Non-surgical Modalities of Facial Rejuvenation and Aesthetics

32

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32.1 Introduction to Ageing Face

32.1.1 Facial Changes Due to Ageing

The Face is a mirror of what we are from inside. It is like an opera that reveals a person's inner self, nature, personality and health. The signs and symptoms of age, illness, deficiencies and personality traits show on our faces. A lot can be postulated by just observing the different facial expressions of a person. A minuscule defect on the face engraves an exaggerated long-lasting impression on a person's mind and soul.

Ageing is a process which cannot be defied. With the passage of time, every individual goes through a phenomenon of complex transformations which takes away the youthfulness. The various signs of ageing seen on the face include recession of hairline, wrinkles on the forehead, drooping of the upper eyelid, hollowness in the under-eye area, deepening of nasolabial fold, folds on the face, sagginess of skin at the border of mandible, etc. (Fig. 32.1). Today, with the changing cultures and requirements in the profession, every individual wants to look better than what he or she is.

As the saying goes "Beauty has no age", more and more elderly people also want to have their face rejuvenated. So, today we have a range of patients of vast age variations who want to have a more rejuvenated look. The various modalities for rejuvenating the ageing face require fine skill and artwork combined with scientific knowledge and understanding of the whole face including scalp, forehead, periorbital area, perioral area, neck, etc., so as to achieve a more youthful appearance.

Time and technology has evolved. For many years the standard had been chemical peels as the non-invasive procedure to facelift as the invasive modality for face rejuvenation. Today, we have a vast range of procedures and technologies to counter ageing phenomenon and provide a rejuvenated appearance. We shall discuss the various non-surgical modalities in this section which physicians are adopting to treat patients with a wide range of Facial Aesthetic concerns.

The ageing of human face is a highly complex, irreversible and progressive biologic phenomenon that occurs with the ticking of time. The main factors leading to facial ageing include gravity, bone remodelling, subcutaneous fat redistribution and loss, hormonal imbalance, chronic sunlight, pollution and smoking. Other environmental factors that allegedly affect facial appearance include mental stress, nutritional deficiencies, work habits, drug abuse and disease. This dynamic process is a synergistic effect of various factors and actually takes place at 4 distinct levels (the 4 S levels): Skin, Subcutaneous tissue, SMAS and facial Skeleton.

32.1.2 Ageing of Skin

The epidermis contains keratinocytes and dead corneocytes. The basal cells at the stratum basal divide to form keratinocytes, produce keratins and drift upwards as they mature. By the time keratinocytes reach the most superficial layer, they lose their nucleus and cytoplasmic organelles and are known as corneocytes. In a total period of 40–50 days, the keratinocytes come to the surface and corneocytes exfoliate. This time taken for the process of keratinisation, that is maturation of keratinocytes along with shedding of corneocytes, is known as the turnover time.

The natural process of desquamation sheds off the dry, old, hardened skin cells and gives way to the new cells to

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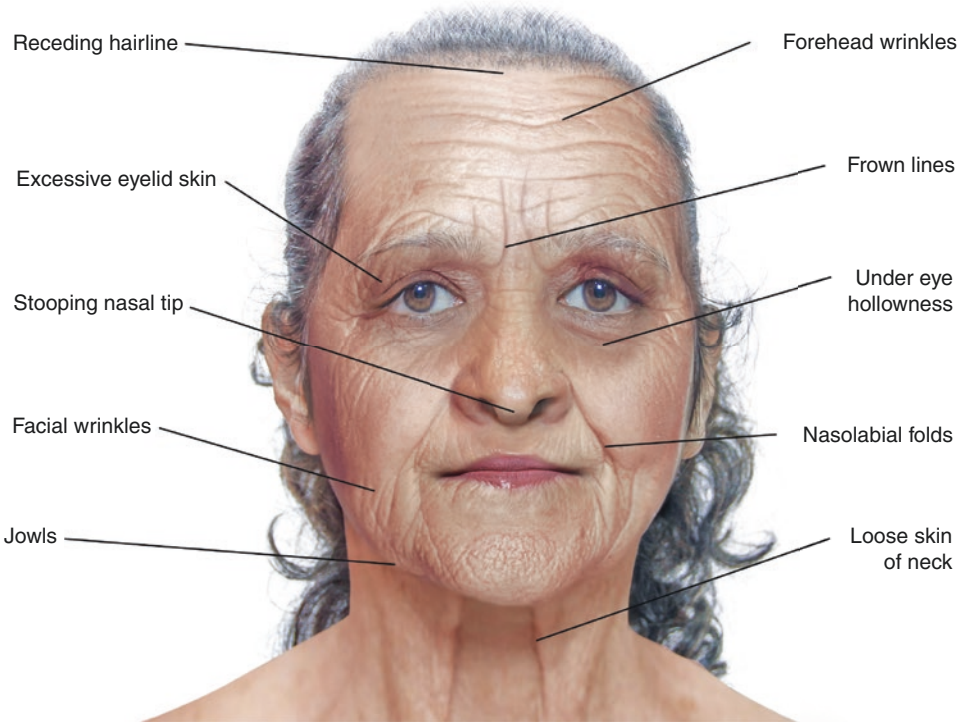

Fig. 32.1 Various signs of an ageing face include but not limited to forehead wrinkles, droopy eyelids, under-eye hollowness, deep nasolabial folds, jowl formation, loose neck skin and thin lips

come to the surface. This process also eliminates damaged and contaminated cells that carry pollutants and microorganisms from the environment.

The specialised fibroblasts in the dermal layer produce two key proteins-collagen and elastin. Collagen constitutes 80% of the dermis and provides strength and firmness to the skin. While elastin, as the name implies, provides elasticity to the skin and enables the skin to bounce back to its original shape after it is stretched, thus preventing wrinkles.

Skin ageing is a dynamic mechanism that transpires due to two basic factors:

- Intrinsic or Innate factors are insidious deteriorating elements that are influenced by internal metabolic processes, genetic programming, cellular metabolism and hormones;
- Extrinsic or Exogenous factors include Ultraviolet rays in the sunlight, cigarette smoking, environmental pollution, etc.

Intrinsic ageing is an inevitable natural ageing process which commences as early as mid-20s. It consists of internal physiological factors that cause inherent degenerative process in the body. Dead corneocytes do not desquamate as swiftly as expected and the turnover of new epidermal cells decreases somewhat. In the dermis, the production of collagen and elastin slows down. The cumulative effect which is seen in case of the inherent ageing includes fine wrinkling, parched, thin and transparent skin and depleted elastic nature of the skin.

Extrinsic ageing is because of the aggregated damage caused by environmental factors such as sun's UV radiation, gravity, sleeping posture, pollution, smoking, exposure to chemicals, etc. These exogenous factors along with the innate factors cause premature ageing of our facial skin. The face, which is most commonly exposed part of the human body to the UV radiations of the sun, undergoes ageing prematurely than any other part. Photoageing with recurrent sun exposure causes the skin to lose its capability to renovate and thereby accumulating damage. Recurrent and continual UV exposure disintegrates collagen and impedes the synthesis of new collagen. Alongside, there is a breakdown of elastin. This causes the facial skin to become slack, wrinkled and leathery much earlier than a sun-protected skin.

Gravity constantly works on different parts of our facial skin. As the skin elasticity reduces with age, the effects become evident. It precipitates jowls, nasolabial fold, drooping of eyelids, elongation of ears, etc. (Fig. 32.2).

Sleep lines are wrinkles that are etched on the facial skin of the people who sleep with the face pressed on the cushion or sleep on the sides.

Cigarette smoking over a period of time causes many biochemical alterations in our body. It has deleterious effects on skin and expedites the ageing process. The nicotine causes vasoconstriction thereby impairing the supply of oxygen and

Fig. 32.2 Influence of ageing on skin. Facial wrinkling, jowls and droopy eyelids clearly demonstrate the ageing process

important nutrients, such as vitamin A to the skin. Many of the over 7000 chemicals released from the burning cigarettes cause increased production of matrix metalloproteinases (MMP) that causes degradation of collagen and causes abnormal creation of elastosis materials. These cause premature facial skin wrinkling.

32.1.3 Ageing of Subcutaneous Tissue

The subcutaneous fat gives the volume and shape to the face. As explained by Rohrich and Pessa [1], the subcutaneous fat is distributed throughout the face in a multidimensional fashion and is highly compartmentalised. A youthful face is characterised by a smooth transition between these subcutaneous compartments. The superficial musculoaponeurotic system (SMAS) divides this fat into superficial and deep layers. As explained anatomically by Rohrich and Pessa [1], the external recess is in between the skin and SMAS while the internal recess lies under the SMAS and is adherent to the periosteum. The superficial and deep fat recesses are as explained in Fig. 32.3.

Furnas in 1989 first described the osteocutaneous ligaments within the cheek that anchor the dermis to the underlying fibro-osseous structures [2]. He outlined the zygomatic ligaments (McGregor's patch), the mandibular ligament, the platysma auricular ligament and the anterior platysma-cutaneous ligament that anchor the dermis and also support the midface soft tissue. Two theories explain the characteristic soft tissue changes that are distinguished during the mid-face ageing. The gravitational theory advocates that with the attenuation of the osteocutaneous ligaments, there is vertical descent of facial soft tissue which contributes to the deep creases of the ageing face [3]. The diminished strength of the ligaments is because the age-related elastosis and also because of the repeated animation of the muscles of facial expression.

Donofrio explained the volumetric theory in 2000. He suggested that it's the corresponding volume loss or gain in the adjoining areas of the face is what creates the deep creases of age [4]. This theory was later in 2007 reinforced by Lambros who stated that the ageing process was due to the relative deflation of certain fat pads, especially the deep fat pads [5].

32.1.4 Ageing of SMAS

The superficial musculoaponeurotic system is a multidimensional scaffold of organised fibrous tissue that connects the facial muscles with the dermis [6]. This fibromuscular layer also segregates the superficial and deep facial fat pads. Anatomically, the SMAS lies in the midface, inferior to the zygomatic arch and superior to the muscular belly of the platysma. It blends with the superficial temporal fascia and frontalis muscle superiorly, and with the platysma muscle inferiorly. Since it connects the facial muscles to the dermis, its purpose is to transmit, distribute and amplify the activity of all facial muscles [7].

As we age, and with the continuous use of the muscles of facial expression, the SMAS weakens and the strength diminishes. So, the ability to hold up the muscles, fat and the skin gets impaired. Combined with the effect of gravitational forces, the weakening causes the structures of the face to slump. The youthful appearance of the face changes as jowls are formed, the nasolabial fold deepens and the mandibular line angle becomes ill defined.

32.1.5 Ageing of Facial Skeleton

The bony skeleton serves as a framework for the soft tissues of the face including the skin, muscles and subcutaneous fat. The facial skeleton keeps changing anatomically throughout life with only degenerative and catabolic changes occurring after adolescence.

With ageing, the facial skeleton keeps resorbing in a very predictable manner and that contributes to the appearance of an aged face. Areas with strong tendency to resorb include the periorbital area, the midface, the perinasal area and the mandible (Fig. 32.4).

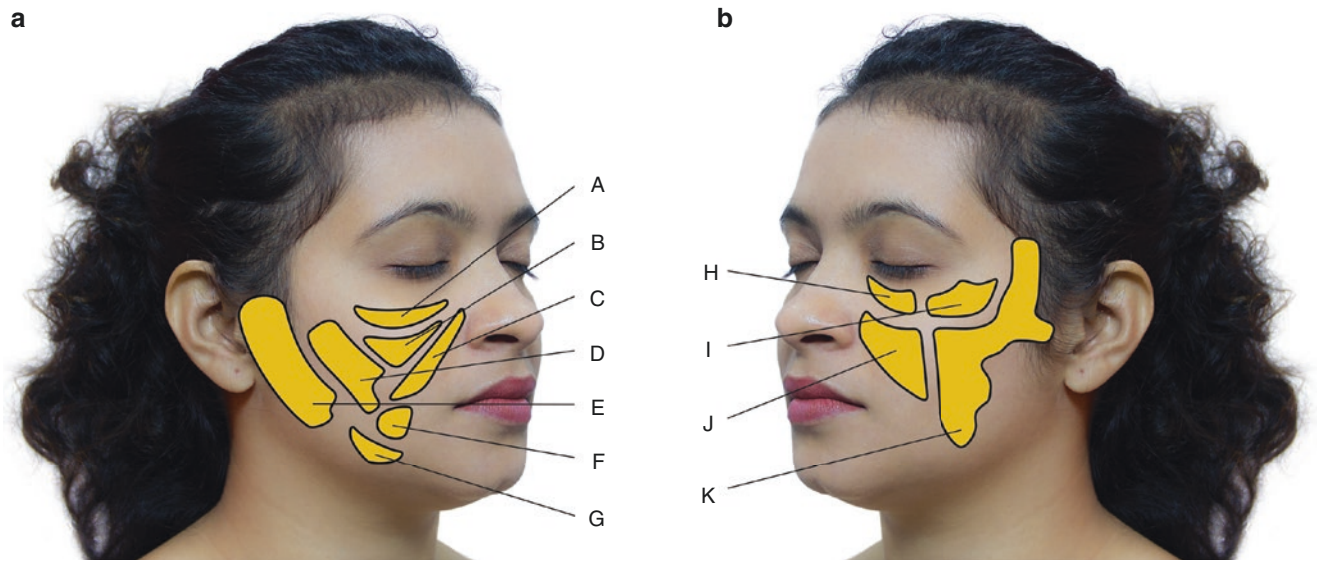

Fig. 32.3 (a, b) (**A**) Infraorbital fat, (**B**) Medial cheek fat, (**C**) Nasolabial fat, (**D**) Medial cheek fat, (**E**) Lateral cheek fat, (**F**) Superior jowl fat, (**G**) Inferior jowl fat, (**H**) Medial sub-orbicularis fat, (**I**) Lateral sub-orbicularis fat, (**J**) Deep medial cheek fat, (**K**) Buccal fat

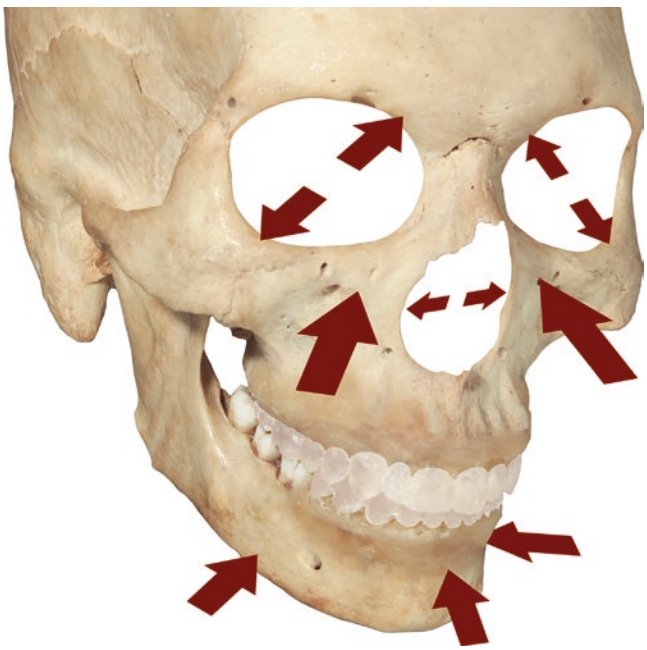

Fig. 32.4 Various areas of facial skeleton as marked are predominantly destined to resorb contributing to the appearance of aged face

The orbital aperture enlarges with age in all dimensions. The superomedial and inferolateral aspects tend to recede more which imparts the stigmata of periorbital ageing such as increased prominence of the medial fat pad, elevation of the medial brow and lengthening of the lid cheek junction [8].

