



Approved Provider

CE Activity provided by:

**National Coalition of Estheticians,
Manufacturers/Distributors & Associations (NCEA)**

**ESTHETIC TECHNOLOGIES
RF/ULTRASOUND/MICROCURRENT**

INSTRUCTIONS

1. To reinforce your learning and retain the information, highlight or underline the answers to each of the (30) Study Objectives.
2. Take the Three (3) Self-Assessment Tests, and then attach the tests to the CE Registration Form. Total test scores must be 75% or higher in order to obtain your CE Certificate.
3. Complete the CE Registration (Section A) and Course Evaluation (Section B).
4. Section C - Enclose a check or money order payable to NCEA:
NCEA Member Price: \$44.95 *Non Member Price: \$64.95*
5. Mail completed CE Registration Form, payment, & three tests to:
NCEA CE Program, 484 Spring Avenue, Ridgewood, NJ 07450-4624.

GENERAL PURPOSE STATEMENT

To provide the skin care professional with a review of Esthetic Technologies. The COA has approved this activity for 4 CEs and is good through January 1st, 2019.

LEARNING OBJECTIVES

After completing this interactive esthetic technologies CE activity, the skin care professional will be able to:

1. Evaluate the role of RF vs Lasers and their applications.
2. Describe RF/Ultrasound/Microcurrent procedures for cosmetic and medical indications.
3. Understand scope of practice and required knowledge to use these devices.
4. Summarize the indications/contraindications of applying these technologies.

**ESTHETIC TECHNOLOGIES
RF/ULTRASOUND/MICROCURRENT**

Section A – CE Registration:

PRINT CLEARLY (Illegible forms will not be processed)

Name: _____

Address: _____

City: _____ State: _____ Zip: _____ + _____

Tel: _____ Fax: _____

Email: _____

*Delivery Method used to send CE Certificate

Are you NCEA Certified? ___Yes___ No If yes, NCEA Certified# _____

License# _____ State of Issue _____

Type of License:

Esthetician ___ Cosmetologist ___ Teacher ___ Medical Professional ___

Other ___ Please specify: _____

Section B – Course Evaluation:

1. Did this CE activity's learning objective relate to its general purpose? ___Yes ___No

2. Was the interactive format an effective way to present this material? ___Yes ___No

3. Was the content relevant to your skin care practice? ___Yes ___No

4. What type of setting do you currently work in? _____

5. How long in minutes did it take you to read the article _____, study the material _____, and take the self-assessment tests _____?

6. Suggestions for future topics _____

Section C – Payments and Discounts:

**The fee for this CE Activity for NCEA Members: 44.95 Non Members: \$64.95
(Check or money order payable to NCEA)**

*We offer special discounts for 6 or more CE Activities that are for institutional use.

Call (201) 670-4100 Ext 5, for visit www.NCEA.tv more information.

Jean, Trisha, and Bob were excited to be attending a skin care trade show so they could evaluate some of the new technologies for face and body treatments. Jean was NCEA Certified and preparing to recertify, so she was looking at taking classes that had been nationally COA-Approved education. She shared her experience with Trisha and Bob regarding the importance of being part of NCEA and attaining the national certification credential. They entered the tradeshow exhibit area and stopped to plan their day.

"I want to learn more about so many devices including something they call radio frequency (RF)," remarked Jean. "My friend works in a medical practice with Dr. Smith where they do a procedure called "Thermage®." I believe it uses radio frequency (RF) but I don't really know how it works or how it affects the skin." I also am going to visit a vendor who has a new device that I heard of that uses RF combined with light emitting diodes (LEDs) for body contouring. Perhaps we can get more information on that as well," she told her friends.

"I really don't understand what it does or how it effects the skin, and I want to be sure that I can find training in order to use the device correctly," echoed Trisha. "Bob, do you know anything about it?"

"No not really," answered Bob. "As a matter of fact I listened to a lecture not too long ago regarding microcurrent for face and body contouring. I saw some great before and after photographs."

"In school we saw a demonstration of a microcurrent machine so I have some idea of how it works but certainly need to learn more before I can use it safely. We also had a vendor show us the ultrasonic paddle device for skin cleaning."

"Well I guess we have a lot of education and research to do," said Jean. "There are just so many advances in esthetic technologies so it is important that we understand them. Plus I don't feel comfortable using something about which I have little knowledge. I'm not even sure if some of these devices are within our scope of practice as a licensed esthetician in our state."

Jean, Trisha and Bob spent the day attending manufacturer classes and took the time asking questions on the trade room floor. Using the NCEA Equipment Evaluation Form as a guide, they gathered as much information as possible. When they met after the show they realized that they needed to do more homework and to find additional information.

- What challenges will you have regarding fully understanding the science behind these technologies?
- Do you understand the affect they will have on the skin tissue?
- What more do you need to know when selecting a treatment for a client?

Overview of Esthetic Technologies

The world of esthetic technologies has broadened during the past several years with the introduction of innovative and non-surgical devices that offer cosmetic improvements to the face and body. The level of use for each modality may vary depending upon its purpose, degree of intrusiveness, and the environment in which it is being performed. Many devices are used in both medical and skin care settings.

Newer advanced technologies elicit the need for a higher level of knowledge when it comes to the science of the skin, the nature of skin conditions and the tissue responses that occur during their use. Electrical esthetic devices also require at least a core understanding of electricity and the realization that the skin is also electromagnetic meaning that it generates its own electricity and polarities through a chemical electric process. The body is its own body electric. The entire nervous system, the muscles, and the cell membranes are all activated and operate by an internal electrical voltage called microcurrent. An electrical grid of nerve fibers extends from the spinal column bringing electrical impulses to all cells and organs in the body.

