Treatment of Chin Deformities

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Facial beauty depends on the form, proportion and position of its various units. The chin is the most prominent element of the lower third of the face, both in the frontal view and in profile.
The surgical approach to chin deformities did not start until the second half of the twentieth century. The development of silicone prostheses and the emergence of sliding genioplasty offered surgeons a whole new range of options to modify the size and position of the chin.
We have performed a historical review of chin surgery, the multiple aesthetic analyses available and the advantages and disadvantages of the different alloplastic materials and osteotomies. To do so, a comprehensive search through current scientific literature on the topic has been carried out, focusing on large series, long-term follow-up studies, research in animal models and medical evidence.
As happens in almost any topic in facial plastic surgery, no strong evidence useful in ENT practice for handling chin deformities can be found in today's scientific literature. Ethnicity influences the aesthetic analysis; the type and degree of deformity to be corrected will determine the alloplastic augmentation of the chin or the suitability of osteotomy. Porous polyethylene (Medpor, Porex Surgical, Newman, Ca, USA) and solid silicone (Silastic, Michigan Medical Corporation, Santa Barbara, Ca, USA) show a clear advantage over other alloplastic materials. Moderate-to-severe retrogenia benefits from sliding genioplasty strategies rather than prosthetic enlargement.

Key words: Retrogenia. Mentoplasty. Genioplasty. Silastic. Medpor. Osteotomy.

Tratamiento de las deformidades del mentón

La belleza facial se basa en la forma, la proporción y la posición adecuadas de sus distintos elementos. El mentón domina el tercio facial inferior, tanto en el plano frontal como en el sagital.
El tratamiento de las deformidades del mentón no se desarrolló hasta mediados del siglo XX. La aparición de las prótesis de silicona y la descripción de la genioplastia de deslizamiento supusieron el inicio de un gran número de opciones para modificar las dimensiones y posición de esta estructura.
En este artículo realizamos una revisión de la historia de la cirugía del mentón, las distintas formas de análisis estético y las ventajas y los inconvenientes de los distintos materiales aloplásticos y osteotomías. Para ello hemos llevado a cabo una exhaustiva búsqueda en la literatura científica actual sobre el tema, en que primaron las series largas, los artículos con seguimiento a largo plazo, los estudios en animales de experimentación y la evidencia médica.
En el momento actual, al igual que en casi cualquier tema de cirugía plástica facial, hay escasa evidencia científica que pueda guiar la práctica del especialista en otorrinolaringología en el manejo de las deformidades del mentón. Las variaciones étnicas condicionan el análisis estético; el tipo de deformidad a corregir y su grado determinarán la colocación de una prótesis o la realización de una osteotomía. En las mentoplastias con prótesis la silicona sólida (Silastic, Michigan Medical Corporation, Santa Barbara, Ca, Estados Unidos) y el polietileno poroso (Medpor, Porex Surgical, Newman, Ga, Estados Unidos) muestran una ventaja clara sobre los otros materiales aloplásticos. En retrogenias moderadas o severas la osteotomía se muestra como la mejor opción.

Palabras clave: Retrogenia. Mentoplastia. Genioplastia. Silastic. Medpor. Osteotomía.

Review commissioned from the Facial Plastic Surgery Committee of the Spanish Otorhinolaryngology Society.

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Received February 15, 2008.
Accepted for publication March 5, 2008.

INTRODUCTION

The chin is one of the most visible structures of the face. Located on the midline, its shape and size have been related since remote times with certain characteristics of the individual's personality. Males with a small or retruded chin are unwittingly associated with a weak, hesitant, passive,

Figure 1. Plane of the face by González-Ulloa.

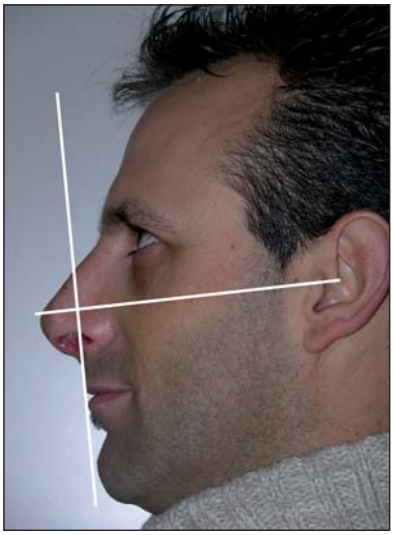

Figure 2. Position of the chin according to Bell.

and shy personality, whereas a prognathic chin reflects a strong, manly and determined personality. The aesthetically ideal female chin is smaller in size and projection, fits into a more curved facial outline with gentler angles.[1]