The midface skeleton is formed by the maxilla medially and the zygoma laterally. With age, the maxilla recedes and the maxillary angle decreases by about 10° between the age of 30 and 60 years [9]. The piriform aperture enlarges with age, as the edges of the nasal bones recede [10]. The anterior nasal spine also retreats which reduces the skeletal support and thereby contributing to retraction of the columella, with a downward rotation of nasal tip and apparent lengthening of the nose [11]. In regards to the mandible, it is well established that the mandibular angle increases, the ramus height and mandibular body height and length decreases with age [12]. The above-mentioned skeletal resorption patterns contribute significantly to the appearance of an ageing face.

In the recent years, the demand for facial rejuvenation has increased exponentially. Individuals from every socioeconomic strata and from all age groups today desire a younger and rejuvenated look. Evolution of numerous surgical and non-surgical procedures has led to an increase in patient demands and expectations. Every aesthetic physician should understand the facial anatomy and the facial ageing process well so as to perform the procedures that would best suit the requirement of the individual to deliver the best of the results. The various non-surgical modalities of facial rejuvenation include the use of Botulinum toxin, dermal fillers, thread lifts, platelet concentrates and radiofrequency waves. Botulinum toxin and fillers are elaborated in the subsequent chapter. The following is a detailed description of the role of thread lifts, platelet concentrates and radiofrequency waves in achieving facial rejuvenation.

32.2 Non-surgical Facelift with Threads

Age-related changes on the face include remodelling in the facial skeleton and reorganisation of musculature, connective tissues, fat and skin. The dynamic process of ageing is unstoppable and it induces an ever-progressing slackness in the soft tissues that leads to a ptotic brow, jowl formation, ill-defined mandibular margin and deep nasolabial folds.

Gravity is an important factor that causes drooping of the upper, mid- and lower-facial soft tissue, which adds to the effect of an aged appearance. The hollowness of the midfacial and infra-orbital area is because of the downward shift of the malar fat pad. To manage this ptotic situation, surgical facelift procedures have been the most effective treatment as they not only excise the redundant tissues but also haul the soft tissue in the opposite vector of ageing process. The other non-invasive procedures cannot be as effective as the facelift procedure. But because of the significant downtime, cost and risks involved, facelift is not accepted by patients very readily. To have a way in between the surgical and non-invasive modalities, thread lift has become a popular procedure to manage drooping tissue of the face because of ageing.

32.2.1 Introduction to Thread Lift

Thread lifting modality is a minimally invasive cosmetic procedure that utilises a biocompatible implant placed into the deeper layers of face to predictably shift and realign tissues in a predetermined direction or vector. When compared to a surgical facelift procedure, this elevates the drooping tissues with least amount of risks and complications, immediate results and rapid recovery.

Historically, Ruff in Durham, North Carolina, in 1992 and Sulamanidze et al. in Moscow, Russia, in 1996 independently developed barbed sutures for correcting facial ptosis. FDA in 2004 approved Ruff's clear, barbed, unidirectional, polypropylene sutures for treating ptotic skin of face and neck [13].

32.2.2 Classification

(A) Depending on the modality of their action (Fig. 32.5):
- Redefinition of the facial contours—Barbed threads
- Induction of collagen production—Mono PDO threads

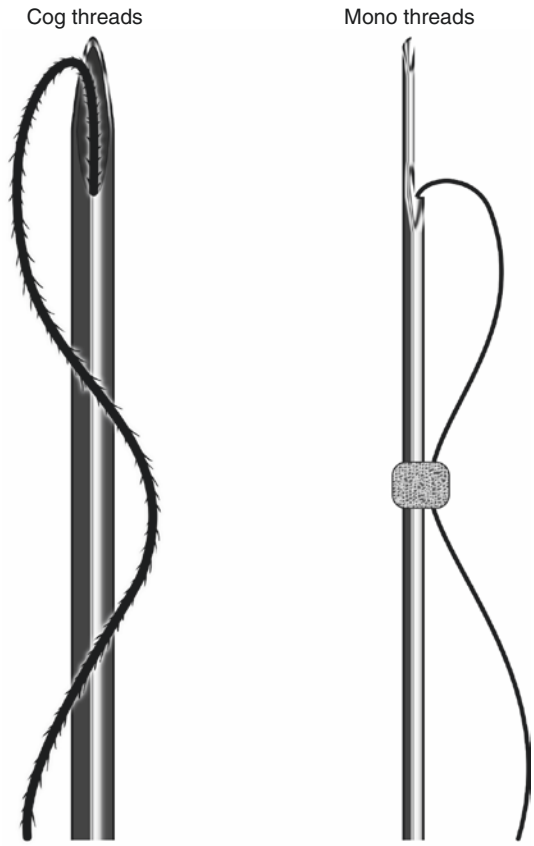

Fig. 32.5 Various types of polydioxanone threads are mono threads for facial rejuvenation and cogs threads for redefining facial contours

(B) Depending on pattern of resorption of implant material:
- Permanent/Non-resorbable threads—Polypropylene threads like Aptos threads, Silhouette lift threads, etc.
- Resorbable threads—Polydioxanone threads like Alfa aqualift, and Poly-L Lactic acid threads like silhouette soft threads, etc.

(C) Depending on mode of Fixation:
- Anchored: Wherein the thread is anchored to a proximal fixed place like the deep temporal facia or mastoid facia.
- Free floating: They are not fixed and cause the pull because of the thread design.

(D) Depending on the surface texture of the thread:
- Barbed
- Non-barbed

The Barbed threads are of 3 types:

- Unidirectional barbed threads—these are anchored on to a fixed point like the deep temporal facia, e.g. Contour thread
- Bidirectional barbed threads—these are placed in the treatment area by a canula and stretch the skin because of the design, e.g. Aptos threads.
- Cogged threads—these can be unidirectional, bidirectional or multidirectional and they lift the skin towards the point of entry once tissues get entangled with the cogs.

The Non-barbed threads can be:

- Plain
- Spiral or spring

32.2.3 Mechanism of Action

From a clinical point of view, the barbed sutures simply work by grasping and mechanically pulling the ptotic skin. These barbs get entangled in the subcutaneous tissues and as the thread is pulled backwards, the tissues get squeezed along the barbs and stay there as the thread outside is cut off.

From a histologic aspect, a basic mechanism of mechanical transduction happens when the polydioxanone threads are placed in the tissues. A torrent of intracellular signals in the surrounding cells through which the polydioxanone threads pass is triggered by the mechanical stresses instigated by the threads thus influencing the metabolic responses and encouraging cellular growth and survival and modulating tissue morphology and architecture [14].

There are 2 major types of collagen proteins that are found in our skin. The type 1 collagen or the fibrous collagen makes up about 70% of the total collagen while the type 2 collagen or the reticular collagen makes up to about 5–20%. Both of them provide structural support to the skin. Today, most of the aesthetic procedures are aimed at a phenomenon of biostimulation. The main intention is to improve on the plasticity, resilience, flexibility, firmness and turgor of the skin tissues that are normally lost with ageing due to the loss of proteins like collagen and elastin. This is achieved by penetrating the dermis with substances that would encourage the production of these proteins [15]. The biostimulation caused with PDO threads is due to neocollagenesis, i.e. the production of type 1 collagen which is essentially fibrotic in nature. The PDOs resorb in 6 months and till that time it keeps inducing collagen. The fibrotic collagen exhibits a retracted effect improving the skin appearance. Concurrently, the compaction and stiffening of the collagen fibres also determine the functional damage [16].

32.2.4 Indications

There are 2 major indications for the threads treatment:

- Skin rejuvenation
- Elevating the sagging skin

Skin rejuvenation can be done with the use of plain polydioxanone threads. It also increases the volume in certain areas where there is minimal volume loss.

The barbed threads are indicated in areas where there is ptosis of the tissues. The barbs work as cogs and by engaging the tissues along its path, it mechanically pulls the tissues upwards thereby reducing the ptosis.

The plain polydioxanone threads can be used for facial rejuvenation and are mostly utilised for the following indications (Fig. 32.6):

- Fine lines and wrinkles in any part of the face like the periorbital area, malar areas, perioral areas, chin, etc.
- Skin tightening—Under the neck, cheek lifting, lines around and under the mouth.
- Crepey skin
- Acne scar filling
- Outlining of Lips to create a fuller look naturally (Fig. 32.7)

The barbed threads can be used to lift the ptotic skin and hence be utilised in the following areas (Fig. 32.8):

- Nasolabial folds
- Eyebrow lift
- Upper and lower cheeks
- Neck & Jawline
- Marionette lines

32.2.5 Treatment Protocol [4]

Choosing the ideal procedure for rejuvenation depends on the grade of skin ageing.

(A) Mild skin ageing
  - Rejuvenation—Apply Plain or screwed PDO threads (Fig. 32.9)
  - Lifting
    - for a "natural look" lifting—apply PDO cogs along with plain PDO threads.

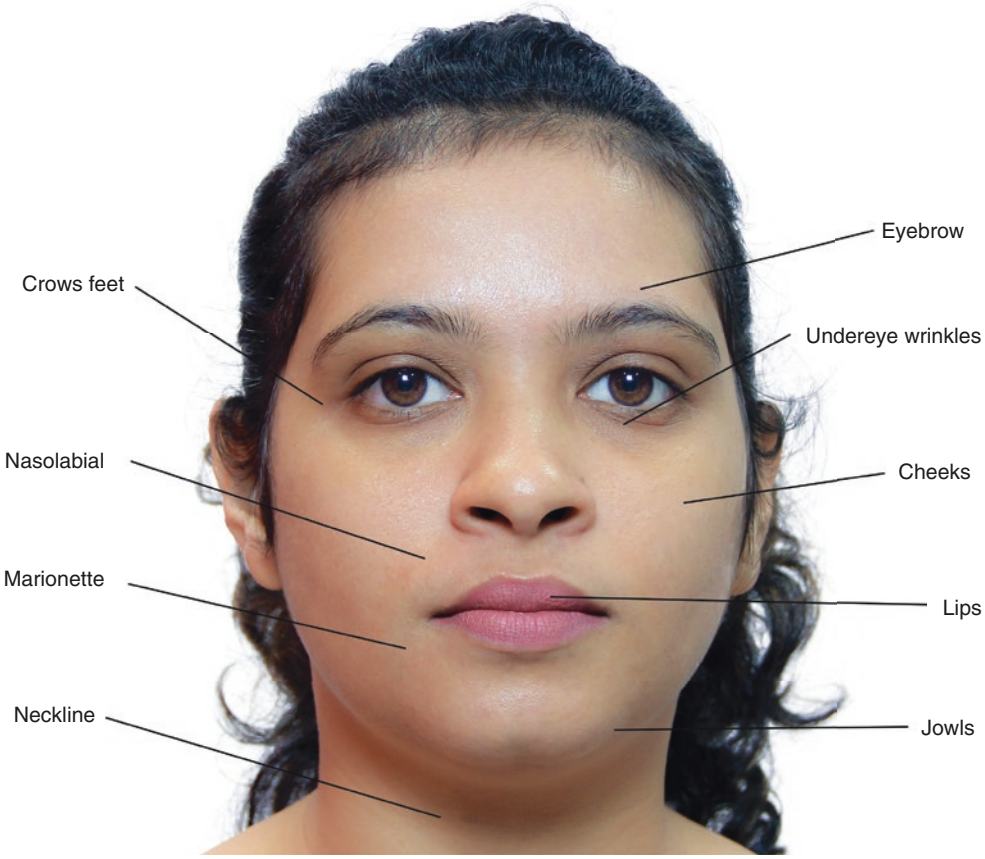

Fig. 32.6 Various indications of mono polydioxanone threads for facial rejuvenation

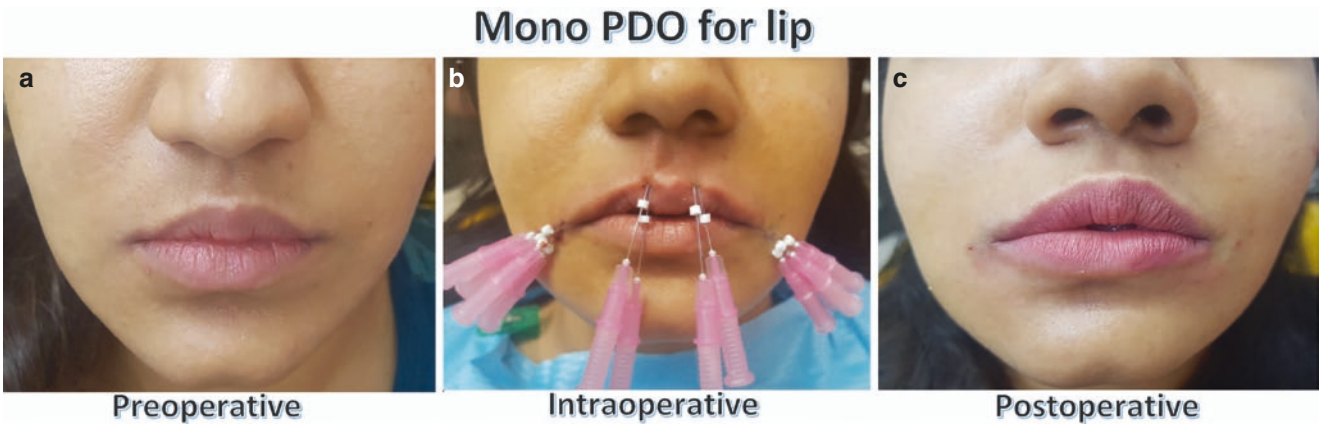

Fig. 32.7 (a, b, c) Mono polydioxanone threads can be used to create the lip borders and also to create a fuller looking lip

  - for heavy lifting—apply anchored sutures or long suture technique.

(B) Moderate to severe skin ageing
- Rejuvenation—Apply short PDO cogs along with plain PDO threads (Fig. 32.10).
- Lifting—Not recommended.

