UNIVERSITÉ DE NANTES

UNIVERSITE DE NANTES

_____

FACULTE DE MEDECINE

_____

Année : 2019 N° (Renseigné par la Scolarité) 2019-117

THESE

pour le

DIPLOME D'ETAT DE DOCTEUR EN MEDECINE

D.E.S de Chirurgie Générale

par

Marine ANQUETIL

Née le 18 avril 1989 à Beauvais

_____

Présentée et soutenue publiquement le 13 septembre 2019

_____

EVALUATION DE L'OSTEOTOMIE VERTICALE RETROSPIGIENNE POUR LA CORRECTION CHIRURGICALE DE L'INSUFFISANCE VERTICALE POSTERIEURE UNILATERALE, RESULTATS A LONG-TERME.

_____

Président
Monsieur le Professeur Pierre CORRE

Directeur de thèse
Monsieur le Docteur Hélios BERTIN

Membres du jury
Monsieur le Professeur Jacques-Marie MERCIER
Monsieur le Professeur Joël FERRI
Monsieur le Docteur Jean-Philippe PERRIN

TABLE DES MATIERES

ABREVIATIONS

PVI	Posterior Vertical Insufficiency
HFM	Hemifacial Microsomia
TMJ	Temporo-Mandibular Joint
VRO	Vertical Ramus Osteotomy
CD	Chin Deviation
CCG	Costo-Chondral Graft
DO	Distraction Osteogenesis
LFI	Le Fort I
SSO	Sagittal Split Osteotomy
TMD	Temporo-Mandibular Disorders
IMF	Inter Maxillary Fixation
PREOP	PREOPerative (time)
POSTOP	POSTOPerative (time)
1 YR.	1 Year
LAST	LAST (follow-up)
Hmand	Mandibular Height
IMF	Inter-maxillary fixation

ABSTRACT

Purpose – The posterior vertical insufficiency (PVI) is a growth defect of the mandibular condyle, leading to a facial asymmetry. Various surgical procedures can be proposed to elongate the hypoplastic ramus. The aim of this study was to evaluate aesthetic and architectural long-term outcomes of the vertical ramus osteotomy (VRO) in patients with unilateral PVI.

Materials and methods – Forty-eights patients operated with unilateral VRO were included in this retrospective study. Aesthetic and architectural parameters were evaluated on frontal photographs, on frontal and lateral cephalograms pre-operatively, post-operatively, at 1-year and at the end of the follow-up.

Results – The aesthetic assessment revealed a significant correction of the chin deviation (CD) and of the lip commissural line tilt after VRO ($p1=0.0038$ and $p2=0.0067$ respectively) with stable results. The architectural analysis revealed a significant improvement in maxillary and mandibular occlusal planes, as well as the chin deviation ($p<0.0001$). A trend for relapse was noted for the mandibular canting and the CD during the follow-up. VRO allowed for a mean mandibular lengthening of 8.39 mm, ranged from 2.5 to 14mm.

Conclusion – VRO shows good results for the ramus lengthening in patients with unilateral PVI.

KEYWORDS

Malocclusion; mandibular condyle; mandibular osteotomy; orthognathic surgery; hemifacial microsomia

INTRODUCTION

The unilateral posterior vertical insufficiency (PVI) of the mandible is a default of the condyle unit growth, leading to aesthetic, architectural and functional alterations. Several etiologies have been responsible for this anomaly, dominated by congenital condyle hypoplasia, hemifacial microsomia (HFM) and post-traumatic injury (1,2). The PVI is characterized by a shortening of the mandibular ramus, causing an asymmetry of the lower third of the face. The commissural line is often elevated, while the chin is deviated on the affected side. An elevation of the maxillary occlusal cant is observed, as well as a dental class II malocclusion on the affected side. When associated with facial syndromes, various facial abnormalities can be found, as auricular malformation and soft tissue hypoplasia in HFM, cleft lip and/or palate.

The treatment of PVI requires a multidisciplinary approach. An early orthodontic phase can boost the condyle growth, but a surgical approach is often necessary to restore the facial symmetry (3,4). The surgical therapeutic options differ according to the temporo-mandibular joint (TMJ) function. In the case of an altered or absent TMJ, the costo-chondral graft (CCG) allows the condyle and ramus to be reconstructed while the mandibular growth is promoted (5–7). In the case of conserved TMJ function, the ramus reconstruction differs according to the centers, and can be managed by distraction osteogenesis (DO) or orthognathic ramus elongation procedures. Vertical ramus osteotomy (VRO), as described by Caldwell and Letterman (8) aims at restoring the ramus length and allowing for a mandibular advancement to correct the Class II malocclusion, with no alteration of the TMJ function.

To our knowledge, there is no comprehensive study in the literature about the results obtained with the VRO technique. The purpose of this study was to retrospectively evaluate long-term aesthetic, architectural and functional results of VRO for the treatment of unilateral mandibular PVI.

MATERIALS AND METHODS

Data collection

Patients treated by unilateral VRO in the Maxillofacial Surgery and Stomatology Department of the Nantes University Hospital, France, between 1983 and 2017 were included in the study, and analyzed retrospectively. The patient's charts were reviewed, and data were completed documenting the date of birth, the affected side (right vs left), the etiology of PVI, dates and types of operation, and additional procedures. TMJ function and potential surgical complications were also collected. In this retrospective study, no change to the current clinical practice or randomization was performed. An ethics committee approval was not required in order to use these data in the epidemiologic study, as per French legislation article L. 1121-1 paragraph 1 and R1121-2 of the Public Health Code.

Surgical protocol

The correction of the PVI was achieved using a VRO according to the Caldwell-Letterman technique (8). The procedure was performed under general anesthesia with nasotracheal intubation. An extra-oral approach was performed by low submandibular incision. In most of cases it was associated with an intraoral incision for muscular detachment and coronoïdectomy. After protecting the inferior alveolar pedicle and nerve, the ramus was sectioned vertically from the sigmoid incisura to the pre-angular notch. The ramus could be elongated while the functional mandibular condyle remained in the same location. Osteosynthesis was performed with a 0.8- or 1-mm-thick L-shaped miniplate (fig. 1). A posterior open bite was created on the affected side and an interocclusal splint was positioned and progressively reduced in length to promote secondary maxillary teeth egression. In some cases, the VRO was associated with other conventional orthognathic procedures such as Le Fort I osteotomy (LFI), contralateral sagittal split osteotomy (SSO) and/or genioplasty. An orthodontic preparation was usually needed, and intermaxillary elastic fixation was achieved for 6 weeks postoperatively.

