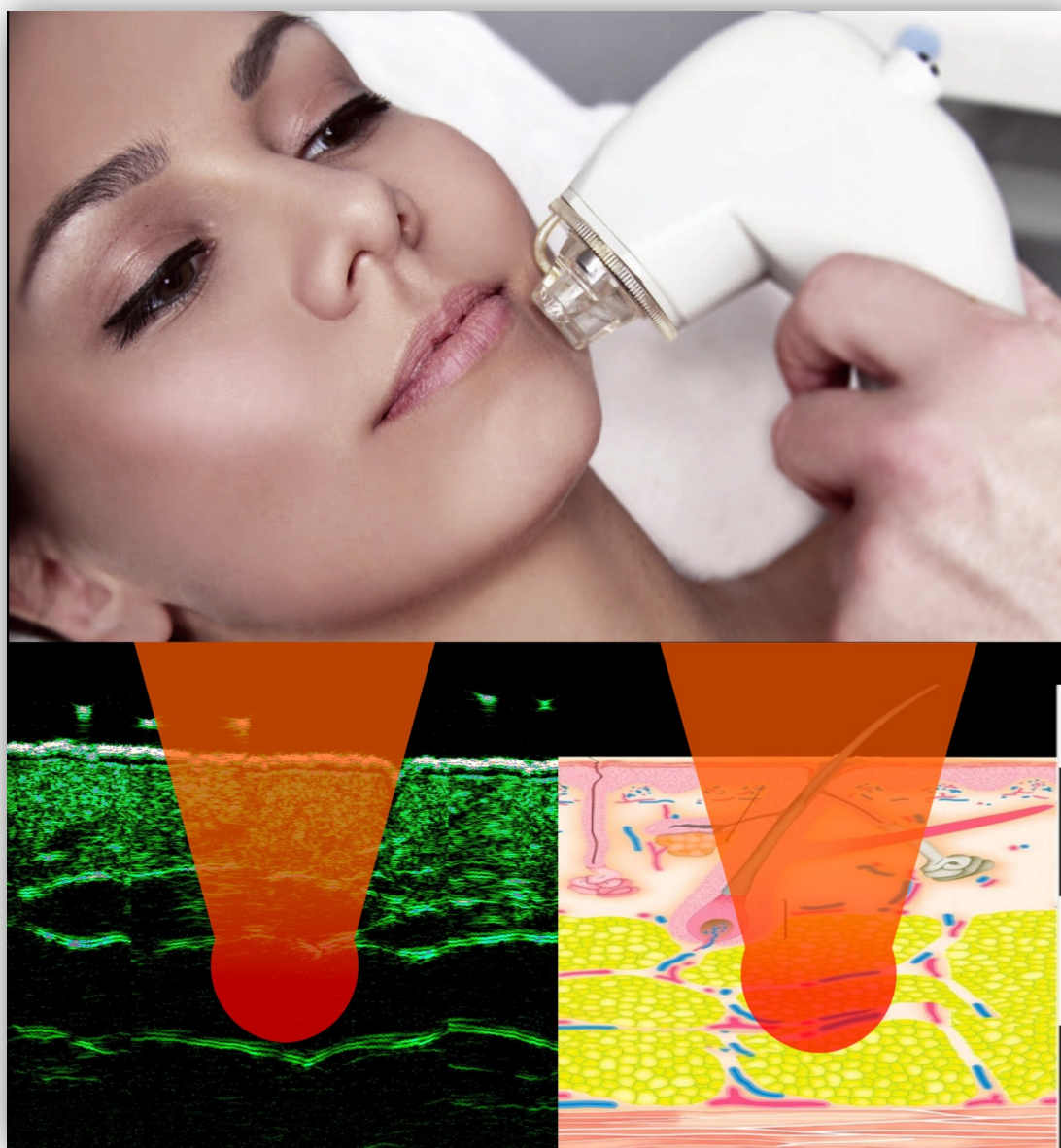
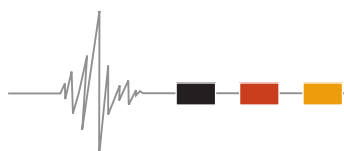