32.2.6 Procedure

The Polydioxanone thread used in facial rejuvenation are basically of 2 types: Mono PDO thread and Cogs PDO thread

(A) The Mono PDO thread—These are 5-0 or 6-0 suture materials which are essentially monofilament and

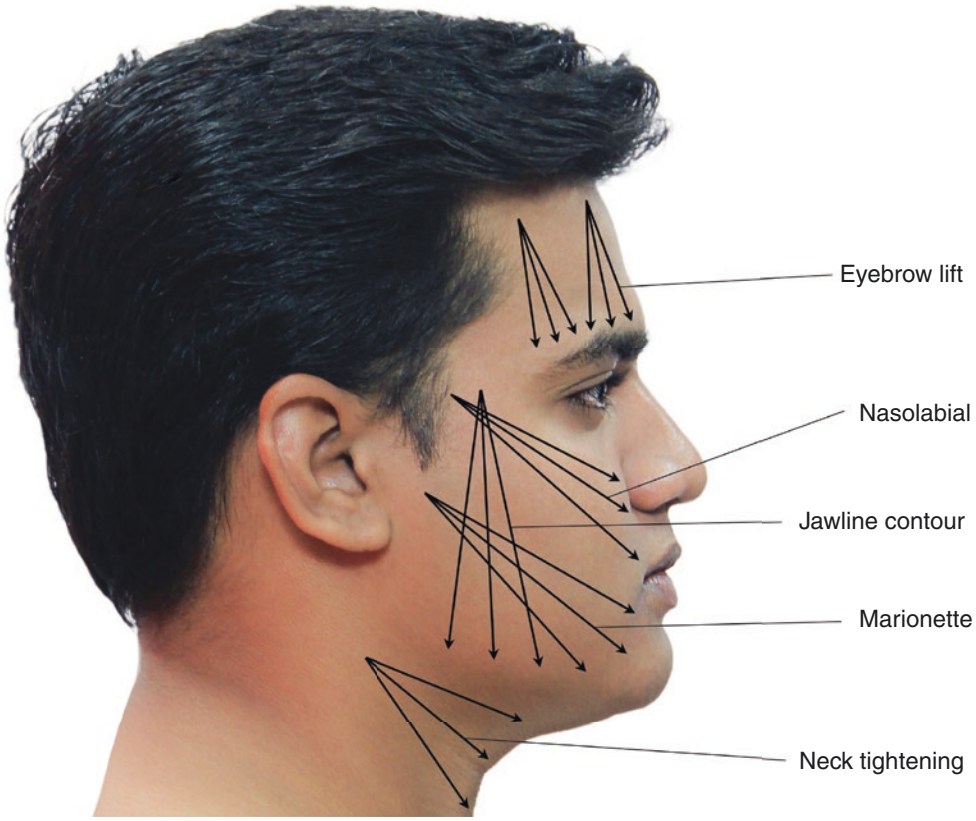

Fig. 32.8 Various indications of barbed PDO threads for redefining facial contours and lift the ptotic tissues

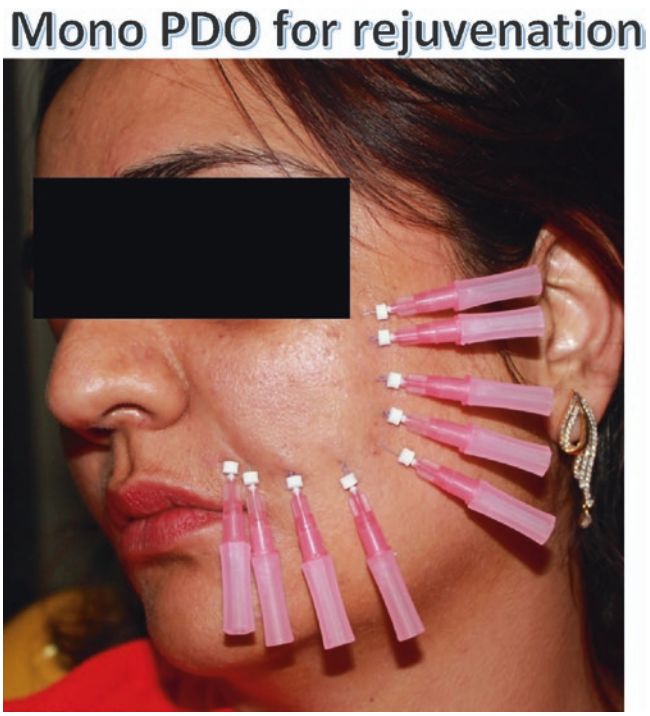

Fig. 32.9 Mono PDO threads for facial rejuvenation

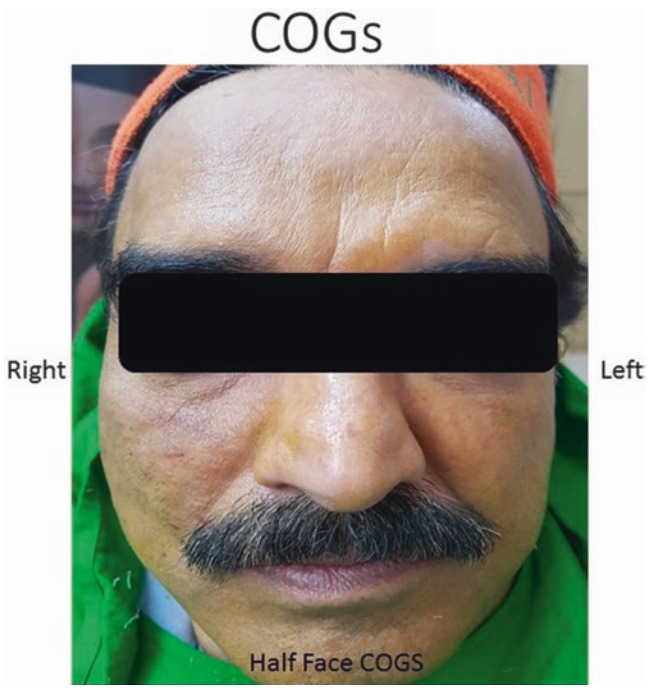

Fig. 32.10 Cogs thread for lifting nasolabial folds. Note the lifted up right nasolabial fold only as the thread has been applied only on that side. Left side is still untreated

non-barbed. It can also be braided to a spring to provide more tensile strength [17]. The thin suture material forms a V-shape when inserted to a needle of 26–30 g, with one half of the thread inside the calibre of the needle and the other half on the outside. Once the needle with the suture material is inserted into the dermal layer, the thread gets buried into the tissues and at the removal of the needle, the thread stays back intact.

These types of threads are placed in the dermal layer where they cause collagen formation.

EMLA cream must be applied 45 min prior to the procedure. The full face was cleansed with povidone iodine solution. Once ready, the mono PDO threads are placed in the dermal layer making up meshes in the areas of indication. One must keep observing for any threads that stay outside the skin. It must be removed immediately by grasping it with a needle holder so that it doesn't cause any infection or granuloma.

(B) The Cogs PDO thread—Cog PDO thread has small barbs or spikes all along its length, which get engaged to the tissues when inserted and lifts it once pulled back.

Depending on the direction of the spikes, cog PDO thread is classified as unidirectional, bidirectional or multidirectional.

The cog thread is actually 3-0 suture which has barbs and this thread is mounted on an 18 g canula or needle. The canula is considered safer as it does not damage the blood vessels and nerves.

The barbed threads must be placed in the subcutaneous layer so as to prevent any palpability of the implant material.

Local anaesthesia should be given with 2% lidocaine with epinephrine. The full face is cleansed with povidone iodine solution. The path of insertion of the canula is marked on the skin with a sterile marking pen. The vectors are checked by manually stretching the skin upwards. Point of insertion is marked on a line 1.5 cm in the preauricular area. A small opening is made with an 18 g needle for the insertion of the canula. The barbed thread mounted on the canula is then passed along the vector in the subcutaneous plane all the way till the nasolabial fold or the marionette line. Once in place, the end part of the thread gets hooked in the subcutaneous plane, and the canula is pulled back and taken off the skin. The thread stays entangled in the subcutaneous plane. Once all threads are positioned in the skin, the distal part of the suture is held in one hand and the skin is pushed in the opposite direction to fully engage the threads and lift the tissues. The end part of the suture is then cut very close to the skin with help of sharp scissors so that the ends go into the tissues to prevent any future granuloma formation (Figs. 32.11a–d).

Post-operatively, ice packs are applied to minimise edema and bruising. Oral antibiotics are prescribed for 5 days after the procedure.

Anti-inflammatory tablets should be avoided as the more the inflammation at the site, the better would be the results. Patients generally do not require anti-inflammatory drugs post-surgery. Within the first 3 weeks after the procedure, the patients are advised against any strenuous movements of the muscles of midface such as yawning, wide smiling and laughing.

32.2.7 Complications and Management

The various complications that could occur with the PDO barbed threads include:

1. Bruising—Bruising is quite common while placing the PDO threads. Post-procedure application of ice prevents further bruise.
2. Pain and Swelling—Thread lift surgery causes very mild to moderate post-operative pain and swelling. Patients are generally asked to apply ice externally to reduce inflammation and pain. If a patient complains of severe pain, anti-inflammatory may be advised. In case of serious swelling, the patient must be evaluated for hematoma and infections.
3. Infection—Proper aseptic protocol needs to be followed to prevent any type of skin infection. However, it is better to prescribe oral antibiotics for 5 days for the thread lift surgery.
4. Palpability of the thread—If the threads are placed too superficial, they become palpable from outside the skin. The barbs or cogs should always be placed in the subcutaneous layer.
5. Hematoma—Since the placement of threads is a blind procedure, the chances of damage to a blood vessel is always there. The patient should always be informed prior to the procedure regarding hematoma. Pressure application and cold compressions should be immediately given. After a period of time, the skin over the hematoma may turn bluish then brown and yellow as the blood is dissolved and absorbed. It may take 1–4 weeks for the hematoma to subside.
6. Nerve damage (Fig. 32.12)—There is always a chance of trauma to the branches of facial nerve since the placement of the threads is in close vicinity to the nerve, especially the marginal mandibular and frontal branches. Thus, the muscles of facial expression can be impaired. Fortunately, the nerve damage resolves soon and motor functions are restored.
7. Asymmetry: Pre-existing asymmetries on the face should be explained to the patient prior to treatment. It's

always a good practice to let the patient seat vertically straight while inserting the barb threads and making the patient participate while retracting the tissues by visualising with a mirror to avoid any potential problems of asymmetry later on.

8. Dimpling: This normally would happen if the depth of the advancing thread is too superficial. A depression or an irregular contour would occur at a portion where the barb is located close to the skin. Most cases normally resolve spontaneously. But remarkable dimples need to be managed by manual reduction at that time itself.
9. Rippling and puckering: The skin would ripple over the thread and cause visible folding if tightened too much while retracting the tissues. This typically resolves itself in a few days if the thread has been placed in the correct tissue plane.
10. Granuloma: Higher incidences of granuloma formation are essentially seen if the threads placed in a more superficial plane and they are not cut very close to the skin.
11. Thread loss: With mono PDO thread, if there is a protruding thread, the end should not be cut as with barbs and cogs, but grasped firmly and removed. It's safer to remove a monofilament thread than leaving it there, thus risking the formation of granuloma. Barbed and cogged threads are very difficult to retrieve and hence excessive care should be taken to place them in the right plane.
12. Thread breakage: This can happen during the tightening of the barbs and cogs just before cutting at the skin level. Hence, careful manipulation should be done to avoid breakage during insertion and tightening.
13. Thread exposure: Repeated inflammation and migration of the thread to superficial layers can cause thread exposure. It can be prevented by placing the threads in proper plane.

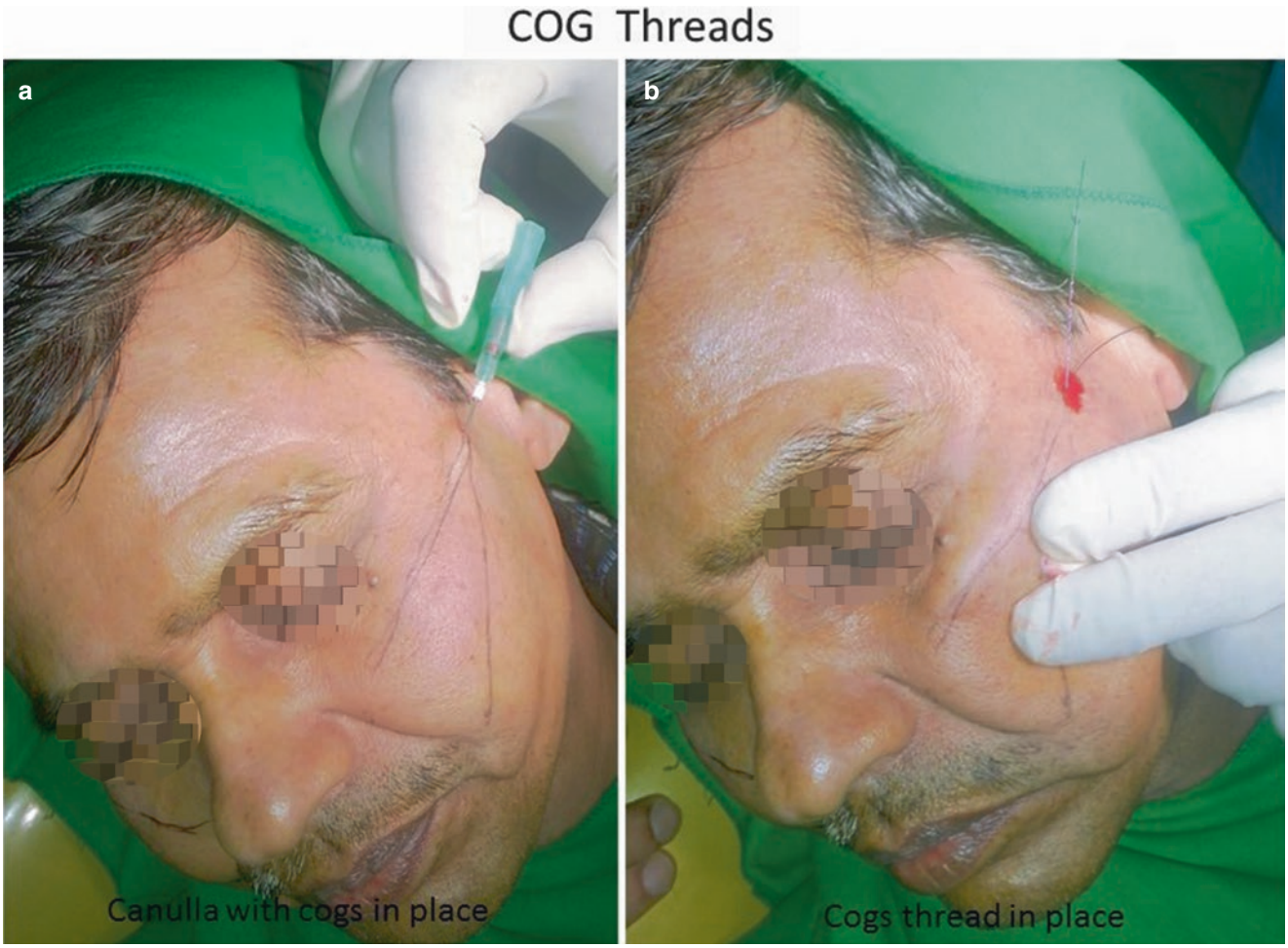

Fig. 32.11 (**a**, **b**) Placement of cannula with cogs threads along the vectors for nasolabial folds and after removal of cannula the cogs threads in place. (**c**, **d**) Pulling the cogs threads to lift the ptotic nasolabial fold tissues and final twisting and snipping the threads just below the skin level