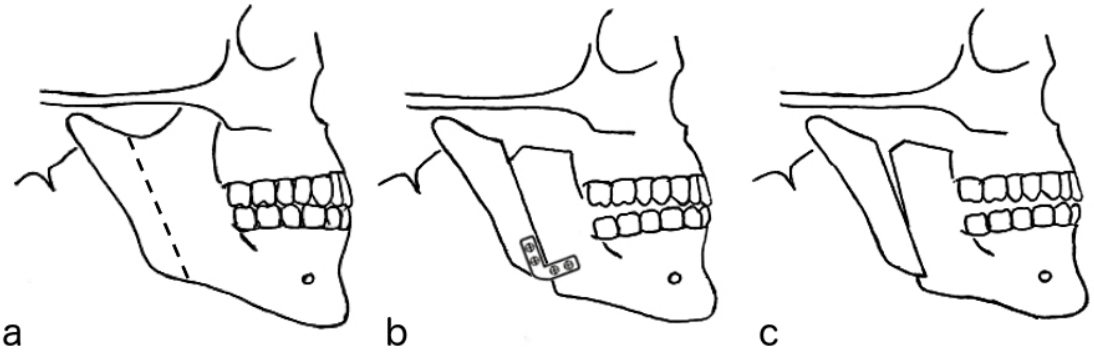


Figure 1 Schematic representation of the Caldwell-Letterman VRO technique. Osteotomy drawing line (a). Fixation of the ramus lengthening with a L-shaped miniplate (b). Use of the Mehnert's notch to lock the ramus elongation (c).

Clinical evaluation

Frontal standardized photographs were analyzed pre-operatively, post-operatively, at 1-year post-operatively, and at the end of the follow-up. To assess chin deviation, the angle α between the facial median line and a line from glabella to chin was measured. The angle β of the tilted lip commissure plane was measured using a parallel to pupillary line (fig. 2) (6,9,10). A scar evaluation was performed on the last follow-up photographs by 12 maxillofacial surgeons and non-medical staff members (nurses, secretary), using a visual scale ranged from zero to ten (zero representing an unsightly scar and ten corresponding to an invisible scar).

Radiographic evaluation

A cephalometric analysis was performed on frontal and profile cephalograms pre-operatively, post-operatively, at 1 year postoperatively, and at the last follow-up.

Two reference lines were used for the frontal analysis: the supra-orbital line joining the tops of the orbital roofs and a perpendicular line, passing through the crista galli, representing the median facial line. SO was defined as the distance measured between the supraorbital line and the most prominent cuspid of the second maxillary molar or the occlusal point on the non-affected side. SM was defined as the distance measured between the supraorbital line and the most prominent cuspid of the second mandibular molar or the occlusal point on the non-affected side. The reference lines in the affected side were designed as SO' and SM'. The SO'/SO ratio was used to assess the maxillary canting of the occlusal plane, while the SM'/SM ratio was used to assess the mandibular occlusal plane tilting in a frontal view. The chin deviation

(CD) was defined as the distance between the projection point of the axis of the lower incisors on symphysis and the median facial line (fig. 2).

On the profile analysis, the reference line used was the C1 line defined in the Delaire's analysis as the line joining the metanasion (M) to the clinoid fossa (Cl) (11). The distance from C1 to the distal cuspid of the last mandibular molar in occlusion (Hmand) allowed to determine and follow the lengthening of the mandibular ramus in postoperative times (fig. 2).

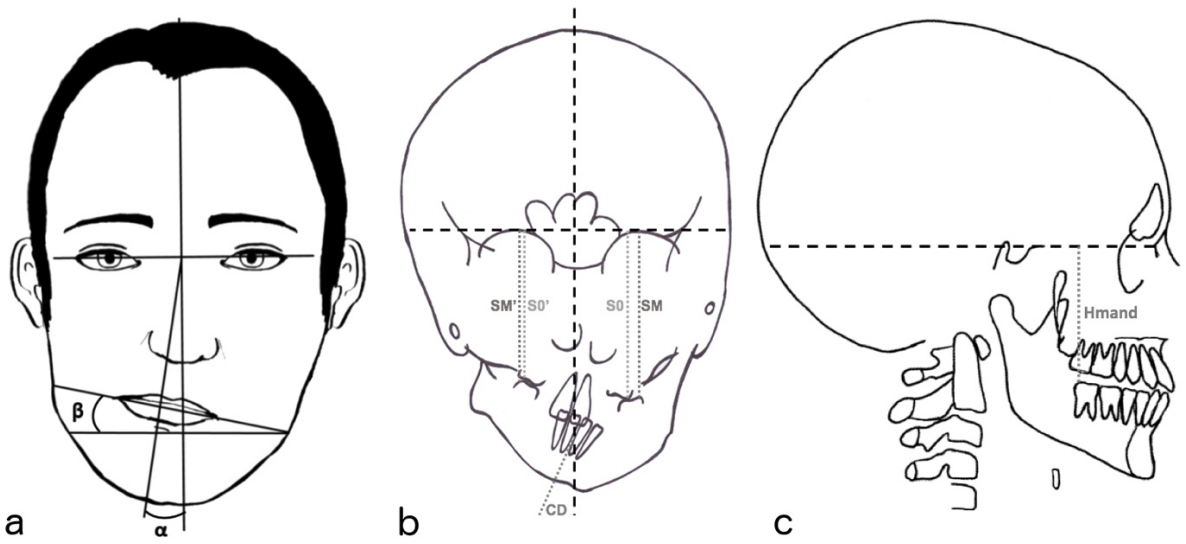


Figure 2 (a) Clinical evaluation of the facial soft tissues. Angle α: Chin deviation. Angle β: Bi-commissural line tilt. Cephalometric analysis on frontal (b) and lateral (c) X-rays. SO: Distance between the supra-orbital line and the maxillary molar occlusal point on the unaffected side. SM: Distance between the supra-orbital line and the mandibular molar occlusal point on the unaffected side. SO' and SM': Distance SO and SM on the affected side. CD: Distance between the projection point of the axis of the lower central incisors on symphysis and the medial facial line. Hmand: Distance between C1 and the mandibular occlusal point on the affected side.

