ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 4, Issue – 2, March - 2021, Page No. : 569 - 577

A review-The art and science of facelift surgery

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Citation of this Article: Dr. Gunjan Rawat, Dr. Vipul Garg, Dr. Sumit Chopra, Dr. Ankit Aggarwal, "A review-The art and science of facelift surgery", IJDSIR- March - 2021, Vol. – 4, Issue - 2, P. No. 569 – 577.

Type of Publication: Review Article

Conflicts of Interest: Nil

Abstract

Facial ageing is a dynamic, complex and multidimensional process with interaction of several factors result in changes in the anatomical layers of face. The ageing factor is influenced by various genetic factors. The wrinkles and the thinning of the facial skin makes it droop. Thus, giving facial skin more older appearance due to lack of elasticity. The desire of youthful facial skin is around the globe. Facelifting is a facial rejuvenation procedure in which by dissection of subcutaneous layers and various suturing techniques the skin is stretched which gives juvenile facial appearance. This article presents with history indication, techniques, and complications of facelift surgery.

Keywords: Ageing, Facelifting, Rhytidectomy, SMAS, Rejuvenation, Complications.

Introduction

With the development in the field of medicine and science there is longevity of human life. Facial aesthetic surgery have also evolved in past few decades. In aesthetic plastic surgery, anti-aging procedures focus on giving a juvenile facial appearance to an individual. The major problem that appear on aging face are wrinkles, blemishes, age spots, volume loss, and sagging of tissues. The chief problem addressed in Asians is sagging of facial skin due thick skin architecture. Westerner has thin skin which results in more of wrinkles. A rhytide or wrinkle (Greek ritis-wrinkle, and ektomi-excision) is a crease on the skin.In a majority of people, wrinkles start to form in the late 20s in places with the thinnest skin such as the periorbital area, and as these people grow older, volume loss and drooping of tissues develop.[1, 2]The Facelift surgery is also known as rhytidectomy or removal of wrinkles from skin. Facelift surgery was originally conceived as a method of placing traction on the aging face by excising skin in the periphery of the face and closing the resulting defect under tension. Since that simple beginning over 100 years ago, the procedure has evolved to encompass a wide range of techniques which lift, augment, and rearrange facial

tissues in anattempt to rejuvenate the aging face. Facelift surgery is the most comprehensive cosmetic facial procedure, and the most impressive and emotional cosmetic surgery anywhere on the body.No other procedure than facelift in plastic surgery is rightful in theeye of the public. A surgeon should always run a fewer number and simplest exercises to address the patients complaint in a realistic fashion. If not, performed properly the procedure can be calamitous, resulting in visible scars, unnatural creases or operated look and more are the complications.[2].

History of facelift surgery

The History of aesthetic facial surgery reported by various authors Rogers, Rees and Wood-Smith, Gonzalez-Ulloa, Reesand Barton. There is still uncertainty who performed the first facelift procedure. Most of the data sources date back to 20thcentury. Eugen Hollander in 1901 reported appearance of a once-ravishing Polish aristocrat at his Berlin practice, brandishing a drawing that showed how she believed her raddled visage could be tautened. Eugen Hollander stated 'the victim of the arts of feminine persuasion, he removed pieces of skin at the margins of the hairline and in the natural aging skin folds of a woman to freshen up “her wrinkles and drooping cheeks”.[3]However, Lexer in 1932 reported about facelift surgery which was performed for an actress in 1906.[3,4]Also, Joseph in 1921 reported that he had performed a surgery in 1912 to correct aging cheeks tissues for a 48 years female.[3]In year 1907, Charles Conrad Miller stated the surgical approach to eliminate wrinkles from facial skin. He performed a subcutaneous sectioning of the facial muscles, from the buccolabial sulcus. Miller used paraffin, braided silk and gutta percha for the substitute of resorbed adipose tissue during the process of aging. Roger in his publication on “History Of Cosmetic Surgery” expressed Miller was “something of a quack and at the same time something of the surgical visionary”.[4]In 1919, Passot published articles having done elliptical excision of skin of hairline, temporal, forehead, and preauricle areas to tighten skin along with elliptical excision of fat and skin of submental region to reduce fat deposits. Bourguet in 1924, had performed similar excision of fat in periorbital region for rectify the herniation of periorbtal fat, which published in year 1925.[3,4,5]Noel was a true master of that era describing facialplasty, blepharoplasty, forehead lifting, and correction of loose skin of the neck, burns, scars, protruding ears, and laxity of the upper arms.[5]Kolle had described in his book “Plastic And Cosmetic Surgery” about aggressive surgical procedures eliminating excess skin of eyelids.[3] Bettman illustrated first continuous temporal scalp, pre auricle, post auricle and mastoid incisions.[5] Pennisi published literature on transposition of fat from lateral neck and cheek region suturing it to parotid and sternocleidomastoid fascia.[6]Baker in his publication 1969 describe removal of wrinkles of forehead, upper lip, cheeks, jowls, fat pads of the neck and blephroplasty.[7]John burke Tipton in 1972 had described plication of the subcutaneous tissue for cervico facial rhytidectomy to tighten the face and produce a smoother chin line.[8]Mitz and Martine 1976 in cadaveric dissection studies affirm that plication of superficial muscular and aponeurotic system (SMAS) by retrofasical approach for facial plasy. Hamra introduced the deep plane rhytidectomy followed by composite facelift in order to improve the per orbital and Nasolabial regions.[9]John.Q. Owsley described mid face malar fat pad dissection below the or bitomalar septum along with suture suspension for correction of infraorbital flattening, reduced prominence of Nasolabial fold also reduction in postoperative edema and ecchymosis.[10]Ramirez introduced sub periosteal rhytidectomy endoscopic technique to address three thirds