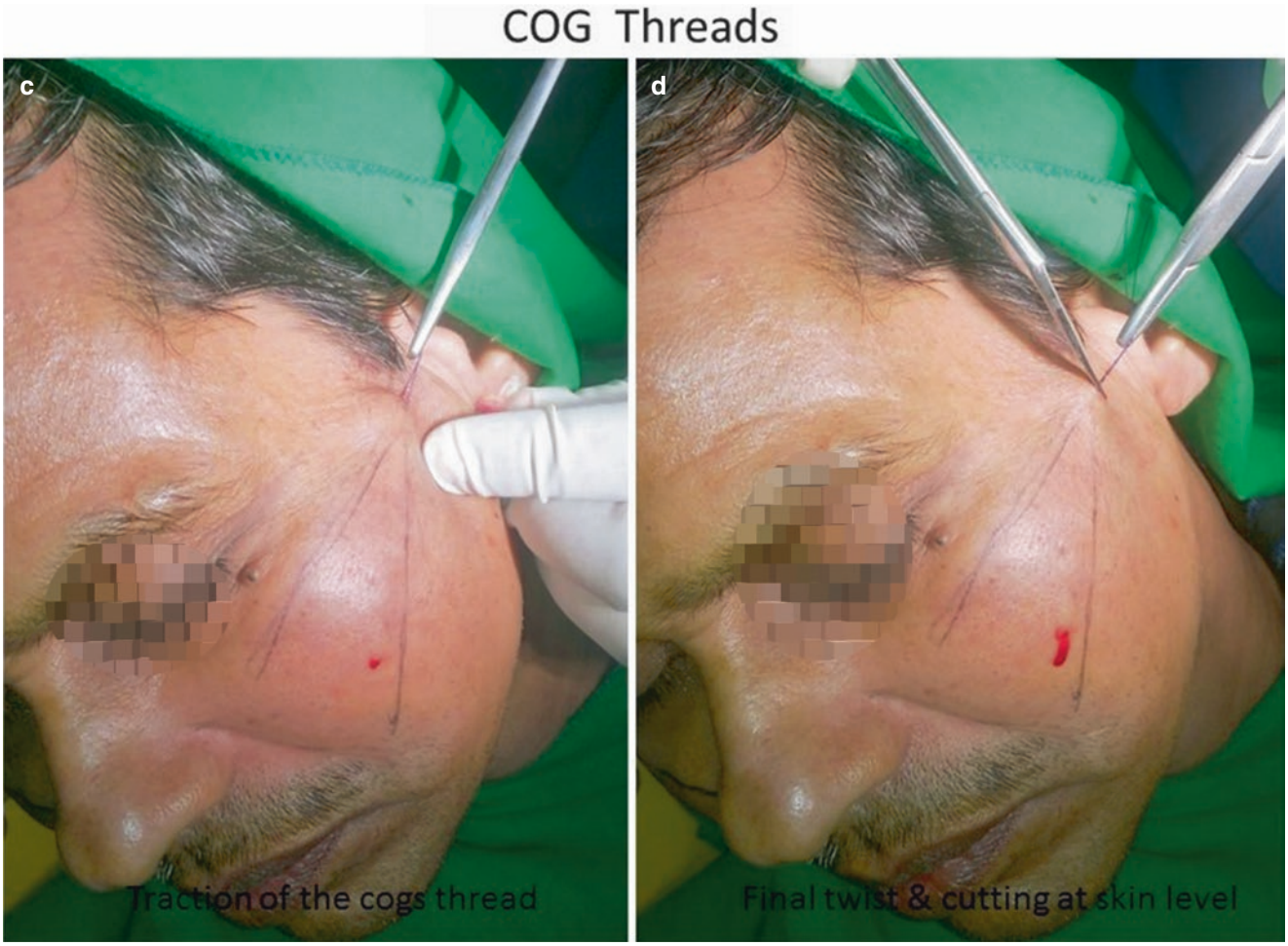

Fig. 32.11 (continued)

32.2.8 Conclusion

The PDO thread lift is a non-invasive procedure that actually gives a "lifted effect" of the ptotic skin. It has been widely accepted as a standard procedure for patients who do not want to opt for a more aggressive surgical facelift. Patient selection is of prime importance. Only patients with mild to slightly moderate levels of ptosis should be selected for polydioxanone cogs thread lift. The patient should be given a realistic expectation of the lift of no more than 1 cm. Patients who are too chubby or who are too skinny should not be considered for thread lift. Overall, every aesthetic practitioner should have knowledge of thread lift as it is a simple and versatile anti-ageing procedure.

32.3 Biostimulatory Lift with Platelet-Rich Plasma

Today, Platelet-rich plasma (PRP) has been incorporated in many medical specialities including orthopaedics, general surgery, plastic surgery, dental surgery and dermatology because of its healing capabilities. Its usage in aesthetics and trichology has touched newer horizons as we have come to know about the healing cytokines present in the platelets which can be used for antiageing therapies and therapies for regenerative aesthetics.

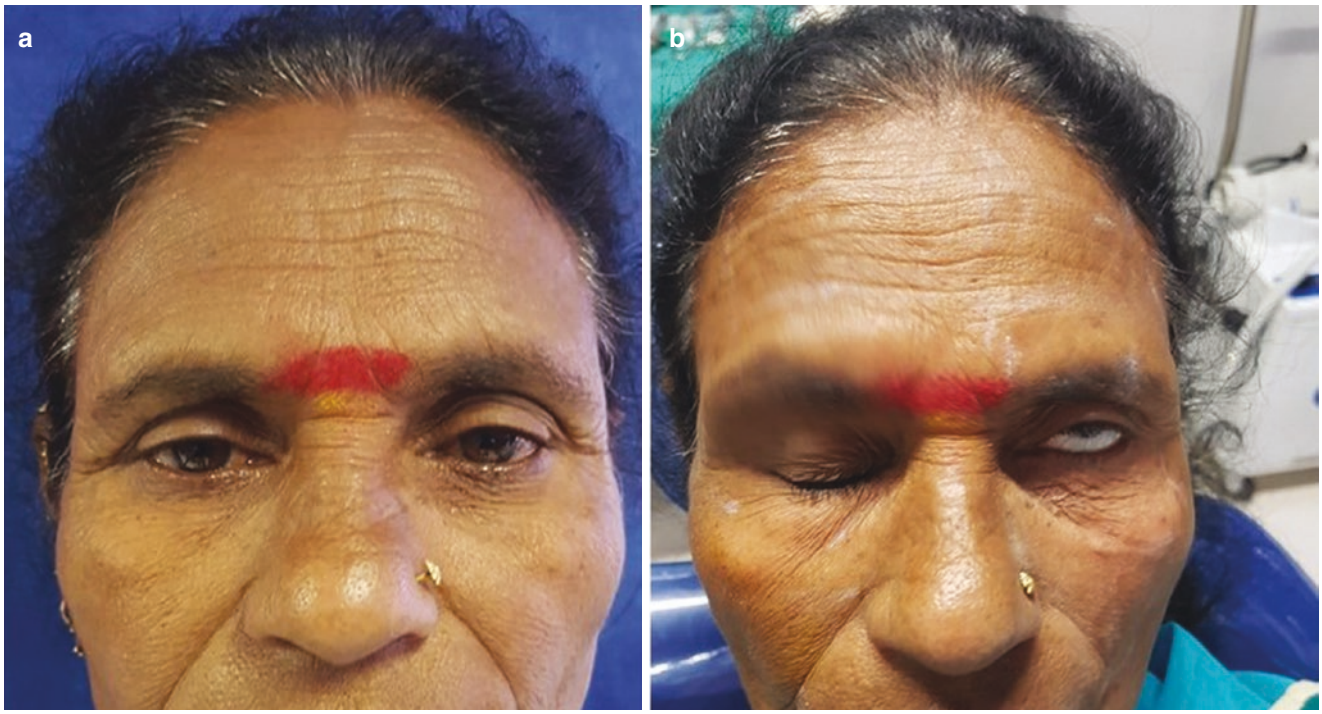

Fig. 32.12 (**a**, **b**) Damage to frontal branch of the facial nerve during placement of cogs threads

32.3.1 Platelets and Platelet Concentrates

Platelets, also called thrombocytes, are enucleated fragments of cytoplasm that are derived from the megakaryocytes of the bone marrow, which are released into the circulation. They have a fundamental role in haemostasis and wound healing.

The platelets contain various secretory granules, namely the alpha granules, dense granules and lysosomes. The alpha granules are the most abundant ones and contain the coagulation factors, growth factors, also called cytokines, adhesion molecules, and a variety of other angiogenic factors which efficiently encourage the proliferation and activation of cells required for wound healing including fibroblasts, mesenchymal stem cells (MSCs) and facilitates angiogenesis [18].

The growth factors along with their function are listed below [19]:

1. PDGF (platelet-derived growth factor)—PDGF plays a role in embryonic development, cell proliferation, cell migration and angiogenesis.
2. TGF-β1 & β2 (transforming growth factor)—TGF is involved in regulating and mediating processes at the cellular level, including cell proliferation, differentiation, motility, adhesion and apoptosis as well as causes wound healing and angiogenesis.
3. VEGF (vascular endothelial growth factor)—Chemotactic and mitogenic for endothelial cells, mediates angiogenesis.
4. EGF (epidermal growth factor)—Mediates angiogenesis, causes proliferation of fibroblasts, endothelial cells and keratinocytes.
5. HGF (hepatocyte growth factor)—Mediates regeneration.
6. FGF (fibroblast growth factor)—Mediates tissue organisation and regeneration.
7. FGF-9—Aids generation of new follicles.

These growth factors or the "cytokines" are proteins, each of about 25,000 Daltons molecular weight. In response to the thrombocyte aggregation, as occurs in injury or surgery, the cell membrane activates the alpha granules which in turn unleash these growth factors via active extrusion through the cell membrane. The active secretion begins within 10 min during which 70% of stored growth factors are released and more than 95% of the presynthesised growth factors are secreted within 1 hour. Platelets then synthesise additional amount of growth factors for about 8 days till they die [20].

Platelet concentrate means plentiful amounts of platelets that are concentrated into a small volume of plasma. There are various types of platelet concentrates which can be formulated, all differing in the way they are made [21]. A general classification takes 2 key parameters into consideration: the presence of a cell content (mostly leukocytes) and the fibrin architecture.

There are 4 major families:

1. P-PRP
   Pure Platelet-rich plasma is a preparation without Leukocytes. It has low-density fibrin network after activation. It is used as liquid solutions or an activated gel form and can be injected. P-PRP is commonly used in sports medicine & aesthetic medicine.
2. L-PRP
   Leukocyte and PRP is a preparation with leukocytes in it. Even this has low-density fibrin network after activation. It is used as liquid solutions or an activated gel form and can be injected. L-PRP is used in aesthetic medicine, sports medicine, orthopaedics, trichology, etc.
3. P-PRF
   Pure Platelet-rich fibrin is a preparation without leukocytes. It has a high-density fibrin network and exists as a strongly activated gel form. It cannot be injected, but can be handled like a real solid material. It has been very commonly used in dentistry & maxillofacial surgery today.
4. L-PRF

Leukocyte and PRF is a preparation with leukocytes. It has a high density of fibrin network and exists as a strongly activated gel form. It cannot be injected and can be handled as a real solid material. It is today used in implant dentistry, periodontal surgeries, oral surgeries, treatment of skin wound ulcers, etc.

32.3.2 Mechanism of Action of PRP

PRP can be described as a biologic product derived from autologous blood with the plasma fraction containing platelets at a concentration of more than 3–5 times above baseline.

The scientific evidence suggests that wound healing enhancement is seen using concentrates of 1,000,000 platelets/μl. Any concentration lower than this cannot be depended on to enhance wound healing, and concentrations far more than this has not been scientifically proved to help and enhance healing [22].

So, PRP by virtue of its increased concentration of platelets and thereby an inflated amount of growth factors or cytokines have been theorised to encourage tissue repair and regeneration by neocollagenesis, neoangiogenesis and much more. It has been embraced as a frontline treatment modality for the management of facial ageing, androgenetic alopecia, acne scarring, etc.

32.3.3 Indications of PRP Therapy in Aesthetic Medicine

1. Facial rejuvenation.
2. Skin tightening and Antiageing therapy
3. Acne scar management
4. Alopecia
5. Skin lightening
6. Improvement of skin quality in under eye area.

32.3.4 Preparation of PRP

PRP is derived from autologous blood by using a centrifuge and can be performed under local anaesthesia under aseptic conditions. An anticoagulant, like citrate dextrose solution formula A (ACD-A) or sodium citrate 3.8%, is used to inhibit platelet aggregation.

Manual Double Spin Method (Figs. 32.13, 32.14, 32.15, and 32.16)

Whole blood is collected by venipuncture from antecubital vein in 15 ml polystyrene tubes under sterile conditions containing 3.8% sodium citrate as an anticoagulant. In each tube, 1 ml of sodium citrate is mixed with 12 ml of whole blood. Eight such tubes are taken to make up a volume of 104 ml. The tubes are slowly turned upside down twice to homogeneously mix the whole blood with the anticoagulant. All the 8 tubes are placed in the centrifuge (Remi 8c) and are centrifuged at 1500 rpm for 10 min. This is called the 'soft spin' which separates the whole blood into 3 layers. The erythrocytes settle at the bottom of the tube because of the highest specific gravity or density of about 1.090. Just above the erythrocytes, a hazy layer is seen which contains the leucocytes with a specific gravity of 1.060 and platelets with a specific gravity around 1.040. At the top, we find the clear plasma with the lowest concentration of platelets with a specific gravity of around 1.020.