Secondary endpoints

The surgical complications were collected and were considered as severe if it required to stop the procedure or to achieve a new intervention (infection, pseudarthrosis). The other complications were classified as minor (temporary lip hypoesthesia, facial nerve paresis). A condyle resorption was systematically looked for at one year and at the last follow-up. The TMJ function was investigated, when

possible, in search of temporo-mandibular disorders (TMD) (pain, joint cracking, articular locks) and articular amplitudes.

Statistical analysis

The methodical error of the cephalometric and facial measurements was assessed by the Dahlberg's formula (mean square error ($S.E^2$)=$d^2/2n$), where d is the difference between the first and the second measurements, and n is the number of double measurement (12,13). To determine the intra-observer error, cephalometric lengths and facial angles were measured twice by the same investigator at 4-week interval in ten random patients.

The statistical analysis was performed using GraphPad Prism 5.0 for Mac (GraphPad Software, La Jolla, CA, USA). Quantitative data were analyzed using a paired t-test when there were more than 30 replicates values and a Wilcoxon test when there were less than 30 paired observations. A Mann-Whitney comparison test for non-paired observations was used to compare the postoperative results between in subgroup analysis. A p-value of less than 0.05 ($p < 0.05$) indicated statistical significance.

RESULTS

Epidemiological data

Fifty-two patients were operated with a unilateral VRO in our department during the inclusion period. Four patients were excluded because of the lack of medical records. On the remaining 48 patients, a female predominance was observed (66.7% vs 33.3%, p=0.002). The left side was most often affected than the right side (58.3% vs 41.7%, p= 0.15). The mean age at the time of the mandibular surgery was 21.2 ± 10.3 years (7.6-44.3), and the mean follow-up duration was 73.8 ± 60.6 months (table 1).

Concerning the etiologies (table 2), we observed a predominance of isolated unilateral PVI in 68.8% of cases, represented by congenital condyle hypoplasia, post-traumatic injury, TMJ ankylosis, or condylo-mandibulo-dysplasia. Associated facial malformations were found in 31.2% of cases mainly represented by HFM and clefts.

Table 1. Patients characteristics.

Patients characteristics	
Sex: Females/Males, n (%)	32 (66.7) / 16 (33.3) (p= 0.002)
Affected side: Left/Right, n (%)	28 (58.3) / 20 (41.7) (p= 0.153)
Isolated, associated facial malformations n (%)	33 (68.8%) / 15 (31.2%)
Age at the time of the surgical procedure (years), mean ± S.D. (range)	21.2 ±10.3 (7.6-44.3)
Follow-up duration (months), mean ± S.D. (range)	73.8 ± 60.6 (1.4-255.6)

n, Number of patients; S.D., standard deviation.

Table 2. Etiologies of PVI and associated craniofacial anomalies.

Etiologies and associated craniofacial abnormalities	
Congenital condyle hypoplasia, n (%)	24 (50)
Hemifacial microsomia (types I and IIA), n (%)	9 (18.7)
Post-traumatic injury, n (%)	5 (10.4)
Associated cleft (lip/palate), n (%)	3 (6.3)
Condylo-mandibulo-dysplasia, n (%)	2 (4.2)
Temporomandibular joint ankylosis, n (%)	2 (4.2)
Asymmetric Treacher-Collins syndrome, n (%)	1 (2.1)
Asymmetric Russel-Silver syndrome, n (%)	1 (2.1)
Unilateral Saerthre-Schotzen syndrome, n (%)	1 (2.1)

n, number of patients.

Surgical protocol

All the patients were given a VRO to correct a unilateral postero-vertical insufficiency. The mean increases in the mandibular ramus, reflected by the Hmand, was 8.39 ± 3.12 mm (2.5-14) in immediate post-operative time ($p<0.0001$). A trend for recurrence was observed at 1 year (loss of 2.80 ± 2.58 mm; $p<0.0001$) with stable results at the last follow-up and was not correlated to the lengthening amount.

In more than half of patients (54.2%) a contralateral SSO was associated to the procedure for mandibular derotation and/or advancement. Half of cases were associated with a LFI osteotomy (23 patients, of which 4 younger than 18 years of age, where a LF1 was justified to realign the inter-incisors maxillary point and/or rise the maxillary on the non-affected side) and genioplasty. All the associated procedures are listed in table 3. The mean inter-maxillary fixation (IMF) duration was 1.7 months, and the mean duration for interocclusal splint wearing was 3.1 months.

A secondary orthognathic procedure was performed in 6 patients (12.5%), consisting in genioplasty (5 cases), contralateral SSO (3 cases), second VRO (1 case), homolateral SSO (1 case), and LF1 osteotomy (1 case). The second intervention was performed in average 25.3 ± 18.9 months (3.1-50.6) after the first procedure, at a mean age of 20.8 ±10.4 years.

Table 3. Additional associated osteotomy;

Associated orthognathic procedures	
Contralateral SSO, n (%)	26 (54.2)
LF1 osteotomy, n (%)	23 (47.9)
Genioplasty, n (%)	24 (50.0)

n, number of patients; SSO, sagittal split osteotomy; LF1, Le Fort I.

Aesthetic results

The mean Dahlberg standard error for alpha and beta measurements was respectively 0.19 ± 0.22° (0-0.5°) and 0.21 ± 0.37° (0-2°).

The VRO allowed an immediate and significant improvement in the chin deflection and a correction of the lip commissural line tilting (fig. 3) respectively reflected by α and β angles. The angle α was corrected after the mandibular procedure from 3.88 ± 2.76° in pre-operative time to 0.37 ± 1.58° in post-operative period; p=0.0038). The angle β was corrected from 4.12 ± 2.29° in pre-operative period to 2.41 ± 1.86° in post-operative time, p=0.0067). The surgical results remained stable over time concerning the bicommissural line tilting, while a non-significant trend for relapse was noted at one year for the angle α (fig. 4).

The evaluation of the cervical scar was realized on nineteen profile photographs at the last follow-up visit. The mean aesthetic score was 8.1 ± 1.5 (3-10) for a mean evaluation time at 4.7 ± 3.9 (1-12.7) years after surgery.

Figure 3. Young patient presenting with a right PVI corresponding to a congenital condyle hypoplasia, who underwent a VRO and a contralateral SSO at the age of 11 years. Frontal photographs preoperatively (a), 3 months postoperatively (b), 1 year postoperatively (c), and 5 years postoperatively (d).