of face. Soft tissue cervicoplasty for younger individuals was also stated by the author.[11] In this article, we will review the basic face lifting procedure which are used today with brief discussion of technique and efficacy. The goal is to give understanding of each technique in facial aesthetic surgery.

Anatomy of the face

The soft tissue of face has consisted of layers arranged in concentric pattern. From superficial to deep namely skin, subcutaneous tissue, superficial musculo-aponeurotic system (SMAS), retaining ligaments, paratidomassestric fascia(deep fascia), nerves, arteries, veins, parotid duct and buccal pad fat. The age related changes occur in each layer, procedure to reposition these tissues forms basis of rejuvenation surgery.

Skin

The skin is attached to the underlying fat by reticular cutis system, to bones and muscles via connective tissue fibers. Nerves and vessels reach skin running adjacent to these fibrous structures, dissection in these areas is tough and bloody. The dermal plexus of blood vessels aid in good vascularity of skin and facelift flap. The viability of facelift flap is enhanced by clinging fat to dermis. In the skin, flattening of the dermo-epidermal layer along with reduction in collagens III, IV and VII, elastin, oxytalan fibers, melanocytes, chondroitin sulphate, langerhans cells determine susceptibility to age related changes.[12]Individuals in their 20's have length of skin from helix to ala of nose 12 cm and ear lobule to the chin is 13 cm. For people in 3rd, 4th, 5th, 6thdecade of life this length changes to 13 cm, 14.5 cm, 14 cm, 16 cm respectively. This suggest there is in average increase in 1-1.5 cm of skin per decade, by removing 1-1.5 cm of skin these individuals can gain younger appearance.[1]In the cadaveric study to evaluate relative thickness of skin in 39 distinct subunits in human face by Karan Chopra et.al(2015) stated the area of the face with the thickest dermis was the lower nasal sidewall (1969.2 μm, dRT: 2.59), and the thinnest was the upper medial eyelid (758.9 μm, dRT: 1.00). The area with the thickest epidermis was the upper lip (62.6 μm, eRT: 2.12), and the thinnest was the posterior auricular skin (29.6 μm, eRT: 1.00).[13]2 SUBCUTANEOUS TISSUEThis layer is sandwiched between superficial dermal anddeeper SMAS layer. The subcutaneous layer have two important structure: the subcutaneous fat and retinacular cutis.The retaining ligaments of the face represent an additional dimension of this anatomy and are important in understanding concepts of facialaging and rejuvenation. The retaining ligaments of the face are strong and deep fibrous attachments that originate from the periosteum or deep facial fascia and travel perpendicularly through facial layers to insert onto the dermis. These ligaments act asanchor points, retaining and stabilizing the skin and superficial fascia (SMAS) to the underlying deep fascia and facial skeleton in defined anatomic locations. This branching network is called retinacular cutis and Gosain et al stated this layer as "fascial fatty layer" of face. This retinacular cutis forms septae in subcutaneous layer divide it into fat compartments. The face is covered with superficial fat layer which lie deep to dermis. The layer of fat may vary in thickness, which carry surgical implication of difficulty in repositioning but dissection is easy. The most thickened layer of subcutaneous fat is in malar region. Malar pad fat is triangular in shape present throught life and guarded with infraorbital arch, Nasolabial fold, and diagonal line across the mid cheek.[3,14]In a study by Raskin and Gregroy (2006) anatomic dissection of 10 fresh hemi-cadaver range of 42-86 years results showed 80% of fat was in face and 20% in neck region. In the face, 57% of the fat mass was found above the SMAS, and 43% was found below the SMAS, whereas in the neck 65% of the