Ivory, ox bone, auto-transplants of bone or cartilage or different alloplastic materials have all been used to increase the size of this structure.[2] The description of sliding genioplasty by Hofer[3] and its subsequent improvement by Trauner and Obwegeser[4] in the middle of the last century allowed surgeons to make use of a procedure to alter the chin's dimensions 3-dimensionally. The emergence of prostheses made from silastic and the development of new biomaterials have implied a simplification of the therapeutic approach for most patients.[5]

From an initial aesthetic analysis seeking only a modification of the chin's anteroposterior axis in the profile of the face, we have progressed to a more complex analysis in which the chin forms part of a combination including the lower lip, the labiomental fold, the sub-mentonian area, the lower edge of the mandible and the mentocervical angle. Asymmetries in the midline, the size of the body of the mandible or the ratio between the point of maximum projection of the chin and the tip of the nose are determinant when it comes to deciding how to handle a patient.[6]

Associated with this progression in the aesthetic analysis, the last few years have seen the design of anatomical prostheses that alter not only the chin area but also the body of the mandible, prostheses that deal with the antegonial sulcus or increase the vertical diameter.[7] The indication of osteotomy or implant, the choice of type of alloplastic material for the prosthesis or its super-periosteal or sub-periosteal placement are still controversial issues.[8]

Chin surgery, initially described for the treatment of dentofacial alterations, has had its indications extended towards the correction of certain deformities associated with facial ageing.[9] Finally, the repositioning of the mandibular symphysis in a more anterior location, with the subsequent anterior displacement of the base of the tongue, has demonstrated a certain value of sliding genioplasty in the treatment of snoring and the obstructive sleep apnoea syndrome.[10]

AESTHETIC ANALYSIS

Anatomically, the chin is defined as the area comprised under the labiomental fold. When the face is observed from the front, it is difficult to distinguish the chin from the lower lip, so the region of the lower lip-labiomental sulcus-chin-submentocervical complex is assessed as a whole. Any procedure seeking to alter the chin will completely modify this group of structures.[6,11]

The simplest way to evaluate the position of the chin in the sagittal plane was described by González-Ulloa et al[12] (Figure 1). The method consists in drawing, on a cephalometric image or a profile photograph, the Frankfurt plane (the line passing through the upper edge of the external auditory canal and along the inferior orbital edge) and then drawing a perpendicular to this line passing through the nasion. The point of maximum projection of the chin (pogonion) must touch this line in males or remain a few millimetres behind it in females.[12]

Other cephalometric analyses such as those by Ricketts,[13] Zimmer,[14] Riedel,[15] or Hambleton[16] offered new points, lines and planes to define the ideal position of the chin's point of maximum projection in profile.

Bell et al[6] have proposed the use of the subnasal point (where the upper lip joins the nasal columella) as the reference to determine the ideal position of the pogonion (Figure 2). The line perpendicular to the Frankfurt plane passing through the subnasal point must cut the pogonion in an ideal face; the points of maximum projection of the upper and lower lips (labrum superior and labrum inferior) will be slightly anterior to this line. In biprotrusive individuals, the analysis will not be useful as the subnasal point remains too far behind the labrum superior and labrum inferior points.[6]

The inferior sulcus point (the point of greatest depth of the labiomental sulcus) determines the depth of the labiomental sulcus. Tracing a line from the labrum inferior to the pogonion, and then one perpendicular to this straight line passing through the inferior sulcus, we can measure the depth of the furrow in millimetres. Any manipulation of the chin must avoid creating a furrow of more than 6 mm; with 4 mm the ideal size.[6,11,17] Too deep a furrow usually

reflects the need for orthodontic treatment or even orthognathic surgery; treating only the chin in such circumstances would lead to a less than optimal result. Once again, a biprotrusive face allows for a deeper labiomental sulcus than a flatter face.[6]

On the frontal plane, we start by drawing 2 horizontal parallel lines passing through the nasion and the subnasal point. The 3 areas so defined are the thirds of the face; the lower third (57%) must be slightly larger than the middle third (43%). In this lower third, the lower lip and chin complex (from the stomion to the tip of the chin) must represent 2/3 of this segment.[18] In addition, a horizontal line passing through the lower edge of the vermillion of the lower lip must divide the lower third into 2 equal halves.[19]

The transverse dimension of the chin must also be assessed in the frontal plane. The horizontal diameter of the chin must correspond to the width of the nose and be approximately 2 cm smaller than the labial fissure. In the frontal plane, we also have to detect whether there are any asymmetries or deviations from the facial midline affecting the chin. To do so, we will draw a vertical midline passing through the nasion and the tip of the nose, verifying that it divides the chin into 2 equal parts (Figure 3). If there is asymmetry in the chin, it may be reflecting a congenital condition (hemifacial microsomia, Goldenhar syndrome) or an acquired one (condylar hyperplasia) requiring more complex treatment.[20]