The buffy coat is separated along with some amount of plasma and placed in a separate tube. At this time, if the buffy coat is separated along with the slightest superficial erythrocyte layer, it is referred to as L-PRP (leukocyte-PRP) and if it

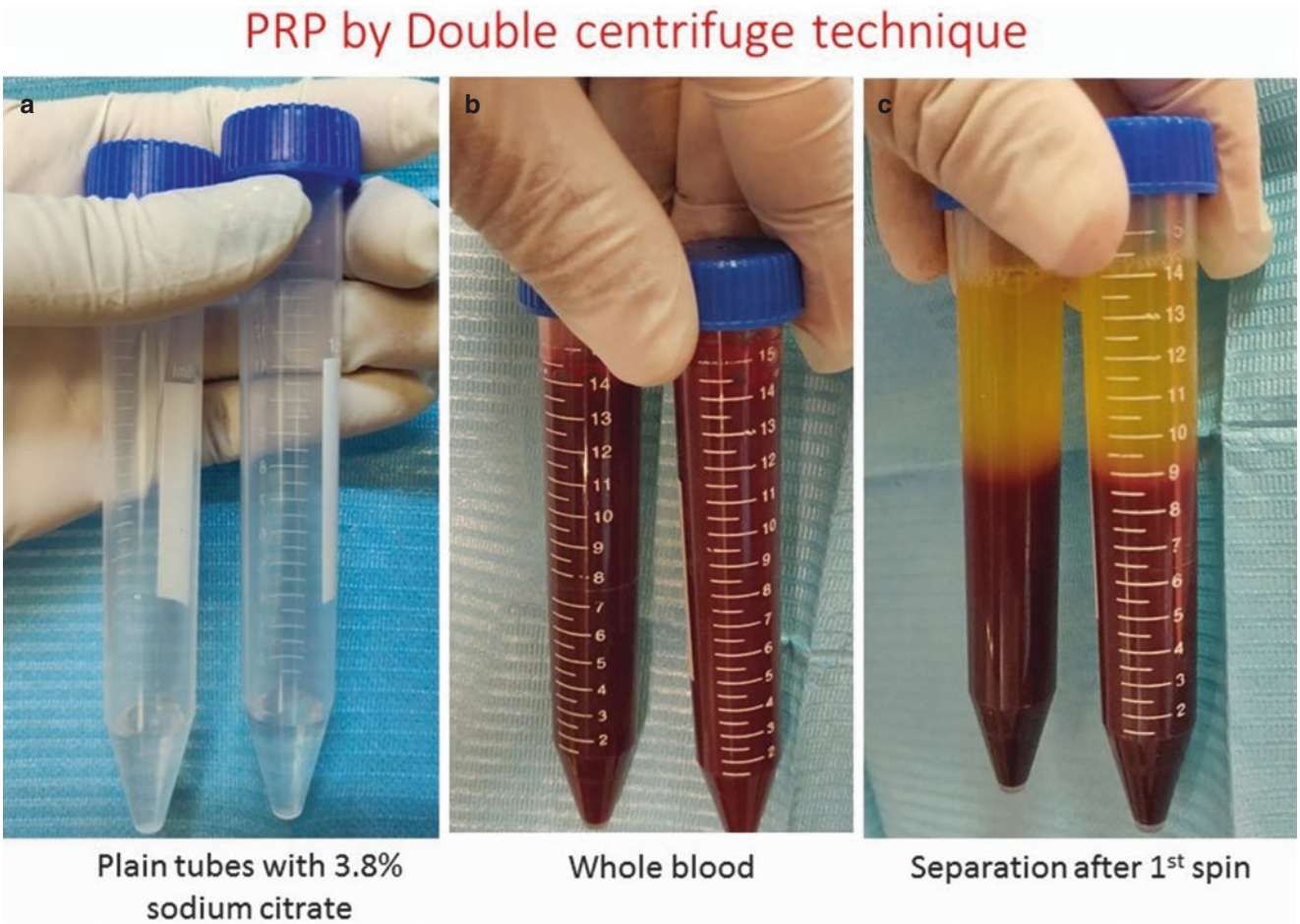

Fig. 32.13 (**a**, **b**, **c**) Primary separation of erythrocytes during the preparation of platelet-rich plasma using plain tubes containing sodium citrate 3.8%

is taken above the layer of erythrocytes, it is referred to as P-PRP (pure-PRP) depending on the kind of PRP preparation, i.e. with or without leukocytes. About 10 ml of these are taken in 2 tubes and placed in the centrifuge for a second spin called the 'hard spin' at 2500 rpm for 15 min. At the end of the spin, a platelet plug is found at the bottom of the tube. The top 3 quarter of the platelet poor plasma was discarded and the lowest quarter with the platelet plug was mixed and used as the PRP. This gives us a viable platelet count of 5 times the baseline. This was activated by mixing with calcium gluconate at a ratio of 9:1 in an insulin syringe and injected immediately.

Automated Devices (Fig. 32.17)
Numerous commercial devices of varying standards are now available for the preparation of PRP. Although time saving, these adapted kits can be quite expensive as compared to the manual process.

In general, a PRP tube typically contains sodium citrate as an anticoagulant along with a separating gel. This gel has a density of about 1.070, which is in between the erythrocytes and platelets.

20 ml of Whole blood is collected by venipuncture and added into two of these PRP tubes. The blood is homogeneously mixed with the anticoagulant by gently turning the tube upside down twice. The tubes are then placed in the centrifuge and spun at 3700 rpm for 9 min. The erythrocytes because of the higher density than the separating gel settle down below the gel, while the plasma along with leucocytes and platelets segregate above the gel. The superficial platelet poor plasma is discarded leaving behind 2–3 ml of plasma above the gel. The tubes can be turned upside down to mix the platelets as they get entangled in the gel. This would give a uniform concentration of platelets throughout. It is now mixed with calcium gluconate as an activator and injected immediately.

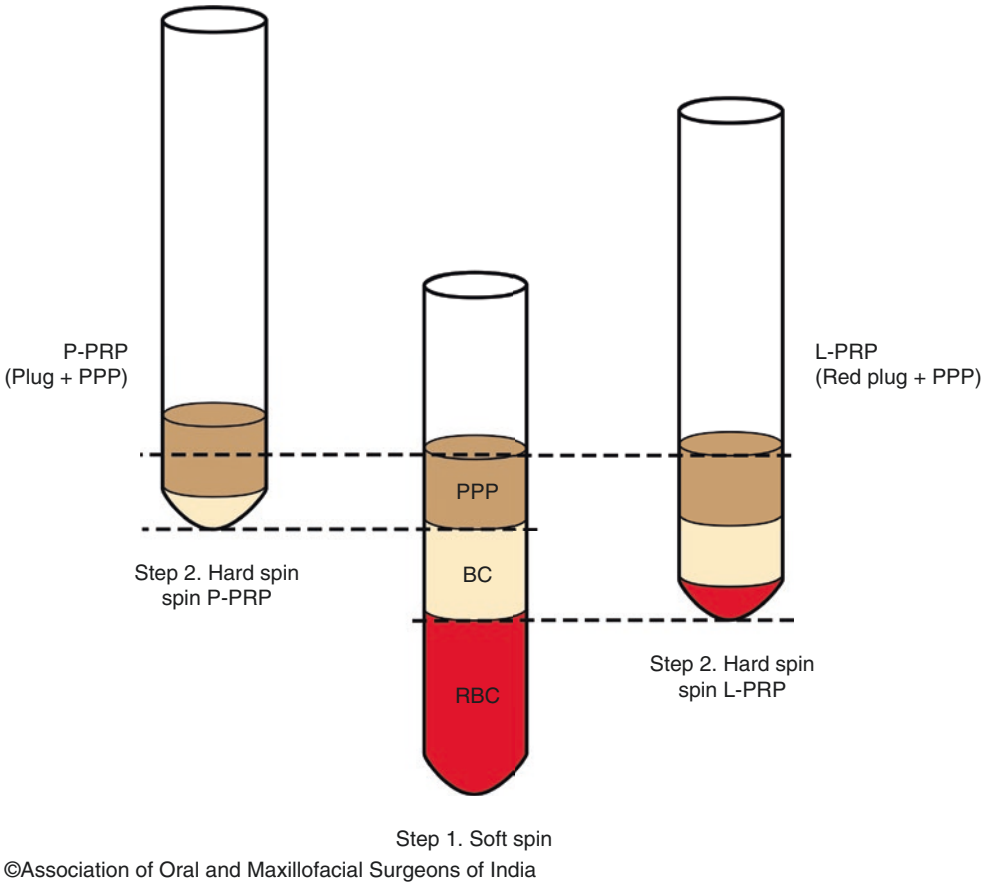

Fig. 32.14 Difference in preparation of L-PRP and P-PRP

32.3.5 PRP Injections for Facial Rejuvenation, Biostimulatory Lift and Acne Scar

Studies have shown that PRP by inducing neocollagenesis through activation of fibroblasts and by removing photodamaged extracellular matrix (ECM) components amplifies dermal elasticity via following molecular mechanisms [23, 24]:

- Encouraging proliferation of human dermal fibroblasts to induce new collagen.
- Increased expression of MMP-1 (matrix metalloproteinase-1) and MMP-3, resulting in the removal of photodamaged ECM.
- Enhanced creation of procollagen type I peptide and expression of collagen type I, alpha-I, resulting in the synthesis of fresh collagen.
- Increases expression of G1 cell cycle regulators resulting in accelerated wound healing.

PRP can be injected using an insulin syringe that has 31 g needle. Local anaesthetic in the form of nerve blocks should be given prior to the session. The facial skin should be cleansed with povidone iodine solution. Multiple intradermal injections of PRP after activating it are given all over the face including the infraorbital area. Three sessions each at a gap of 1 month of PRP therapy along with micro-needling (collagen induction therapy) with derma pen with a needle depth of 0.7–1 mm has been shown to give very good results for rejuvenating the aged skin and acne scars. Histologically, the treated skin showed improved length of dermo-epidermal junction, increased quantity of collagen and fibroblasts.

Post-operatively, patients are advised to apply ice on the face. Sun exposure should be avoided. Patient should be advised not to take anti-inflammatory tablets as the more the inflammation, the better the results are going to be. Most of the times, patients experience very mild post-operative discomfort.

PRP therapy can also be combined with CO2 fractional resurfacing to achieve excellent results in treating acne scars.

PRP has also shown excellent results in infraorbital rejuvenation where the skin is very thin and shows initial signs of ageing [25].

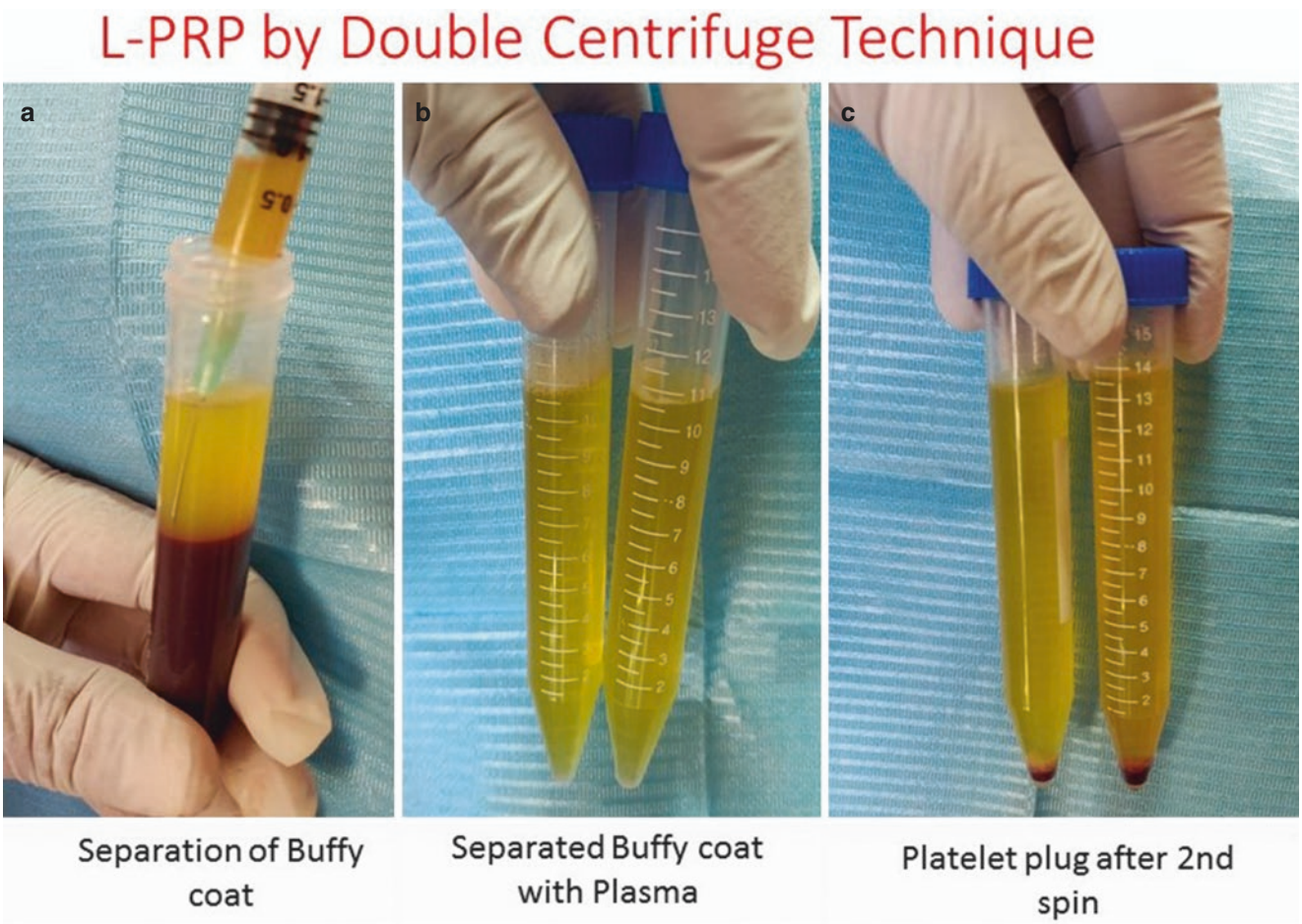

Fig. 32.15 (**a**, **b**, **c**) Platelet plug formed after the second spin during the preparation of L-PRP

32.3.6 Contraindications to PRP Therapy [26]

Absolute contraindications:

- Platelet dysfunctions.
- Thrombocytopenia (low platelet counts).
- Hypofibrinogenemia.
- Local sepsis.
- Hemodynamic instability.
- Septicaemia.
- Patient unwilling to accept risks.
- Patients on long-term anticoagulant therapy (warfarin or heparin).

Relative contraindications:

- Consistent use of NSAIDs and corticosteroids within 15 days
- Recent episode of infections, fever or illness.
- Cancer—especially hematopoietic or of bone.

32.3.7 Conclusion

The use of cytokines derived from platelet-rich plasma (PRP) is an effective modality to promote tissue regeneration and hence can be used in regenerative medicine including facial aesthetics and trichology.

PRP therapy is an inexpensive procedure as it does not require complex and voluminous equipment or extensive training for its execution. Furthermore, since the product is primarily autologous in origin, the patient's apprehension regarding the immunogenic reactions or disease transmission is abolished. Over three decades of its application to various fields and the multitude of studies with enormous positive results, PRP therapy today has become a gold standard for facial rejuvenation and hair loss therapy. The release of bioactive cytokines that help in neocollagenesis which takes care of the ageing process of wrinkle formation has made it a versatile tool for many anti-ageing therapies on the face.

