

## Case Report

# HIFU: New Paradigm for Non-Surgical Facelift in Indian Skins

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## Abstract

With the ever increasing demand for non surgical no downtime skin tightening procedures from patients, physicians are always on a lookout for safe and effective technology. In the past decade, radiofrequency, ultrasound and infrared light based devices have been very popular owing to their ability to deliver precise controlled heat to the dermis. This in turn causes neocollagenesis with some skin tightening. However the need for multiple sessions usually becomes a limitation with these devices. Introduction of High intensity focus ultrasound (HIFU) for skin tightening could help achieve better clinical results owing to the precise thermal zones at various depths, which further can achieve higher tissue temperature, cause stronger tissue remodeling and produce longer lasting results in lesser number of sessions. We present our results of using HIFU technology for face and neck in 10 Indian patients. However longer follow up and more clinical data will help us to establish the efficacy of this treatment.

## Keywords:

HIFU; Non surgical skin tightening

## Introduction

High intensity focused ultrasound (HIFU) has already been established as a tool for the treatment of solid benign and malignant tumors for many systemic disorders for decades [1]. Recently, HIFU was explored in the cosmetic industry as a new treatment modality for skin tightening and rejuvenation [2]. High intensity focused ultrasound can produce small, micro-thermal lesions at precise depths in the dermis up to the fibromuscular layer, causing thermally induced contraction of collagen and tissue coagulation with subsequent collagenesis, while sparing the epidermis [3-5]. The introduction of HIFU technology in India is recent and till date, no clinical studies have evaluated the efficacy of HIFU for skin tightening and contouring on Indian patients. In this study, we evaluated the effects of HIFU on 10 patients for skin tightening, volume reduction and contouring.

## Evolution of Non Surgical Technology

Traditional ablative laser skin resurfacing with carbon dioxide or erbium: yttrium-aluminium-garnet devices selectively ablates the epidermis while delivering significant thermal injury of upto 35-45 degrees to the dermis sufficient to stimulate robust wound healing response with subsequent collagen remodeling and contraction [6-8]. However, traditional ablative laser skin resurfacing is associated with extensive postoperative recovery and risk of delayed dyspigmentation [9].

Modest skin tightening can also be induced by RF devices that rely on heat delivery upto 2-4mm into the dermis to stimulate the wound healing cascade and neocollagenesis without epidermal injury and associated clinical recovery [10-12].

## What is HIFU?

HIFU-High Intensity Focussed Ultrasound

It was originally introduced for its use in treatment of cancer like in bladder , prostate ,kidney cancer, but since it did

not prove to be as effective as surgical techniques, it lost its importance in treating cancer.

Hifu has created a benchmark in the field of non surgical face lift. It is an acoustic energy, known to propagate much deeper through tissue than laser or RF energy, has been previously investigated for use in bulk heating for the treatments of solid organ tumors as mentioned above [13-15] and is recently adapted for subcutaneous lipolysis [16].

## Mechanism of Action

These Ultrasound waves penetrate deeper in to the tissues without affecting the epidermis and focus at a single point in the adipose tissue and cause Thermal Injury.

Each treated area is tightly focused at a given depth and heated precisely using shorter pulses to produce small zones of coagulative necrosis at the site with surrounding tissue and superficial layers essentially unaffected [17-19].

The epidermal surface remains unaffected as long as the energy delivered is not excessive for the given focal depth and frequency ranging from 4-7MHz emitted by a given transducer, eliminating the need for superficial cooling and speeding the recovery process, as healing occurs rapidly from untreated adjacent tissue [20,21].

This device is able to penetrate deeper into tissue than its non surgical predecessors in an effort to affect superior tissue tightening and longevity of results by selectively targeting the superficial musculoaponeurotic system (SMAS).

The SMAS lies deep to the subcutaneous fat, envelops the muscles of facial expression, and extends superficially to connect with the dermis [22].

The SMAS layer is composed of collagen and elastic fibres similar to the dermal layer of the skin ,however, it has more durable holding property and less delayed relaxation after lifting procedures than skin alone [23]. Thus, SMAS is a desirable target for non invasive skin tightening procedures.

The HIFU device has refined this technology using transducer hand pieces with exact depth of penetration and desired temperature in skin tissues.

Unlike lasers, which penetrate the skin from the outside-in, the HIFU procedure bypasses the surface of the skin, and delivers targeted energy specifically into the deep, structural tissues and SMAS targeting the collagen and connective tissue. HIFU involves penetrating ultrasound energy to stimulate collagen production in the deeper dermal and sub-dermal levels, which results in micro injury to that tissue. As the tissue heals, it causes neocollagenesis and as the collagen fibers organize and shorten, a tightening effect is seen on the tissues.

## Hyperthermia Lifting Therapy

Creating skin coagulation on the target layer of skin tissue by 65-75 degrees of energy. No damage to the skin surface is seen (Table 1).