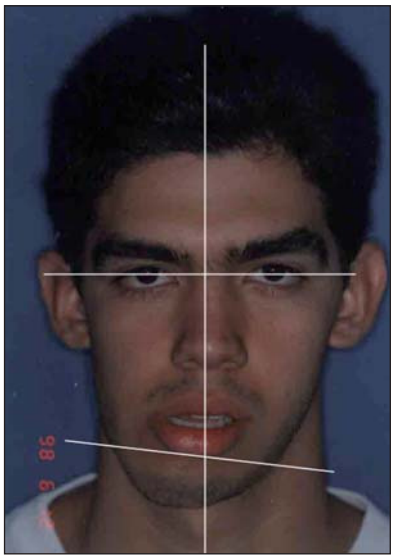

Figure 3. Deviation of the chin's midline in a patient with condylar hyperplasia.

CHIN PROSTHESES

Biomaterials

Despite the discovery of new materials and the every greater awareness of the phenomenon of biocompatibility, there is still no perfect biomaterial to increase the mentonian area.

The goal of bio-engineers is to achieve a non-depletable substance that can be incorporated into the surrounding native tissue, does not produce any inflammatory reaction and is easy to sculpt yet will withstand the chronic stresses borne by this specific area of the face.[21]

Materials made from carbon or elements with a similar covalent structure, with pores measuring more than 50 µm, allowing macrophages and fibrous tissue to penetrate inside, and, above all, those hard enough not to detach any microfragments in response to the chronic stress are those that have been shown to have a higher level of biocompatibility with human tissue.

Gore-Tex

Polytetrafluoroethylene (Gore-Tex, Gore and Associates, Flagstaff, Arizona) is a fluorinated carbon polymer. It is precisely the combination of the carbon atom with the fluorine atom that gives it its bio-stability, as there is no organic enzyme capable of breaking this bond.

Gore-Tex is approved by the FDA for increasing the facial skeleton. Despite the small size of its pores (0.5-30 µm in diameter), it has demonstrated considerable resistance to bacterial infection and extrusion over decades of use.

The presentations used are sheets of polytetrafluoroethylene or pre-moulded prostheses. Its use in chin enlargement has been shown to be safe and satisfactory, with a low rate (1.5%) of rejection for the implant and a high degree of satisfaction among both patients and surgeons.[22,23]

Nonetheless, Gore and Associates, the manufacturers of Gore-Tex prostheses, suspended production of their facial plastic surgery material in April this year, so its distributors of chin prostheses throughout the world are not going to be able to replenish their stock once it runs out. This difficulty means that the use of Gore-Tex chin prostheses should currently be discouraged.

Mersilene

Polyester fibre mesh (Mersilene, Ethicon, Somerville, New Jersey) is non-reabsorbable polyester fibre marketed in the form of sheets and first introduced in the 1950s for the repair of inguinal hernias. This material combines high tensile strength and biocompatibility; it is placed in a sub-periosteal pouch around the chin to allow for growth of the host's fibrous tissue.

There are no pre-formed chin prostheses made from mersilene, so they have to be made in the operating theatre by rolling up sheets of material and moulding them to suit the degree of projection required.

The infection and resorption rate is reasonably low (2.3%) and the cost per patient is extraordinarily cheap (less than 30 euros); surplus material can be re-sterilized and used for other patients. Another advantage of mersilene is that no sub-periosteal resorption has been shown and the patient cannot feel the presence of a prosthesis.[24,25]

Its main disadvantage is the increase in surgery time due to the production of the prosthesis in situ. On the other hand, it does not present the solidity of other materials such as Silastic or Medpor and it achieves smaller chin augmentation. It may suffer from displacement and even deform the lower vestibular fold and it is not appropriate to increase the body of the mandible. Nowadays, it has practically ceased to be used for mentoplasty.

Figure 4. Anatomical extension prosthesis for the chin.

Silastic

Solid silicone or polydimethylsiloxane (Silastic, Michigan Medical Corporation, Santa Barbara, California) is a silicon-derived compound available for medical applications since 1948. Silastic is the alloplastic material most commonly used world-wide. Unlike the other materials, silastic has no pores, which implies, on the one hand, that no bacteria can penetrate inside and, on the other, that the fibrous tissue cannot grow either to reduce its stability.