The heart muscle has an internal pumping system with its own internal microcurrent generator that controls its rate and rhythm and sends signals from the top to the bottom coordinating all heart cell activity. The contraction of its upper chambers (ventricles) pumps into the two lower ventricles.

Topical application of an external electrical device influences the physiology and biology of the skin, no matter how minimum the treatment. Cells, tissue and muscles may be activated or stimulated through the use of them. For example, a TENS device (transcutaneous electrical nerve stimulation) will modulate a low intensity or frequency through the skin for alleviating musculoskeletal pain.

Some devices create a thermal effect such as with a non-ablative laser/intense pulsed light (IPL) or create more of a warming effect as experienced with radio frequency (RF). Others may work through a system of polarity such as with

Study Objectives

Highlight/underline the answers to the following questions as you read:

1. What does “body electric” mean??
2. How do external application of an electrical devices influence the skin?
3. What is the first step prior to beginning any skin management program?
4. What is radio frequency?
5. What is the endothermic response?
6. What is the difference between CRF and PRF?
7. What is meant by collagen denaturation?
8. What are the effects of RF?
9. What are the areas for the application of RF?
10. What is the difference between RF and a LASER?
11. What is meant by “bulk heating”?
12. What are the contraindications for RF?

your galvanic device or with the slight buzzing, tingling sensation of a high frequency electrode. Moreover different procedures may present minimum to no sensation with the exception of the movement of the hand piece across the skin, i.e., microcurrent.

Photodynamic therapies such as light emitting diodes (LEDs) also present biological responses that non-invasively support cosmetic skin improvement. The range of most LED devices for the intended use of beautifying & stimulating the skin are 410 nm – 945 nm. (nm = nanometers) They can also be used for pain management and tissue healing.

As a NCEA Certified professional it is our responsibility to remain current with procedures and education in order to understand new devices and their application. Furthermore a scientific approach to skin assessment is also fundamental to the outcome of a treatment choice. Prior to beginning any skin management program, it is appropriate to follow a pathway of analysis that creates detailed parameters of your client's health profile. This includes past history, risk factors and probability of success during your esthetic care. The evaluation of risk factors ensures that you are making reliable choices for treatment, based on the information supplied to you by the client and your knowledge found during a skin evaluation.

The NCEA Commission on Accreditation (COA) was formed to facilitate and supervise the continuing education requirements of the skin care professional for recertification and/or relicensure. There

are already several topics that are covered on the continuing education page on the NCEA websites.

The introduction of non-ablative lasers and IPL devices has also brought about a selection of services including hair reduction and skin rejuvenation.

PART 1

RADIO FREQUENCY

History

Physicist and Nobel Price winner, *Guglielmo Marconi* (1874-1937) discovered a way to manipulate and exploit radio frequency energy. He experimented with signals that could be sent long distance through the air and named it wireless telegraphy and radio transmission. He also invented a microwave radio beacon for ship navigation.

Both British scientist, *Michael Faraday* and American *Joseph Henry* developed the theory of inductance noting that electrical current flowing through one wire could create (induce) a current to flow in a separate wire.

Radio Frequency Spectrum

Radio frequency (RF) refers to the number of electromagnetic waves per second within the radio wave portion of the electromagnetic spectrum. Moving at the speed of light, RF wavelengths can range from 1 millimeter to 100 kilometers (.62 to 62 miles) with a frequency range of 3 kHz to 300 GHz. RF energy treatment uses electromagnetic waves that oscillate 5 million times a second.

RF in Medicine

Conventional continuous radiofrequency (CRF) is a high-frequency alternating current that creates coagulative necrosis (destruction) to target tissue. Tissue destruction occurs with a probe temperature between 60° and 80° C. It has been used in medicine as an ablative surgical tool for hemostasis and tissue ablation. For example it may be used in the treatment of heart conditions such as atrio ventricular (AV) reentrant tachycardia or for the removal of tumors.

Since the 1970s, pulsed radiofrequency (PRF) has been applied therapeutically for pain control. PRF is able to deliver treatment successfully without the tissue destruction that normally occurs with CRF. The mechanism by which pain is controlled by PRF is not always fully understood. Many researches conclude that it may involve a temperature-independent pathway mediated by a changing electrical field.

PRF has been applied to alleviate lower back pain generating heat around the nerve that destroys the nerve signal to the brain. In manufactured devices, RF is a high-frequency current produced by a generator that passes from the electrode to the grounding pad through the body tissues to complete the circuit.

Esthetic applications – How does RF work?

In more recent years, RF has been introduced into the esthetic arena to support shrinking and tightening of tissue through a mechanism of collagen denaturation (controlled wounding). When RF is applied to tissue, the rapid oscillation of

electromagnetic energy causes movement of charged particles through the tissue. Known as an endothermic process, this molecular motion is absorbed as heat in the surrounding internal tissue. The skin acts as an electrical current resister.

As previously discussed, a method of pulsed RF (PRF) is used to reduce excessive heating of tissue thus less destructive than the traditional thermal RF (CRF) used in more ablative procedures. PRF may be used in cellulite body treatments for beneficial effects on adipose-connective structures for overall improvement.

Collagen Remodeling

We are discussing radio frequency in this section, however, be mindful that the following discussion applies to a general understanding of what occurs when remodeling collagen. The degree will vary depending upon the device and treatment goal. The focus is for you to visualize how temperature affects the denaturing process. Table 1 illustrates this process.

The Denaturing Process

Collagen molecules are produced in fibroblasts, the cells in the dermis that manufacture collagen, elastin, and ground substance–Glycosaminoglycans: hyaluronic acid, proteoglycans, and glycoproteins. Fibroblasts make collagen by creating three polypeptide chains that wrap around one another forming a triple helix. When RF is applied to the skin, dermal collagen is heated producing a denaturing of the triple helix. The cross links become broken causing it to go into a gel-like state also

known as “denaturation.” The cumulative affects of unwinding the links of the triple helix cause a wound response and subsequent tissue remodeling by the formation of new collagen. The exact heat-induced behavior of connective tissue and the result of tissue shrinking are dependent upon several factors.