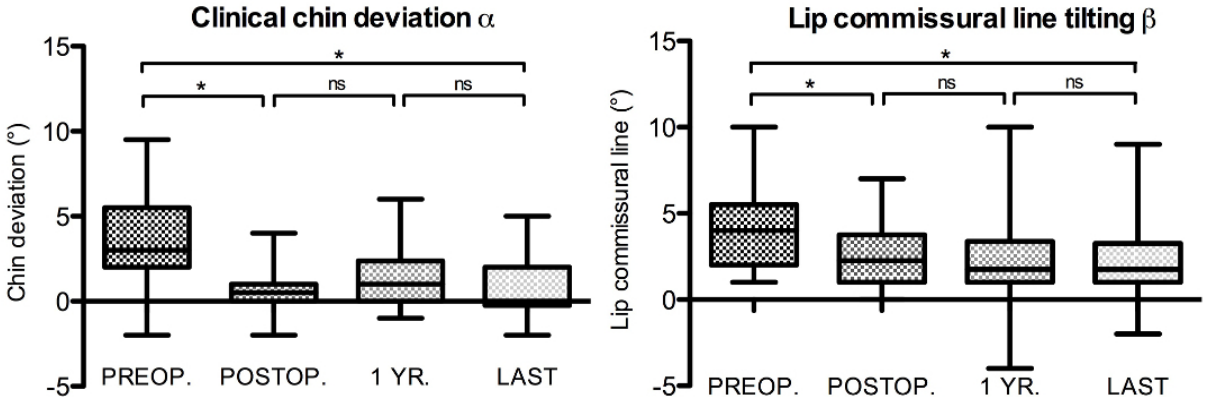


*Figure 4 Variation in the chin deviation and the lip commissural line tilt preoperatively (PREOP.), postoperatively (POSTOP.), at 1-year (1 YR.) postoperatively, and at the last follow-up (LAST) in the patients receiving a unilateral VRO. *p<0.05; ns, not significant.*

Architectural results

The mean Dahlberg standard error for the distance measurements was $2.57.10^{-4}$ (0-$2.22.10^{-3}$) for the SO'/SO ratio, and $1.78.10^{-4}$ (0-$9.45.10^{-4}$) for the SM'/SM ratio. The mean error for the distance measurement (CD, Hmand) was 0.64 mm (0-2).

The maxillary occlusal canting reflected by the SO'/SO ratio was significantly improved in postoperative time, with a progressive horizontalization over time due to the spontaneous egression of the maxillary teeth (0.93 ± 0.03 preoperatively, 0.97 ± 0.04 postoperatively, 0.99 ± 0.03 at 1 year; $p<0.0001$), with stable results at the last follow-up (0.99 ± 0.03; $p=0.29$) (fig. 5). When an associated LF1 osteotomy was performed, the maxillary canting was immediately restored (0.93 ± 0.04 in pre-operative time vs 1.00 ± 0.03 in post-operative period; $p=0.0001$) with stable results (fig. 6). No difference in the maxillary occlusal canting was observed in the preoperative time and at the last follow between patients receiving or not a concomitant LF1 osteotomy.

The frontal mandibular occlusal canting reflected by the SM'/SM ratio was significantly improved and over-corrected after VRO (0.93 ± 0.03 in pre-operative time vs 1.01 ± 0.02 in post-operative time; $p<0.0001$) with a slight trend for recurrence of the mandibular asymmetry at one year and at the last follow-up (0.99 ± 0.03 and 0.98 ± 0.04 respectively; $p_1=0.03$ and $p_2=0.01$).

The chin deviation was corrected after VRO (9.74 ± 5.30 mm in preoperative time vs 0.44 ± 4.41 mm in postoperative period; $p<0.0001$). A trend for relapse was noted at one year, with stable results at the last follow-up (2.23 ± 4.25 mm and 2.50 ± 5.01 mm; $p_1=0.01$ and $p_2=0.46$ respectively) (fig. 6).

Figure 5. Patient presenting with a left condyle hypoplasia, who underwent a one-stage surgical procedure at the age of 16 years with a left VRO, contralateral SSO and genioplasty. Facial and occlusal photographs: preoperatively (a, e), at 6 months postoperatively (b,f), at 1-year postoperatively (c,g), and at 5 years postoperatively (d,h). Corresponding frontal cephalograms: preoperatively (i), postoperatively (j), at 1 year (k) and at 5 years (l) postoperatively.