## INDIVIDUAL SKIN PARAMETERS



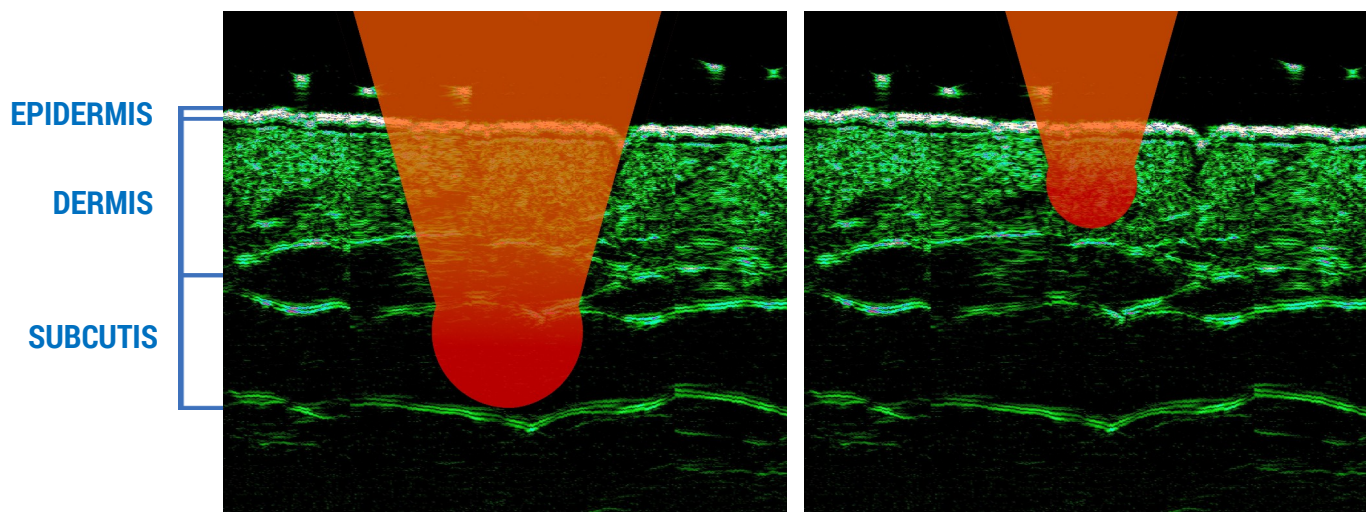
## IN HIFU AND OTHER ENERGY-BASED METHODS IN AESTHETIC MEDICINE



## USING THE SKIN-SCANNING METHOD TO EVALUATE INDIVIDUAL SKIN PARAMETERS DURING THE ENERGY BASED TREATMENT

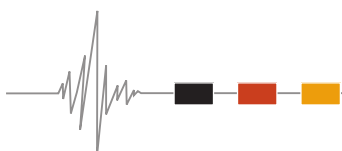
The different anatomical, age- and gender-specific characteristics of the skin require a complete diagnostic picture. In aesthetic medicine and plastic surgery, the assessment of individual skin parameters is necessary to improve the quality and safety of the procedures performed.

When using high-energy exposure methods - laser, RF (Radio Frequency), HIFU (High-Intensity Focused Ultrasound) - high-frequency ultrasound scanning is required to determine the depth of exposure to the target tissue - papillary dermis, reticular dermis, subcutaneous tissue, SMAS (Superficial Muscular Aponeurotic System). The choice of the location of the exposure points and adequate power significantly increase the effectiveness and safety of the treatment.



Targeted energy distribution, directed impact on morphological structures.

Determination of dermis thickness and assessment of the skin condition in the treated area are necessary to select the tactics for patient management and targeted treatment. This includes the evaluation and selection of the application point, the preliminary measurement of the application depth, the selection of the applicator with the required focal length and the control of the effectiveness of the procedure. The evaluation of the thickness of the skin layers also enables the selection of the most effective settings for laser systems, RF (radio-frequency) procedures and HIFU.



## HIGH INTENSITY FOCUSED ULTRASOUND (HIFU)

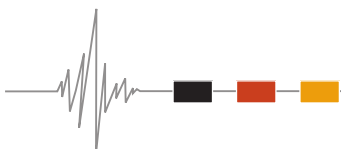
The target of HIFU (High-Intensity Focused Ultrasound) is the SMAS (Superficial Muscular Aponeurotic System). The SMAS is a continuous and organized fibrous network in the face that connects the facial muscles to the dermis. The SMAS has a three-dimensional architecture and is composed of collagen fibers, elastic fibers, fat cells, and muscle fibers [Ghassemi et al/ 2003].



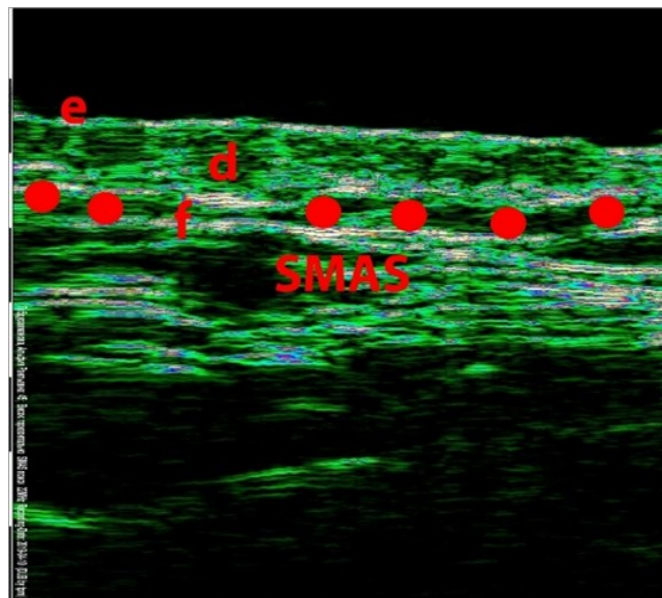
The manufacturers of HIFU systems recommend to use different transducers for corresponding anatomical zones.

**IMPORTANT: the depth of SMAS location and thickness does not always match the common preset values.**

The features of HIFU technology are directly related to the physical factor of the method and the morphofunctional properties of the skin.