1. The degree of temperature created within the tissue.
2. Amount of exposure time.
3. The hydration level in the tissue.

How Temperature Affects Collagen

Temperature influences the level or degree by which collagen becomes denatured. Depending upon the goal of a treatment, each manufacturer calibrates and programs their device to deliver a precise amount of thermal energy in order to create collagen denaturation (controlled wounding). Heat delivery and degree of depth may vary depending upon the device. Heat variables may be considered sub optimal to destructive, each influencing the rate of neo-collagenesis (collagen contraction and denaturation). Table 1 illustrates the affect of graduated temperatures on collagen tissue. Table 2 shows comparative samples of thermal effect for RF, ultrasound, and laser.

Table 1 - Temperature effects on collagen tissue

	Normal Body/Skin	Sub-Optimal Neo-Collagenesis to	Ablative – CO2 Laser
Celsius	35° - 37° C	40° –to– 60°C	70°C
Fahrenheit	(98.6°F)	(104°F) (140°F)	(158°F)

Table 2 - Comparative samples of thermal effect

	RF-Radio Frequency	Ultrasound for tissue remodeling	Laser (non-ablative) fractional
Temperature	Temperature >40° C - 55°C - Suboptimal heating - neocollagenesis	Optimal Collagen Denaturation 60-70°C - Optimum	Resurfacing destroys epidermis 100° C; vaporization and coagulation
Depth	>3mm; varies dependent upon the device and targeted area	Variable Settings 1.55 mm 3 mm 4.55mm (fat/connective tissues to fascia)	,1.5mm; Epidermal
Precision	Bulk Heating Preserves the epidermis	Precise & Fractional – microfocused Preserves the epidermis	Precise & Fractional – Interrupts epidermis

The Use of RF in Esthetic Applications

Earlier generation RF devices had a tendency to be painful with a greater possibility for adverse effects such as fat necrosis (cell destruction) and tissue arcing leading to scar formation. Included in this mix was edema, swelling erythema and scabbing that has now been eliminated with newer technologies. The current RF devices are more comfortable with updated hand pieces and tips, modified algorithms and technology that allow for greater comfort, treatment flexibility and better results. It is reported that there is less of a risk of burns and skin damage with the use of multi-polar devices. Technique is essential. Moreover an overall health assessment and risk factor for each client is fundamental prior to setting up a treatment program.

Each manufacturer's device is treatment specific and must be applied according to directives put forth for its use. Many devices have more than one built-in modality with the capability of customizing each program. Operators of RF devices must be trained and certified and work within the scope of their licensing.

Areas of Application

When applied to the body for the treatment of the appearance of cellulite, the non-ionizing emission of electromagnetic waves of RF may help create a positive restorative effect on the lymphatic system, adipose and connective structures.

RF may be used to remodel several areas of the body.

- Thighs
- Arms
- Abdominal circumference
- Cellulite appearance and the stim-

ulation of fat metabolism. Note that cellulite is an inflammation of the subcutaneous adipose tissue (fat cells) and has several causes including hormones. There is lengthening and weakening of the connective tissue.

- Sagging skin
- Face wrinkles and fine lines

Effects on the face may include:

- Skin tightening
- Reduction of lines and wrinkles
- Stimulation of the microcirculation
- Repair/rebuilding
- Firming

Effects on the body may include:

- Improvement of lymphatic flow and drainage
- Enhanced circulation
- Acceleration of fat metabolism
- Dermal tightening of the fibrous septae due the thermal injury effect that creates neocollagenesis /remodeling
- Fibroblast stimulation to create a firming effect
- Helps to increase tone

Difference between RF and Laser

Lasers convert light energy into heat through a process called "selective photothermolysis". The laser must be attracted to a specific molecule called a "chromophore" such as melanin, blood or water. For example, the chromophore in a hair follicle is melanin. The chromophore in a vein is blood. When performing laser rejuvenation, the chromophore is water. RF produces heat in a greater volume of tissue known as "bulk heating", and is not chromophore-specific. Instead, the tissue's electrical resistance converts the electric

current to electromagnetic thermal energy deeper into the dermis. Due to RF being non-chromophore specific, there is little risk of destroying epidermal melanin, especially in darker skin types including Asian skin.

Preparations for treatment

Be mindful that age, health, and life style play into the probability for a positive outcome. The biosynthesis of collagen and elastin diminishes with age.

Results may vary from client to client. A full health intake profile and assessment should be considered prior to any treatment program. An informed consent should be signed as well. The number of sessions for each device may vary according to both the manufacturer guidelines and the age and skin laxity/condition of the client.

Contraindications

- Pacemaker.
- Metallic implants in the treatment area.
- Any medication that may alter the cutaneous response; example would be retinoic acid.
- Any invasive procedure performed in the treatment area during the previous six months including laser hair reduction or laser resurfacing.
- Any suspicious lesions.
- History of keloids and hypertrophic scarring.
- Pregnancy or breast-feeding.
- Epilepsy or severe migraines.
- Infection.
- Pain or abscess in the treatment area.
- Presence of tattoos or body piercing in the treatment area.
- Autoimmune disorders.

- Diabetes.
- Eczema or dermatitis in the treatment area.
- Anticoagulant therapy.
- History of thrombosis.
- Psychological disorders.
- Clinician-exclusion criteria.

