Rhytidoplasty Fundamentals

Fundamentos da ritidoplastia

Review Article

Authors:
Josué Montedonio[1]
Wail Queiroz Filho[2]
Carlos Eduardo T. Pousa[3]
Mauricio Pedreira Paixão[4]
Antônio Esaú Ferraz de Almeida[5]

[1] Specialist, accredited by the Sociedade Brasileira de Cirurgia Plástica; and Plastic Surgeon, Clínica de Cirurgia Plástica Dr. Esaú – Santos (SP), Brazil
[2] Surgeon, Clínica de Cirurgia Plástica Dr. Esaú
[3] Specialist, accredited by the Sociedade Brasileira de Cirurgia Plástica; and Plastic Surgeon, Clínica de Cirurgia Plástica Dr. Esaú
[4] IT Director, Grupo Brasileiro de Melanoma – São Paulo (SP), Brazil
[5] Full Professor, Clínica de Cirurgia Plástica Dr. Esaú

Correspondence:
Dr. Josué Montedonio
Av. Conselheiro Nébias, 366
Cep: 11015-002 – Santos – SP, Brazil
e-mail: mauricio.dermato@terra.com.br

ABSTRACT

The aging process causes significant changes to the face. Rhytidoplasty is a surgical procedure aimed at treating such changes. Understanding essential aspects of facial anatomy (including high-risk areas and the importance of the superficial muscular aponeurotic system), existing surgical techniques and potential major complications is crucial in order to recommend and conduct this procedure successfully. In order to meet increasing patient demands for ever improving outcomes, physicians must use adjuvant techniques. This article addresses these fundamental concepts, which are considered essential in rhytidectomy, emphasizing the potential benefit of a multidisciplinary approach involving dermatology and plastic surgery.

Keywords: rhtidoplasty; surgery, plastic; skin aging.

RESUMO

O envelhecimento traz mudanças marcantes na face. A ritidoplastia é cirurgia que busca combater essas alterações. Aspectos essenciais da anatomia da face, incluindo as zonas de perigo da face e a importância do sistema musculoaponeurótico superficial (SMAS), as técnicas cirúrgicas existentes e as principais complicações são fundamentais para indicação e para o êxito cirúrgico. A crescente demanda dos pacientes por melhores resultados impõe desafios. O uso de técnicas adjuvantes representa, portanto, abordagem complementar de valor estratégico. O presente artigo aborda esses fundamentos considerados essenciais na ritidoplastia, enfatizando o potencial benefício de uma abordagem multidisplicinar envolvendo a dermatologia e cirurgia plástica.

Palavras-chave: *ritidoplastia; cirurgia plástica; envelhecimento pele.*

INTRODUCTION

One of the great challenges in cosmetic surgery is the treatment of facial aging. Understanding the physiology of aging, including anatomical variations that happen over time, is an important prerequisite to surgical success. The surgeon's experience is also crucial for the success of rhytidoplasty.

Facial aging is complex and occurs from the osseous plane, with perceptible reabsorption mainly in the orbital and malar margins in the alveolar level, extending to the most superficial planes with the involvement of the ligamentar, musculoaponeurotic, subcutaneous and tegumentary tissues.[1]

For instance, the osseous volume reduction in the orbital edges and the soft parts' flaccidity encourages the herniation of the orbital fat pads and the alteration of the fat in the malar region, which deepens the nasogenian sulcus. Another example is the soft parts' sagging in the inferior third of the face and neck region, causing the loss of the cervico mandibular contour (Figure 1).[2]

Intrinsic and extrinsic characteristics – determined by the individual's genetics, and by factors such as exposure to the sun,

Received on: 09/11/2010
Approved on: 01/12/2010

This study was carried out at the Clínica de Cirurgia Plástica Dr. Esaú – Santos (SP), Brazil.

Conflicts of interests: none
Financial support: none

smoking, ionizing radiation – determine the intensity of the alterations involved in facial aging.[3] In the process of cellular maturation, the epidermis is altered, which triggers a cellular disorganization that affects the layout of its layers. Atypias are then found, the thickness decreases and the skin becomes more irregular. In the dermis, the collagen fibers become less intense and the elastic fibers degenerate, causing the dermis to thin.[4] Alterations in the facial fatty tissues also take place and are easily verified in the malar fat and in the infra-palpebral fat pads.V

Regarding the muscle fibers, the orbicular muscle of the eye becomes atrophic and ptotic with age.[5] In addition, the muscles used for facial expressions become shortened and thickened, interfering with the fat layout and causing a more rigid facial expression. With the aging process, the increase of the musculature's tone is also verified.[6,7]

There are a great number of facial alterations resulting from aging, making any attempt of ad integrum restitution considerably challenging. Surgical alternatives used in rhytidoplasty, in addition to the benefits of adjuvant techniques, will be discussed. Rhytidoplasty is known by several names, including rhytidectomy, meloplasty, facial lift, lift, and facial rejuvenation surgery.[8]

BRIEF HISTORICAL OVERVIEW

From antiquity, Egyptian, Greek and Romans looked for methods to lessen the signs of facial aging.[9] So-called facial rejuvenation surgery does not have a precise date of inception, and has a very controversial first performance.[8] Perhaps the first surgical description of scientific character is attributed to Passot, in 1917, with the first article on the subject written by Von Hollander.V It is interesting to note the high degree of discrimination and the negative connotation then linked to the procedure; physicians were criticized for prioritizing financial interests and patients were said to be excessively vain. [10] The first techniques described consisted of skin resections in the pretragal (pre-auricular) region. Results were deemed meagre and with only short-lasting improvement, sometimes with the enlargement of the scars.[8]

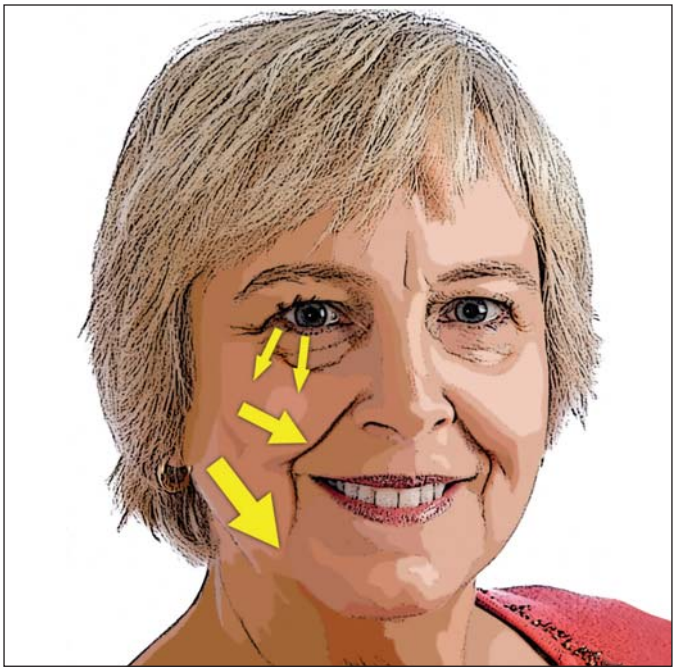

Figure 1 – Changes in the face due to the aging process (effects shown by red vectors)

