

## Targets for Non-invasive Skin Tightening

Lama N. Alotaibi

Al-Maarefa Colleges for health sciences, Riyadh, Saudi Arabia

Corresponding author: Lama N.alotaibi, Telephone : +966599543218, Email: Lama93@live.com

### ABSTRACT

Noninvasive skin tightening is a technology done to lift the skin without even minimal penetration to skin layers. Therefore, cosmetic surgeons can effectively tighten moderately lax or crepey skin on the face, neck, and body, helping patients improve their appearance without surgical intervention. It works on stimulating collagen reproduction by inducing heat to the deep layers of the skin. There are two types of skin tightening technology; MFU (Microfocused ultrasound) and Non-Ablative Radiofrequency.

This article focus on MFU, its efficacy, safety, complication and patients who are suitable for MFU.

**Keywords:** radiofrequency – Microfocused ultrasound – noninvasive skin tightening - laxity

### INTRODUCTION

Noninvasive skin tightening or lifting is a nonsurgical recent technology. In general, non-surgical skin tightening procedures work by using targeted energy to heat deeper layers of skin, which stimulates collagen and elastin synthesis in the deep dermis and subdermal tissue thus gradually improves and effectively tighten moderately lax or "crepey" skin on the face, neck, and body, helping patients improve their appearance and postpone the need for surgery. This brought a significant improvement and satisfaction of skin lifting from 3 months up to 6 months depending on several factors that can affect the results like patient's age, skin laxity, selected area and the amount of energy used at this area. The demand for noninvasive skin/aesthetic treatments has grown significantly over the past several years.

Patients seek these kinds of treatments and doctors are more than willing to deliver them, once they prove their safety and efficacy in clinical trials. Skin tightening could be done for several sessions using one of the two technologies;

1. RF (Non-Ablative Radiofrequency.)

2. MFU (Microfocused ultrasound).

#### 1) Radiofrequency (RF)

RF energy is not new in aesthetic medicine; in fact, it has been a staple in skin tightening since 2001. The effects of dermal heating are well-recognized and include immediate effects on collagen structure with stimulation of dermal fibroblasts inducing a synthesis of new collagen fibers (known as neocollagenesis) and elastic fibers (known as neolastogenesis).<sup>(1)</sup> However, this less invasive approach is historically associated with inferior efficacy so that surgery remains the treatment of choice to address moderate to severe tissue laxity.

#### 2) Microfocused ultrasound (MFU)

MFU uses much lower ultrasound energy to treat the superficial layers of the skin. MFU uses 0.4–1.2 J/mm<sup>2</sup> of energy, a frequency of 4–10 MHz, and a focal depth of only 1.5–4.5 mm.<sup>(2)</sup> MFU depends only on heating the tissue of minimum 60°C up to 70°C, producing small (<1 mm<sup>3</sup>) thermal coagulation points to a depth of up to 5 mm within the mid-to-deep reticular layer of the dermis and subdermis while sparing overlying papillary dermal and epidermal layers of skin.<sup>(3)</sup> This technology depends only on using the heat of minimum 60 up to 70°C focused specifically on one area to achieve collagen denaturation, contraction, and neocollagenesis enhancement.<sup>(4)</sup> When collagen is exposed to 60°C- 65°C, it undergoes denaturation. One study showed that new collagen synthesis is observed after 30 days and another study showed that new collagen and elastin synthesis observed at ten weeks, along with the deposition of hyaluronic acid.<sup>(5,6)</sup> Since MFUS device can penetrate deeper into tissue than its nonsurgical predecessors to affect superior tissue tightening and longevity of results by selectively targeting the superficial musculoaponeurotic system (SMAS). SMAS is a subcutaneous, fan-shaped structure that covers the face<sup>(7)</sup> and connects the facial muscles with the dermis<sup>(8)</sup>. The SMAS layer composed of collagen and elastic fibers 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.<sup>(9)</sup> Thus, the SMAS is a desirable target for noninvasive skin tightening procedures.

#### Ulthera Microfocused ultrasound system

Ulthera system (Ultherapy), a high-resolution US system approved in 2009 by the US Food and Drug

Administration for noninvasive eyebrow elevation. It has been routinely used for panfacial and submental treatments, like face, neck, periorbital area, jawline and nasolabial folds, SMAS, upper arms, knee, and buttock with variant improvement depending on the area applied to. The net result is noninvasive tightening and lifting of sagging facial and neck skin and improvements in the appearance of wrinkles.<sup>(10)</sup> Recently, MFU has also been applied to improve lines and wrinkles of the décolleté.

**Depending on the area applied to the target tissue can be set to variable depths:**<sup>(11)</sup>

- 1.5 mm, target dermis
- 3.0 mm, which targets deep dermis
- 4.5 mm, which targets the superficial muscular aponeurotic system (SMAS) and platysma.