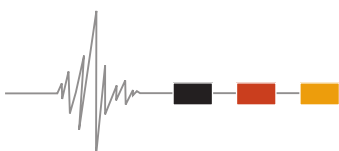
The focal depth is defined for each specific HIFU applicator. There are a number of applicators that are designed for different exposure depths. At the same time, there are restrictions on the duration of use for each applicator. The HIFU applicators are one of the most expensive items in the cost of any procedure. Therefore, its use should be accurate and targeted, i.e. when exposing the SMAS, it is necessary to use the applicator exactly for the correct depth determined during the high frequency measurement



**33 MHz scan of temporal skin, e-epidermis, d-dermis, f-superficial fascia, SMAS is located at a depth of 1.0-1.3 mm (marked with red circles).**

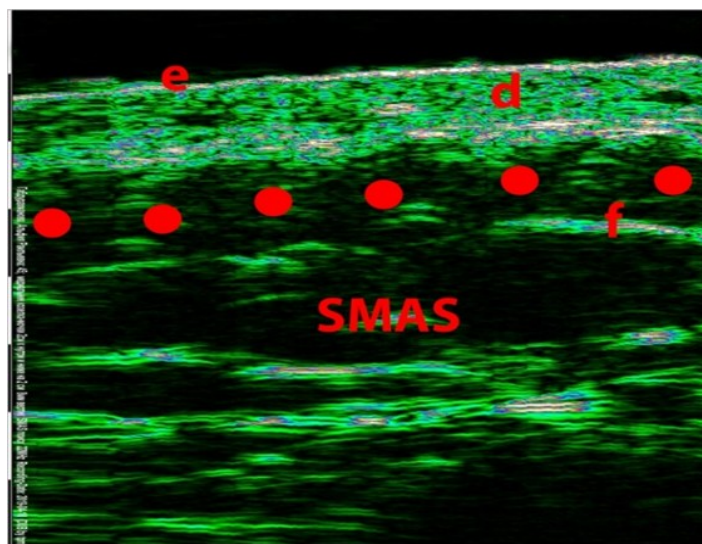
For HIFU in this area, 1.5 mm focused applicators are typically used, so the tissue impact is deeper than the SMAS location in the fascia and muscles, which can lead to burns, severe pain syndromes and lack of efficacy.

The propagation and absorption of ultrasound waves is directly related to the structural characteristics of the tissue that is penetrated by the ultrasound waves. Therefore, the degree of heating at the focal point, the so-called “thermal point”, depends not only on the radiation power, but also on the conditions of the tissue located above the impact zone and in the path of the ultrasound.





Therefore, a timely diagnosis of the skin condition and the presence of obstacles such as foreign bodies is important before the HIFU procedure. The presence of foreign bodies in the tissue (fillers, implants, complications in the form of fibrosis, etc.) located along the propagation of ultrasound waves can lead to uneven distribution of thermal energy, overheating or insufficient heating of the tissue, which can lead to complications after the HIFU procedure or a lack of effect.



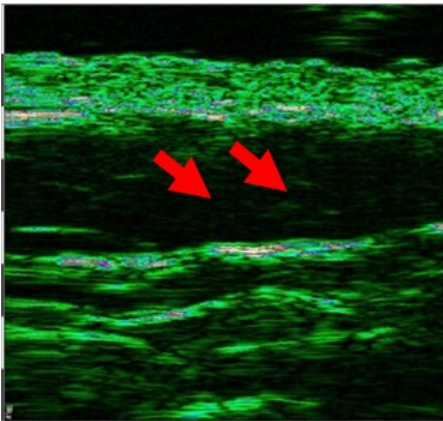
**33 MHz scan of the cheek skin in the parotid region, e-epidermis, d-dermis, f-superficial fascia, SMAS is located at a depth of 1.4 to 2.5 mm (marked with red circles).**

For HIFU in this area, 3.0-4.0 mm focused applicators are generally used, as the effect is directed at deeper tissue, as in the previous case, which can lead to similar complications.

Prior measurement of skin thickness is a necessary part of the patient's diagnosis before HIFU. A decrease in skin thickness (dermis) is often the result of a decrease in cell activity (synthesis of collagen, elastin, etc.), which may be associated with a systemic violation of the body's regulatory function (genetic, age-related, hormonal disorders), which leads to a significant decrease in the effectiveness of the procedure.

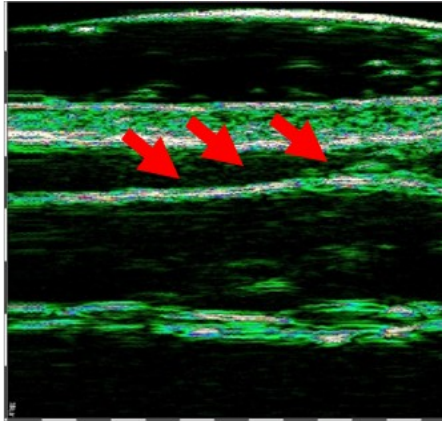
**Examples of high-frequency ultrasound visualization and depth measurement of SMAS**