Self Assessment Test 1

1. Radio frequency (Circle all that apply)
 - a) is part of the electromagnetic spectrum.
 - b) can travel at a great distance.
 - c) is used as an ablative tool in medicine causing necrosis.
 - d) is a collimated sound wave.
2. The endothermic process is (Circle all that apply)
 - a) caused by rapid oscillation of the electromagnetic energy.
 - b) the heating of tissue caused by movement of charged particles through internal tissue.
 - c) Does not hurt tissue.
 - d) All of the above
3. Conventional RF (CRF) does not cause necrosis.
True or False?
4. Fibroblast cells (Circle all that apply)
 - a) form collagen and elastin.
 - b) form glycosaminoglycans.
 - c) support cell repair during the wounding response.
 - d) are found in the epidermis.
5. Denaturing of collagen (Circle all that apply)
 - a) is caused by high heat breaking the collagen triple helix.
 - b) is not temperature dependent.
 - c) has an accumulative effect within the dermal collagen.
 - d) All of the above.
6. RF in esthetic applications (Circle all that apply)
 - a) can be used on the body and face.
 - b) requires client health intake and assessment
 - c) helps improve circulation.
 - d) is a safe and effective modality.
7. Heat delivery and degree of depth may vary depending upon the device?
True or False?

PART 2

ULTRASOUND (SONOPHORESIS)

History

The history of ultrasound history has traveled throughout many years and is used in numerous medical specialties including transporting images during diagnostic procedures.

As early as 1794, scientific observations by biologist and physiologist, *Lazzaro Spallanzani*, first observed the bats and their ability to navigate through a process called echolocation. Bats and sea animals such as whales and dolphins send out sound waves that bounce off objects.

In 1826 *Jean Daniel Colladon*, a physicist experimented with an under-water church bell as a transducer (a device that converts energy) to calculate the speed of sound through water proving that sound traveled faster through water than air.

By 1880, *Pierre & Jacques Curie* discovered the Piezo-electric effect that eventually led to the development of transducers for the detection of icebergs and also submarines during World War 1. Piezo electricity is the ability for certain materials to generate an alternating current (AC) in solid materials such as crystals (quartz) when subjected to mechanical stress or vibration or to an AC voltage or both. Examples of piezoelectric devices are microphones, earphones, beepers and wireless applications.

Karl Dussic, a neurologist and psychiatrist at the University of Vienna has been regarded as the first physician to use ultrasound for medical diagnosis of brain tumors in 1942.

George Ludwig, M.D. used ultrasound in 1948 to diagnose gallstones and subsequently, by 1958 *Ian Donald*, MD, pioneered the OB-GYN ultrasound.

In more recent years low-pulsed ultrasound technology has crossed over into the fields of medicine and esthetics. It is also being researched for the promotion of wound healing such as pressure ulcers.

Study Objectives

Highlight/underline the answers to the following questions as you read:

13. What is another name for ultrasound?
14. What is meant by the term "echolocation"?
15. What are the biological affects of sonophoresis in tissue?
16. What are some of the physical changes in skin when using sonophoresis?
17. Explain the function of the bilayers?
18. How are cavitations produced?
19. What is piezoelectric effect?
20. What is ultrasonic skin cleaning?
21. What are the contraindications for sonophoresis?

Ultrasound (sonophoresis)

Ultrasound technology uses sound waves at specific frequencies to create physical changes in the skin. The penetration of product by ultrasound is known as sonophoresis. Sono-chemistry is the interaction of sound with matter through the process of cavitation, whereas the process of iontophoresis requires polarization.

- Low frequency sonophoresis increases the transpermeability of the skin in order to absorb active ingredients. It has been used as a delivery system for medications and also as a non-ionizable alternative for skin care actives.
- Sonophoresis (ultrasound) may be used in skin tightening esthetic therapies and the improvement of cellulite.
- Ultrasonic cleaning of the skin.
- Ultrasound may be used in combination with iontophoresis.

The Skin Barrier

To gain a better understanding of how sonophoresis and other devices are used for penetration, one must be familiar with the biology of the skin barriers within the intercellular spaces of the stratum corneum. The primary function of the barrier is to extend optimum protection to the epidermal and dermal structures and monitor the ever-changing environment; changes in temperature, relative humidity, a potential disruption, or threat of invasion by other organisms. Essentially, the skin is highly impermeable and naturally resistant to external penetration of substances. The use of sonophoresis in esthetic treatments helps to enhance the permeability of products into the skin.

A strong cohesive skin barrier is made

up of compact corneocytes with an intercellular lipid matrix found within the “lamellar structures” or “microstructures” that act as biological barriers. They are horizontally layered between the corneocytes and have numerous functions that must remain balanced and free of injury. The intercellular lipids within the lamellae help regulate the stratum corneum barrier function and the desquamation process. They act as a reservoir for water balance (hydration) including manufacturing of the Natural Moisturizing Factors (NMFs). A balanced and functioning lipid barrier is also necessary for the formation of enzymes that dissolve cell-connecting desmosomes during the desquamation process.

Many skin conditions are caused by an impaired barrier function. This barrier is also affected by any external stimuli. A simple analogy would be that of bricks and mortar. The bricks are the corneocytes and the mortar is the lamellar lipid matrix.

Penetration of Ingredients: Understanding the Nature of Bilayers

Active ingredients in skin care, especially if highly water-soluble, may not always fully pass through the top of the skin due to the protective skin barrier that is lipophilic (repels water) in nature. The bi-layers also repel any substances that are of high molecular weight since they cannot pass through the microscopic gaps between the small lipid heads of the bilayers. The lipophilic nature within the stratum corneum repels water molecules from the outside as witnessed when you walk in the rain and notice that the water beads on top of the skin. Any water-based formulas do

not easily penetrate into the skin. As an example, the application of water-soluble vitamin C has to be presented in higher concentrations. In order to penetrate ingredients, the nature of the bilayers has to be altered. The acidic nature of vitamin C destabilizes some of the bilayers in order to allow for small amounts to penetrate. External components that are oil-soluble have more affinity for penetration.

