

a look at ultrasonic machines and esthetics

If a skin care device sounds too good to be true—chances are highly likely it is. Estheticians beware!

All one has to do is attend a trade show, open the back pages of one of our professional magazines or search the Internet to find a myriad of skin care devices based on the use and application of sound waves, for home or professional use, which promise untold benefits. Who of us can say we have not been tempted by the claims of extraordinary, magical results coupled with mega profits?

But, how do we really know what works and what doesn't with ultrasound machines? How can we determine who to buy from and who do we believe on the claims?

Types of ultrasound

There are two major types of ultrasound (US) technology used in skin care devices: high frequency and low frequency. Rest assured there is a world of difference in the application and effectiveness of each as related to skin care. No matter what the level of ultrasound used, it is not a panacea in our industry. There are more outlandish and unsubstantiated claims than one could imagine. For example, a quick Internet search revealed the following description of an ultrasound machine from Asia for sale in the United States: "Multifunction Ultrasonic Body and Skin Care Machine with the following features—smooths wrinkles, cleans freckles and pouches under the eyes, cleans the skin and promotes weight loss." One manufacturer claims its machine can perform a nonsurgical facelift with ultrasound that "yields great results." ➔

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Measuring success

BEFORE DELVING into the science behind ultrasound, I need to explain hertz, the measurement unit used to gauge the strength of sound waves named after the German physicist Heinrich Hertz.

A hertz is a measurement of cycles per second; 1 hertz is one cycle per second; 100 hertz is 100 cycles per second; 1 kilohertz (kHz) is 1,000 cycles per second; and 1,000,000 cycles per second is a megahertz (MHz).

The more cycles, the faster the sound travels. The more time between cycles, the slower the waves travel. The faster the cycles (e.g., MHz) the closer the waves are to each other. This fact is critical, according to university scientists, for the application and effectiveness of ultrasound in skin care.

—R.T. and C.T.

There are many such devices on the market, many from China and Korea, promising similar results. Prices range from several hundred dollars to more than \$10,000. Can these claims be true? If one studies the science behind the use of ultrasound in our field, the answer is a resounding “no” for most manufacturers’ assertions.

How ultrasound works

Ultrasound (US), sound at a frequency greater than can be heard by humans, is also referred to as *sonophoresis*. Low frequency is generally referred to as under 120 kilohertz (kHz) while over that is called high frequency. Most machines sold to skin care professionals are in the range of between 1 megahertz and 3 megahertz (MHz) or high frequency.

Science behind ultrasound

Some of the most notable studies on the effects of ultrasound were conducted at the Massachusetts Institute of Technology (MIT), the University of California, Santa Barbara and Ben Gurion University. This research found that low-frequency US (20 to 100 kHz) yielded better penetration than higher levels. Researchers showed that low-frequency US produced the transport of molecules through the stratum corneum from the direct mechanical impact of gas bubbles collapsing on the skin surface, causing micro jets and shock waves that propel products.

Several faculty members at the University of Geneva also confirmed that low-frequency US allowed, for a time, the transport of molecules through the intercellular lipid bilayers found in the stratum corneum while the thermal or heating effects from high-frequency US were not nearly as effective. The higher the frequency, the more heat generated, the less effective the transport of products, and the less there is any mechanical reaction. Also, in improperly designed machines, heat and excessively high frequencies may cause bleeding and infection as the skin barrier can be compromised.

One of the pioneers of the use of ultrasound in professional skin care is Dr. Des Fernandes, founder and chief medical director of Environ Skin Care. Using his own body of research and building on the work of others, he found that sonophoresis at prescribed levels will allow the passage of appropriately formulated skin care products through the stratum corneum.

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Before purchasing an ultrasound device, be clear on what you want it to do. Different types of ultrasound are used depending on the treatment goals.

Combining US with pulsed iontophoresis (the use of electrical current to facilitate greater penetration of vitamins into the skin), Dr. Fernandes patented a new device, the DF Machine. This device is designed to increase the penetration of products by 40 times in comparison to simple topical applications. Dr. Fernandes produced the first machine on the market based on low-frequency US. There are now others being marketed in the United States but none that combine US and pulsed iontophoresis.

Alan Bunting, president of DermaWave, an authority on ultrasound, describes three basic frequencies in the higher range used in many skin care devices. He has found that 1Mhz will penetrate 40mm into tissue, which is too deep for the face. Three MHz will penetrate 3 to 5mm, which is too shallow. Two MHz frequency is considered ideal for the face because it penetrates about 11mm.

The shape of the ultrasound beam is critical to achieving beneficial effects in the form of increased blood circulation. Focused ultrasound beams are a characteristic of most devices available. Focused ultrasound is cheap to make but offers a very small, pinpoint treatment area so treatments are totally ineffective and take a long time to perform correctly. Collimated beams have a parallel treatment beam close to the size of the applicator or sound head. This means a much larger area of tissue is treated in a much shorter time frame.

Bunting believes that for ultrasound to be effective, the temperature of the blood must be elevated by at least 9 degrees Fahrenheit to improve circulation. When the temperature of blood is elevated, the body's self-regulatory mechanism must cool the blood to normal temperature. To do this, more blood must be brought to the area. More blood equals fibroblast activity, which is the direct initiator of collagen deposition.