4-5 mm



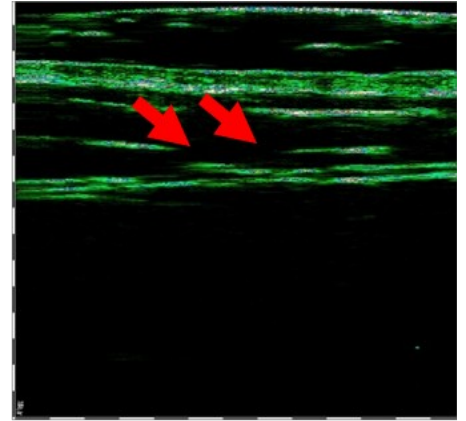
NECK, BORDER WITH LOWER JAW

1.5-2 mm



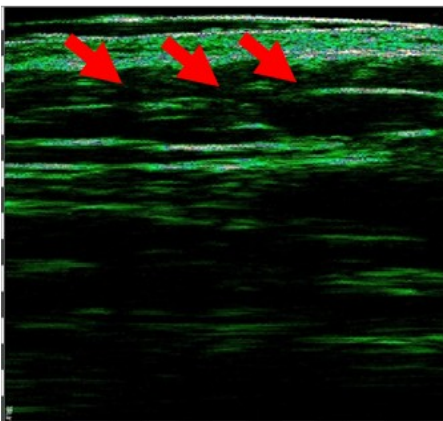
LOWER JAW, EDGE

2 -2.5 mm



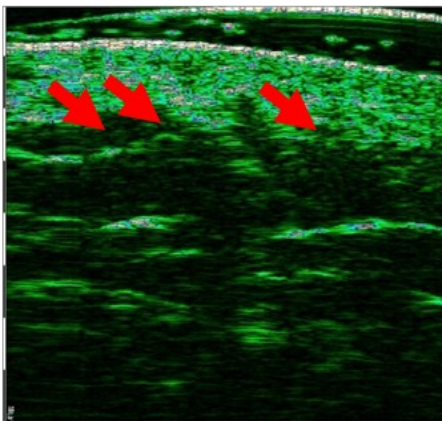
THE LOWER JAW, MIDDLE

3.5-4 mm



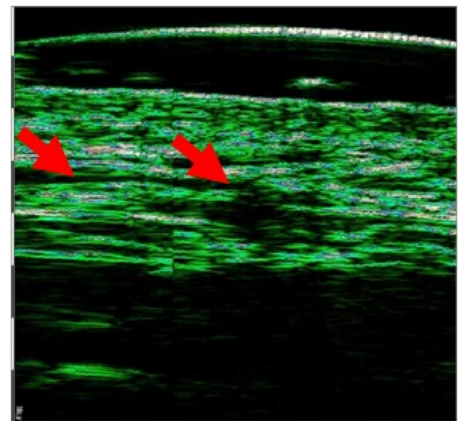
2 CM MEDIAL TO THE AURICLE

2.5-3.5 mm

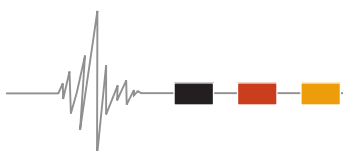


CHEEK

1.5 - 2 mm

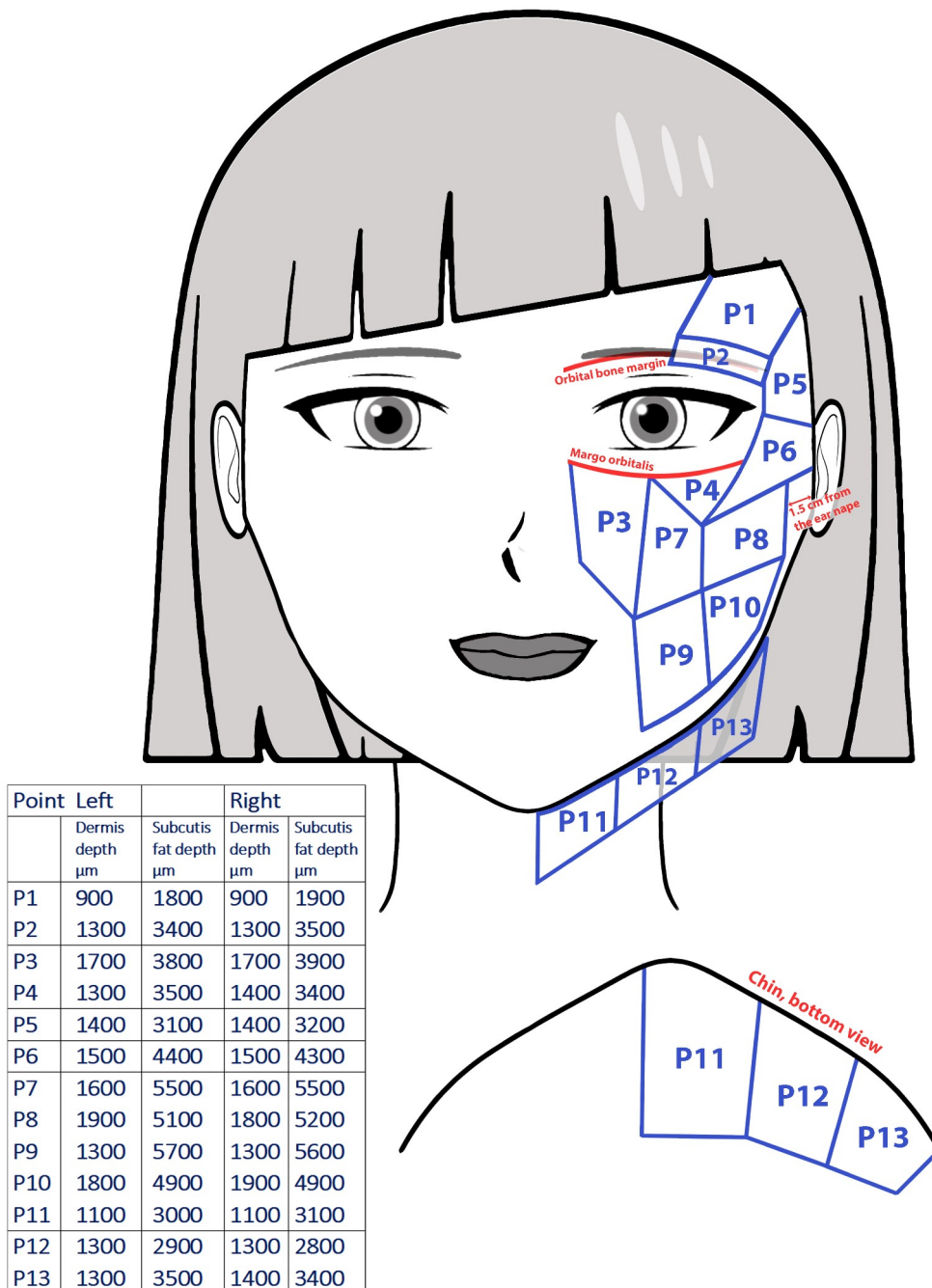


TEMPORAL REGION