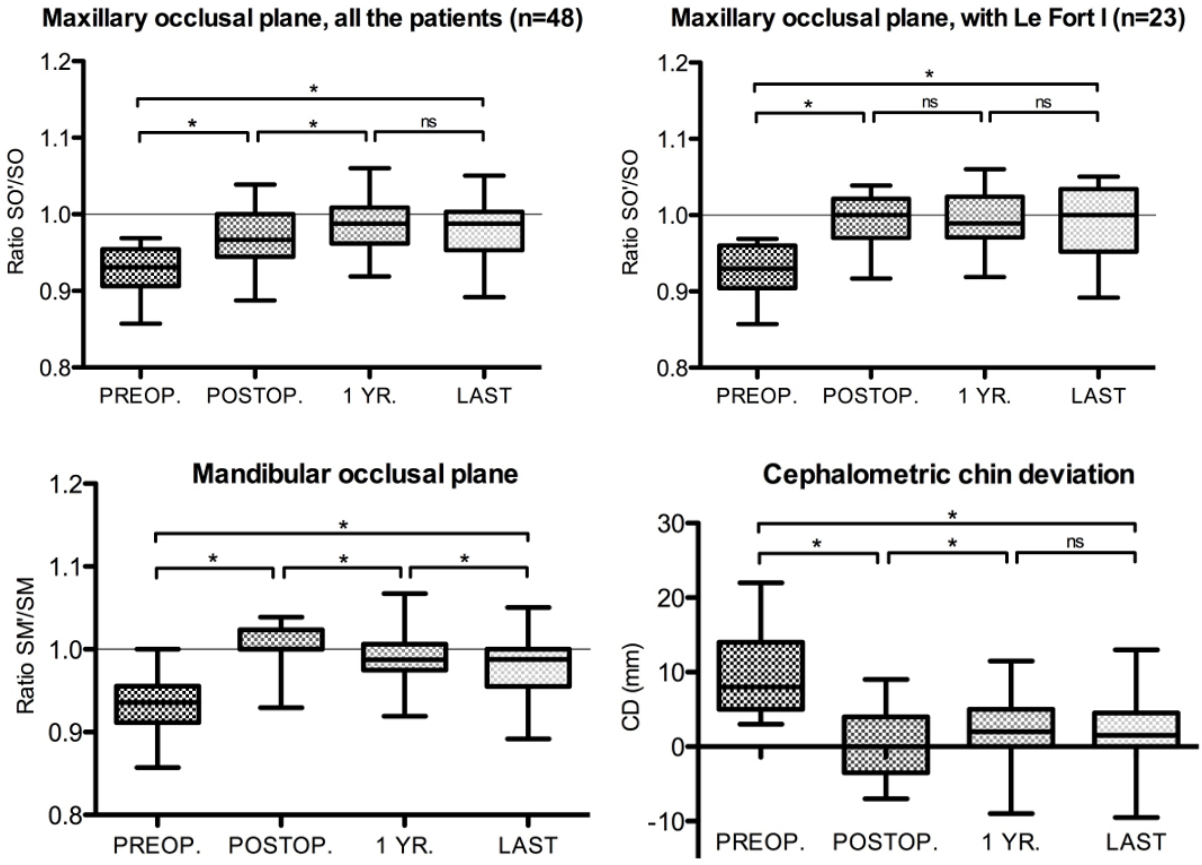


*Figure 6 Variation of the maxillary occlusal plane preoperatively (PREOP.), postoperatively (POSTOP.), at 1-year postoperatively (1 YR.), and at the last follow-up (LAST) in all the patients and in patients with LF1. Variation of the mandibular occlusal plane and the cephalometric chin deviation preoperatively (PREOP.), postoperatively (POSTOP.), at 1-year postoperatively (1 YR.) and at the last follow-up (LAST). *p<0.05; ns, not significant.*

Secondary endpoints

Four severe complications (8,3%) were reported, one of which required to stop the surgical procedure because of a maxillary artery significant bleeding. Three patients needed another procedure (one case of infection, one bad split and one late pseudarthrosis) with good outcomes.

Ten patients (20,8%) presented a hypoesthesia in the inferior alveolar nerve territory, with a total recovery in the year following the procedure for 9 patients, and one case of definitive hypoesthesia. A normal sensibility was noted six months after the procedure for the others. A temporary facial paresis with complete recovering six months after the surgery was reported in four cases (8,3%). The others related

complications were: intense bleeding controlled with vascular clips in one case, one postoperative infection resolved with antibiotic therapy, one limited mouth opening and one condylar resorption.

The TMJ function was known for 12 patients at the end of follow-up. Six patients presented TMJ disorders, whose four with cracking of the joint, four with pains, and two with articular locks.

DISCUSSION

Regarding the literature analysis, the posterior vertical dimension is less studied than the anterior vertical height. The PVI is correlated to a growth defect of the condyle unit. It can be from an acquired origin (14) after a condyle fracture (15,16), a TMJ ankylosis, or a juvenile idiopathic arthritis (17,18). The other cause is the congenital condyle hypoplasia, isolated or associated to a craniofacial malformation such as HFM (2,19,20). The treatment of PVI can be challenging for both orthodontists and maxillo-facial surgeons (4,21). The surgical treatment aims to achieve a facial symmetry and a normal occlusion, and to maintain functional and aesthetic results after completion of growth. The CCG remains the gold standard for the replacement of the TMJ in HFM Prusansky Kaban types IIB and III (5,7,22), in case of TMJ ankylosis or degenerative joint disease (6,23,24). It allows for restoring a normal function, and an important growth potential in children (5,7,25). When the TMJ function and anatomy are preserved, a ramus osteotomy is more suitable to provide facial symmetry (2,20). The VRO technique was first described by Caldwell and Letterman in order to set back the mandibular ramus for the correction of prognathism (8). Most of literature about the procedure is related to the treatment of Classe III malocclusion from mandibular origin (26–28). In our practice, we have been using the VRO technique for many years for the correction of the unilateral and bilateral PVI with normal TMJ.

We reported the aesthetic and the architectural results obtained with VRO in a series of 48 patients. Most of patients (68.8%) presented with an isolated unilateral PVI from congenital or acquired origin, while 31.2% of patients presented an associated craniofacial abnormality, mainly types I and IIA HFM. The procedure was proposed by the age of 7 years as it does not interfere with the mandibular growth, as well as in adult population. The VRO provided an immediate restauration of the symmetry of the lower third of the face, evidenced by photographic and cephalometric analysis. A trend for relapse was noted at one year postoperatively regarding the mandibular canting and the chin deviation, with stable results thereafter with a mean follow-up duration of 6 years after the procedure. These outcomes are consistent with those obtained by Bertin *et al.* in 15 patients treated by VRO for a type IIA HFM (6). The procedure allowed for a significant ramus lengthening ranged from 2.5 to 14 mm without using bone graft, with a 33% loss of height at one year after the procedure,

and stable results at the last follow-up. Nevertheless, this measurement doesn't represent the real bone lengthening, which is more important but difficult to assess because of the mandibular angle remodeling. The partial relapse was not correlated with the lengthening proportion and can be explained by the action of the masticatory muscles, the potential condyle resorption, or because of the soft tissue hypoplasia in patients with HFM (10,29). This loss is clinically hardly discerning and corresponds to the overcorrection of the lengthening and the part of relapse. In our practice, we perform a large soft tissue detachment with section of the pterygo-masseteric muscular strap, as well as a superior coronoidectomy, to keep the ramus height and to minimize the recurrence of the PVI. Furthermore, an hypercorrection of the mandibular lengthening is performed to prevent the potential relapse. For more stability, a notch can be shaped on the posterior side of the distal fragment to lock the ramus proximal fragment, as described by Mehnert (fig. 1) (30,31). A one-stage correction of the maxillary occlusal canting was obtained either by a concomitant Le Fort I osteotomy (half cases), or by the spontaneous dento-alveolar adaptation of the maxillary bone in response to the generated open bite (32). This highlights the importance of the elastic therapy and the use of an occlusal splint to guide the vertical movement of the maxilla. These results remained stable over time.