Sonophoresis causes cavitations inside and outside the cell due to the oscillations of cavitation bubbles that can cause increased water channels in the cell allowing for the passage of water. The sound waves create increased cavitations and therefore a pore pathway for the penetration of both polar and nonpolar molecules across the area of the stratum corneum and the keratinocytes.

Mechanisms of Ultrasound

Ultrasound works by eliciting sound waves (sonophoresis) at specific frequencies to temporarily reduce the density of lipids within the intercellular spaces. This is achieved through generating micromechanical oscillations that generate acoustic waves, thermic (heat), and cavitation (microchannels) process. Known as Lacunae, cavitations are produced through generating low frequency sound waves that create alternating regions of compression and expansion forming aqueous channels (bubble channels) about 100 microns in diameter. The bubbles instantly implode causing a heating effect.

The ultrasound head or hand piece called a “sonicator” contains a crystal that converts normal 110-volt energy from its

power source through a transformer. The electrical charge is delivered to the crystal causing it to vibrate and create sound waves called the “piezoelectric effect”. Sound waves are measured in megahertz (MHz) and represent the number of sound wave vibrations that occur per second. Ultrasound works in a range exceeding 20,000 cycles/second (20 kHz).

There is a difference between ultrasound devices that are used in physical therapy versus those used for product penetration.

- Ultrasound can be continuous or pulsed mode. Pulsed mode reduces the severity of side effects of continuous ultrasound that creates high thermal effects. It also is more advantageous for penetrating product.
- Lower frequencies, 1 – 2.5 MHz (LFS), have a wider depth of penetration that permits for more areas of compression and expansion allowing for greater infusion of product. Research has shown that skin permeability increases to about 800%. Furthermore, when used in conjunction with pulsed iontophoresis there is a synergist effect. Product permeability has been shown to be up to 4000%.
- Higher frequencies of 3 MHz are used for clinical use such as in wound healing or physical therapy. High frequency ultrasound is not effective for increasing skin permeability due to its limited threshold. Thermal effects of higher frequencies are required when there is a clinical requirement for higher heat volume.

Difference between Ultrasound and Iontophoreses

Ultrasound creates a cavitation process called sonophoresis that permits both polarized and non-polarized ingredients to be diffused into the skin.

Penetration occurs by disrupting the lipid-bilayer of the stratum corneum through a process of creating micro channels. Iontophoresis requires water-soluble, polarizable ingredients whereby charged ingredient molecules are able to transport and penetrate into the skin via a direct current and process of ionization.

Safety Features of Sonophoreses

Whenever an external device such as ultrasound is applied to the skin, there is an immediate physical change within the skin. The nature of the creating cavitation is also due to increased molecular activity. Increased forced activity also creates heat the degree of which is variable depending upon treatment focus. Depending on the intended purpose and use of a device, its design, internal components including a microprocessor, controls all mechanisms contributing to its effective operation. It directs the degree of energy being released into the tissue. The operator must be educated in the physics and use of the device as well as its biological effects within the skin.

Ultrasonic Skin Cleaning

Ultrasonic cleaning methods have been used in industry, medical and laboratory settings. The use of ultrasound enhances the cleaning fluid by a process of cavitation. The creation of numerous micro-bubbles in the cleaning liquid is also generating intense waves that remove all impurities and debris.

In skin care, ultrasonic exfoliation and cleaning devices are like vibrating scrappers that use the ultrasound pulsations to emulsify and vaporize

cellular debris on the skin surface and within the follicles. It is used with a specialized cleansing solution and has been found to not irritate the skin.

Ultrasound for Face Tightening

Newer medical ultrasound devices have been developed to help lift areas of the face non-invasively such as the neck, eye area and other regions. In one particular machine, the hand piece transfers an image of the skin onto a computer screen allowing the operator to view for a very focused delivery of ultrasound energy into the deeper layers of the dermis up to 4.5 mm targeting the foundational tissue layers. Focus ultrasonic energy creates optimum thermal coagulation points (65-70°C) without ablation within the collagen (dermis) area of the skin. This causes the area to contract creating a wound healing response whereby the collagen begins to denature and remodel. It continues to do so within 60-90 days. The epidermal area of the skin is unaffected.

Ultrasound for Cellulite

Low frequency ultrasound may be employed for the treatment of cellulite.

- Supports lymphatic circulation
- Mobilize fat
- Helps improve skin tone/elasticity

Contraindications for Ultrasound

- Acute inflammation
- Metal plates
- Implants
- Pregnancy
- Pacemaker
- Thrombosis

Self Assessment Test 2

1. Echolocation is (Circle all that apply)
 - a) how whales, dolphins, bats navigate.
 - b) used in medicine for imaging.
 - c) sound waves that bounce off of objects.
 - d) a form of chanting.
2. Sonophoresis increases _____ within skin tissue through a process called _____.
3. The lipid bilayers are found in the (Circle all that apply)
 - a) dermis.
 - b) intercellular space between the corneocytes.
 - c) acid mantle.
 - d) None of the above.
4. Sonophoresis frequencies higher than 2.5 MHz are effective for increasing skin permeability for product penetration?
True or False?
5. Sonophoresis uses _____ to temporarily reduce the density of the _____ within the _____.
6. Low frequency sonophoresis (Circle all that apply)
 - a) supports lymphatic circulation.
 - b) promotes water transport through the cells.
 - c) decreases product penetration.
 - d) stimulates stem cells.
6. High frequency sonophoresis is used for (Circle all that apply)
 - a) wound healing.
 - b) physical therapy.
 - c) higher heat volume.
 - d) muscle contraction.
8. Estheticians shall represent their _____, _____, _____, and _____ honestly.
9. Sonophoresis requires use of polarized ingredients in order to penetrate the skin
True or False?

NCEA Code of Ethics

1.29.08 Revision

Client Relationships

Estheticians* will serve the best interests of their clients at all times and will provide the highest quality service possible.