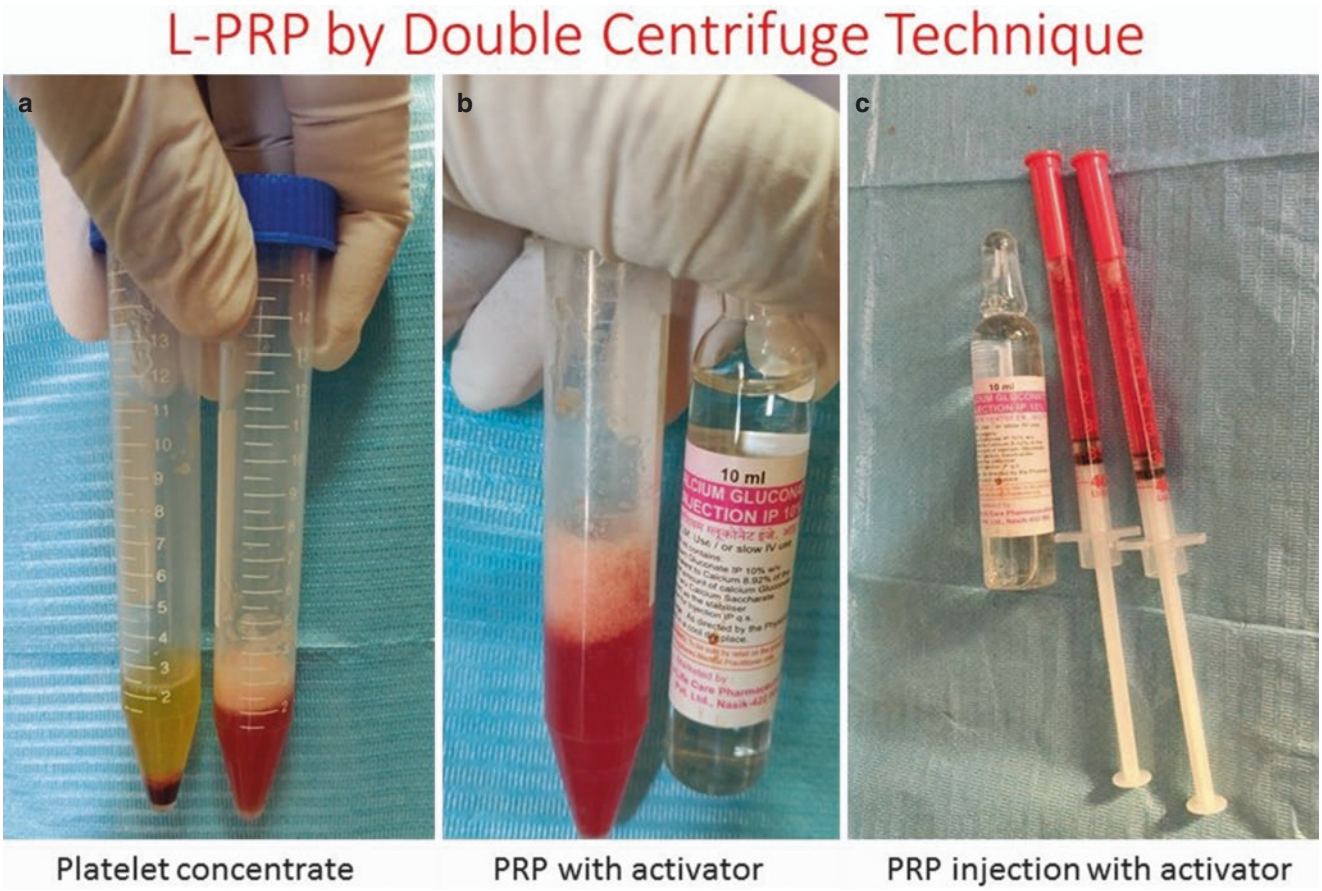

Fig. 32.16 (**a**, **b**, **c**) Platelet-rich plasma needs to be activated for release of cytokines from the alpha granules

32.4 Face Tightening with HIFU (High Intensity Focussed Ultrasound)

Facial wrinkles, reduced elasticity of the facial skin and sagging parts of the face are the most common concerns today an aesthetic surgeon encounters from the patients. In the present social scenario, facial skin laxity is considered highly disgraceful and has a great impact on a person's psychology and quality of life [27]. The natural process of ageing which is inevitable and the other external factors like sun's UV radiations, stress and worry, smoking, unhealthy diet, etc. are the major factors which cause the wrinkles and sagginess. We are aware that the loss of the important proteins viz collagen and elastin, which gives the strength, resilience and elasticity to the skin is the reason behind the loose skin and wrinkles.

Various treatment modalities have been utilised to manage these concerns of the face. Surgical excision of the redundant skin via facelift surgery definitely gives the best results. But with the increasing concerns over the complications and the downtime, the focus of therapeutic modalities is shifting towards non-surgical aspects.

Non-surgical treatment modalities like microdermabrasion, chemical peels, fractional lasers, etc. have been advocated in the past. In recent times, newer modalities like the HIFU and RF have come into limelight due to their non-invasiveness and low or no downtime for the treatment of sagging skin.

32.4.1 Introduction to HIFU

Ultrasound was introduced for its diagnostic ability. The capability of the focussed ultrasound energy to cause tissue regression and ablation has been well utilised today as a non-invasive modality to treat solid tumours and also being used to treat both primary and metastatic tumours as these can precisely locate the mass for ablation [28].

More recently this intense focussed ultrasound has also been utilised in many painful conditions including neuropathic pain and musculoskeletal degeneration [29].

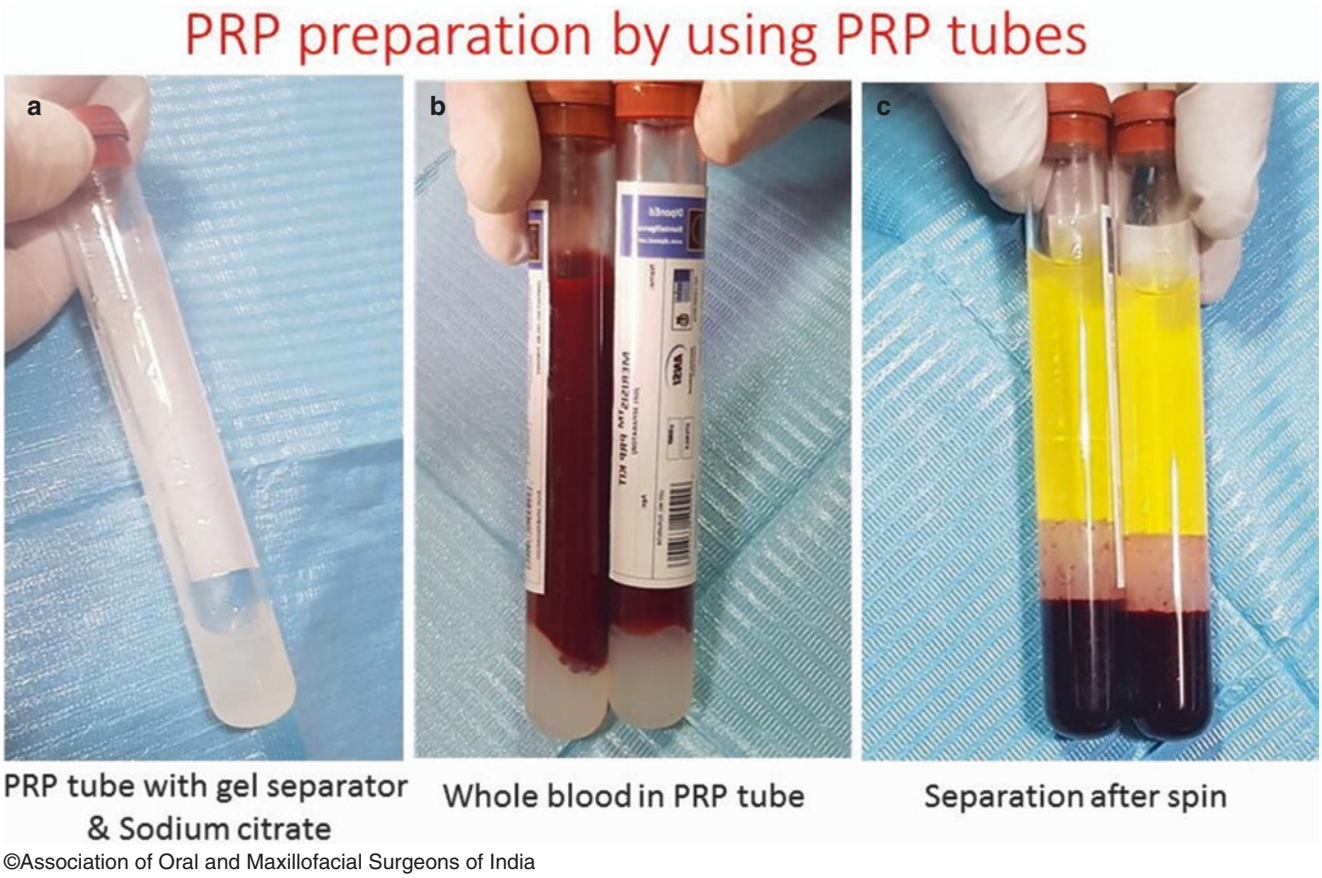

Fig. 32.17 (**a**, **b**, **c**) Preparation of Platelet-rich plasma with the help of PRP tubes containing anticoagulants and the separating gel

HIFU or high intensity focussed ultrasound was introduced into the field of facial aesthetics very recently to manage the facial wrinkles and periorbital rejuvenation.

FDA in 2009 approved the use of HIFU in brow lifting as the first dermatologic and aesthetic indication following the report by White et al. [30] in 2008. It was later in 2014 cleared as an indication to improve lines and wrinkles of the upper chest and neckline (décolletage). Currently, its use for facial rejuvenation, skin lifting and tightening and body contouring is considered 'off-label'.

32.4.2 Mechanism of Action

High intensity focussed ultrasound or HIFU embodies a piezoelectric transducer which produces focussed ultrasound beams. This transducer releases ultrasound waves over a length of around 2.5 cm which are focussed at 1.5, 3 or 4.5 mm depth. The 1.5 mm focusses the superficial or papillary dermis, while the 3 mm focusses the deep or reticular dermis and the 4.5 mm focusses the SMAS layer. Like a magnifying glass, the transducer focusses the ultrasound to the desired depth and at the focal spot, there is a swift rise in temperature to 60–80°C within a very short period (typically 1–20 s). This causes an immediate contraction of native collagen which is subsequently followed by cell injury and tissue shattering due to both coagulation necrosis and protein denaturation. These events occur at the deeper focussed zones, while the superficial tissues are left safe and unaffected [31] (Fig. 32.18).

The focussed ultrasound energy is absorbed by the tissues and this causes the molecules to vibrate rapidly. The friction due to molecular oscillations results in heat generation and a rapid rise of temperature at the focal zone. This thermomechanical process causes tissue injury at the site of focus. Supplemental to this, the ultrasound waves that propagate through the tissues cause continuous compressions and rarefactions that result in powerful shear forces. This microscopic but mighty shearing motion results in frictional heating [32]. Once tissue destruction is done, the inflammatory phase (in first 48 h) sets in wherein the damaged cells are removed and the WBCs, growth factors and enzymes create swelling, heat, pain and redness.

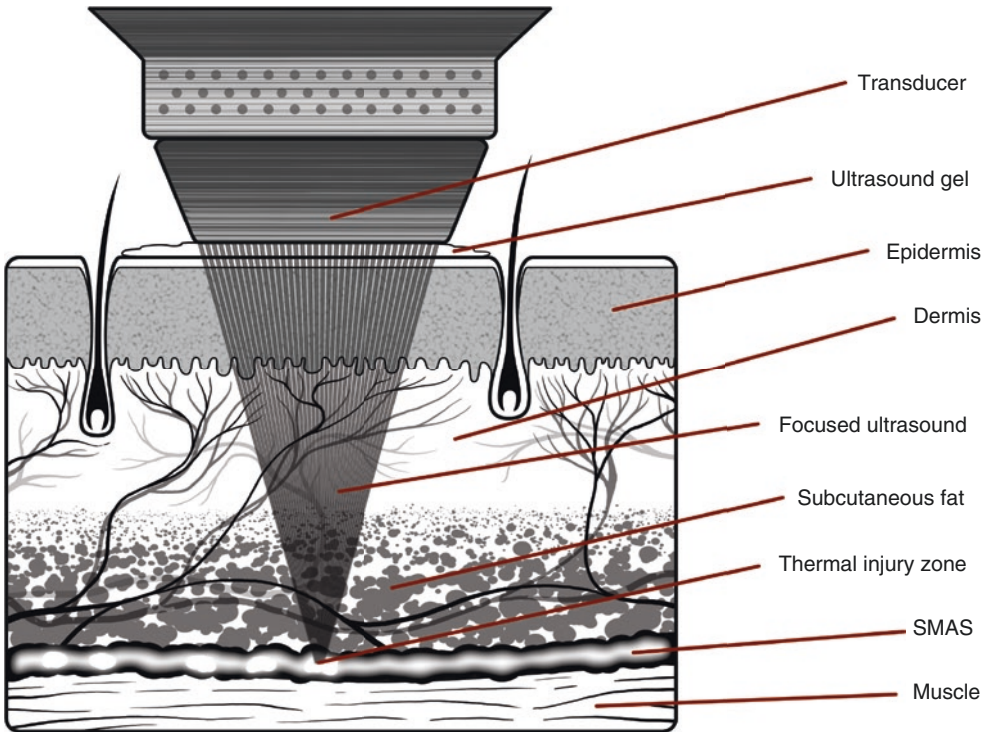

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Fig. 32.18 Mechanism of high-intensity focussed ultrasound. Thermal coagulation zones are created due to the extreme heat produced by the ultrasound focussed to a particular depth

In the next proliferative phase (up to 6 weeks), there is tissue contracture due to the myofibroblasts which are built. New tissues made up of collagen and extracellular matrix are formed.

The last maturation phase (from 3 weeks to 6 months) shows collagen is remodelling from type III to type I. The collagen which was laid down during the proliferative phase is now aligned along the tension lines and also there is cross-linking of the collagen. A histological evaluation post HIFU treatment exhibited significantly regenerated and proliferated quantity of dermal collagen and elastic fibres [33]. This causes skin tightening over a period of time. The results keep improving and the best final results are seen by 6 months.

32.4.3 Armamentarium

The HIFU machine basically consists of 2 parts: the body and the transducer (Fig. 32.19).

The screen in the body keeps monitoring the number of shots, depth of shots, length of release of ultrasound waves and the energy of the ultrasound in real time. The transducer releases the focussed ultrasound waves. The following are the 3 transducers usually used on the face:

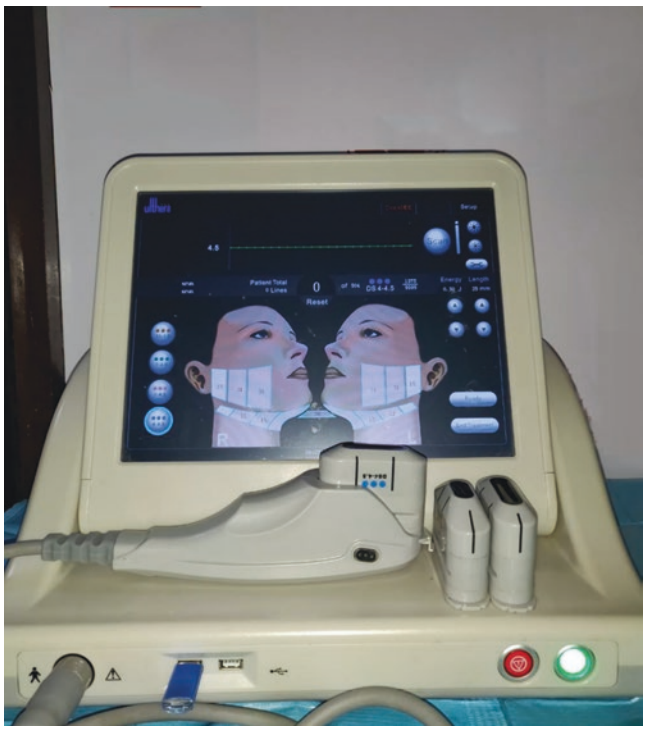

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Fig. 32.19 High-intensity focussed ultrasound device

1. DS-4.5 4—Focussed ultrasound of 4 MHz frequency is transmitted to a depth of 4.5 mm to the SMAS layer, forming "thermal coagulation" spots. It is normally targeted to thicker skin, such as cheeks, etc. and is the most important aspect of midface tightening.
2. DS-3.0 8—High-frequency ultrasound of 8 MHz is focussed to the deep dermis layer at 3.0 mm depth and is responsible for activating the skin's collagen. It effectively reduces the appearance of wrinkles and also ameliorates large pores.
3. DS-1.5 10—Here, 10 MHz frequency ultrasound energy is focussed to the superficial dermis. It is used in thinner tissue in the periorbital area.