In the first half of the 20th century, advances in the technique included the incorporation of new methods for treating facial aging. In 1921, Joseph suggested widening the incision to extend from the temporal to the pre-auricular region, rounding the earlobe and ending in the mastoid area. In 1932 Malignac described the first attempt of fat and skin resection in the submentonian region as an adjuvant alternative to conventional rhytidectomy. In 1948, Padgett and Stepheson described the combination of the submentonian lipectomy with the platysmal bands plicature in the middle line. The correction of glabellar wrinkles through the resection of the corrugator muscles was described by Pierce in 1947. Eduards suggested the definitive treatment of frontal wrinkles using a method of bilateral temporal neurotomies.[11]

The mid-1960s surge in demand for rhytidoplasty spurred a great number of scientific publications and stimulated scientific interest and rigor in this surgery. [10] The cervicofacial fat plicature was carried out by González-Ulloa as an auxiliary treatment in rhytidoplasty. [12] In 1967, Pitanguy described modifications and enhancements in the technique, with incisions that follow the contours of the tragus's anterior region and pass above the retroauricular crease. Another modification was the rotation and suspension of the supra-auricular flap, reducing the elevation of the base of the hair.[13]

Skoog is considered a great innovator in rhytidectomy. In 1968, he developed a flap to elevate the platysma of the neck region and lower third of the face. This sub-platysmal flap offered advantages such as longer-lasting results due to the traction exerted from deeper structures. [14] This technique was published in 1974. [14,15]

In the 1970s, several surgeons, such as Aston, Guerrerosantos, Connell and others, contributed to the development of the technique with an approach that focused on the treatment of the platysmal muscles. [10]

Another fundamental contribution to the development of rhytidoplasty entailed from a deepening understanding of the relevant anatomy. In 1976, Mitz and Peyronie described the superficial muscular aponeurotic system (SMAS) in a very consistent way, including radiological and anatomopathological studies (see below for more detail). Its close relationship with the platysmal musculature was demonstrated. This was a very valuable discovery, for it corroborated the importance of that plane in performing deep flaps in rhytidoplasty. [16]

In 1977, Owsley published the first study demonstrating the benefits of SMAS in rhytidoplasty. [17] Since then, with a better anatomical understanding of the SMAS and the implications for the final surgical result, the use of the SMAS during this surgery was consolidated. Eminent plastic surgeons, such as McKinney,[18] Pitanguy,[19] Stuzin, [20] Baker, [21] Hamra, [22] Ramirez [23]

and Mendelson,[24] contributed decisively to the developments of the technique by proposing new approaches that included other procedures combined with rhytidoplasty.

ANATOMY

SMAS

An important anatomical structure called the cellular membrane 25 was already known before the 19th century. In 1859, Gray named it the subcutaneous superficial fascia. Mitz and Peyronie, residents supervised by the renowned French plastic surgeon Paul Tessier, described a subcutaneous superficial fascia, which included the platysma's musculature that merged into the parotid fascia's external surface. They named it the SMAS.[16,25]

The SMAS included the platysma musculature in the neck and malar regions. Anteriorly, the SMAS becomes thin and ends covering the muscles of facial expression. Laterally, the SMAS merges into the parotid capsule. Superiorly, the SMAS ends above the zygomatic arch, joining the temporal superficial fascia.25 This structure is of paramount importance for carrying out rhytidectomy.

MUSCLES OF FACIAL EXPRESSION

The muscles that formulate facial expressions can be divided into superficial and deep. The superficial layer includes the major and minor zygomatic muscles, the levator labii superioris muscle , the risorius, and the depressor muscle of the angle of the mouth – in contact with the orbicular muscles of the mouth and eye. The deep layer is comprised of the levator angulis oris muscle , the buccinator, the depressor muscle of the lower lip, and the mentalis muscle.[25]

SUPPORT LIGAMENTS OF THE FACE

The facial fat and skin receive support from the muscular fascia, however the subcutaneous fat depends on the presence of osteocutaneous ligaments (called support ligaments) that cross the dermis in the direction of the periosteum in certain areas. The most prominent are the zygomatic, parotid, mandibulocutaneous and the zygomatic-cutaneous (malar membrane). Along the jaw's border there is a membrane called the mandibular septum that separates the fat of the central portion of the face from that of the neck region.[26]

INNERVATION AND DANGER ZONES

The facial nerve is the seventh cranial pair. It surfaces in the stylomastoid foramen. When passing through the parotid gland, it becomes separated into superior and inferior branches, and distributes into the facial muscles.[25]

Most individuals have an arch shaped innervation connecting the facial nerve's superior and inferior branches, which helps protect against neurological damage resulting from traumatic events such as surgery. However, the frontal sub-branch of the superior branch and the mandibular sub-branch of the inferior branch are terminal and devoid of parallel innervation, and are therefore more prone to suffer permanent neurological lesions.[27]

Three nerves are involved in the sensory innervation of the central portion of the face and the auricular pavilion. The auriculotemporal nerve sends superficial branches to the pre-auricular portion. The great auricular nerve, arising from the cervical plexus, innervates the inferior portion of the auricular pavilion, and the small occipital nerve innervates the superior portion of the ear.[25]

It is very important to recognize the facial regions (known as danger zones) that are more prone to neurological damage during surgery (Figure 2). During facial surgery, deeper facial dissection involves a greater risk of neurological damage.[25] Therefore it is important to understand the danger zones and to recognize potential individual anatomical differences (Table 1).