Bunting's findings point out that the quality of the ultrasound head design is also a critical factor in the selection of a device that actually works. Most cheap ultrasound machines have an inconsistent temperature gradient across the surface of the sound head. In some cases, the center part of the sound head, which is supposed to be the warmest, is actually the coldest, which diminishes efficacy.

According to physician researchers, the heating effects of high-frequency US are important

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Before purchasing a machine, find out if you'll have fair marketing support. Ask if collateral materials are provided by the manufacturer. If so, do you have to pay for them?

while the mechanical effects of low-frequency US are vital to its effectiveness. These researchers found that low-frequency US produces acoustic cavitation, the nucleation and pulsation of bubbles. Researchers have also discovered that low-frequency US produces acoustic radiation that results in pressure and torque that can be used to increase the permeability of cell walls. In simple terms, low-frequency US can be used to push products deeper into the skin by creating micro-channels. This does not happen in the same way with all high-frequency US (over 1 MHz) found in machines marketed to skin care professionals. In high-frequency US and in some devices that use sound to vibrate a blade, the blade can get hot and cause client discomfort, possible thinning of the skin, and not allow for the necessary contact-time on the skin for the probe to generate sufficient cavitation because of client discomfort associated with heat. The use of sound at 2 MHz, did not cause the same, potentially problematic actions, says Bunting.

Before you buy

Before purchasing an ultrasound device, be clear on what you want it to do. Decide on what the goals and objectives of your treatment are. If you are only concerned about skin cleaning, modest removal of debris or creating a source of heat, one type of US may be right for you. If your objective is to increase the penetration of active ingredients, another might be more appropriate.

Before conducting your research, also keep in mind your basic training. The skin is the body's first line of defense—it protects us against infection, ever increasing environmental damage, toxic substances and loss of water. It is also constructed to prevent chemicals from entering our body. We must be extraordinarily careful in damaging, thinning or removing skin. The same must be said about trying to increase the penetration of products. Be doubly sure of whatever you are using with ultrasound. Are the products protected from oxidation or contamination? Are they stored in open containers? Were they subject to human contact and resulting, potential bacterial contamination? Only use products specially designed for use with US.

Also, it is critically important to ask questions, of the manufacturer or vendor, about customer service. Below, please find examples of questions that you have every right to ask and that a reputable vendor will gladly answer before they sell you a device.

- What guarantee and warranty are provided with purchase?
- How long has the company been in the skin care business?
- What training is provided and how frequently (on site, regional classes, a manual)? As my staff changes (all of us know this is a fact of our profession) is training provided equal to that first offered when I purchased the machine?
- Are the indications and contraindications on the machine's use clearly spelled out?
- Does the device come with a satisfaction, money-back guarantee?
- Does the company provide a reference list of licensed skin care professionals or physicians using the device?
- Are clinical studies available supporting the device's efficacy?
- If there are studies, can they be supported by independent sources?

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Low-frequency ultrasound is a valuable tool in enhancing the efficacy of professional skin care treatments. But make sure you choose a machine, manufacturer and vendor after careful research.

- In the event of a breakdown, is a loaner device sent, at no charge, within 24 hours?
- Where is the service department and technical support located?
- Does the company send the replacement device free of charge plus include a return label for the repair of your machine?
- Does the vendor have liability insurance and what is the amount?

Marketing support

While the technology is the most important thing, it is vital to know about the company you are buying from, in addition, it is vital to know about the marketing support offered.

- Are collateral materials provided? If so, do you have to pay for them? Is the cost fair and reasonable?
- Does the vendor provide brochures for clients and your business' waiting area? Are they up to your standards (printing, language, realistic claims, and image)?
- Are before and after pictures supplied?
- Are ad slicks, client postcards, posters, display cards and newsletters available to you?
- Overall, what is offered to you to help educate your clients on the benefits as well as risks (if any) associated with the device in question?
- In the event of client dissatisfaction, will the vendor stand by you?

Sanitizing

Another point critical to estheticians is the possibility of infection and cross-infection from the ultrasound probe and gels used, in the case of any tears or openings, no matter how small, that can be found on the skin. Researchers have found that US probes must be thoroughly cleaned with alcohol or appropriate disinfectant after and before each use and gels must be carefully stored and not re-used to avoid contamination. There is actually a greater chance of infection from the gel used than the probe itself. In addition, the area where the probe is placed must also be thoroughly cleaned.

The bottom line

The National Coalition of Estheticians, Manufacturers/Distributors and Associations (NCEA) was ahead of its time, issuing in 2003 an advisory notice on the issue of ultrasound use by skin care professionals. The association raised three areas of concern: the increase in the illegal importation of noncertified, re-labeled equipment; the increase in potentially false and/or misleading outcome claims from suppliers; and the usage of ultrasound equipment for phonophoresis treatments, which may contravene FDA guidelines and be out of the scope of practices for estheticians. The NCEA's points are as pertinent today, if not more so, than in 2003.

In conclusion, low-frequency US is a valuable tool in enhancing the efficacy of professional skin care treatments. If you are considering purchasing a machine, first establish realistic goals and expectations for your practice and your clients. Second, choose a machine, manufacturer and vendor after careful research. Finally, make sure you are provided substantial documentation on the science behind the device, information to support any claims made, along with education and training (hands-on and theory) that allow you to educate your clients and yourself while offering a valuable service. **LNE**

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