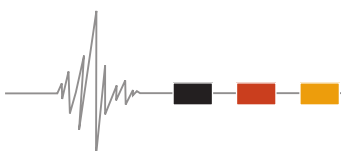


## HOW TO MEASURE THE SMAS DEPTH BEFORE THE HIFU PROCEDURE

The patient`s face should be marked into the following zones:



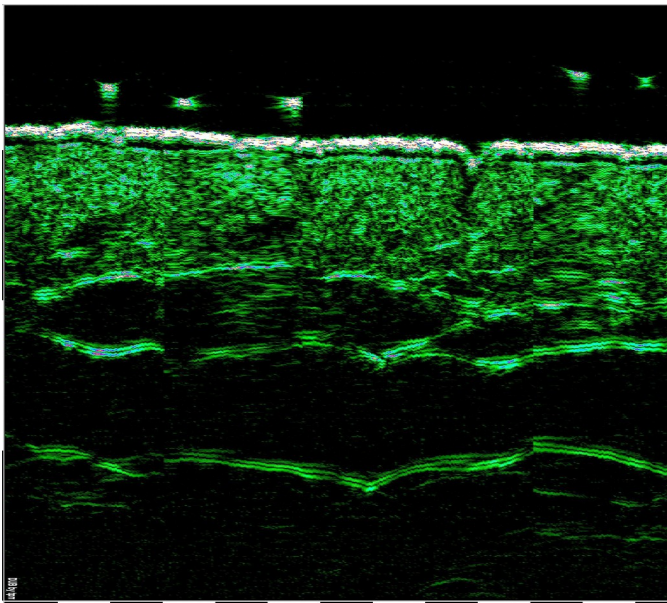
Measure the depth of the dermis and hypodermis and fill in the table as shown in the example. Then select the HIFU transducer with a focal length that lies between these two values - separately for each exposure zone.