The damage of the main branches of the facial nerve, especially when closer to their points of surfacing in the face, can cause serious (sometimes irreversible) facial deformities. In certain situations, even though recovery of the muscular function is achieved, the contracture and shortening of the muscles can yield permanent damage to the faciae. In turn, the interruption of sensory nerves can result in paresthesia, dysesthesia and even permanent pain.[27]

Another anatomic reference, instrumental in determining the location of the accessory nerve, is the Erb's point. It is located 6cm below the middle point between the mastoid apophysis and the angle of the jaw. Another way to estimate its location is to use the horizontal imaginary line that passes over the thyroid prominence. The accessory nerve is 2cm above or below that line, in the sternocleidomastoid muscle's posterior border. The lesion of that nerve will cause the loss of motor function of the trapezoidal muscle, paresthesia /dysesthesia of the upper

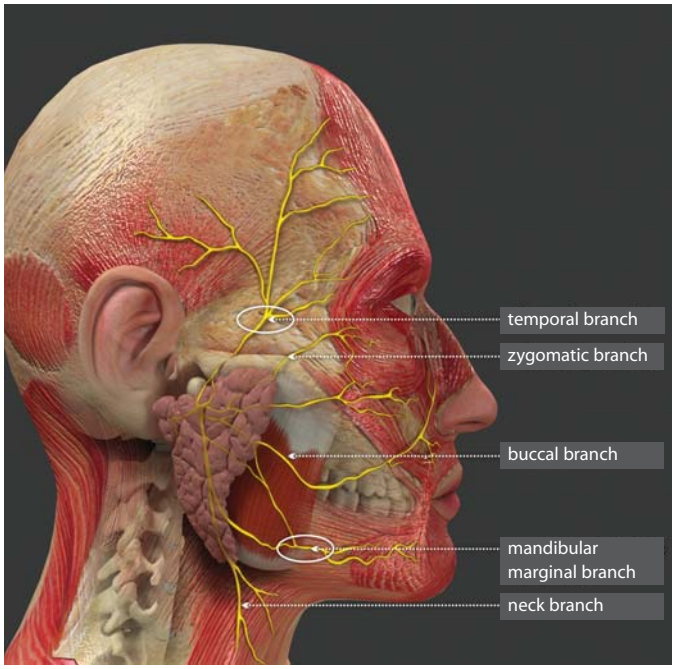

Figure 2: Danger zones of the face (the circles indicate the mandibular and temporal nerves' higher risk areas)

arm, drooping shoulder and the inability to lift the shoulder more than 80°. [27,28]

INCISIONS

The scar resulting from the surgical incision should be as discreet as possible. The use of less visible sites, with greater "camouflage" potential, such as the scalp and the limits of the facial aesthetic zones, enhances the final aesthetic result.

In rhytidoplasty, there are two incision variations in the pre-auricular area (Figure 3). The pre-tragal incision is the preferred route in patients with a very dense beard, for it avoids the transfer of the flap's hair threads to the tragus region. Furthermore, this option reduces the risk of distortion of the tragus induced by the traction or elevation caused by the flap. In turn, the post-tragal incision is a good option for patients that have uniform skin coloration and no beard.[25]

Posteriorly, the function of the mastoid incision is to allow the removal of the excess skin from the neck region (Figures 4 and 5). The size of the incision in such topography is directly proportional to the amount of excess skin (patients requiring less skin removal will have smaller incisions).[25]

Another important aspect is the vertical advance of the flap. Vertical traction, rather than horizontal, reduces the size of the incision. Notwithstanding, it is important to avoid the formation of vertical cutaneous bands resulting from insufficient incisions. In such cases, the prolongation of the incision can be made towards the occipital region of the scalp or towards the posterior cervical hair line.[25] The tension level is a decisive factor for the final result: the larger the tension, the greater the chance of a widened, hypertrophic and unattractive scar.

PLANES / TECHNIQUES USED IN SURGERY

SUBCUTANEOUS RHYTIDOPLASTY

Subcutaneous rhytidoplasty can be used as a starting point. Widely used in the past, it involves the detachment of the cutaneous flap above the temporal region's, the platysma, the malar region on the parotid fascia (Figure 6) and the sternocleidomastoid muscle, with cephaloposterior rotation and advancement, with exeresis of the surplus skin to correct the ptosis.[29]

This technique has limitations, since the skin under tensional stress deforms and settles, yielding only short-term results results. Furthermore, it does not correct the fat and musculoaponeurotic ptoses. It has restricted indication for thin patients and those without sagging in the remaining soft parts.[30]

SMAS TECHNIQUE

The identification of the anatomy and functionality of the SMAS marked a new era for facial surgery. The detachment of the SMAS above the parotid fascia, and the traction, elevation and tightening of the structures increases the surgery's efficiency (Figure 7).[15]

Table 1 – Danger zones of the face and respective innervations

Nerve	Relationship to SMAS	Location	Associated lesion
Great auricular	Behind the	6.5 cm below the external ear canal	Paresthesia/dysesthesia of the lower two thirds of the ear, malar and adjacent neck region
Facial nerve's temporal branch	Underneath the	Below the imaginary line passing 0.5 cm below the tragus and 2 cm below the supercilium laterally	Paralysis of the face
Facial nerve's mandibular marginal branch	Underneath the	Middle part of the mandible, 2 cm behind the oral commissure	Paralysis of the lower lip
Facial nerve's zygomatic and buccal branch	Underneath the	Triangle formed by the malar prominence, the mandible's angle posterior border, and the oral commissure	Paralysis of the upper lip and cheek
Supraorbital and supratrochlear	Anteriorly to the	Superior orbital border, above the midpupillary line	Paresthesia/dysesthesia of the face, upper eyelid, dorsum of the nose, and scalp
Infraorbital	Anteriorly to the	1 cm below the inferior orbital border, below the middle part of the opening of the iris	Paresthesia/dysesthesia of the lateral part of the nose, cheek, upper lip, and lower eyelid
Mentonian	Anteriorly to the	Middle portion of the mandible, below the second premolar tooth	Paresthesia/dysesthesia of the lower lip and chin

Figure 3 – Pre-auricular incision

Figure 4 – Preparation of the posterior flap

With a curved cutaneous incision in the temporal region, descending to the posterior-tragal and mastoid pre-auricular skin, extending to the scalp slightly above its implantation, 31 a wide cutaneous flap detachment is carried out exposing the fatty tissue and SMAS that, appropriately dissected, can be pulled in several directions. Its fastening allows the correction of ptosis and facial repositioning (Figure 8), and the removal of the surplus skin without tension.[32]