Pathologically	Clinically
Inflammation Phase--0-48 hours. Homeostasis , skin coagulation, cell migration.	Inflammation Phase mild tenderness, oedema ,erythema ,bruise, nerve damage.
Proliferative Phase 2-6 weeks. Granulation tissue, wound contraction, collagen synthesis.	Proliferative Phase Tightness, tenderness extended, start seeing reduction and contouring.
Remodeling Phase 3 weeks 6 months. Collagen Rearrangement , strength increase, kin lifting effect	Remodeling Phase Main contour and lipolysis seen here. Maximum 3-6 months are required for best results.

Table 1: Wound Healing Process.

## About the Machine Parameters and Variables

There are 4Handpieces

4.5mm,3mm, 1.5mm and 13mm which will penetrate the depth respectively.

4.5mm used on neck and lower face.

3mm neck, lower and upper face.

1.5mm Used in thin, sagging skins (neck, upper and lower face)

**Power:** Ranges from 0.1-1jls. We can adjust the power depending upon the amount of bulk of fat, desired result and tolerability of the patient.

**Pitch:** It is the spacing in a single shot. The lower the pitch, the stronger will be the shot as more concentrated and focused will be the shot.

**Length:** 25cm.This is the length of the shots that the probe will cover which is usually kept the maximum as we would want to cover maximum area with each shot.

Energy type :HIFU4Mhz/ 7Mhz

Depth : 1.5mm,3mm,4.5mm

Length : 5mm–25mm(1mmincrement)

Energy output : 0.1J–1J (0.1Jincrement)

Weight : 34kg

## Indications

Cheek relaxation and mandibular contouring (Picutre 2)

Deep nasolabials and mentolabial grooves.

Submental skin and platysmal relaxation.(picture3)

Brow lift

Double Chin

Lower eyelid bags

40-60 years, thin loose sagging skin.

30-40 years, heavy and chubby face (Figure 1).

3mm--100 shots on each side, Power--0.9j, pitch--1.5mm (Figure 2).



**Figure 1:** Total shots given: 500, 4.5mm 150 shots on each side, Power--1j, Pitch--1.5mm.



**Figure 2:** Total shots given: 700, 4.5mm--200 shots on each side, Power--1j, Pitch--1.5mm 3mm--100 shots on each side, Power--0.9j, Pitch--1.5mm, 1.5mm--50 shots on each side, Power--0.9j, Pitch--1.5mm.

## Our Protocol

- The number of sessions is decided by the bulk of adipose tissue, the extent of sagging skin and the desired result. Usually, 1 session is sufficient, but if 2 sessions are needed then the 2<sup>nd</sup> session should be at a gap of 3 months after the result of 1<sup>st</sup> session has shown.
- Maintainance once a year.
- Need for neuromodulator like botulinum toxin in massetter and lower face to be assessed after 3 months of 1<sup>st</sup> session.
- In authors experience, there has been a need to inject neuromodulators as after 3 months of hifu when the bulk of fat is destroyed, the facial asymmetry due to inequality of masseters shows up and by injecting the neuromodulators into the masseters also helps to contour the face.

## Contraindications

- Open facial wounds or lesions
- Metal stents/implants in the face or neck (dental implants OK)

- Implantable electrical devices
- Within two weeks after the Botox
- Pregnant or breast-feeding woman
- Permanent dermal implants
- Anti-thrombosis therapy
- Active systematic or skin disease which may hinder regeneration
- Hemorrhagic disorders or dysfunctions
- Unrealistic expectations of Treatment

## Procedure

- After taking the consent of the patient and making sure that all the indications are met and that the patient does not come under any absolute contraindications,
- Face is cleansed with Povidone Iodine and Saline or alcohol swab.
- Marking is done on the face as to which areas are to be targeted and which areas to be avoided.
- Gel is applied on the face and initially ,shots with 4.5mm cartridge are given on neck and lower face only. The direction of the shots should be always anti-gravity, pulling the tissues upwards. Firm pressure is applied perpendicular to the skin surface making sure that the entire surface if the probe is in contact with the skin along with the transducer.

## Upper Face Contouring

1.5 mm and 3 mm cartridge is used for upper face as the skin there is thinner compared to lower face.

Again, the parameters are adjusted as per the need and tolerability of the patient.

The number of shots to be given depends upon the bulk of the adipose tissue. On an average ,50-200 shots of 4.5mm and 50-150 shots of 3.5mm are given on each side. Spot treatment can also be given to the problem area restricting the number of shots (Figure 3).



**Figure 3:** Total shots given--200 (double chin), 4.5mm--100 shots on each side, Power--1j,Pitch--1.5mm 3mm--100 shots on each side, Power--0.9j,Pitch--1.5mm.

Then, the skin is cleaned, gel is removed and iced if needed and anti-allergic can be given orally as well as a mild topical steroid can be given.

## Does Hifu Face Lifting Hurt?

It does not cause major discomfort. You may feel some discomfort, warm or heat sensations or even a slight pain that lasts for a few seconds and only during the pulsation cycle when the ultrasound energy is being applied. This discomfort or sometimes even pain is very brief and a good sign that collagen-building process has begun. The level of discomfort depends on the settings used, the area being treated, and the individual sensitivity. Around the eyes and over any bony prominence tend to be more intense. The neck region seems to be the area that tolerates the HIFU treatment the best.