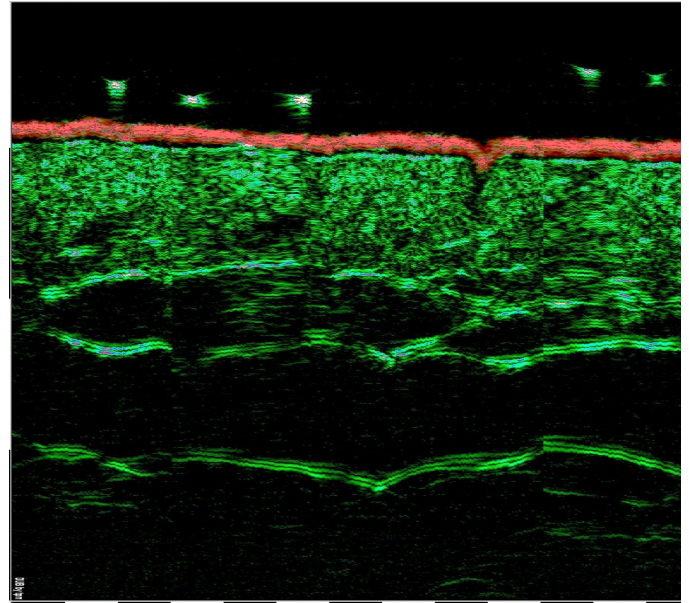


## RF-LIFTING PROCEDURES

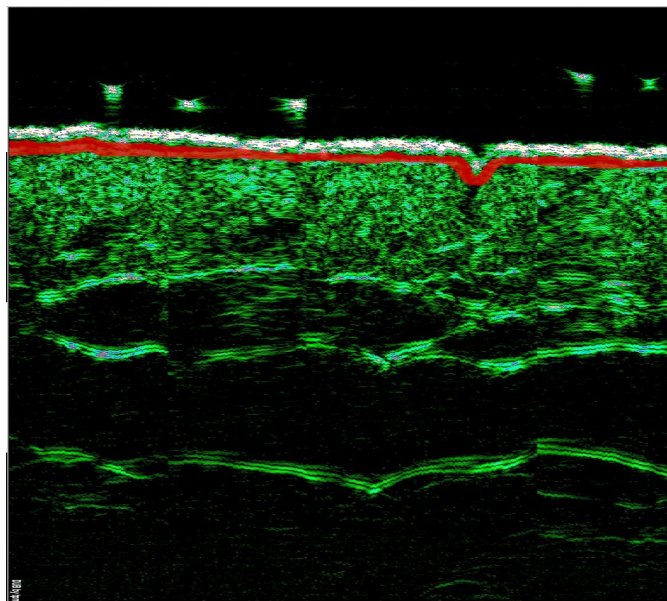
Similar errors can occur with Radio Frequency lifting, with such targets as the papillary dermis, reticular dermis, and SMAS.



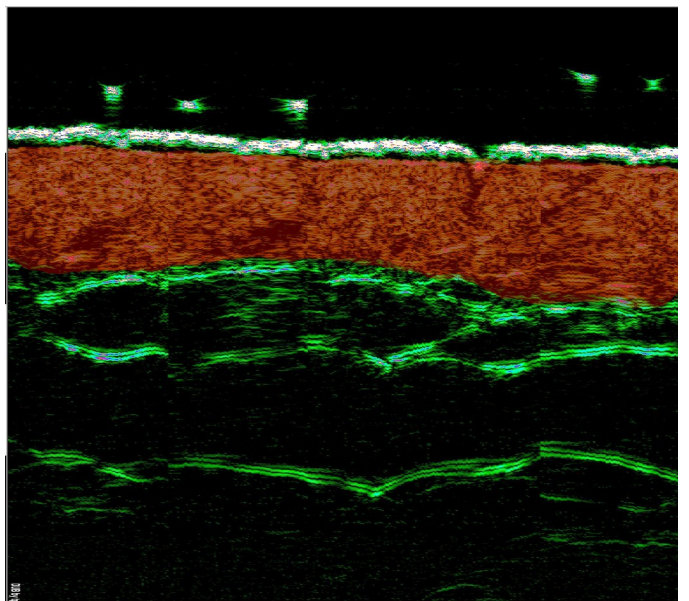
Normal skin



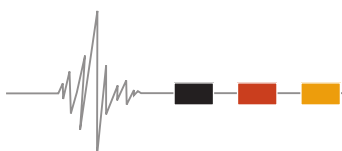
Epidermis



Papillary dermis



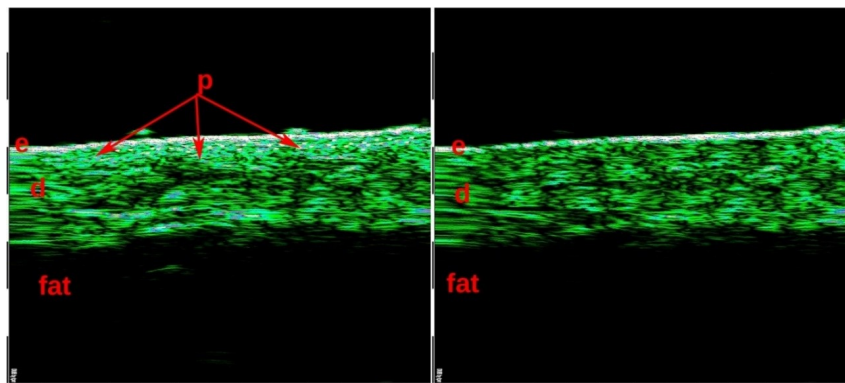
Linear dermis





## LASER TREATMENT PROCEDURES

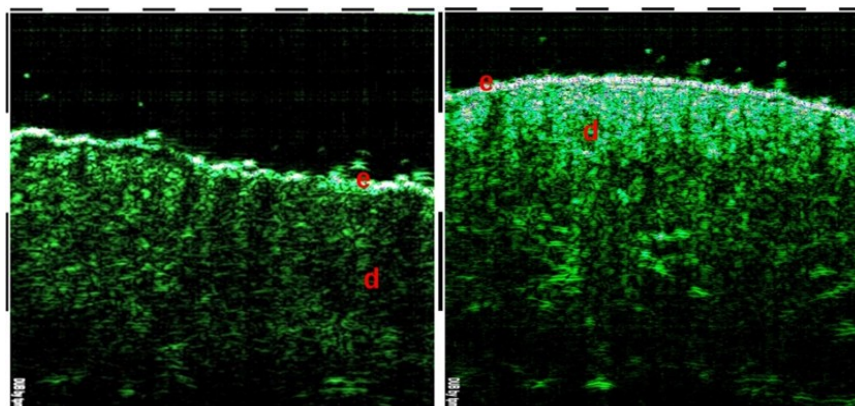
When removing tattoos, nevi or other unwanted objects with the laser, it is important to know the depth and distribution of the pigment. According to the high-frequency ultrasound examination, the pigment is located in the papillary dermis at a depth of 100 to 350 micrometers. This information should be used to determine the depth and intensity of laser exposure when removing tattoos, for example.