When a silastic prosthesis is put in place, the human body reacts by creating a capsule around it. The fibrous tissue on the inner face of the capsule has impaired irrigation, so it tends to develop infections. Silastic prostheses experience micro-displacements due to its lack of anchorage to the surrounding tissue. These micro-displacements occasionally give rise to a chronic peri-implantitis that explains the occasional extrusions.[26]

Although theoretically not the ideal material for facial prostheses, the rate of complications reported is less than 0.5%[27] and its flexibility and ease of placement have given it a place among the first choices. Silastic prostheses have been designed for all kinds of mentonian augmentation, including prostheses for chin extension, increasing the vertical diameter or camouflaging the prejowl sulcus.[7,28]

Medpor

Porous polyethylene (Medpor, Porex Surgical, Newman, Georgia) has a chemical configuration similar to polytetrafluoroethylene, with the difference that the ethylene monomers are not fluorinated. Medpor has pores measuring from 100 to 300 µm in diameter, which means it not only allows the entry of macrophages, thus reducing its rate of infection, but also the introduction of fibrous tissue, so the micro-displacements are reduced and consequently the percentage of extrusions.[29]

Medpor chin prostheses are generally placed in the sub-periosteal plane. Although their biochemistry and structure are perfect, they present 2 inherent problems. The first of these is their scant flexibility; it is necessary to submerge them in warm saline solution to be able to bend them and they require large incisions, unlike silastic prostheses, in order to place them in the pouches in the soft tissue. The second is that it is recommendable to fix them in place with osteosynthesis material, which increases the surgery time, the cost of the procedure and its complexity.[30]

Types of Prosthesis

The first chin prostheses were carved by hand from blocks of silicone. They were oval in shape and their transverse diameter was similar to the width of the chin. The aesthetic outcome achieved by this kind of prosthesis was less than perfect as the increase in volume generated was solely located in the central area of the chin, leaving an unnatural oval appearance and deepening the prejowl sulcus.[7,31]

Current aesthetic analysis divides the mentonian area into various sub-areas (centre of the chin, sub-mentonian area, body of the mandible); current prostheses cover all possible combinations of defects[32] and it is even possible to manufacture a tailor-made prosthesis for unusual situations or to combine different prostheses.[33]

The prostheses most commonly used at the present time are anatomical extension prostheses.[1,7,18,31] These prostheses cover the area of the centre of the chin and include lateral arms that extend towards the mandibular angle and gradually merge with the body of the mandible (Figure 4). Extended prostheses can provide different degrees of projection for the pogonion; there are specific types that increase the vertical diameter of the mentonian area, give a square profile, produce a split chin, raise the tuft of soft tissue or fill in the prejowl sulcus.[7,28,34]

There are prostheses that only fill in the area at the centre of the chin, that can be placed on top of previous extension prostheses, and also prostheses that only increase the sub-mentonian area. For the treatment of the prejowl sulcus associated with ageing, chin prostheses have been designed that do not project the pogonion and only fill in the defective area.

Most of the prostheses described are made from silastic (Implantech) or medpor (Porex). Silastic prostheses are more flexible and therefore easier to put in place. To overcome this slight disadvantage, Porex provides medpor prostheses that are split down the midline and are assembled after both halves have been inserted into their respective pouches.

Extension prostheses require greater dissection than their non-extension equivalents, which increases the risk of complications. They may be counterproductive in females, by leaving too strong or masculine a mandible. The selection of one type of prosthesis or the other must be individualized on the basis of the patient's anatomical characteristics and desires.

Surgical Technique

The placement of a chin prosthesis can either be by means of an intra-oral or a sub-mentonian approach. Neither approaches is superior to the other and the choice is basically determined by the surgeon's experience.

In the intra-oral approach (Figure 5), an incision is made from canine to canine in the free gingival mucosa of the lower lip about 5 mm from the vestibular fold. The dissection of the pouch for the prosthesis is carried out in the super-periosteal or sub-periosteal plane; the prosthesis is inserted and the incision then closed by layers (Figure 6). The main advantage of the intra-oral approach is that it leaves no external scar.[1,7,35]

In the sub-mentonian approach, the incision takes place in the sub-mentonian fold, traversing the skin and