fat mass was found above the platysma and 35% below the platysma.[15]The authors also described "psuedoptosis" due to age related deflation of deep medial fat compartments of the superficial fat.[16]This also causes "inverted V shaped deformity" as result of Deeping of Nasolabial fold.[17]During youth the cheeks volume is full and jowls are less with age it is reversed. The face changes from heart to rectangle this is known as "inverted cone of youth", which also lead to reversal of "ogee" curve.[3]

Superficial Musculo aponeurotic System (SMAS)

Mitz and peyroniehas introduced the term SMAS, although clear anatomic definition is still lacking. This layer separate subcutaneous fat from paratidomassestric fascia. SMAS is continuous with the temporoparietal fascia in temple region, galea in scalp, and superior cervical fascia in neck. SMAS is continuous with the platysma. Facial muscle motor nerve lie in this layer. SMAS allow the face to move as a unit aid in better facial expressions.[3]A study on 18 cadaver done to study the morphology of SMAS. According to Har-shai et alskin is connected to SMAS by fibrous septa and SMAS has intimate connections to mimetic muscles; the SMAS is a composite tissue comprising collagen, elastin, fat cells, and interstitial fluid. There are two different architecture of SMAS: Type I-The common architecture in the posterior part of the face is a meshwork of fibrous septa which envelops lobules of fat cells. These lobules can act as small pads with viscoelastic properties. The interconnecting fibrous network is anchored to the periosteum(retaining ligaments) or connected to the facial muscles. This type is come in forehead, zygomatic, infraorbital region and lateral part of Nasolabial fold. Type II-This second architectural model is a meshwork of intermingled collagen and elastic fibers and muscle fibers. The muscle fibers reach up to the dermis of the skin. Fat cells are interposed between this collagen fiber–muscle meshwork. Type II SMAS is present in upper and lower lip aid in movement of oral skin. Type I architecture lateral to the nasolabial fold is more susceptible to the aging process SMAS consist of nerves and vessels that is important for surgeon to avoid injury to anatomical structure specially facial nerve as it enter parotid fascia it in relation to SMAS.[19]

Retaining Ligaments

The retaining ligament of face is divided into two groups namely: fasciocutaneous and osteocutaneous. The fasciocutaneous run from deep fascia to SMAS like parotid ligament and massestric ligament. The osteocutaneous run from periosteum to insert to dermis includes zygomatic ligaments (Mcregor's patch) and mandibular ligament.[1, 3] Medelson described retaining ligaments of face arranged in inverted L shaped fashion. The retaining ligament play dual role in face-lift surgery. They help in sub-SMAS relief and mobilization of mid-face flap distally and mesially, which is a important aspect of sub-SMAS techniques. Ligaments play a guarded role for peripheral facial nerve branches as they run deep to superficial to innervate facial muscles. Furnas first described the zygomatic upper rami of facial nerve run deep and inferior to zygomatic ligament. Stuzin et al stated the transition zone between SMAS of malar and mid-face region due to close relation to zygomatic branch of facial nerve. [20]

Muscles

The muscle of facial expression divided into superficial and deep groups. The superficial muscles lie outward to plane of facial nerve and the latter lie deep to facial nerve. The facial muscles which are important to surgeons orbicularis oculi and platysma is manipulated and zygomaticus major used as a landmark during facelift procedure.[3]All muscles of facial expression originate

from bone and insert in dermis. The platysma muscle is subcutaneously placed originate from fascia of pectoralis and insert over anterior mandible. Over the neck region platysma is thick and becomes thin running superiorly to attach lower fibers of orbicularis oculi. Both of these muscles are undergo age related change, orbicularis oculi result in “lower eyelid festoons”, which is a result of thinning of orbitomalar ligament.[21]The platysma muscle also fall away from the deeper cervical attachment resulting in obtuse cervico-mental angle and visible platysma band in its anterior border.[3]