32.4.4 Indications and Contraindications in Facial Aesthetics

The numerous indications of HIFU are given below.

1. Brow lifting
2. Facial rejuvenation.
3. Fine and deep wrinkles of face.
4. Infraorbital area laxity.
5. Crow's feet.
6. Nasolabial folds (Fig. 32.20).
7. Mentolabial grooves.
8. Jowls.
9. Submental skin.
10. Double chin.

The contraindications are the following;

1. Open facial wounds or lesions in treatment region.
2. Pustular acne in the treatment region.
3. Active implants (e.g. pacemakers or defibrillators) in treatment region (no contraindications to Dental Implants).
4. Perform fillers and threads treatment after the HIFU session.
5. Pregnant or breast-feeding woman.
6. Directly over mechanical and permanent dermal implants.
7. Existing keloids in the treatment area.
8. Patients with active systemic and skin diseases like herpes, etc.
9. Unrealistic expectations of treatment.

32.4.5 Procedure for Face Tightening

32.4.5.1 Facial Rejuvenation - HIFU (Video 32.1)

The sequence for HIFU application includes the following:

1. Patient consent and explanation of the procedure, adverse effects and alternatives.
2. Removal of all makeup from face.
3. Cleansing the full face and neck area.
4. Application of local anaesthetics ointment like EMLA, Toplap, etc., and occluding it with plastic sheet for 45 min.
5. Markings of the skin for treatment.
6. Application of ultrasound gel on the skin and face and application of transducer tip at an angle perpendicular to the skin.
7. Start with 4.5 mm transducer, followed by 3 mm and then 1.5 mm with a number of shots and area as mentioned in the figures.
8. Removal of ultrasound gel and explaining post-operative instructions before discharging the patient.
9. Follow up on the next day to assess any complications and at 3 and 6 months to assess the results.

32.4.6 Adverse Effects

Severe adverse effects of HIFU are very rare and hence considered a very safe procedure to perform on an outpatient basis. The adverse effects that have been described may be:

- Pain—Transient discomfort may be experiences during the procedure which resolves within 2 h to 2 days. Tenderness is also possible and typically resolves in maximum 2 weeks.
- Erythema—May exhibit immediately after the treatment which resolves in few hours (Fig. 32.21).
- Edema—Skin may exhibit slight edema following treatment which settles in 3–72 h after treatment.
- Motor Nerve paresis—Symptoms of motor nerve paresis can be seen in the first 12 h of the treatment. It normally happens with the marginal mandibular and temporal branches of facial nerve which are pretty superficial. The HIFU could cause inflammation of these nerves and this may lead to disruption of motor function. The frontalis muscle and the muscles of perioral area are affected. The symptoms usually resolve in 2–6 weeks. Anti-inflammatory medications can be prescribed if symptoms of nerve paresis arise.

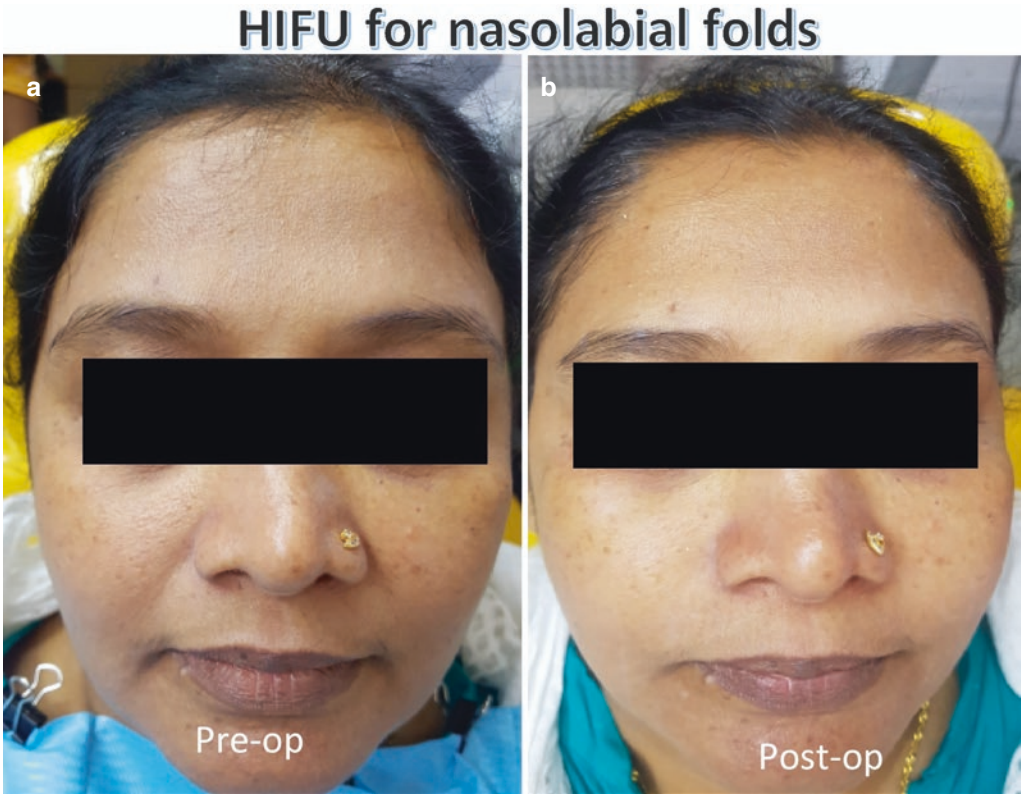

Fig. 32.20 (a, b) Lifting of nasolabial fold with HIFU

- Skin burns: This happens when inadequate ultrasound gel is not applied between the transducer and the skin. There is thus inadequate acoustic coupling and defocussing of the beam due to air entrapment and deposition of energy at the skin surface leading to skin burn (Fig. 32.21).
- Scarring: Rarely happens if correct treatment protocol and technique is not followed.

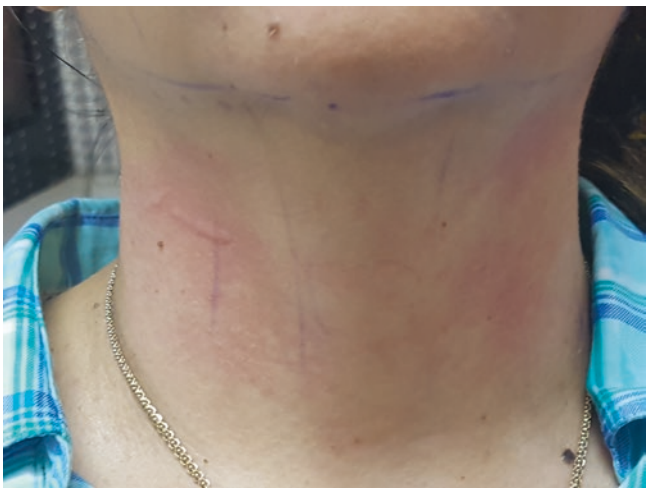

Fig. 32.21 Complication during HIFU—erythema and skin burn

32.4.7 Conclusion

HIFU can be considered as a very effective, non-invasive and safe procedure for tightening the facial skin. The advantages over a surgical facelift are hard to deny. There are no incisions, no scarring and no downtime. Of course, it is much less expensive than a surgical facelift. If patients are chosen carefully, like patients with mild to moderate skin laxity, facial wrinkles, lower eyelid laxity, etc., HIFU can be an excellent option for facial skin tightening.

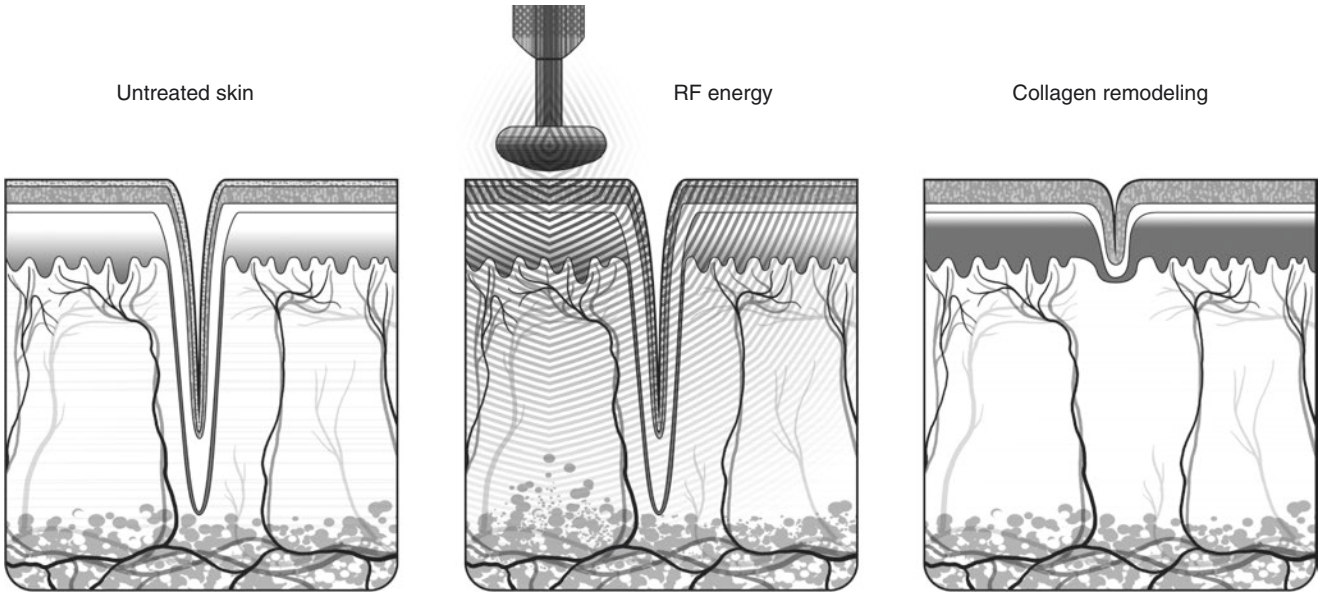

Fig. 32.22 Mechanism of action of non-ablative radiofrequency. Collagen remodelling takes place because of the heat generated due to the tissue resistance to radiofrequency energy

32.5 Skin Tightening with Radiofrequency

Non-ablative radiofrequency or RF is another non-surgical and non-invasive modality of skin tightening. The selective and controlled rise in tissue temperature is because of a high-frequency alternating current (0.3–10 MHz). The amount of energy applied and the tissue resistance determine the amount of temperature and the depth of heating [34].

Since electrical current produces the RF energy, the tissue damage like a laser is minimised and neither is the epidermal melanin compromised to cause hyperpigmentation.

RF therapy was first FDA approved as a non-invasive treatment modality in periorbital rhytids in 2002. Subsequently in 2004 it was cleared for full face. Since then, it has become a very popular non-invasive treatment modality for the facial skin tightening.

32.5.1 Principle of Action

High frequency (0.3–10 MHz) alternating current is utilised in a RF therapy. Intrinsic tissue resistance (impedance) to the passage of electrons converts the electric current to thermal energy causing heat generation. Ohm's Law relationships state that:

$$\text{Power}\left(P\right) = I^2 \times R \text{ and Energy}\left(E\right) = P \times T$$

Hence, Energy (E) = $I^2 \times R \times T$ (where I = current, R = tissue impedance and T = time of application). The level of energy of the alternating current and tissue resistance determines the amount of rise in temperature and the depth of heating. High tissue resistance as demonstrated by subcutaneous fat generate more heat [35]. The thermal damage thus caused stimulates the alterations in collagen configuration and produces neocollagenesis in deep layers of skin and subcutaneous tissue (Fig. 32.22).

Significant results can be observed 2 months post-application of radiofrequency energy. Histological pictures after each session demonstrated expansion of the papillary dermis due to oedema and vascular congestion, followed by accumulation of intercellular substance. Post 2 months treatment histological pictures showed escalated amount of collagen, elastic fibres and mucopolysaccharides [36].

32.5.2 Armamentarium

There are 2 major components of the RF machine: the RF generator and the handheld tips (Fig. 32.23). The membrane electrode functions by dispersing energy uniformly across the skin surface by a mechanism termed as capacitive coupling that creates a zone of raised temperature at depths of 3–6 mm [37]. The energy transmitted to the skin is by utilising the capacitive method (bipolar, tripolar or multipolar electrode). Montesi et al. (2007) described the main difference between the inductive and the capacitive method. It depends on the configuration of the electrodes that are applied to the skin that influences the energy transmission in the tissues.

The inductive method (monopolar electrode) uses an active and a passive electrode, in which the passive electrode

acts as a grounding electrode. The active electrode transmits power to the tissue via a single point of contact. This enhances the penetration of the generated current.

In the capacitive method (bipolar, tripolar or multipolar electrode), energy alternates between 2 electrodes situated at a short distance from one another. In the tripolar and multipolar devices, bipolar energy switches between different poles at any given point of time. The energy is concentrated at the site of treatment and the achieved depth is half of the distance between the two electrodes [38].

Parameters utilised by the device includes frequency ranging from 1 to 6 MHz and the power ranging from 40 to 240 W. All the parameters can be modified during the treatment. Throughout the procedure, the temperature of epidermis is maintained at 40 °C, whereas that of dermis rises to about 50–75 °C. This heating up of the dermis causes new collagen and elastin production.