Duration of treatment usually depends on the selected area, the amount of energy used and other factors. For the face and neck, treatment usually takes from 30 to 60 minutes with a much longer duration for the face. Overall it does not exceeds 90 minutes. Before treatment, the skin is freshly cleansed, dried, and cleared free of makeup, sunscreen, or products. Each targeted region for treatment is outlined with a planning card to determine the number of treatment columns required to deliver energy with minimal overlap. Ultrasound gel is applied to the skin, and the probe is placed firmly and gently on the target site, so the entire transducer is evenly coupled to the skin surface. Treatment lines of ultrasound pulses are manually delivered adjacent and parallel to one another with minimal spacing (<3 mm).<sup>(12)</sup> The overall number of lines placed in a treatment area will depend on the size of the treatment area. Treatment over soft tissue augmentation material and implants should be approached with caution. Because there are no commercially available eye shields known to prevent propagation of ultrasound energy over the globe, treatment inside the orbital rim is not possible. The thyroid gland is palpated and marked before treatment to avoid inadvertent delivery of ultrasound pulses over the area.<sup>(12)</sup>

### Postoperative management

After treatment, ultrasound gel is removed, and a bland moisturizer applied. Patients are instructed to care for their skin as they normally would with no restrictions on activity. If systemic pain management was used, the patient is discharged with appropriate transportation. If desired, the patient may apply cold compresses to the treatment area in the hours after

the procedure to minimize local edema; however, its use is not mandatory in all patients, as degrees of swelling after treatment are variable.<sup>(12)</sup> Although uncommon, more serious complications after MFUS skin tightening can occur, including the development of palpable subcutaneous nodules and motor nerve paresis.<sup>(13)</sup> Fortunately, these effects are temporary and can be avoided with proper operative technique.

### Limitations of MFU:

<sup>(14)</sup>

- ⑩ Results appear gradually over several weeks or months following treatment
- ⑩ Multiple treatments may be needed to achieve desired results
- ⑩ Treatment will need to be repeated periodically to maintain results
- ⑩ Not effective on more advanced skin sagging, such as pronounced jawline or stretched skin following pregnancy or weight loss.

### Safety

The Safety of Micro-focused Ultrasound has been well established in both controlled clinical studies and clinical use, showing only mild and transient anticipated side effects and only rare unanticipated adverse events. Events that are typically seen include tenderness, redness, and slight edema. Rare events include bruising, welting, and nerve-related effects (paresthesia and paresis). Rare incidence of surface thermal effects was seen in some cases where the improper technique was used. In all cases where the device was used properly, the safety events reported tended to be transient, mild in nature, and resolved without sequelae. In general, unexpected and rare adverse events could be attributed to incorrect treatment technique or classified as unrelated to MFU-V treatment. Side effects that do occur are generally mild and transient in nature. MFU-V consistently allows for safe treatment when correct treatment technique is used.<sup>(15)</sup>

### Patient selection

Non-surgical skin tightening is best suited for patients who are bothered by mild to moderate skin laxity and do not need the more dramatic lifting and skin removal possible with cosmetic surgery.

To achieve satisfying results and maximum benefit from MFU-V, patients must be selected properly, and realistic expectations should be fitted. Patients better to be selected first according to their age, younger patients are ideal ones, this is based on

the capability of new collagen synthesis and better clinical response.<sup>(16)</sup> Also the degree of laxity is important since mild to moderate is much suitable for MFU-V. Open wounds, skin infections, papules, severe acne, pacemaker and defibrillators and other metallic implants are absolute contraindications to MFU-V. The treatment better not to be applied directly on keloids, permanent fillers and implants high precautions should be made in these cases.<sup>(16,17)</sup>

Alcohol and major illness are not approved to be related to the outcomes. On the other hand, smoking seems to have negative affect on the results since it leads to impairment in wound healing and the smokers' ability to create collagen in response to thermal injury may be inadequate making them less favorable candidates.<sup>(16,17)</sup>

In one study, BMI was found related to better outcomes, patients with BMI  $\leq 30$  kg/m<sup>2</sup> will benefit from the procedure.<sup>(18)</sup> In contrast to patients with BMI > 30 kg/m<sup>2</sup>, changes was not detected in more than 50% of patients. Older patients with extensive photo-aging, severe laxity of the skin, marked platysmal banding, and extensive neck laxity will not benefit from the treatment with MFU-V, and surgical intervention should be recommended to that kind of cases.<sup>(19)</sup>

**The study was done according to the ethical board of King Abdulaziz university.**

## CONCLUSION

MFU has been recently developed to meet the public demand for achieving significant, noninvasive skin lifting and tightening. It is the best suitable for patients who are bothered by mild to moderate skin laxity and do not need the more dramatic lifting and skin removal possible with cosmetic surgery. Also, combining MFU with high-resolution ultrasound imaging (MFU-V) allows the user to visualize where the MFU energy will be applied.

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