Estheticians will maintain client confidentiality, keep treatment and documentation records, and provide clear, honest communication.

Estheticians will provide clients with clear and realistic goals and outcomes and will not make false claims regarding the potential benefits of the techniques rendered or products recommended.

Estheticians will adhere to the scope of practice of their profession and refer clients to the appropriate qualified health practitioner when indicated.

Scope of Practice

Estheticians will offer services only within the scope of practice as defined by the state within which they operate, if required, and in adherence with appropriate federal laws and regulations.

Estheticians will not utilize any technique/procedure for which they have not had adequate training and shall represent their education, training, qualifications and abilities honestly.

Estheticians will strictly adhere to all usage instructions and guidelines provided by product and equipment manufacturers, provided those guidelines and instructions are within the scope of practice as defined by the state, if required.

Estheticians will follow, at minimum, infection control practices as defined by their state regulatory agency, Centers for Disease Control & Prevention (CDC) and Occupational Safety & Health Administration (OSHA).

Professionalism

Estheticians will commit themselves to ongoing education and to provide clients and the public with the most accurate information possible.

Estheticians will dress in attire consistent with professional practice and adhere to the Code of Conduct of their governing board.

**For the purpose of the NCEA Code of Ethics, the use of the term "Esthetician" applies to all licensed skin care professionals as defined by their state law.*

PART 3
MICROCURRENT

What is microcurrent?

Microcurrent is the natural voltage (current) system that is generated by the body and for example, is required for muscle movement. The body indeed is chemical electric and generates its own current (voltage) for biological purposes. When you observe the spinal column, it appears as an electrical network delivering nerve branches to all organs in the body. Regulating voltage (current) is very important to the function of all nerve impulses and ultimately to every cell in the body, especially during wound healing in the event of injury.

- Volts and amperes are measures of electricity.
- An ampere is the common measurement unit of electron movement.
- A current is the count or number of electrons flowing through a circuit.
- Microcurrent is current measured in millionths of an ampere and it is the current used within the body.
- 1000 microamps equals one milliamp

The Science of Electrophysiology

Electricity in human and animal tissue has been a topic of exploration for over two hundred years. Understanding the principles of this science within the cells contributes to our appreciation of how our electrical devices stimulate and interact with tissue. The science of electrophysiology is the study of the electrical properties of biological cells and tissues. It encompasses the voltage (current) activities and fluctuations that regulate the flow of ions throughout a cell membrane, the nervous system and muscle organs such as the heart. Ions are atoms or molecules in tissue that carry a charge.

For more information regarding lasers and light therapy:

- NCEA's 42-Hour Laser Light Curriculum Outline
- Recertification Section - Lasers and Light Therapy

Available from www.ncea.tv

Study Objectives

Highlight/underline the answers to the following questions as you read:

22. What is microcurrent?
23. What is the study of electrophysiology?
24. What occurs with ATP when microamps are increased to milliamps?"
25. What are ion pumps?
26. How do molecules move in and out of the cell?
27. What are mitochondria?
28. What is the "current of injury"?
29. What are the contraindications for microcurrent?
30. What evaluation guidelines are there for choosing a device or piece of equipment?

Notables such as physician and physicist, *Luigi Galvani*, (1737- 1798) and Italian physicist and neurophysiologist, *Carlo Matteucci* (1811-1868), confirmed that biological tissue was a generator of electricity that influenced nerve impulses. Matteucci's experiments exhibited that injured tissue could disrupt this electrical flow altering the cell frequencies.

Emil Du Bois-Reymond (1818- 1896), founder of modern electrophysiology, continued with the recording of electric phenomena involved in the production and conduction of nerves (negative "oscillation" or "variation") and muscle. He explained electrical phenomena in "excitable cells," and developed his "electrical molecules" theory that prompted the eventual "membrane theory" built by one of his students.

Moving into the twentieth century along with the improvement of modern instrumentation, the study of electrical frequencies and their characteristics within cells became more understood. The late 1970s brought about the innovative invention of an extracellular patch clamp by German Nobel prizewinners, *Erwin Neher* and *Bert Sakmann*. Their creation allowed for a more precise measurement of the flow and regulation of ion channels within a few millionths of a second. This compelling research sanctioned further studies towards understanding the effect of defective ion channel regulation during the presence of disease as well as toxic substances.

More recent twentieth century research by *Robert O. Becker*, M.D. is found in his book "The Body Electric" that provides excellent information regarding his

research in tissue healing and electro-magnetic influences both within the body and its surrounding environment. His work describes two different electrical control systems in the body; direct current and alternating current.

The 1982 study by *Ngok Cheng*, PhD on the importance of electrotherapy using microcurrent verified the effects of electric current of changeable intensities and the ability for tissue to heal. Cheng's research confirmed that at 500 μ A (microamps) the production of adenosine triphosphate (ATP) increased by approximately 500%, while amino acid transport increased by 30-40% over control levels using 30 to 40 percent above the control levels using 100-500 μ A. When microamps were increased to the milliamperage range, ATP generation was depleted, amino acid uptake was reduced by 20-73% and protein synthesis was inhibited by as much as 50%. It was suggested that the higher milliamp currents inhibit healing and the lower currents promoted healing.

Overview of cell membranes

A unique bipolar membrane envelopes all cells and separates extracellular and intracellular fluids. Cells within the skin are negatively charged on the inside (intercellular) whereas the space outside of the cell (extracellular) is positively charged. This difference in charge arises due to the fact that cell membranes contain channel proteins that contain ion pumps to move sodium ions out of the cell in exchange for potassium ions, which are pumped, into the cell. This pumping action is important for moving single molecules or complex molecules (potassium, sodium, calcium,

and chloride) through regulated gated channels that rapidly open and close via electrical conduction.