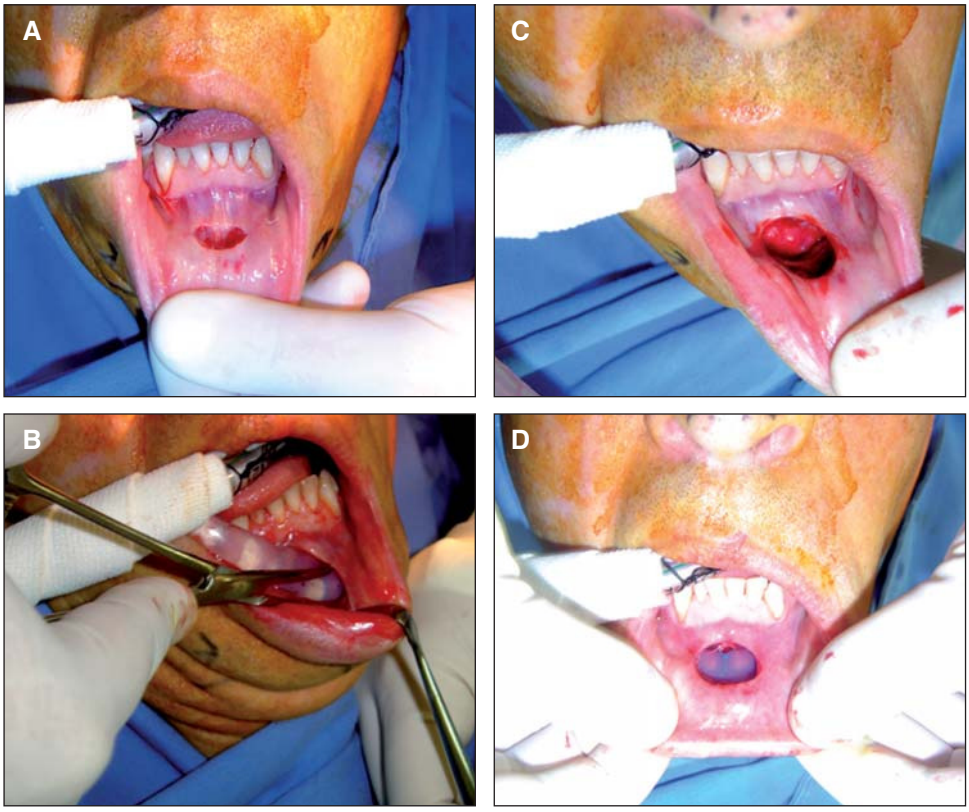

Figure 5. Placement of a silastic prosthesis using the intra-oral approach.

Figure 6. Mentoplasty with silastic prosthesis using the intra-oral approach.

subcutaneous soft tissue to reach the mentonian skeleton. The dissection of the pouch for the prosthesis can also be done in the super-periosteal or sub-periosteal plane and it is very important in the closure to use an impeccable technique to leave a practically invisible scar. The advantages of this approach are greater asepsis, as the oral cavity is not in contact with the pouch for the prosthesis, the technique is easier to perform and there is less separation of the tuft of mentonian soft tissues, thus reducing the risk of soft tissue droop. In patients in whom it is necessary to perform submentonian liposuction or lipidectomy or even cervicoplasty, it is possible to take advantage of the incision to conduct both procedures.[1,7,36]

The pouches for the prostheses are dissected in a sub-periosteal, super-periosteal, or mixed plane. Silastic prostheses, at least their central portion, are placed above

Figure 7. Sub-periosteal resorption induced by a silastic prosthesis.

the periosteum to diminish long-term bone resorption. The side arms of the anatomical prostheses are placed in sub-periosteal pouches.[37]

Medpor prostheses are usually placed sub-periosteally, in theory because they produce less bone resorption and the avascular sub-periosteal plane is easier to dissect; it is recommendable to fix the prosthesis in place with a titanium screw to reduce micro-displacements.[30,37] So far, the location of the prosthesis above or below the periosteum has not been shown to have any effect whatsoever on long-term bone resorption.[8]

Complications

The main complication in the placement of chin prostheses, whether in the sub-periosteal or super-periosteal plane, is bone resorption, first described at the end of the nineteen-sixties.[38,39] Resorption always occurs and seems to be due to the continuous pressure exerted by the mentonian muscles on the prosthesis and by the prosthesis on the external cortex (Figure 7). The aesthetic impact is, however, limited, as is the impact on dental stability.[38,40,41] Theoretically, the greater the degree of retrogenia, and therefore the larger the prosthesis put in place to fill in the defect, the greater the activity of the muscles in the chin (mentonian quadrate) and the greater the bone resorption. Hard-consistency silastic prostheses seem to produce more resorption than those of intermediate consistency.[1]

Presumably, the fact that the prosthesis is placed on top of the periosteum interferes less with the bone's vascularization and reduces resorption. The remodelling of the prostheses on their posterior face to reduce the area of the same in contact with the anterior face of the mentonian skeleton, is also posited as a useful manoeuvre to minimize this phenomenon.[1,7,41]

In point of fact, there is currently no scientific evidence to relate the size of the prosthesis with the degree of resorption nor has sub-periosteal placement been shown to be superior to super-periosteal.[8] Some authors report that sub-periosteal resorption occurs only in the first few months and is a phenomenon contributing to the stabilization of the prosthesis by allowing it to settle into the mandibular symphysis.[1] Other studies claim that resorption increases over time.[42]

The incorrect design of the pouch may bring about a greater malposition of the prosthesis, eliminating the labiomental fold or even pressing on the orbicular musculature and depressing the lower lip to the point of interfering with its function. This complication is particularly associated with the intra-oral approach[43] due to the need for the dissection of a larger tunnel to insert the prosthesis.