In order to better correct the nasogenian crease and reposition the malar region, the SMAS dissection should extend beyond the parotid fascia, up to the major and minor zygomatic muscles and deep ligaments; this allows these structures and the malar fat to be stretched and secured. Although extended SMAS rhytidoplasty can affect change in a larger area, there is a greater risk of nervous lesion, especially in the zygomatic and buccal branches.[20]

The SMAS plicature is an alternative approach, with no deep dissection (Figure 9). This technique is effective in thin patients with little sagging and ptosis of the fatty soft tissues, or as a secondary surgery after the SMAS has already been manipulated and there is no neck flaccidity. The approximation of the SMAS surface and its fastening allows the filling of the malar region through the apposition of the surfaces, improving its volume and contour.[33]

SUBPERIOSTEAL APPROACH

The subperiosteal approach can be used in patients who present ptosis of the structures of the middle third of the face, yet without sagging of the soft parts. By detaching the whole malar region in a subperiosteal plane through the superficial temporal fascia, the tissues are anchored and fastened to the deep temporal fascia in the opposite direction to the ptosis; the malar tissues are repositioned as a whole, mainly in a medial projection.[34]

This approach can be carried out either separately or in combination with the detachment of the cutaneous flap and treatment of SMAS. In secondary or tertiary surgeries without sagging of the soft tissues, the simple elevation of the tissues as a whole is effective. There is the disadvantage of a longer lasting edema due to the greater trauma. Ectropion can also occur when combined with blepharoplasty.[35]

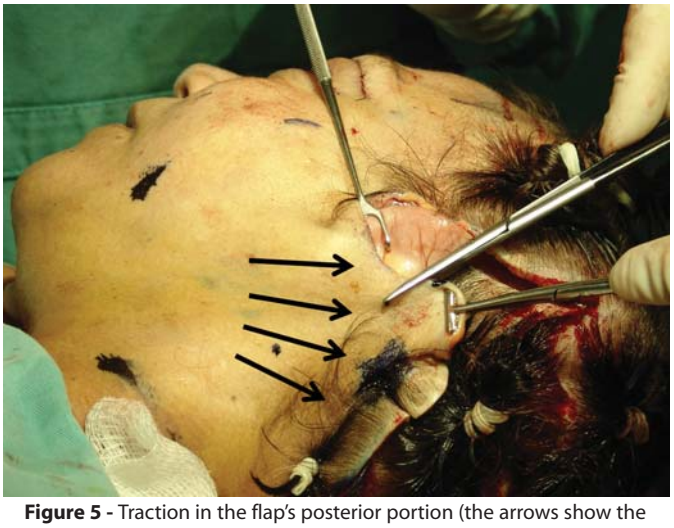

Figure 5 - Traction in the flap's posterior portion (the arrows show the traction vectors and the effects in the cervico mandibular contour)

Techniques can also be combined. The deep composite rhytidoplasty suggested by Sam T. Hamra[22] is an example. In this procedure, the SMAS dissection is carried out in the deep middle third of the face, and the orbicular orbital and zygomatic muscles and malar fatty tissue are repositioned. The detachment of the flap in the inferior third is subcutaneous, on a more superficial plane, where its traction corroborates the cervico mandibular delineation. The author states that the results are attractive and render the grounds that the treatment of facial aging is meticulous; each plane is approached separately.[22] Moreover, variations in the extension of the cutaneous incision can occur. Mini facelifts, which are indicated when there is no cervical sagging to be corrected, require smaller incisions. Another variation is an incision in the shape of a peninsula in

Figure 6 – Anatomic plane used in subcutaneous rhytidoplasty

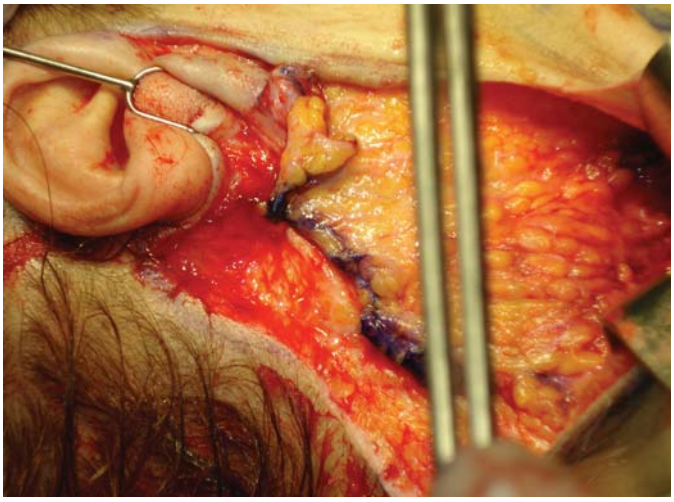

Figure 8 – SMAS flap fastened to the mastoid portion after traction and plicature

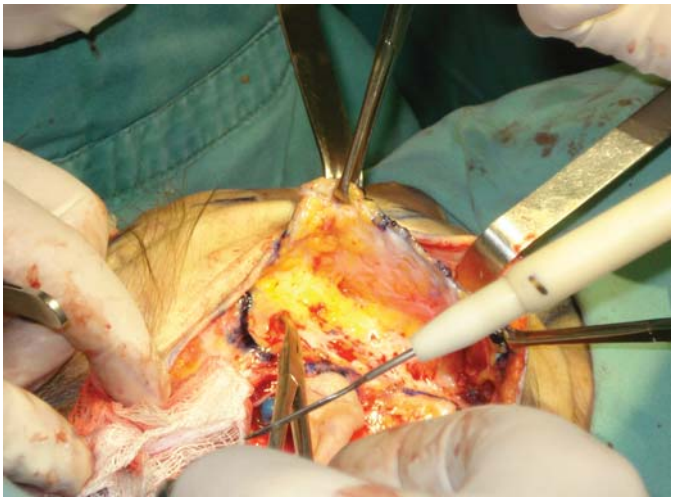

Figure 7 – Anatomic plane used in sub-platysmal rhytidoplasty (anatomic dissection beneath the SMAS, with exposure of the parotid fascia, can be observed)

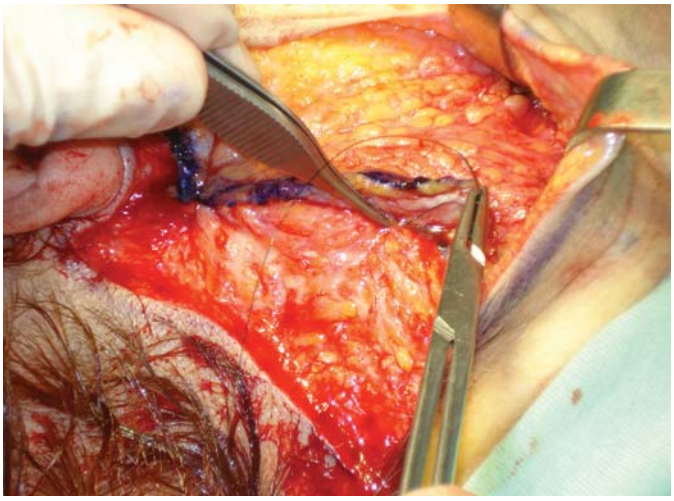

Figure 9 – SMAS plicature with fastening in the mastoid portion

the sideburn, used mainly in secondary rhytidoplasty, which allows the vertical elevation of the skin without distorting the facial hair. This technique avoids the stigmatization caused by the traction, which could produce an beheading appearance of the type. There is no ideal technique among those discussed. The safest and most efficient method should be determined by an assessment of the individual patient's requirements.