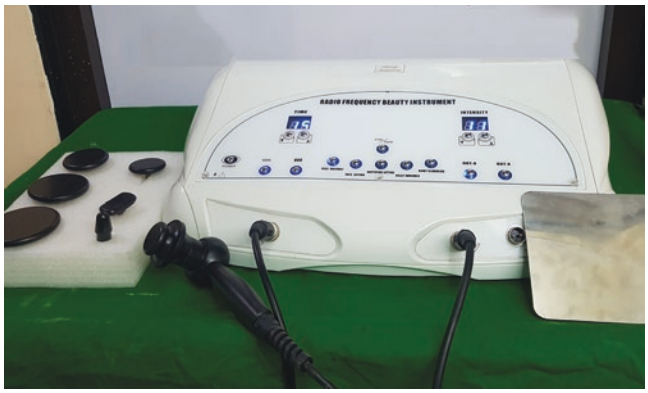

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Fig. 32.23 Non-ablative radiofrequency device

32.5.3 Indications

The various indications of RF include the following:

1. Complete facial rejuvenation.
2. Wrinkles around eye
3. Fine lines on forehead.
4. Jowls
5. Nasolabial folds (Fig. 32.24)
6. Perioral fine lines
7. Undefined jaw line

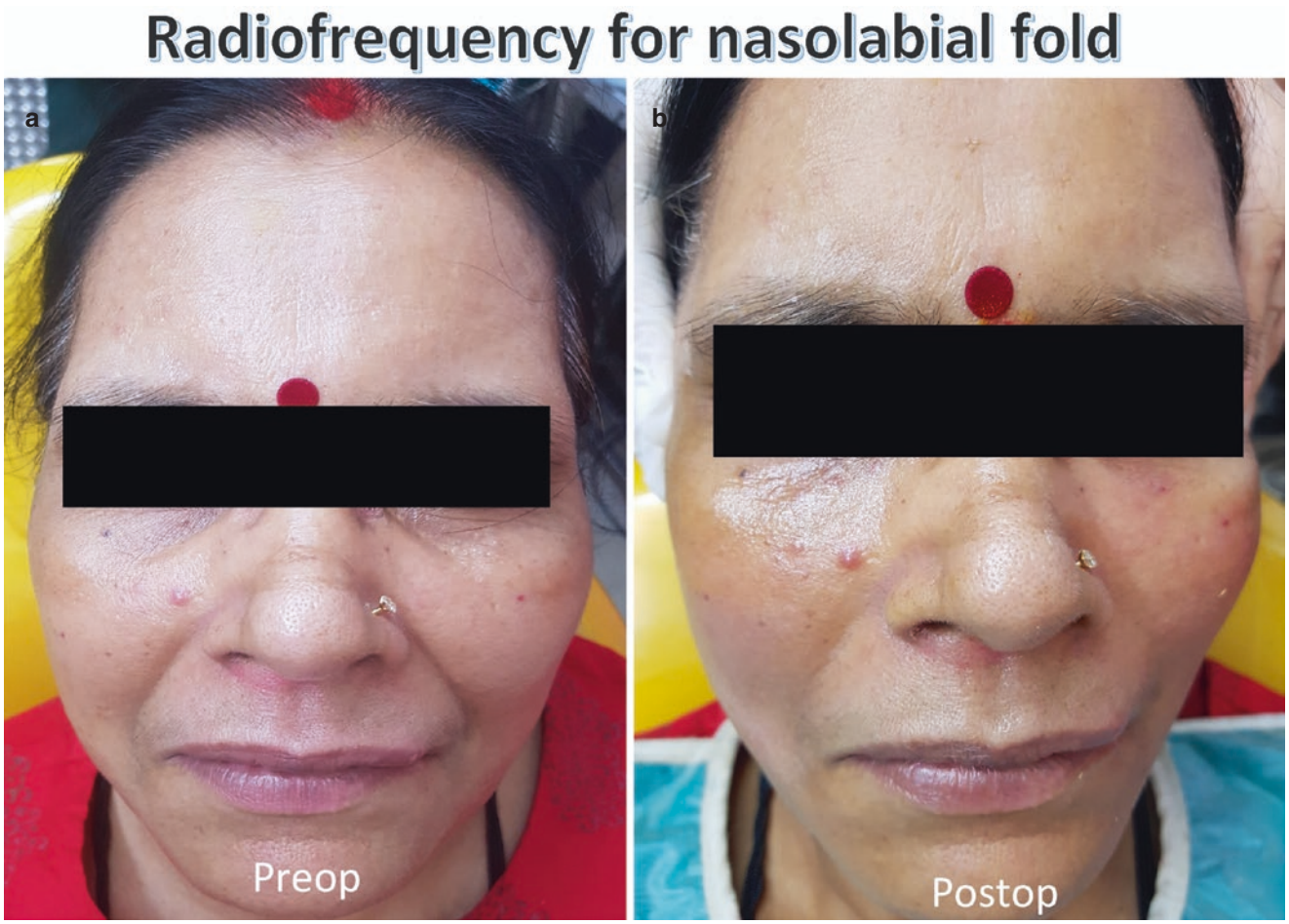

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Fig. 32.24 (**a**, **b**) Nonablative radiofrequency for tightening nasolabial folds

32.5.4 Advantages

The biggest advantage of RF is unlike lasers, the energy does not disturb the epidermal melanocytes and thus can be used for all skin types, i.e. type 1–6. The procedure can be performed frequently as per requirement without any adverse effect and different depths of tissue can be treated, allowing for ultimate collagen contraction and production of new collagen.

32.5.5 Procedure of RF for Face

Application of RF is done systematically and the various steps involved are mentioned below.

1. Patient consent for the treatment is mandatory after a detailed explanation of the procedure, side effects, benefits and alternatives.
2. Removal of all make-up from face.
3. Cleansing of the full face and neck area.
4. Application of prilocaine and lignocaine skin anaesthetic cream like toplap, prilido, etc.
5. Ultrasound gel is applied generously to the facial skin to establish uniform thermal and electrical contact between the treatment tip and the skin and to enhance proper energy conduction.
6. For each session, a total of 5–8 passes per treatment region can be given.
7. Removal of ultrasound gel and explaining post-operative instructions before discharging the patient. Post-operative instruction includes prevention of sun exposure by using sunscreen to promote healing.
8. Follow up on the next day to assess any complications and at 1, 3, 5 weeks to repeat the procedure and at 3 and 6 months to assess the results. The possible side effects of RF application are found in Box 32.1.

Box 32.1 Side Effects of RF Treatment

1. Burns
2. Permanent scarring
3. Skin pigmentations
4. Deeper skin fat loss.
5. Mild swelling of the treated skin.
6. Redness.
7. Sinking of the treated area.
8. Skin sensitivity.

32.6 Conclusion

Non-ablative radiofrequency is an effective and non-invasive modality for tightening and rejuvenating wrinkled, photoaged facial skin and contour facial skin laxity. It works on the principle of stimulation repair process by producing new collagen and elastin and by reversing the clinical and the histopathological signs of ageing. The procedure has an added advantage of being relatively risk-free with little or no downtime.

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32.7 Case Scenarios

32.7.1 Patient 1 (Fig. 32.25a–d)

A 48-year female approached us with complaints of sagging skin. She wasn't happy with her deepening nasolabial folds, loose skin in her neck and the fine wrinkling on her face.

Treatment options included surgical facelift, thread lift therapy and non-invasive therapies like HIFU and RF. The patient consented to undergo non-invasive treatment which included a session of High intensity focussed ultrasound (HIFU).

After cleansing the face, proper markings were made. The treatment was performed with sequential transducers of 4.5, 3 and 1.5 mm with number of shot as recommended, area wise. The patient was evaluated post-operatively and patient's satisfaction was recorded. Post-operative instructions were given before discharging. Patient was recalled for revaluation after 1 month.

32.7.2 Patient 2 (Fig. 32.26a–g)

A 52-year male approached us with complaints of loose skin on the face. His main concern was the deepening nasolabial folds and the fine wrinkling on the face. The treatment options included surgical facelift and thread lift therapy. The patient consented to get a thread lift procedure done. It was decided to use 3 COG threads along with 20 mono PDO threads on either side.

After cleansing the face with povidone iodine, vectors were marked to lift the nasolabial folds. Lignocaine with adrenalin was used as local anaesthetic agent. The thread lift procedure with COGS thread was performed with placement of the COGS in the subcutaneous layer for the proper lift and

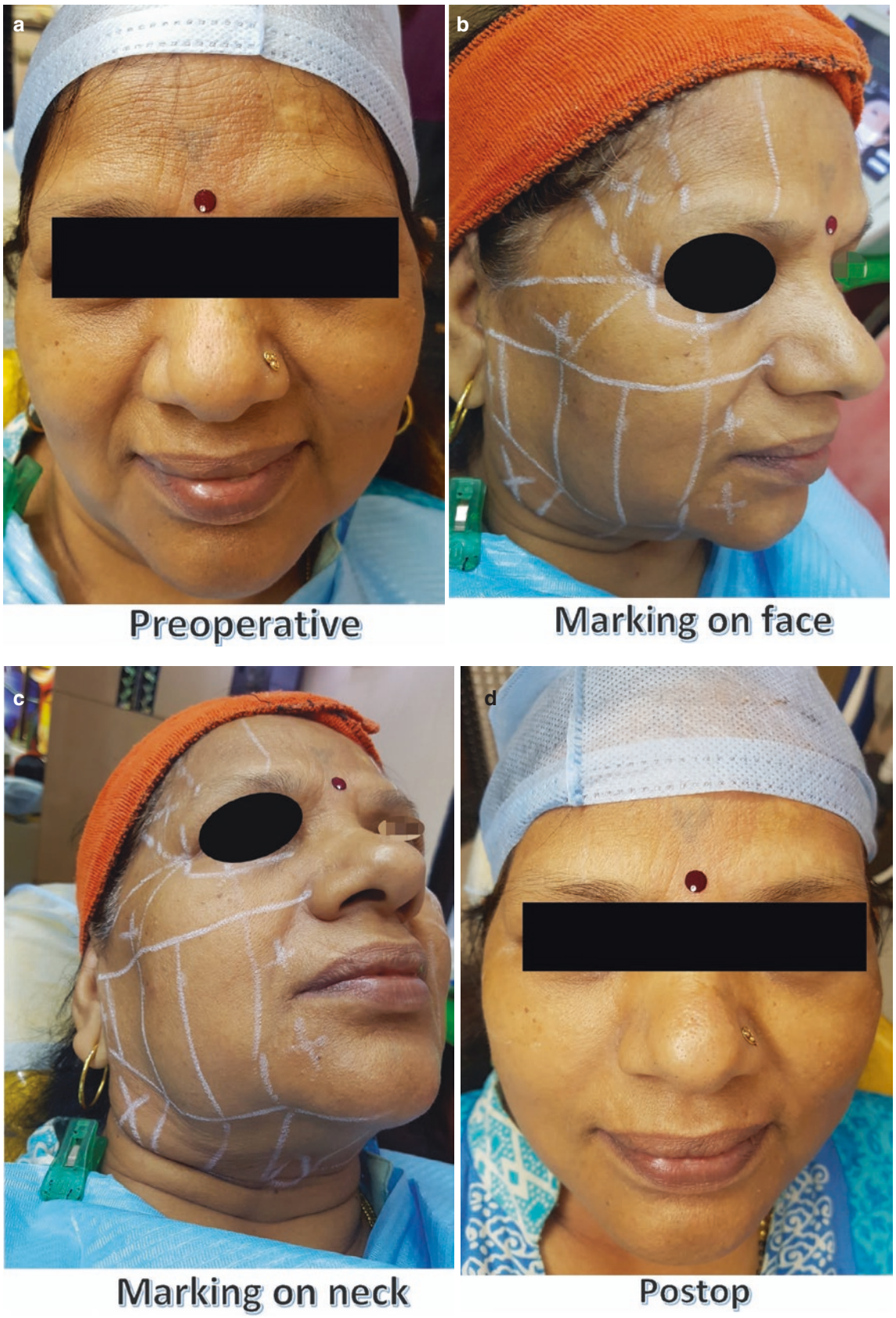

Fig. 32.25 (**a**–**b**) Case Scenario 1. (**a**) Pre-op photograph. (**b**, **c**) Marking on face and neck, right side. (**d**) Post-op photograph

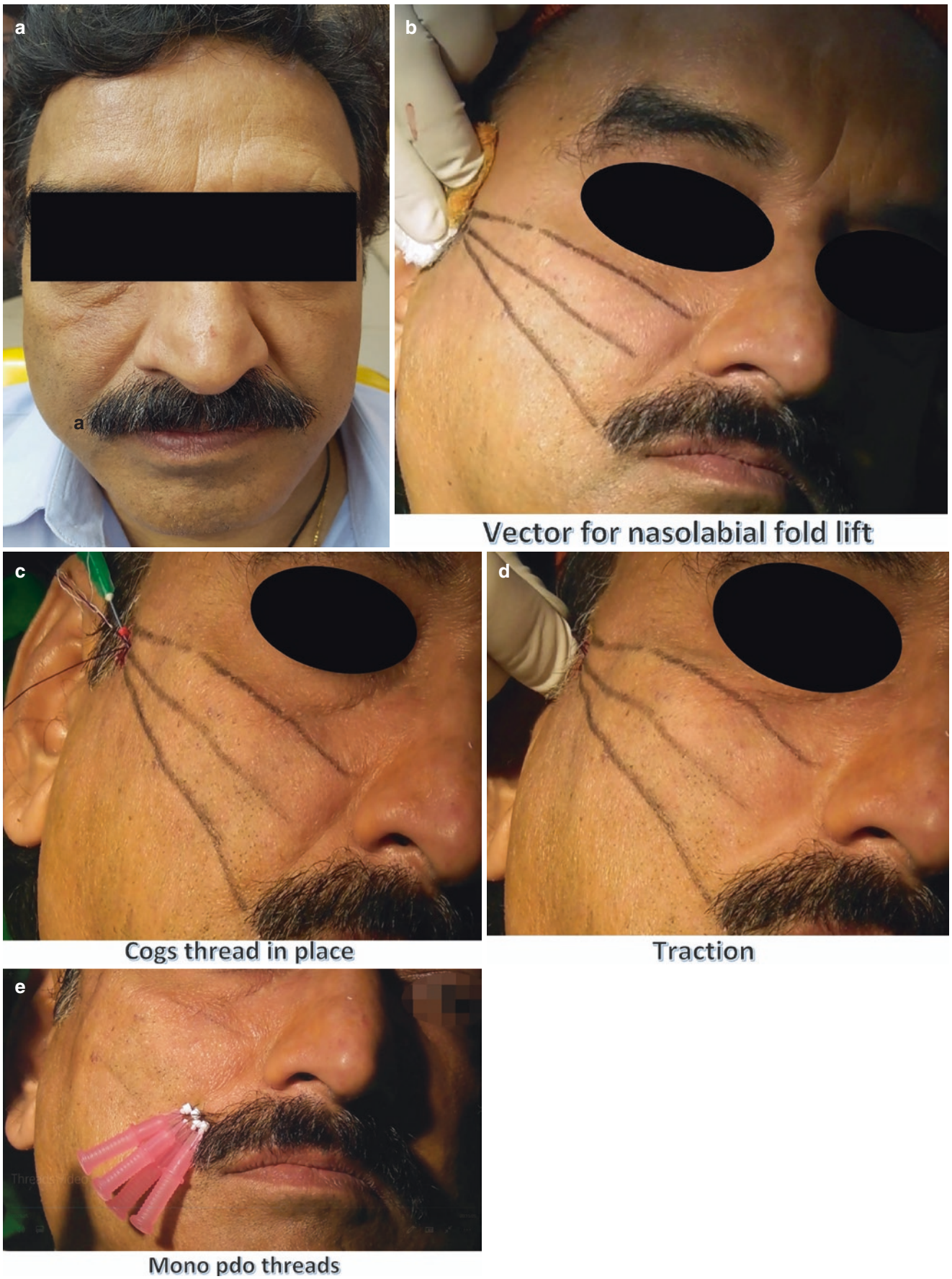

Fig. 32.26 Case Scenario 2. (**a**) Pre-op photograph. (**b**) Marking of vectors. (**c**) 3 cogs in place at subcutaneous layer. (**d**) The traction on threads lifts the nasolabials. (**e**) Placement of mono PDOS. (**f**, **g**) Post-op photograph (also see Fig. 32.10)

Fig. 32.26 (continued)

the mono PDO at the dermal layer for rejuvenation and fine lines.

The patient was evaluated post-operatively and patient's satisfaction was recorded. Post-operative instructions were given before discharging. Patient was recalled for revaluation after 3 days and after 1 month.

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