the research after the evaluation of the results in the previous chapter, it can be affirmed that the objectives set at the beginning of this research were achieved since the diagnostic elements that led to deciding the surgical management using the LF III osteotomy were described in the light of the findings, their analysis and discussion, for the correction of midface deficiency in patients with cleft lip and palate, based on the clinical and imaging evaluation, the interdisciplinary consultation and the general health status of the patient, complemented by the experience of the treating clinician. Likewise, the surgical procedures used in the surgical resolution of the patients are discussed, detailing with the support of photographic images the steps executed during the surgical approach and the surgical procedures planned in them. In this way, the evolution of the patients in the case study surgically approached was presented, explaining in detail the findings observed clinically and/or imaging in the postoperative evaluations performed, proceeding then to discuss such results taking as frame of reference previous studies disclosed in specialized publications.

From the above, it is clear the importance of improving the esthetic and functional characteristics of these patients, to contribute to their social insertion of these people without invalid features to achieve a prosperous future for them and their families. It is worth mentioning that these procedures were performed in a single surgical time, unlike the bibliography previously consulted, avoiding the surgical risks of the patients inherent to the general anesthesia implemented by the anesthesiology service; also highlighting that the patients were managed with non-prolonged hospitalizations, without having intra and postoperative complications, both immediate and mediate.

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