VIDEOENDOSCOPIC RHYTIDOPLASTY

Videoendoscopic rhytidoplasty was developed in the early 1990s by Keller and Ramirez.[36] In Brazil, Graf and colleagues demonstrated their experience in the treatment of the frontal and medial regions using videoendoscopy.[37]

The use of the endoscope allowed the surgeon to use minimal incisions to access the areas to be treated[36,37] combined with a greater magnitude in the visualization of the image. This combination reduced the risk of nervous lesions, alopecia, paresthesia, bleeding, as well as the surgical time, allowing greater precision and versatility in the treatment of aging of the middle and upper thirds of the face.[38,39]

The indications for videoendoscopic treatment of the frontal region include the lifting of the lateral portion of the supercilium and the treatment of vertical glabellar wrinkles, transversal frontal wrinkles caused by frontalis muscle hyperactivity, and nasal dorsum wrinkles.[36,37]

The principles of subperiosteal rhytidoplasty can be applied to the upper third of the face, without the scarring and paresthesia caused by the conventional technique's bicoronal incision.[40,41]

In the middle third of the face, videoendoscopy allows the surgeon to 36 remodel the malar region, elevate the soft tissues,[37] and minimize side effects such as facial edema, pareses and neurological lesions.[42] Indications for treatment of the middle third of the face are a pronounced nasolabial crease and ptosis in the middle third of the face, with the flattening of the malar region, especially in young patients without significant excess

skin 39 who are not willing to undergo classic rhytidoplasty.

The main disadvantage of the endoscopic approach when compared to the conventional technique is the steep learning curve: the procedure is highly dependent on the surgeon and the equipment.[38]

COMPLICATIONS

HEMATOMA

The earliest complication in rhytidectomy is the hematoma.[22] The adrenaline absorbed after the injection and before the surgical dissection can lead to hypertension and hematoma. The hematoma incidence in people with normal bloos pressure is 3%, however it can be approximately 8% or higher in male and hypertensive patients. The use of supplements and substances that inhibit the platelets' function increases that risk. The most representative example is the use of non-hormonal anti-inflammatories (NHAIs). Adrenaline dilutions of 1:800,000 are more appropriate, with the use of highly concentrated solutions (<1:100,000) restricted to small regions.[25]

This complication is much less common when the dissection plane is deeper, due to the lack of subcutaneous vessels in the dissection plane above the masseteric-parotid fascia and the presence of a thicker flap with greater tension. In rhytidoplasty involving two anatomical planes (subcutaneous and sub-platysmal), hematomas are more commonly located in the subcutaneous plane (more superficial) than the sub-platysmal plane. The latter represents a true anatomical plane, without the presence of vessels in the transversal direction. Bleeding caused by retroauricular vessels in the posterior region, mainly in hypertensive patients, is common.[25]

PERSISTENT EDEMA

Edema occurs more rapidly in subcutaneous rhytidectomies due to the absorption capacity of the subcutaneous fat. In addition, the more superficial lymphatic damage can justify its lower persistence.[22]

SEROMA

The accumulation of liquid is less frequent in deeper rhytidectomies due to the flap's greater thickness and its higher absorption capacity. The thinness of the flap, combined with the gravitational stimulus, predisposes the formation of seromas in the neck region. The distention caused by the seroma can produce cutaneous sagging that requires additional surgical intervention. Moreover, the tension level in the incised borders can increase due to a seroma. Ideally, treatment of a seroma should be carried out in the first four days after surgery.[25]

INFECTION

Infection is very rare in patients who have undergone rhytidectomy. Since Pseudomonas aeruginosa can be present in some individuals' external ear canals, some surgeons recommend the pre-surgical topical use of gentamicin in order to avoid infection in the pre-auricular region. Infection by this pathogen normally responds to drainage and the use of oral ciprofloxacin. [25]

The presence of methicillin resistant *Staphylococcus aureus* (MRSA) can be found in the nasal secretions of healthy patients. Health professionals are prone to be carriers of this bacterium, which can be eradicated by topical mupirocin and soap containing chlorhexidine. MRSA infections need to be treated with oral or intravenous vancomycin.[25]

NEUROLOGICAL LESION

Neurological lesions are an uncommon complication, occurring in less than 1% of patients. There are very few reports of permanent neurological damage after dissections carried out below the SMAS plane. Although the buccal nerve's branches are more frequently damaged, the great number of crossed innervations reduces the chance of permanent sequelae 22 Lesions in the temporal and mandibular nerves are more serious, since they are terminal nerves, with no redundant innervation.[27] A lesion in the accessory nerve after rhytidectomy has been reported, which caused a reduction in the shoulder's abduction capacity.[43]

CUTANEOUS NECROSIS

Despite the high tension level, there is good vascularization in the facial flap. The incidence of cutaneous necrosis ranges from 1% (in rhytidectomy with deeper dissection planes) to 3.6% (in subcutaneous rhytidectomy). It is higher in patients with obstructive vascular disorders, especially smokers.[25]

Cutaneous suffering can be observed in the healing area, sometimes with the formation of crusts and desquamation in the borders of the flap. It occurs more frequently near the suture line and the upper earlobe. In the scalp, the flap can cause hair loss in some areas, which can improve after some months, when the healing area's tension level is more stabilized.[22]