Motor and Sensory Nerves

The nerves of face run below deep fascia. There are five distinct branches of facial nerve: zygomatic branch, temporal branch, buccal branch, mandibular branch, cervical branch. The zygomatic branch of facial nerve divide into superior and inferior branch. The former divide into deep branches in 95% of cases and 5% in superficial branch. The buccal and zygomatic branch communicate in 70% to 90% of cases both divide into superior and inferior branches both branches exits through anterior border of parotid gland runs below massestric fascia and SMAS.[1] The infraorbital is a sensory branch of second division of trigeminal nerve, damage to this nerve result in numbness of lateral nose, cheeks, upperlip, and inferior eyelid. Injury to mental sensory branch of mandibular nerve result in numbness of lower lip and chin.[22]The greater auricular nerve, branch of cervical plexus most commonly injured in facelift surgical procedure. The nerve course within 30 degree angle to vertical limb perpendicular to the Frankfurt horizontal plane and second limb drawn perpendicular to mid lobule(Ozturk et al.,2014) damage to this nerve leads to numbness of the earlobe and lateral pinna and also a potential problematic neuroma.[23]

Operative techniques of facelift

Subcutaneous facelift: The first facelift procedure dates back to 20thcentury, a simple skin incision at the temporal hairline and pre-auricular region to a more extensive subcutaneous dissection with skin repositioned in a superiolateral vector.[3]The flap is dissected in subcutaneous plane above the SMAS preserving the sub dermal plexus for vascular supply.[24]This procedure is rarely practiced, as it relies on skin tension to create a desired lift, leading to widenend scar and unnatural pulled appearance. This procedure is indicated in previous facelift surgery with SMAS plication, thin skinned individuals, in psuedoxanthoma elasticum. This procedure is not indicated in elderly individuals having sagging deep facial layers.[25]

Subcutaneous facelift with SMAS manipulation

Mitz introduced the concept of SMAS facelift,[18]the fibro-fatty composition of SMAS gives the flap greater strength against gravity. The dissection plane in this technique is supra-SMAS. After dissecting in the subcutaneous plane, SMAS layer is exposed. The mobile segment of SMAS layer is fixed to the posterior relatively immobile layer (i.e., parotidmasseteric fascia) by mainly three sutures in a vertical direction. The excess of SMAS layer could be trimmed after suturing to prevent bulging. The SMAS is advanced is in different vector from skin that avoid skin tension. This technique is indicated in middle aged patients with thin skins and moderate to severe laxity. Obese patients with thick skin types are not candidates for this technique. [3] MACS is the minimal access cranial suspension lift popularized by Tonnard (2007), uses permanent purse string suture anchored to deep temporal fascia to achieve supero lateral suspension of the SMAS-platysma layer. To address neck and lower third of face two purse string suture are used and third suture is used in extended MACS to suspend malar pad

fat. It is effective in younger patients who require minimal skin redraping.[26]

Deep plane facelift (DPFL)

Hamra introduced DPFL for correction of malar fat pad and nasolabial grooves. The subcutaneous dissection is 2-3 mm anterior to tragus in a sub-SMAS plane. The first reference point considered is orbicularis oculi. The second being zygomaticus major muscle dissection plane is superior to the border of this muscle and third is zygomatic minor muscle. The zygomatic cutaneous ligament is relieved to aid in movement of flap. The resulted flap has skin, subcutaneous tissue and malar fat pad. Patients with significant aging changes of Midface and mentolabial fold are good candidates for this procedure.[27]

Lateral SMA Sectomy

Baker described later SMA Sectomy in late 1997, SMAS layer was excised with fat obliquely from angle of mandible to lateral malar eminence. The vector of elevation is perpendicular to Nasolabial fold is not ideal result in “lateral sweep” or “Nike swoosh” or pulled appearance. The point of fixation of vertically elevated SMAS flaplie lateral to orbit along zygomatic arch. These procedure correct excellent jawline, and correcting laxity in the neck. This procedure can rejuvenate mid-third of face by elevation of malar fat pad.[28]

Sub periosteal facelift

Tessie introduced this technique in 1979 used coronal approach enhance mid-third of face. There are three landmark used first is SOOF, line running lateral to eyebrows and inferior orbital rim. The second malar fat pad point is located crossing of horizontal line superior to nasal ala and vertical line passing through lateral canthus. The third point is Bichat’s pad fat which is located at cross point of horizontal line to nasal bse and vertical line to lateral canthus. The temporal incision is placed and supraperiosteal dissection is done and the SOOF, malar fat , Bichat fat sutured to deep temporalis fascia laterally , centrally, medially respectively. This method is suitable in raising the eyebrows, eyelid lateral corners, forehead, glabella, cheeks, and Nasolabial fold.[25]