The prosthesis infection rate shown in the literature ranges from 0.7% to 4%-5%.[7,44] The use of an aseptic technique and the dipping of the prosthesis into an antibiotic solution prior to its placement dramatically reduces this complication. In the case of the intra-oral approach, it is essential to achieve an airtight closure of the incision in the mucosa to prevent the entry of saliva into the pouch. In most cases, infection implies the need to extract the prosthesis. There is no scientific evidence to support a higher rate of infection and extrusion with the intra-oral as opposed to the sub-mentonian approach.[45]

The most frequent complication of mentoplasty with prostheses is the onset of dysaesthesias caused by the manipulation of the mentonian nerves, with a reported incidence of between 20% and 30% of patients.[1,7] This complication is more frequent when an anatomical prosthesis is used, both because of the need to create a more lateral pouch and due to the larger size of the prosthesis. It is important to bear in mind at all times that the mentonian nerve emerges at the level of the second premolar around 1 cm above the lower edge of the mandible so as to avoid its injury. Sensorial alterations will disappear as the months go by in the vast majority of patients; their persistence will oblige us to conduct a surgical review to rule out any malposition of the prosthesis.

OSTEOTOMIES

Horizontal chin osteotomy was first described in cadavers by Hofer[3] in 1942, but it was not until 1957 that Trauner and Obwegeser performed the procedure for the first time, modifying the initial extra-oral approach to an intra-oral one.[4]

The versatility of the procedure rapidly became clear. In 1965, Reichenbach et al[46] performed a wedge osteotomy to achieve a vertical shortening of the chin and pointed out that the surgery also allowed for anterior or posterior displacement in the horizontal plane.

Hinds and Kent,[47] in 1969, were the first to realize the importance of the insertions of the soft tissues into the lower edge of the mandible and the role these had in the final outcome of the surgery.

Types of Osteotomy

Sliding Genioplasty

Sliding genioplasty is the surgical technique of choice for the treatment of moderate retrogenia, defined as a chin deficit in the sagittal plane ≥7 mm and ≤14 mm.[6,11,19,48,49]

As for the rest of the osteotomies, the approach is intra-oral, by means of an incision from the first premolar to the first premolar in the free gum of the lower lip about 5 mm from the vestibular fold.

The dissection is performed in the sub-periosteal plane, reaches the lower edge of the symphysis and extends the pouch laterally as far as possible, with identification of the emergence of the mentonian nerves. Once adequate exposure has been achieved, the cut is made with a reciprocating saw after the midline has been marked to show the upper limit at this level, which must not exceed the level of twice the length of the anatomical crown of the medial incisors to prevent damage to the roots of the teeth.

When making the cut, it is important to leave a margin of at least 5 mm from the orifices of the outflow of the mentonian nerves, as these loop around under and within the bone prior to being exposed and they could be dissected if the saw cuts too close to them.

The cut must go through both corticals and leave the distal segment completely detached from the rest of the mandible and pediculate solely by the muscles in the floor of the mouth. Once the 2 segments have been separated, we proceed to place the titanium mandibular advance plate in the proximal segment, fixing it in place with monocortical titanium screws. Once the plate is in place proximally, the distal segment will be fixed using bicortical screws (Figure 8).

The incision is closed in the same way as in mentoplasty with prosthesis using the intra-oral approach, striving to prevent the passage of saliva into the surgical pouch (Figure 9).

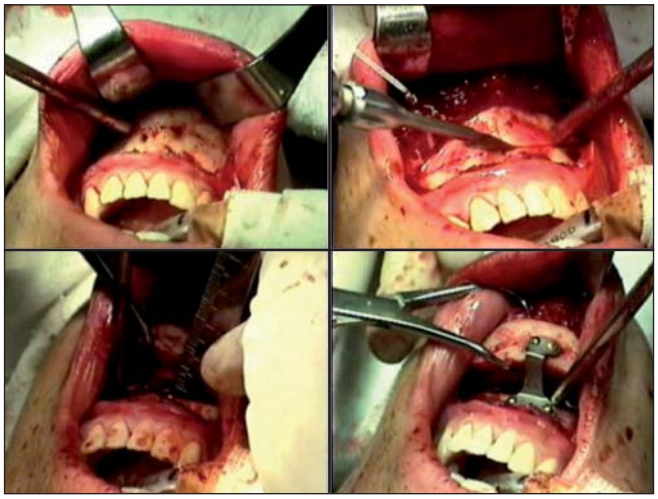

Figure 8. Surgical technique for sliding genioplasty.