The use of an external approach can represent a limit regarding the scar and the potential nervous damage in the facial nerve territory. In our experience, all the patients recovered from a facial paresis, and the cervical scarring was good at the last follow-up according to the 12 evaluators. An intraoral strategy is proposed by various teams to prevent any cutaneous or nerve damage (26,33–35).

Other orthognathic procedures have been described to lengthen the mandibular ramus. The L-inverted osteotomy can provide good results but requires a bone grafting, generating donor site morbidity (36,37). Ferri *et al*. described the possibility to obtain a mandibular lengthening with a conventional Epker-modified-Wolford osteotomy after a complete section of the pterygo-masseteric sling, avoiding extra-oral procedures (29,38). Grimaud *et al*. proposed a different intra-oral osteotomy allowing a mandibular angle lowering and ramus lengthening without coronoïdectomy (35). A lake of long-terms data with those procedures, doesn't let us to know if there are stable outcomes with time. Other teams prefer to perform DO for ramus elongation, particularly in the case of PVI with normal TMJ associated with HFM (i.e. type I and IIA). The DO takes its advantage of an intra-oral device, a minimally

invasive surgery, , and the concomitant expansion of the surrounding soft tissues (39–41). However, long-term relapse is frequently described, requiring further procedures.

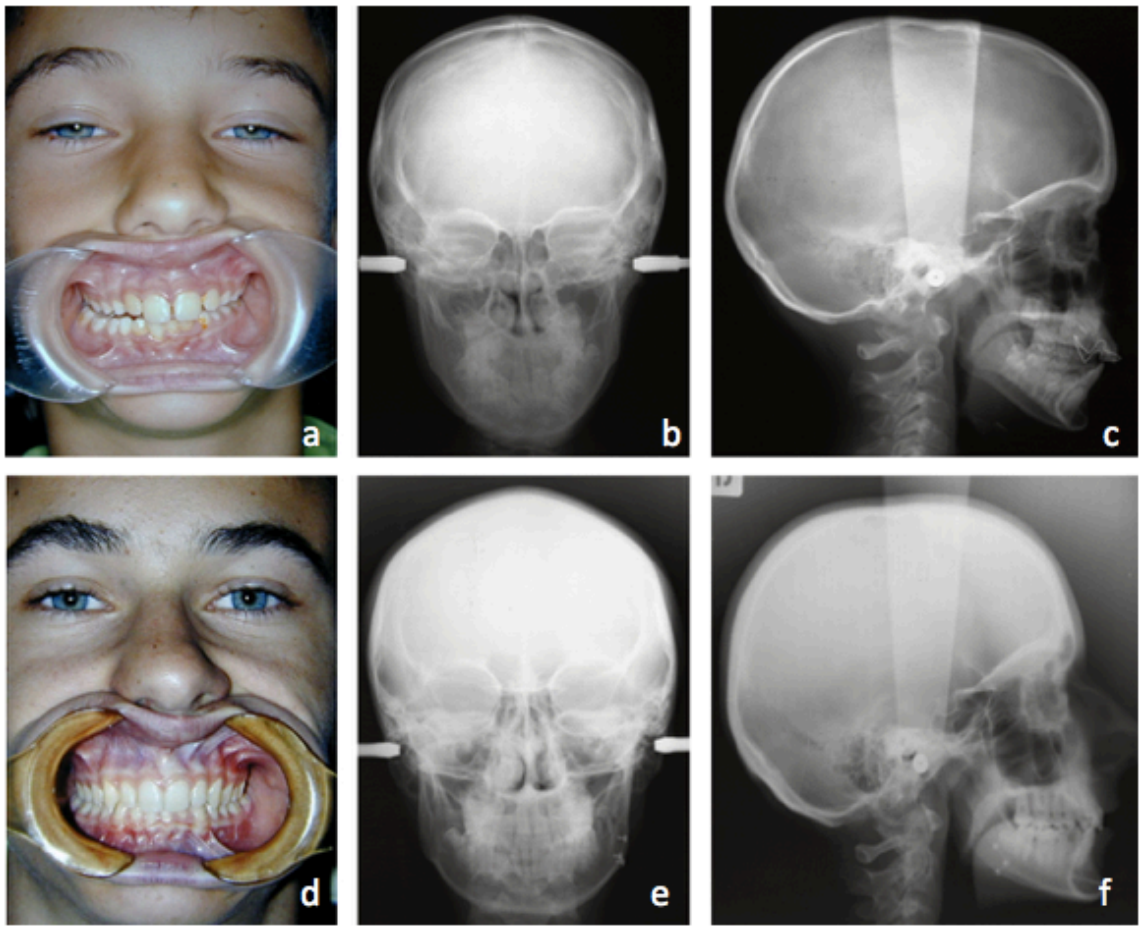
To assess the efficacy of VRO, we used standardized photograph and postero-anterior cephalograms for more reliability in measuring distances. The mandibular lengthening was evaluated with the variation of the distance between a reference cranial line C1, and the cuspid of the last mandibular molar in occlusion. While other authors prefer the use of the Gonion point to evaluate the ramus elongation (29), we consider this point varying because of the remodeling of the mandibular angle after a ramus elongation. The SO'/SO and SM'/SM ratios, reflecting the frontal maxillary and mandibular canting, were used to eliminate the variability factors between radiographs. A three-dimensional analysis would be more relevant to assess the cephalometric changes and could be part of further studies.

The patients included in this work were heterogeneous regarding the cause of the PVI, making it difficult to conclude about the impact of soft tissue (observed in HFM) hypoplasia in the partial relapse of the deformity. Moreover, this study focused on PVI cases with preserved TMJ function, excluding the most severe cases of shortened mandibular ramus. Further studies are needed to compare VRO to DO in unilateral PVI, and the analysis has to be extended to bilateral cases of PVI.

CONCLUSION

We report good aesthetic and architectural long-term results with the Caldwell-Letterman VRO technique to lengthen the mandibular ramus in patients with unilateral PVI.

CASUISTIQUE



<u>CAS NUMERO 1 :</u> Patient porteur d'une condylo-mandibulo dysplasie en bosse de chameau gauche, opéré d'un allongement vertical rétro-spigien gauche à l'âge de 11 ans. Photographies de l'occlusion de loin en pré-opératoire (a) et à l'âge de 17 ans (d). Téléradiograhies de face et de profil en pré-opératoire (b,e) et à l'âge de 17 ans (c,f).