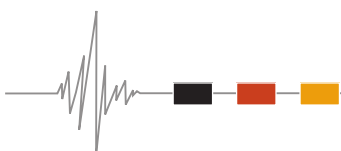
**22 MHz sonogram of tattooed skin, left sonogram is tattoo, right is a control sonogram of unaltered skin.**

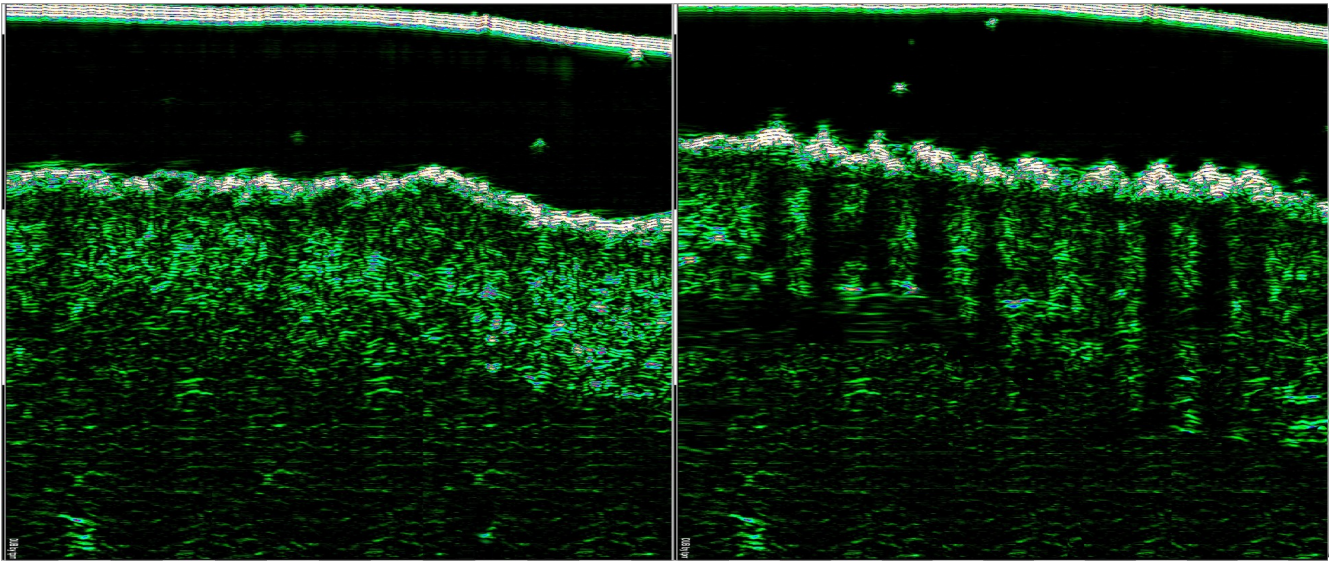
In the figure: e - epidermis, d - dermis, fat - subcutaneous tissue, p - hyperechogenic pigment particles located in the upper parts of the dermis are indicated by arrows.

The fractionated lasers used in aesthetic medicine also require precise exposure. The use of high-frequency ultrasound not only makes it possible to measure the individual skin parameters before the procedure, but also to display the results of the procedure.



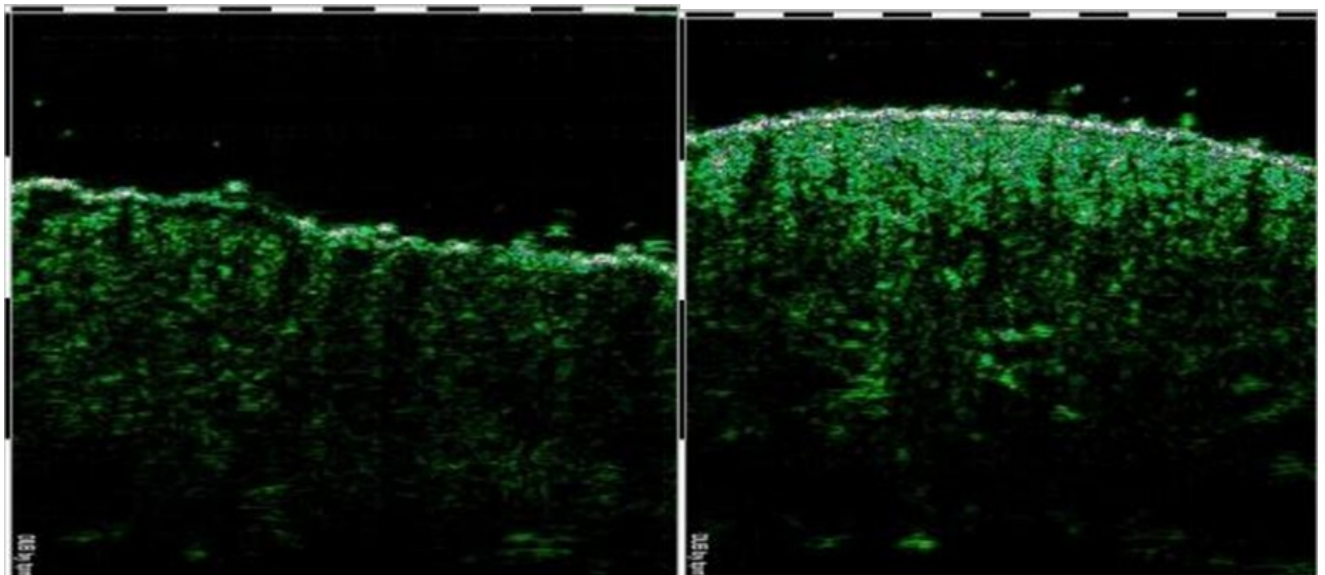
**75 MHz sonogram - forehead skin of a 52 year-old female patient before and 12 months after two sessions of fractional photothermolysis treatments. In the figure: e- epidermis, d- dermis.**