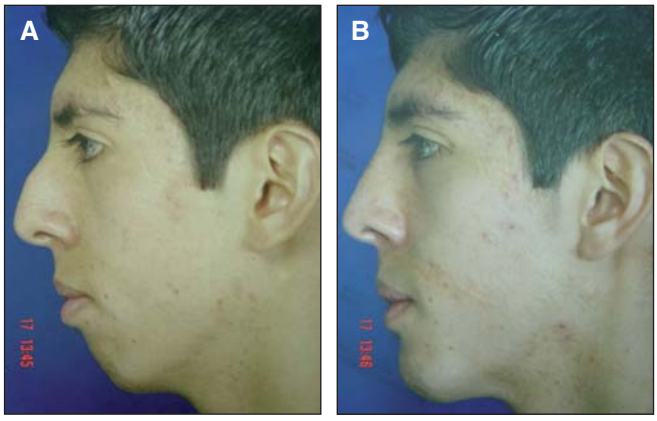

Figure 9. Sliding genioplasty.

Stepped Genioplasty

In cases of severe retrogenia requiring advances in excess of 14 mm, conventional advancement runs into the problem of a lack of adequate contact between the proximal and distal bone segments. For this situation, stepped genioplasty has been described.[6,50]

After having performed the usual approach to expose the bony skeleton of the chin, 2 parallel cuts are made: the first the same as in sliding genioplasty and the second 10 mm below it.

The segments are advanced independently. First the intermediate segment is fixed to the proximal segment and then the distal segment is attached to the intermediate one. In this way, we can achieve chin advances of over 20 mm.

Wedge Genioplasty

This procedure is designed to deal with the excessive horizontal or vertical size of the chin. Two parallel osteotomies are effected with only 2 or 3 mm between them.

The intermediate segment is extracted and the distal segment is impacted and fixed to the proximal one. This manoeuvre produces a reduction in the chin's vertical dimension. The chin can be relocated to a more posterior position by reducing its horizontal dimension (Figure 10).

The problem of wedge genioplasty with posterior repositioning of the distal segment is the resulting redundancy of soft tissue, particularly in the sub-mentonian area, potentially requiring a second procedure for its correction. Unlike advancement genioplasty, retrocessive genioplasty does not obtain a proportion of 1:1 between the retrocession of the skeleton and the retrocession of soft tissues. The tuft of the chin regresses in a proportion[51] of 0.6:1.

This technique is not indicated for the correction of prognathism. Only a few patients with chin hypertrophy and Angle class I occlusion are candidates for this procedure. Patients with a shallow labiomental sulcus would also not be suitable for this surgery.[52]

Graft or Interposition Genioplasty

When we wish to increase the chin's vertical dimension, it is necessary to effect the osteotomy and insert bone grafts between the 2 segments.[48,53]

The most common source for bone grafts in the chin is the iliac crest; it is important for the bone harvested to contain marrow.[6] The proximal and distal segments will be fixed in place as usual.

Centred Genioplasty

The performance of an asymmetric wedge in the vertical or horizontal plane allows correction of mild or moderate deviations of the chin.[54]

In any case, if there is a deviation of the chin's midline, this should make us suspect other mandibular involvements such as condylar hyperplasia or craniofacial microsomia,

Figure 10. Wedge genioplasty with subsequent repositioning.

which may require a more complex solution than genioplasty. This procedure, in isolation, has very few indications.[6,50]

Complications

The most frequent complication in sliding genioplasty is a lesion to the mentonian nerve. More often than not, such a lesion is a transient neuroapraxia due to manipulation and the patient recovers sensitivity in the symphytic area in weeks or even months (10% of patients have persistent hypoaesthesia in the mentonian area 1 year after the sliding genioplasty was performed). Osteotomy close to the nerve's emergent orifice may lead to its transection and cause permanent injury. The intra-operative identification of a resected mentonian nerve makes it obligatory to perform an immediate microsurgical repair.[55]

Bone resorption, and even avascular necrosis of the distal segment, is a complication that may arise if the sot tissue of the chin are excessively detached to the point of compromising their irrigation. The likelihood of this occurring is practically nil if the pedicle of soft tissues inferior and posterior to the distal segment is respected.[56,57]

Haemorrhage and obstruction of airways are extraordinarily rare phenomena. Bleeding generally comes from the bone marrow or the lingual musculature. It is important to achieve haemostasis as the incision is made into the soft tissues and to avoid injuring the muscles of the tongue when performing the osteotomy with the saw.[50]