ADJUVANT THERAPIES

TREATMENT OF THE LOWER THIRD OF THE FACE

The lower third's typical aging signs include lipodystrophia, cutaneous sagging, platysmal ptosis, submentonian fat ptosis, and prominent salivary glands.[44] Lifting the platysma muscle improves the quality of rhytidoplasty results by increasing the definition of the neck region, particularly the lower border of the mandible and the anterior border of the sternocleidomastoid muscle, which provides better support to the submaxillary gland. The surgical techniques for treatment the platysma's vertical bands include excision and muscular suture through an anterior route or lateral elevation.[45]

The platysmal plicature technique proposed by Aufricht in 1960 achieved only short-term results. With the description of the SMAS by Mitz and Peyronie in 1976, Guerrerosanto identified the platysmal muscles as key elements in cervicofacial rejuvenation surgery.[46]

Other neck rejuvenation methods, which do not require conventional rhytidoplasty, include the increase in the mentum projection (chin implant), lipoplasty/fat excision, isolated cervicoplasty with separated treatment of the platysmal bands (plica-

ture) and type A botulinum toxin application.[46,47]

RESURFACING

There are diverse techniques that can improve the cutaneous surface. One option is the use of chemical peels, which can be administered using a variety of substances. The more superficial chemical peels can be carried out with glycolic, retinoic, or trichloroacetic (low concentration) acids, and Jessner's solution, etc. They promote the more superficial desquamation of the skin, and pose lower risks.[48]

Nevertheless, in a number of circumstances it is important to use deep peeling, especially in patients who underwent rhytidoplasty and frequently present a high degree of photodamage. In those situations, trichloroacetic acid (in higher concentrations) and phenol are most frequently used. Adding croton oil (used in the Baker solution) to phenol increases the peel's depth. Phenol has cardiotoxic and nephrotoxic effects, meaning that sequential treatments carried out over larger areas must be conducted very carefully.[48]

The depth reached with the peeling depends on the degree of coagulation of the proteins. More superficial peelings promote a less noticeable whitening and a rosy tone to the skin's surface. In contrast, a white and opaque tone indicates that the peeling depth was excessive, reaching the reticular dermis and damaging the papillary dermis' vascular plexus. It is important to note that the rubbing level inflicted on the skin before or during the procedure also directly affects the depth reached.[25]

A common method of performing physical peeling is dermabrasion, which involves the use of high rotation speed electric motors or other sanding devices. The use of diamond or steel sandpaper is common in electric dermabrasors. With the latter, special care must be taken in order to avoid excessive depth and irregularity of the sanding process. Diamond sandpapers, as well as other types of sandpaper, offer different granulations, determining the ease of the sanding process and, therefore, the depth reached.[49]

Laser has been frequently used in resurfacing. Commonly used ablative lasers are the erbium:yttrium-aluminium garnet (ER:YAG) or carbon dioxide (CO_2). Many ablative devices supply both types of laser during the treatment. The CO_2 laser has a deeper penetration capacity and generates greater tissue heating, which promotes dermal collagen remodelling. The ER:YAG has good ablative action, allowing greater uniformity. In both, water is the chromophore.[25]

The fractional ablation concept rests on the premise of the formation of microscopic thermal damage zones. Its effect is the stimulation of collagen with less damage to the surface. That is the strategy employed by factional ablative lasers 50 and the fractional radiofrequency 51 to promote thermal damage. Regardless of the technique employed, greater depths involve a higher risk of permanent depigmentation and the formation of unattractive scars.

Although it is possible to carry out rhytidoplasty and ablative resurfacing in the same procedure,[52] we have not opted to do so, in order to avoid further discomfort to the patient. Resurfacing cannot be implemented in the area of the flap, for that will cause further skin damage, with an increased risk of necrosis.[52] We recommend evaluating the facial flap after it has healed, and only later on plan what will be done on the skin's surface.

FACIAL LIPOGRAFTING

Before the development of plastic surgery, facial remodelling was traditionally carried out using procedures associated with high morbidity and better recovery.[53] The use of lipografting became more frequent after liposuction became part of the plastic surgery arsenal.[54] In many ways, fat is the ideal filler. It is readily available, autologous – therefore not causing an immunological response – safe and non-carcinogenic. It can be easily obtained with minimal invasive procedures.[55] Extensive comparative studies to determine the best donor area have been carried out, without achieving consensus; the abdominal area is one of the most frequently used.[55]

The face can be didactically divided into anatomical regions with precise limits for lipografting, each receiving specific fat volumes depending on the aesthetic needs. The main lipografted regions are the glabella, temporofrontal, malar, nasogenian, lips, and mentum region, and the expression wrinkles.[54]

The most commonly described complications are ecchymoses, hematomas and cellulites in the grafted areas, and irregularities in the contour. Other complications described in the literature include facial lipodystrophia, graft hypertrophia, fat embolism in the cerebral and retinal arteries, aphasia, hemiparesis and blindness.[55]

INJECTABLE FILLERS

Fillers containing hyaluronic acid (HA) are the most frequently used. HA is hydrophilic, and is swiftly degraded (in roughly one day) in the body by hyaluronidase. Stabilization through cross-linking techniques is aimed at increasing the duration of the effects.[56] The ideal level of cross-linking must be evaluated carefully, for a higher than necessary level will reduce the HA's hydrophilic property, decreasing its effectiveness as a filling substance and affecting its biocompatibility, which can lead to rejection and encapsulating. [57]

Collagen-based fillers can have bovine, porcine or human origin. The latter can be obtained from cadavers or though the culture of fibroblasts. Human or pig collagens present lower levels of allergic reaction than that obtained from cows. There has been a natural migration trend of those type of fillers to HA.[58]

An additional type of filler is biosynthetic polymers. calcium hydroxylapatiteis one example. Following its injection, thecalcium hydroxylapatitegel is phagocyted, and the calcium hydroxylapatite microspheres are deposited in the tissue. The degradation of the microspheres is slow, sometimes lasting for more than two years.[57]

Poly-L-Lactic acid is not a filler per se. Its injection stimulates new collagen synthesis, with the formation of a granulomatous process.[58] Serial treatments are necessary, with response after six weeks and duration of results for up to two years.[56]

In 2008, according to data from the American Society of Plastic surgery, 1.26 million treatments were carried out with HA, 123,000 with calcium hydroxylapatite, 58,000 with collagen and around 32,000 with Poly-L-Lactic acid. It is believed that the statistics are underestimated, for only dermatologists, plastic surgeons and otorhinolaryngologists with recognized titles were included.[56]

Further examples of fillers are silicone, polymethyl methacrylate gel, and polyacrylamide. It is crucial to be aware of which countries various fillers are authorized to be used in, in addition to the type of use for which they were approved (e.g., deep facial creases, infra-palpebral region, etc.).