Fractional laser photothermolysis with CO2 laser

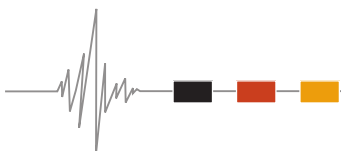
On the left is an ultrasound image of the skin before treatment, on the right - immediately after exposure, within a few seconds. The thermal damage to the epidermis and dermis is visualized in the form of columns.



Fractional laser photothermolysis with CO2 laser

### **Skin condition after 2 sessions in 2 months**

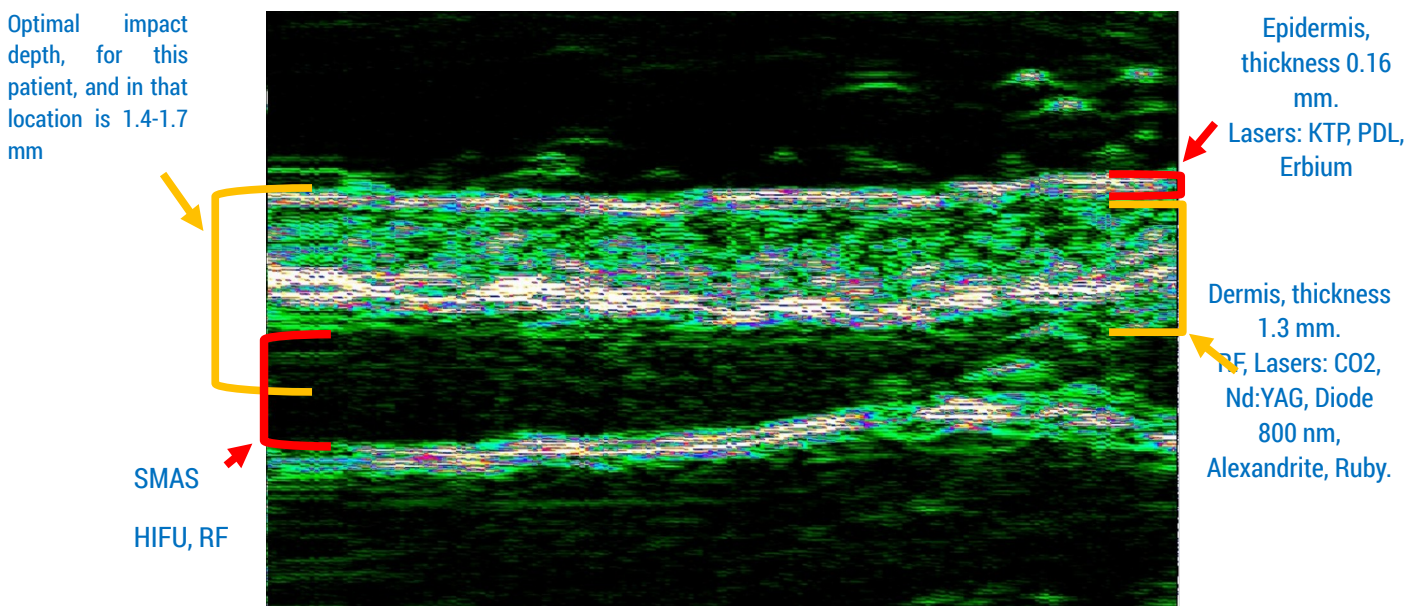
After two fractional CO2 laser interventions, a clear thickening and increase in the acoustic density of the dermis as well as an increase in the thickness and alignment of the outer contour of the epidermis is visible.



High-frequency ultrasound imaging prior to performing high-energy procedures based on the application of physical factors enables accurate determination of the depth, location and condition of the target tissue, including the epidermis, papillary and reticular dermis, subcutaneous tissue, fascia and SMAS.

**IMPORTANT:**

Accurate measurement of the patient's individual skin parameters is necessary for the development of personalized treatment programs using high-energy methods and to improve the efficacy and safety of these procedures.



The use of high-frequency ultrasound examinations is important not only for prescribing and performing the treatment, but also for assessing the dynamics of the condition after the procedure and the timely detection of complications.