An excessively high cut may compromise the irrigation of the dental pulp in the incisors and devitalize them. The rule of cutting at least 2 anatomical crowns below the upper mandibular edge is usually enough to avoid this complication. In all patients scheduled for mandibular osteotomy, it is mandatory to perform a panoramic x-ray to determine the height of the roots.[55,58]

A mandibular fracture is an extremely rare complication that may appear if the cutting of the 2 corticals is not completed adequately before attempting to move the segments. Should this occur, we must be aware of the fact that the fracture line may extend to the ascending ramus and it may become necessary to perform an open reduction. The panoramic x-ray of the mandible will allow us to rule out pathological mandibular cysts, the predisposing condition for the appearance of fractures.[59]

Finally, as with the placement of a chin prosthesis using the intra-oral approach, inadequate closure of the incision without re-suspending the tuft of soft tissue may give rise to post-operative ptosis resulting in a witch's chin deformity. Witch's chin is manifested by flattening of the labiomental sulcus, excessive exposure of the lower incisors, redundancy in the soft tissues in the sub-mentonian area and, in extreme cases, incompetence of the lower lip. Once established, its surgical correction is difficult.[60]

Advancement Osteotomy and Airways

An added value of osteotomy over the placement of a chin prosthesis is its impact on the morphology of the upper airways (Figure 11).

The calibre of the upper airways on the sagittal plane is measured at 2 points: the upper pharyngeal space (distance from the posterior tip of the palate to the pharyngeal wall) and the lower pharyngeal space (distance from the posterior edge of the tongue to the pharyngeal wall). Various studies have pointed out the importance of this lower pharyngeal space for the pathogenesis of the obstructive pathology of the upper airways.[61-63]

The determining factor for the calibre of the lower pharyngeal space is the size and position of the base of the tongue. The insertion of the genioglossal muscle in the

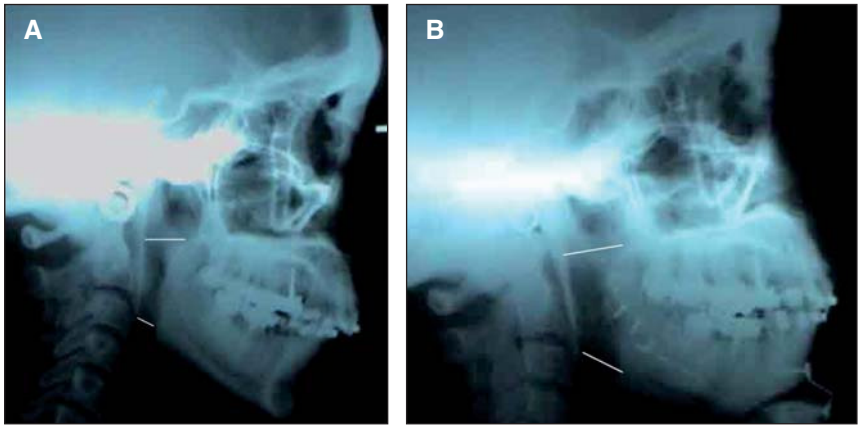

Figure 11. Change in the lower pharyngeal space following sliding genioplasty.

genihyoid tubercle, on the internal cortical of the mandibular symphysis, allows the anterior repositioning of these tubercles by means of an advancement osteotomy, causing an associated displacement of the base of the tongue with an increase in the lower pharyngeal space.[64-66]

Sliding genioplasty is included among the standard treatments for obstructive sleep apnoea syndrome.[67-69] Most patients requiring surgery to the chin for aesthetic reasons have a certain degree of obstruction in the upper airways; in those cases where this obstruction is moderate or severe, osteotomy shows a greater benefit than placement of a prosthesis.[70]

CONCLUSIONS

The chin is an appropriate target for surgical treatment in approximately one third of patients attending an otorhinolaryngological to request rhinoplasty.

There is no single aesthetic or cephalometric analysis to determine the ideal chin for each patient.

Chin prostheses will be useful in cases of mild retrogenia. Silastic and Medpor will be the most suitable materials.

Mentoplasty with silastic prostheses is associated with gradual sub-periosteal resorption. Most times, this phenomenon has no significant aesthetic or functional impact.

In patients with moderate or severe retrogenia, it will be necessary to perform osteotomy. Chin osteotomy allows it to be mobilized in any direction.

Hypoaesthesia of the mentonian and lower lip area is the most frequent complication associated with chin osteotomy.

Advancement osteotomy is associated with an increase in the calibre of the upper airways of demonstrable value in the treatment of mild and moderate obstructive sleep apnoea.

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