Skoog facelift

In 1974, skoog described technique raising skin, subcutaneous fat, SMAS, as a single unit.[25]Again in 1992, Barton had modified Skoog technique known as high-SMAS technique and stated three variants of the high-SMAS technique: sub-SMAS dissection up to the Nasolabial fold, sub-SMAS dissection up to the Nasolabial fold plus trans nasal SMAS graft, or sub-SMAS dissection across the Nasolabial fold to overcome hitching of SMAS to lip elevators and aid in improvement of Nasolabial fold.[29]

Complications of Facelift Procedures

Hematoma: It is the most common post-operative complication, with incidence of 3-4% in women, 8% in men. Acute hematoma occur after 24 hours of rhytidectomy.[25]Berner et al, in 1976, demonstrated that post-operative hypertension key etiologic factor in hemtoma formation also recommended use of Thorazine post-operatively for blood pressure control.Grover et al demonstrated, in their series of 1078 facelifts, a significant association of smoking with postoperative hematoma.[30]

Infection: It is presented in 0.3%facelift cases. The post-facelift infection caused by high BMI, staphylococcus aureus, rare entity.Pitanguy et al reported in their series of 8788 facelifts over 52 years an infection rate of 0.05%. Leroy et al reported 11 procedures complicated by postoperative infection out of 6166 consecutive facelifts performed by 35 surgeons (infection rate 0.18%).[30]

Skin Necrosis: skin necrosis may occur in center of cheeks or edges of skin flap. Common causes are too tight dressing, long and thin flap, retained hematoma, lacerated

scar with elevation of flap, in smokers, burn and cold injuries. Subdermal plexus should be remained intact and smoking should be stopped 10 day prior and 21 days after surgery for prevention of skin necrosis. [1, 25]

Nerve Injury: Facial nerve damage and paralysis is most feared complication, most commonly zygomatic and marginal mandibular branch is involved. Parasthesia of the parietal region after forehead lift due damge to deep branch of supraorbital nerve. Damage to cervical branchis noted in 1.7% cases. The greater auricular nerve is injury leads to interruption of small cutaneous sensory nerve leads to alteration in sensory innervations.[1]

Facelift Stigmata: Architectural disturbances in tragus and lobule, displacement of hairline, risk of asymmetry, lower eyelid inferior malposition. Pixie ear deformity called so because of “stuck on” and “pulled” appearance of the face due to outward pull of the jawline and cheek skin flap over point on earlobe attachment point(o), otobasioninferius. This tension is a result of migration of earlobe from posterior cephalad position to anterior caudal position.[1,30]

Other Complications: less common are alopecia, hypertrophic scars, pigmentary changes, parotid fistulae, edema, and synkinesis. Systemic complications like deep vein thrombosis, pulmonary embolism, stroke and death.[1,2,25]

Discussion

Ageing of soft tissue is caused by multi factorial factors smoking, sun exposure (photo ageing) which in relation to mid-face region increased laxity of the orbicularis oculi, zygomaticus muscles, and elevators of upper lip, orbital septum along with deepening of Nasolabial fold, and fat atrophy. The wear in the structural characteristics of the osseuocutaneous ligaments, with inferior migration of soft tissue and malar fat pads, visible lengthening of lower eyelid giving more vertical appearance of face (Mendelson and wong, 2012).[33]In younger individuals the upper anterior cheek supported by orbitomalar septum with prevent downward migration of fat pad which are also supported by facial ligaments. Variation in the ageing due to age changes in the different compartment of the face which leads to inferior migration of SOOF and malar fat pad resulting in “double-contour” deformity of Midface. The inferior orbital rim consist of lacrimal bone, zygoma, anterior maxilla, these structure are provide support for mid-face soft tissues. Skeletal resorption, at both per orbital and anterior maxilla has attributed to decreased malar projection. This will hamper the attachments of facial ligament, loss of maxillary angle up to 10 degree, leads to deformity of lower eyelid and prominence of Nasolabial fold(Mendelson and wong, 2012).[33]

Conclusion

Since century, innovative surgeons have developed a wide variety of approaches to treat age related changes. Asethetic facial surgical procedures are becoming popular and are well recognized by the patients through audio-visual aids. Individual would seek treatment for wrinkles, dark spots, sagging facial skin. To address these clinical problems facial rejuvenation by facelift can be performed for better cosmetic results and long-lasting effect.

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