We can use a lower energy level and increased number of shots to achieve the desired results with much lower discomfort/pain level. The second factor related to pain/discomfort during HIFU procedure is the type of skin being treated. People with thicker skin or more dense areas will tolerate HIFU treatment very well.

As with any heat-based cosmetic procedure, there are variable degrees of discomfort associated with HIFU skin tightening. Preoperative planning should include a discussion of the patient's historical pain tolerance and response to anxiolytic and narcotic pain medications.

In our practice, pain is usually tolerable and none of our clients needed and pain killers or anxiolytics.

## Post Procedure

There may be post procedure redness which settles in about an hour. The patient is told to avoid laughing, chewing too much for that day.

The patient is told to keep the jaw stable that night and avoiding its movements to apply a crepe bandage around the face so that the movements are restricted.

The patient will feel little soreness on the face for 2-3 weeks but it is normal and they should be counseled about it after the procedure.

## Results

As the process of wound healing and collagen remodeling takes 2-3 weeks, the patient will see only 10% result in 1<sup>st</sup> month, another 10% in 2<sup>nd</sup> month and 80% result in 3<sup>rd</sup> month.

## Prevention of Complications from HIFU

**Motor nerve paresis:** Ask patient to report any facial muscle twitching during treatment near superficial motor nerves and apply ice to any red or inflamed areas after treatment.

**Nodules:** Use appropriate treatment density and technique as confirmed by corresponding ultrasound image on monitor

**Bruising:** Avoid treating patients on blood thinning medications and administering pulse directly to a visible vessel on the ultrasound image

## White Striations or Geometrical Wheals

Typically occur with superficial transducer ensure proper coupling with corresponding ultrasound image before each pulse delivery.

Small areas of purpura may develop and are expected to resolve over 1-2 weeks. Linear or geometrical striations seen after treatment with the superficial transducer are treated with topical corticosteroids and followed for rapid resolution [21-23]. No permanent textural changes from these lesions have been reported. Lingering mild to moderate skin tenderness and edema in the first 1-4 weeks after treatment is common [24,25].

Although uncommon, more serious complications after HIFU skin tightening can occur, including the development of palpable subcutaneous nodules and/or motor nerve paresis. Fortunately, these effects are temporary and can be avoided with proper operative technique. Motor nerve paresis is the most concerning potential complication in the immediate post-treatment period, and its incidence is limited to case reports. The areas at the greatest risk for injury are the temporal branch of the trigeminal nerve as well as the marginal mandibular nerve, where the course of the nerve becomes relatively superficial. The affected patient will present with an inability to contract the frontalis muscle or perioral asymmetry. Symptoms usually occur within the first 1-12 hours after treatment and are likely related to nerve inflammation. Resolution is expected in 2-6 weeks, and no permanent nerve injury has been reported to date.

For patients who notice facial muscle twitching during treatment near "danger zone" regions, ice should be immediately applied and anti-inflammatory medication considered.

## What to Expect after Treatment

There may be slight redness for up to a few hours following the treatment, and a small percentage of clients may have slight swelling, tingling, redness or tenderness to touch, but these are mild and temporary in nature (Figure 4).



Figure 4: Total 600 shots given--4.5mm--200 shots on each side, Power--1j, Pitch 1.4mm. 3mm--100 shots on each side, Power--0.9j, Pitch-1.5mm.

None of our patients needed any pain killers or anxiolytics. Some needed mild topical steroids to reduce the redness post procedure.

## Our Experience

We have been using hifu since 2 years. We have seen a considerable difference in the facial architecture with impressive instant and long lasting results. HIFU is capable of delivering transcutaneous ultrasound energy to selectively heat dermal and subdermal tissues in a linear array of tightly focused zones. As superficial and surrounding tissue is unaffected, rapid clinical recovery is coupled with a favorable side effect profile. Initiation of the wound healing response with subsequent neocollagenesis and tissue contraction leads to gradual lifting and tightening of the skin. The results keep improving everyday and maximum results are seen in 3 months.

We have also seen that apart from the above mentioned indications, we have got the following clients coming to us

- a) Younger Patients
- b) Bulky Face
- c) Brides
- d) Camera conscious clients
- e) Models and Actors

We have used the 1.5mm, 3mm and 4.5mm handpieces and found that pain was felt more with 3mm probe so the power used was lesser with this probe compared to others.

Use of 4.5mm probe was restricted to neck and lower face. Patients felt little pain during the procedure and soreness for few days. Erythema and oedema settled in 1-2 days. Few patients were given topical steroids and pain killers.

The following results were achieved.

- 1) Tighter, better skin, including forehead, eyes, mouth, neck, décolleté.
- 2) Reduced fine to deep wrinkles
- 3) Under eye troughs, bags and dark circles
- 4) Skin lifting
- 5) Slows down the development of aging signs
- 6) Lifts and tightens the cheeks without the surgery
- 7) Slows down the development of aging signs on the face, neck and décolleté
- 8) Improves skin elasticity and shaping of the face contour
- 9) Improves jaw line

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