After initial digestion, food molecules including glucose enter the blood and are transported by carrier proteins into the cell's cytoplasm where they are further processed. They are stored until needed for energy which is produced by the mitochondria that generates ATP. Water moves into the cell via aquaporin channels (water channel proteins). Oxygen transports across the cell membrane through the process of diffusion.

The ability for molecules to move in and out of the cell, is dependent upon the electrical regulation within the cell; the opening and closing of its portals; and signaling molecules that are imbedded in and extrude from the cells membrane. Cellular wastes also move out of the cell into the lymphatic system.

The body's built-in electrical system (microcurrent) allows for the precise regulation of the opening and closing of membrane channels (portals) that influence cell function under normal and pathological (disease) conditions. The harmonious flow of these electrical signals is essential to the healthy function of each cell—including cell-to-cell communication. You can equate cells to miniature batteries that are conductors of electricity. They create energy fields that are powered by a very low level of electrical current.

Electric Potential

The voltage difference in the electrical potential across cell membranes is called "membrane potential". Membrane potential arises from the interaction of ion

channels and ion pumps that are embedded in the membrane. They maintain different ion concentrations in the intracellular and extracellular side of a cell membrane. The flow of ions is compelled by both the concentration and voltage components of an electrochemical gradient. In other words, membrane potential is the difference in electric potential between the interior and exterior of the cell.

Mitochondria

An essential energy-generating organelle within the cell membrane is the mitochondria. It is vital to the growth and function of all cells and accomplishes a multitude of metabolic tasks. There are as many as 500 to 2000 mitochondria scattered throughout the cytoplasm of the cell. The amount is specific to the location of the cell in the body. Mitochondria are sites for aerobic respiration and energy production. They contain their own DNA and convert energy from stored food nutrients. Chemical energy is stored as sugars, amino and fatty acids and is used for conversion into adenosine triphosphate (ATP). Energy is manufactured in the form of ATP through the collaborative actions of proteins located in and on the inner mitochondrion membrane called the electron transport chain. Electrons are passed down this transport chain releasing energy at each step of the conversion process called the Krebs Cycle. This complex electrochemical action is known as ATP synthesis. Understanding the role of mitochondria provides insight into increased skin improvement by applying microcurrent.

The Benefits of Biostimulation with Microcurrent

Application and purpose of a device varies depending upon its intended use. Some machines are manufactured for healing such as in pressure ulcers (bed sores), chronic wounds, or for stimulating bone repair or management of pain. Other devices are designed for cosmetic purposes whereby they are beneficial for face lifting, body sculpting and overall skin enhancement. We will address each for educational purposes. Understanding these basic concepts leads to a greater consideration of the events surrounding ageing cells and barrier dysfunction that may interrupt or alter cell frequencies. This relevant information supports our knowledge when designing effective treatment for skin repair and also prevents too aggressive treatments (peels, lasers) when the skin is compromised. Repair should begin from within.

Tissue Injury and Healing

As far back as World War II, microcurrent was used by the Japanese physicians for fusing of non-healing bone fractures. Further research with microcurrent during the 1970s and 1980s in Europe and the U.S. demonstrated the clinical effects for accelerated healing of injured cells, for example, ulcers and wounds and also in pain relief. *Dr. Reinhold Voll* of Germany developed the first commercial microcurrent stimulating device call the Dermatron in the 1960's. It was used for electro-diagnostic testing purposes but also applied therapeutically to stimulate the body.

The effects were:

- Relief of spasms of smooth muscles of the circulatory, lymphatic and hollow organ systems
- Toning of the smooth muscle cells to relieve stasis and spastic constriction.
- Toning of elastin fibers in the lungs of emphysema patients to increase lung capacity
- Reduction of inflammation
- Reduction of the degenerative process by restoring diffusion-osmotic equilibrium
- Stimulation of ATP in newly injured striated muscle.

Cells of Repair

Microcurrent frequencies within the cells can vary depending on location and condition. When tissue is wounded, the phospholipid content of the cell membrane breaks down. Consequently a cascade of biochemical reactions is triggered resulting in inflammation and pain. At the site of injury the normal flow of microcurrents through tissue becomes interrupted. The body has its own bioelectric system that influences wound healing by attracting the cells of repair, changing cell membrane permeability, and positioning the cell structures to increase proliferation of fibroblasts and protein synthesis. During injury living tissue contains an electro-potential surface containing variable currents to regulate the healing process. In other words, whenever there is a break or wound in the skin, a current termed the "current of injury" is generated between the surface of the skin and the epidermal/dermal areas triggering biological repair. Called the epidermal battery, the wound site is short circuited

producing a conducting pathway to allow for the flow of ionic currents from the skin surface (negatively charged) to the dermal fibroblasts and other cells (positively charged).

In chronic wounding sometimes the “current of injury” is lost, creating a situation of debilitation. The ability for wound healing becomes overwhelmed with the “current of injury” inability to function. As a result there is an increase of clinical infection, inflammation, and overall failure for the wound to heal. The application of low current electrical stimulation (E-Stim) mimics and helps restore the “current of injury” frequencies that encourage increased potential for healing. Current is passed from the margin of a wound to the wound bed the same way that the natural current of injury flows.

The process of bio stimulation with the application of external microcurrent has shown several benefits.

- Promotes cell metabolism and tissue repair.
- Promotes homeostasis (balance and equilibrium).
- May extend an anti-bacterial effect.
- Supports circulation—blood and lymph
- Reduces inflammation .
- Helps increase mitochondria activity through increasing ATP.
- Supports scar repair by dispersion of scar tissue and promote collagen remodeling.
- Increases protein synthesis, gluconeogenesis (GNG) and membrane transport.
- Reeducates and rejuvenates muscle tissue.