BOTULINUM TOXIN

Dynamic wrinkles are caused by the excessive activity of facial expression muscles. Botulinum toxin (most commonly type A) is a good option for reducing the appearance of such wrinkles. It is most frequently administered in the glabella, the lateral of the orbicular muscle of the eye, and the frontal regions. Other indicated treatments are for the platysma and sternum regions, the depressor muscle of the angle of the mouth, and in the treatment of the gingival smile.[59,60]

FINAL CONSIDERATIONS

It is interesting to note the complexity of the facial aging process, which results from both intrinsic and extrinsic factors. It is important, therefore, to understand the difference between intrinsic aging and the additional extrinsic component caused by solar damage, and realize the greater vulnerability of the skin to external factors.

Chronologically aged skin has a dry and pale look, with thin wrinkles, presenting a variable degree of sagging and benign neoplasias. In contrast, allowing for variations in phototypes and level of solar exposure, photoaged skin presents pigmentation irregularities, deep creases with thin wrinkles, atrophies with telangiectasias and premalignant lesions such as actinic keratoses.[4]

There are also histological variations between these two patterns of aging. The most common finding in the intrinsic pattern is the rectification of the dermoepidermal junction. The decrease in the number of melanocytes and Langerhans cells is also verified in that pattern. The dermis presents a decrease of the extracellular matrix with increased levels of metalloproteinases, and a decrease in fibroblasts and vasculature. In turn, in photoaged skin, the most common histological finding is the deposition of amorphous elastic material in the dermal papilla. Irregularities in the thickness of the epidermis, combined with the disorganization of its cellular layers (absence of order in the cellular maturation) and atypias can be found. The melanocytes are irregularly distributed, with areas of higher and lower densities in the basal layer. There is also a significant reduction in the number of Langerhans cells. In addition, in photodamaged skin there is a great presence of inflammatory cells and degenerative alterations of the collagen and elastic fibers.4

It is worth identifying the alterations involved in these two processes and evaluating patient candidates to undergo rhytidoplasty, for the skin has a crucial importance in the aesthetic perception after the procedure. Determined by the plastic surgeon, the repositioning of the soft parts will benefit from the improvement in the cutaneous surface resulting from dermatological treatment.25

A multidisciplinary approach, including plastic surgery, dermatology and dermatologic surgery, requires a greater thoroughness in attention to the patient, which will certainly improve results.

ACKNOWLEDGEMENTS

We would like to thank Sr. Carlos Augusto Zagatto Lazzarin for his preparation of the illustrations contained in this article.