CAS NUMERO 2 Patiente présentant une hypocondylie congénitale gauche, opérée à l'âge de 14 ans, d'un allongement vertical rétro-spigien gauche associé à une ostéotomie sagittale contro-latérale de la branche montante. Photographies de face et occlusion de loin en pré-opératoire (a,e), à un mois post-opératoire (b,f), à 6 mois post-opératoire (c,g) et à quatre ans post-opératoire (d,h). Photographie de profil à quatre ans post-opératoire (i). Téléradiographies de face et de profil en pré-opératoire (j,n), post-opératoire (k,o), à 6 mois post-opératoire (l,p) et à quatre ans post-opératoires (m,q)

CAS NUMERO 3 : Patiente présentant une hypocondylie gauche, ayant précédemment bénéficié d'une génioplastie dans un autre centre, opérée à l'âge de 25 ans d'un allongement vertical rétro-spigien gauche, d'un Le Fort 1 de recentrage et d'ascension droite, et reprise de la génioplastie. Photographies de face et occlusion de loin en pré-opératoire (a,e), à 6 mois post-opératoire (b,f), à 1 an post-opératoire (c,g) et à deux ans post-opératoire (d,h). Photographie de profil à deux ans post-opératoire (i). Téléradiographies de face et de profil en pré-opératoire (j,n), post-opératoire (k,o), à 1 an post-opératoire (l,p) et à 2 ans post-opératoires (m,q).

REFERENCES

1. Moss ML. The primacy of functional matrices in orofacial growth. Dent Pract Dent Rec. oct 1968;19(2):65-73.

2. Mercier J, Gordeeff A, Delaire J. [Changes in the posterior vertical dimension of the face. Etiopathogenic factors, architectural criteria and therapeutic aspects]. Orthod Francaise. 1989;60 Pt 2:575-82.

3. Bardinet E, Duhart A-M. [Orthopedic approach to asymmetry]. Orthod Francaise. juin 2002;73(2):215-28.

4. Salagnac JM, Delaire J, Mercier J. [Vertical development of the face and cervical spine. Diagnostic and therapeutic significance in orthodontics and maxillofacial surgery]. Rev Stomatol Chir Maxillofac. avr 1999;100(1):13-26.

5. Ross RB. Costochondral grafts replacing the mandibular condyle. Cleft Palate-Craniofacial J Off Publ Am Cleft Palate-Craniofacial Assoc. juill 1999;36(4):334-9.

6. Bertin H, Mercier J, Cohen A, Giordanetto J, Cohen N, Lee SH, et al. Surgical correction of mandibular hypoplasia in hemifacial microsomia: A retrospective study in 39 patients. J Cranio-Maxillo-fac Surg Off Publ Eur Assoc Cranio-Maxillo-fac Surg. juin 2017;45(6):1031-8.

7. Birgfeld C, Heike C. Craniofacial Microsomia. Clin Plast Surg. avr 2019;46(2):207-21.

8. Caldwell JB, Letterman GS. Vertical osteotomy in the mandibular raml for correction of prognathism. J Oral Surg. juill 1954;12(3):185-202.

9. Mouallem G, Vernex-Boukerma Z, Longis J, Perrin J-P, Delaire J, Mercier J-M, et al. Efficacy of proportional condylectomy in a treatment protocol for unilateral condylar hyperplasia: A review of 73 cases. J Cranio-Maxillo-fac Surg Off Publ Eur Assoc Cranio-Maxillo-fac Surg. juill 2017;45(7):1083-93.

10. Kahnberg KE. Correction of maxillofacial asymmetry using orthognathic surgical methods. J Cranio-Maxillo-fac Surg Off Publ Eur Assoc Cranio-Maxillo-fac Surg. oct 1997;25(5):254-60.

11. Delaire J. [Architectural and structural craniofacial analysis (lateral view). Theoretical principles. Some example of its use in maxillofacial surgery (author's transl)]. Rev Stomatol Chir Maxillofac. 1978;79(1):1-33.

12. Kamoen A, Dermaut L, Verbeeck R. The clinical significance of error measurement in the interpretation of treatment results. Eur J Orthod. oct 2001;23(5):569-78.

13. Dahlberg G. Statistical Methods for Medical and Biological Students. Br Med J. 14 sept 1940;2(4158):358-9.

14. Chouinard A-F, Kaban LB, Peacock ZS. Acquired Abnormalities of the Temporomandibular Joint. Oral Maxillofac Surg Clin N Am. févr 2018;30(1):83-96.

15. Mercier J, Huet P, Perrin JP. [Functional management of fractures of the mandibular condyle]. Rev Stomatol Chir Maxillofac. oct 2000;101(4):203-6.

16. Demianczuk AN, Verchere C, Phillips JH. The effect on facial growth of pediatric mandibular fractures. J Craniofac Surg. juill 1999;10(4):323-8.

17. Resnick CM, Frid P, Norholt SE, Stoustrup P, Peacock ZS, Kaban LB, et al. An Algorithm for Management of Dentofacial Deformity Resulting From Juvenile Idiopathic Arthritis: Results of a Multinational Consensus Conference. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg. juin 2019;77(6):1152.e1-1152.e33.

18. Stoor P, Hodzic Z, Arte S. Surgical Treatment of Dentofacial Deformities Caused by Juvenile Idiopathic Arthritis. J Craniofac Surg. janv 2018;29(1):e51-7.

19. Gallucci A, Graillon N, Foletti JM, Chossegros C, Cheynet F. [Congenital malformations of the temporo-mandibular joint and the mandibular ramus: Grafting vs distraction osteogenesis]. Rev Stomatol Chir Maxillo-Faciale Chir Orale. sept 2016;117(4):240-4.

20. Mercier J-M, Perrin J-P, Longis J, Arzul L, Corre P. [Facial asymmetries and their skeletal component]. Rev Stomatol Chir Maxillo-Faciale Chir Orale. sept 2014;115(4):219-28.

21. Salagnac JM, Delaire J. [Therapeutic prognosis in skeletal Class II malocclusion dependent on the vertical balance of the anterior and posterior sections of the face]. Orthod Francaise. 1989;60 Pt 2:609-15.

22. Kaban LB, Moses MH, Mulliken JB. Correction of hemifacial microsomia in the growing child: a follow-up study. Cleft Palate J. déc 1986;23 Suppl 1:50-2.