REFERENCES

1. Hudson DA. An analysis of unsolved problems of face-lift procedures. Ann Plast Surg. 2010;65(2):266-269.
2. Barton FE Jr. Aesthetic surgery of the face and neck. Aesthet Surg J. 2009;29(6):449-63.
3. Kennedy C, Bastiaens MT, Bajdik CD, Willemze R, Westendorp RG, Bouwes Bavinck JN. Effect of smoking and sun on the aging skin. J Invest Dermatol. 2003;120(4):548-54.
4. Yaar M, Eller MS, Gilchrest BA. Fifty years of skin aging. J Investig Dermatol Symp Proc. 2002;7(1):51-8.
5. Hudson DA. An analysis of unsolved problems of face-lift procedures. Ann Plast Surg. 2010;65(2):266-9.
6. Le Louarn C. Muscular aging and its involvement in facial aging: the Face Recurve concept.Ann Dermatol Venereol. 2009;136 (Suppl 4):S67-72.
7. Le Louarn C, Buthiau D, Buis J. Structural aging: the facial recurve concept. Aesthetic Plast Surg. 2007;31(3):213-8.
8. Castro CC. Evolução Histórica. In: Castro CC, editor. Cirurgia de Rejuvenescimento Facial. Rio de Janeiro: MEDSI; 1998. p .21-6.
9. Coleman WP 3rd. History of Face Lifting. In: Moy RL, Fincher EF, editors. Procedures in Cosmetic Dermatology Series: Advanced Face Lifting. Philadelphia: Elsevier Health Sciences; 2006. p .1.
10. Rogers BO. A brief history of cosmetic surgery. Surg Clin North Am. 1971;51(2):265-88.
11. Pitanguy I. Ritidoplastia facial y cervical. In: Coiffman F, editor. Texto de Cirugia Plastica, Reconstructiva Y Estetica. Barcelona: Salvat Editores; 1986. p .861-86.
12. Gonzallez-Ulloa M. Facial wrinkles. Integral elimination. Plast Reconstr Surg Transplant Bull. 1962;29:658-73.
13. Pitanguy I. Rhytidoplasty: eclectic solution of the problem. Minerva Chir. 1967;22(17):942-7.
14. Zimbler MS. Tord Skoog: face-lift innovator. Arch Facial Plast Surg. 2001;3(1):63.
15. Skoog T, editor. Plastic Surgery: New Methods and Refinements. W.B. Philadelphia: Saunders Company; 1974. p .500.
16. Mitz V, Peyronie M. The superficial musculoaponeurotic system (SMAS) in the parotid and cheek area. Plast Reconst Surg. 1976;58(1):80-88.
17. Owsley JQ Jr. Platysma-fascial rhytidectomy: a preliminary report. Plast Reconstr Surg. 1977; 60(6):843-50.
18. McKinney P, Tresley GE. The "maxi-SMAS": management of the platysma bands in rhytidectomy. Ann Plast Surg. 1984;12(3):260-7.
19. Pitanguy I.The round-lifting technique. Facial Plast Surg. 2000;16(3):255-67.
20. Stuzin JM, Baker TJ, Gordon HL, Baker TM. Extended SMAS dissection as an approach to midface rejuvenation. Clin Plast Surg. 1995;22(2):295-311.
21. Baker TJ, Stuzin JM. Personal technique of face lifting.Plast Reconstr Surg. 1997;100(2):502-8.
22. Hamra ST. Composite rhytidectomy. Plast Reconstr Surg. 1992;90(1):1-13.
23. Ramirez OM. The subperiosteal rhytidectomy: the third-generation face-lift. Ann Plast Surg. 1992;28(3):218-32.
24. Mendelson BC. Correction of the nasolabial fold: extended SMAS dissection with periosteal fixation.Plast Reconstr Surg. 1992;89(5): 822-33; discussion 834-5.
25. Barton FE Jr. Aesthetic surgery of the face and neck. Aesthet Surg J. 2009;29(6):449-63; quiz 464-6.
26. Ozdemir R, Kilinç H, Unlü RE, Uysal AC, Sensöz O, Baran CN. Anatomicohistologic study of the retaining ligaments of the face and use in face lift: retaining ligament correction and SMAS plication. Plast Reconstr Surg. 2002;110(4):1134-47; discussion 1148-9.
27. Brooke R. Seckel. Facial danger zones: avoiding nerve injury in facial plastic surgery. St. Louis: Quality Medical Pub; 1994. p .52.
28. Salasche ST, Bernstein. Surgical Anatomy of the Skin: Norwalk: Appleton&Lange; 1988. p. 1-12.
29. Ress TD, Aston SJ, Thorne CHM. Blepharoplasty and Facialplasty. In: McCarthy JG, ed. Plastic surgery. Philadelphia: Saunders Company; 1990. p .2360-414.
30. Paul MD, Calvert JW, Evans GR. The evolution of the midface lift in aesthetic plastic surgery. Plast Reconstr Surg. 2006;117(6):1809-27.
31. Rees TD. The Classical Operation. In: Rees TD, ed. Aesthetic Plastic Surgery.: Philadelphia: W.B. Saunders Company. 1980. p . 600-33.
32. Mendelson BC. Surgery of the superficial musculoaponeurotic system: principles of release, vectors, and fixation. Plast Reconstr Surg. 2002;109(2):824-5.
33. Berry MG, Davies D.J. Platysma-SMAS plication facelift. Plast Reconstr Aesthet Surg. 2010;63(5):793-800.
34. Chamorro DR, Costa ASR, Reis FTB, Arguello MA, Santana PSM, editors. Simpósio Brasileiro de contorno facial. Lifting subperiostal com pequenas incisões [Internet]; 2005 Nov 11-15; Belo Horizonte, Brazil. [Acesso 11 Nov 2010] Disponível em: www.hitechbrasil.com.br/sbcp/anais/42/paginas/237.htm.
35. Toth BA, Daane SP. Subperiosteal midface lifting: a simplified] approach. Ann Plast Surg. 2004;52(3):293-6.
36. Patrocínio LG, Patrocínio JA, Couto HG, Souza HM, Carvalho PMC. Ritidoplastia subperiosteal: cinco anos de experiência. Rev Bras Otorrinolaringol. 2006;72(5),592-7.
37. Graf R, Pace D, Araujo LR. Cirurgia videoendoscópica frontal e de terço médio: experiência de 8 anos. Rev Soc Bras Cir Plast. 2005;20(4):197-203.
38. Viksraitis S, Astrauskas T, Karbonskiene A, Budnikas G. Endoscopic aesthetic facial surgery: technique and results. Medicina (Kaunas). 2004;40(2):149-55.
39. Ramirez OM. Why I prefer the endoscopic forehead lift. Plast Reconstr Surg. 1997;100(4):1033-9; discussion 1043-6.
40. de la Fuente A, Santamaria AB. Endoscopic subcutaneous and SMAS facelift without preauricular scars. Aesthetic Plast Surg. 1999;23(2):119-24.
41. Ramirez OM. The anchor subperiosteal forehead lift. Plast Reconstr Surg. 1995;95(6):993-1003; discussion 1004-6.
42. Ramirez OM. Three-dimensional endoscopic midface enhancement: a personal quest for the ideal cheek rejuvenation. Plast Reconstr Surg. 2002;109(1):329-40; discussion 341-9.
43. Millett PJ, Romero A, Braun S. Spinal accessory nerve injury afterrhytidectomy (face lift): a case report. J Shoulder Elbow Surg. 2009;18(5):15-7.
44. Rohrich RJ, Rios JL, Smith PD, Gutowski KA. Neck rejuvenation revisited. Plast Reconstr Surg 2006;118(5):1251-63.
45. Mladick RA. Neck rejuvenation without face lift. Aesthet Surg J. 2005;25(3):285-7.
46. Labbé D, Franco RG, Nicolas J. Platysma suspension and platysmaplasty during neck lift: anatomical study and analysis of 30 cases. Plast Reconstr Surg. 2006;117(6):2001- 10.
47. Matarasso A, Matarasso SL. Botulinum A exotoxin for the management of platysma bands. Plast Reconstr Surg. 2003;112(5 Suppl):138-140.
48. Fabbrocini G, De Padova MP, Tosti A. Chemical peels: what's new andwhat isn't new but still works well. Facial Plast Surg. 2009; 25(5):329-36.
49. Alkhawam L, Alam M. Dermabrasion and microdermabrasion. Facial Plast Surg. 2009;25(5):301-10.
50. Bogdan Allemann I, Kaufman J. Fractional photothermolysis--an update. Lasers Med Sci. 2010;25(1):137-44.
51. Brightman L, Goldman MP, Taub AF. Sublative rejuvenation: experience with a new fractional radiofrequency system for skin rejuvenation and repair. J Drugs Dermatol. 2009;8(11):s9-13.
52. Brackup AB. Combined cervicofacial rhytidectomy and laser skin *resurfacing*. Ophthal Plast Reconstr Surg. 2002;18(1):24-39.
53. Ellenbogen R, Youn A, Svehlak S, Yamini D. Facial Re-shaping using less invasive methods. Aesthetic Surg J. 2005;25(2):144-152.
54. Aristóteles Bersou Jr A. Lipoenxertia: técnica expansiva. Rev Bras Cir Plast. 2008;23(2):89-97.
55. Kaufman MR, Miller TA, Huang C, Roostaien J, Wasson KL, Ashley RK, Bradley JP. Autologous fat transfer for facial recontouring: is therescience behind the Art? Plast Reconstr Surg 2007:119(7):2287-96.
56. Bray D, Hopkins C, Roberts DN.A review of dermal fillers in facial plastic surgery. Curr Opin Otolaryngol Head Neck Surg. 2010; 18(4):295-302.
57. Tezel A, Fredrickson GH. The science of hyaluronic acid dermal fillers. J Cosmet Laser Ther. 2008;10(1):35–42.
58. Bentkover SH. The biology of facial fillers. Facial Plast Surg. 2009; 25(2):73-85.
59. Carruthers J, Carruthers A. The evolution of botulinum neurotoxin type A for cosmetic applications. J Cosmet Laser Ther. 2007;9(3):186-192.
60. Carruthers A, Carruthers J. Botulinum toxin products overview. Skin Therapy Lett. 2008;13(6):1-4.