23. Pluijmers BI, Caron CJJM, Dunaway DJ, Wolvius EB, Koudstaal MJ. Mandibular reconstruction in the growing patient with unilateral craniofacial microsomia: a systematic review. Int J Oral Maxillofac Surg. mars 2014;43(3):286-95.

24. Al-Moraissi EA, El-Sharkawy TM, Mounair RM, El-Ghareeb TI. A systematic review and meta-analysis of the clinical outcomes for various surgical modalities in the management of temporomandibular joint ankylosis. Int J Oral Maxillofac Surg. avr 2015;44(4):470-82.

25. Castellon L, Jerez D, Mayorga J, Fuenzalida C. Remodeling of Costochondral Graft After Mandibular Reconstruction. J Oral Maxillofac Surg. janv 2017;75(1):226.e1-226.e7.

26. Ghali GE, Sikes JW. Intraoral vertical ramus osteotomy as the preferred treatment for mandibular prognathism. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg. mars 2000;58(3):313-5.

27. Choung PH. A new osteotomy for the correction of mandibular prognathism: techniques and rationale of the intraoral vertico-sagittal ramus osteotomy. J Cranio-Maxillo-fac Surg Off Publ Eur Assoc Cranio-Maxillo-fac Surg. juin 1992;20(4):153-62.

28. Iwanaga J, Kikuta S, Nakamura M, Koba A, Ogata K, Toyofuku S, et al. Intraoral vertico-sagittal ramus osteotomy: modification of the L-shaped osteotomy. Int J Oral Maxillofac Surg. déc 2017;46(12):1552-6.

29. Ferri J, Ricard D, Genay A. Posterior vertical deficiencies of the mandible: presentation of a new corrective technique and retrospective study of 21 cases. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg. janv 2008;66(1):35-44.

30. Mercier J, Gordeeff A, Delaire J. [Syndrome of unilateral posterior vertical insufficiency of the face. Clinical and therapeutic aspects]. Acta Stomatol Belg. juin 1989;86(1):13-32.

31. Mehnert H. A variation in the vertical osteotomy of the rami for correction of retrognathism: preliminary report. J Maxillofac Surg. déc 1976;4(4):210-2.

32. Mercier J-M, Perrin J-P, Longis J, Arzul L, Corre P. [Facial asymmetries and their skeletal component]. Rev Stomatol Chir Maxillo-Faciale Chir Orale. sept 2014;115(4):219-28.

33. Choi YJ, Ha Y-D, Lim H, Huh J-K, Chung CJ, Kim K-H. Long-term changes in mandibular and facial widths after mandibular setback surgery using intraoral vertical ramus osteotomy. Int J Oral Maxillofac Surg. sept 2016;45(9):1074-80.

34. Greaney L, Bhamrah G, Sneddon K, Collyer J. Reinventing the wheel: a modern perspective on the bilateral inverted ‘L’ osteotomy. Int J Oral Maxillofac Surg. nov 2015;44(11):1325-9.

35. Grimaud F, Bertin H, Fauvel F, Corre P, Perrin J-P. Vertical ramus elongation and mandibular advancement by endobuccal approach: Presentation of a new osteotomy technique. J Stomatol Oral Maxillofac Surg. févr 2017;118(1):66-9.

36. Tulasne JF. Mandibular micrognathia. Analysis and treatment. Clin Plast Surg. oct 1982;9(4):519-30.

37. Medeiros PJ, Ritto F. Indications for the inverted-L osteotomy: report of 3 cases. J Oral Maxillofac Surg Off J Am Assoc Oral Maxillofac Surg. févr 2009;67(2):435-44.

38. Ferri J, Girod A, Serghini A, Lemière E. [Lengthening the mandibular ramus without external access]. Rev Stomatol Chir Maxillofac. févr 2006;107(1):38-40.

39. Baek S-H, Kim S. The determinants of successful distraction osteogenesis of the mandible in hemifacial microsomia from longitudinal results. J Craniofac Surg. juill 2005;16(4):549-58.

40. McCarthy JG, Stelnicki EJ, Mehrara BJ, Longaker MT. Distraction osteogenesis of the craniofacial skeleton. Plast Reconstr Surg. juin 2001;107(7):1812-27.

41. Molina F. [Mandibular elongation and remodeling by gradual distraction. An experience of 277 cases]. Ann Chir Plast Esthet. oct 2001;46(5):507-15.

NOM : ANQUETIL PRENOM : Marine

Évaluation de l'ostéotomie verticale rétrospigienne pour la correction chirurgicale de l'insuffisance verticale postérieure unilatérale, résultats à long-terme.

RESUME

Introduction : L'insuffisance verticale postérieure est liée à un défaut de croissance de l'unité condylienne, entrainant une asymétrie faciale d'origine mandibulaire. Plusieurs techniques chirurgicales permettent l'allongement du ramus hypoplasique. L'objectif de notre étude était d'évaluer à long-terme les résultats esthétiques et architecturaux de l'ostéotomie verticale rétrospigienne (OVRS).

Matériel et méthodes : Quarante-huit patients opérés d'une OVRS ont été inclus rétrospectivement dans cette étude. Une analyse des paramètres esthétiques et architecturaux a été réalisée à partir des photographies de face, des téléradiographies de face et de profil, en pré-opératoire, en post-opératoire, à un an et en fin de suivi.

Résultats : L'analyse esthétique a montré une amélioration significative de la déviation mentonnière et de la ligne bi-commissurale après l'OVRS ($p1=0,0038$ et $p2=0,0067$ respectivement) avec des résultats stables. L'analyse architecturale a montré une amélioration significative de l'inclinaison des plans d'occlusion maxillaire et mandibulaire, ainsi que de la déviation du mentonnière ($p<0,0001$). Une tendance à la récidive a été notée sur l'inclinaison du plan d'occlusion mandibulaire et de la déviation du menton durant le suivi. L'allongement mandibulaire moyen était de 8,39 mm, allant de 2,5 à 14 mm.

Conclusion : L'OVRS permet d'obtenir de bons résultats sur l'allongement mandibulaire des patients présentant une insuffisance verticale postérieure unilatérale.

MOTS-CLES

Malocclusion ; condyle mandibulaire ; chirurgie orthognatique ; ostéotomie mandibulaire ; microsomie hémi-faciale ; hypocondylie