- Promotes bone healing
- Used in equine medicine during injury
- Supports bone healing

Cosmetic Microcurrent

The presentation of microcurrent supports skin correction by encouraging the repair process. The principles of microcurrent are similar as explained for wound healing. Compromised skin especially with barrier dysfunction and ageing requires a program of restoration that is gradual and progressive for long-term optimum health. Microcurrent gently urges the repair of the stratum corneum, the barrier function and dermal components to foster the skin into a healthier state. In many ways, this approach is a healthier choice for skin correction and does not add more damage to compromised skin as opposed to excessive wounding through peels or thermal injury.

Cosmetic microcurrent has many benefits.

- Enhancement for aged and photo aged skin
- Improvement of skin texture
- Helps reduce fine lines and wrinkles
- Helps diminish the appearance of acne scars
- Beneficial for pre and post surgery procedures
- Post surgical application of microcurrent supports reduction of trauma, irritation, inflammation and encourages skin healing

Contraindications for Microcurrent

- Pacemaker
- Pregnancy
- Epilepsy
- Cancer
- Varicose veins (do not use microcurrent over the area)
- Phlebitis
- Open wounds

Conditions that may require clearance from medical professional

- Diabetes
- Light sensitive migraines
- Metal pins or plates at the site of treatment
- Stroke
- Bells Palsy

Conditions that may interfere with results

- Application of an incorrect conducting product. Use what is recommended from the manufacturer who have tested and calibrated their device to the conducting formula. Poor conducting gels will not send a correct signal to and from the epidermis. Oil based products DO NOT conduct.
- Dehydration
- Age and poor lifestyle (smoking, alcohol) and inadequate nutrition
- Poor sleep habits
- Certain medications
- Thyroid condition

Microcurrent Devices

Microcurrent is a non-invasive, non-thermal, and subsensory therapeutic treatment that delivers direct pulsed current in the millions of an amp called a microamp (μA). Its subsensory property means that is not felt because current is delivered in microamperage. It also does not cause muscles to jump. Intensity levels for microcurrent can range from 25-800 μA depending upon the application. Manufacturers design their devices with variable programmable features and hand pieces.

Frequency Specific Microcurrent

Normally used by acupuncturists and medical personnel, this mode of device targets specific conditions such as muscle and soft tissue injury / pain, back pain, myofascial pain, neuropathic (nerve) pain, wound healing, shingles and more. These applications may or may not be within the scope of licensing for the esthetician. It just depends upon the intended use.

Cosmetic Microcurrent

These devices are used in spas, skin care practices and medical spas for face and body enhancement and overall use for aging skin.

Difference Between TENS, EMS Devices and Microcurrent

A TENS unit is a transcutaneous electrical nerve stimulation device. Its purpose is the use electric current to stimulate the nerves for therapeutic purposes. The stimulating pulses help prevent pain signals from reaching the brain. It also supports the body in producing its own painkillers called Endorphins.

Physical therapists, medical personnel and chiropractors normally use TENS and EMS devices. They may be programmed to deliver short pulses of current in the milliamperage range (mA). The outer layers of the skin will have greater resistance with higher currents that can become painful if set too high. A higher current means a greater resistance in the outer layers of the skin and can be felt.

Electrical Muscle Stimulation devices – E.M.S. – are used to prevent or reduce muscle weakening or loss of muscle tone known as atrophy. Atrophy can occur after surgery or injury.

Guidelines for Use of Microcurrent

Each manufacturer will have a recommended protocol, however, here are some general guidelines:

- Results are dependent upon the age, health, life style and amount of accumulative conditions such as photo damage. Be aware that it does take patience to repair or improve the skin.
- Thoroughly cleanse the skin prior the treatment. Do not do a peel or use microdermabrasion immediately before the treatment. It is not necessary.

Allow the microcurrent to do its job without prior aggressive exfoliation or anything that will disturb the barrier function. (Use of enzyme is the exception)

- Do not try to “layer” too many treatments on the same day with your client. There is a great deal of energy that is delivered to the skin during the hour session of microcurrent. The skin requires time to receive and respond. Do not confuse it.
- It is important to use the conducting product recommended by the manufacturer since they have designed and tested it to provide maximum conductivity. It is an essential interface to carry optimum signals between the electrode and the skin. Be aware that many products may not provide enough conductivity. This includes coupling gels, distilled water, oil based creams and others. If the product cannot carry a charge (ionizable) then it may not be an effective conductor.) Some machines have an indicator light for conductivity, it is a good feature to ensure optimum conductivity.
- Perform treatments in a series: minimum twice – three times weekly (48 hours in between each treatment) for about 10-12 sessions. The effectiveness of microcurrent is accumulative and therefore requires consistent sessions during the initial program. It’s like exercising. One session a week is not going to provide much benefit. After the series then reassess your results. Normally a once a month regular maintenance facial with the microcurrent is a good practice.

-
- With signed client permission, take a before and after photograph at sessions #1, #6, and the last session. Always take photo in same lighting and positioning. Front face, left side view, right side view. No smile and client must either be standing or sitting.
 - Turn off any electrical warming blankets since lying on it may interfere with treatment delivery. You can warm the bed prior to treatment but unplug it during the session. Client's cell phone should be turned off and away from the treatment area.
 - Suggested home care regimen products should be biomimetic to the skin. What that means is that the cell requires saturated fatty acids, linoleic acid, phosphatidyl choline, ceramides, peptides, antioxidant, cholesterol, and other restorative ingredients to help restore the skin. It is not necessary to use products containing exfoliators such as alpha hydroxy acids.
 - Client should be drinking adequate levels of water daily and come

hydrated to the session. Sometimes it a glass of water just prior to treatment may be necessary. Furthermore, eating lots of fruits and vegetables help provide minerals that carry current within the cells.

Regulatory and Use for Microcurrent Devices

There are several microcurrent machines on the market. A reputable company should possess a proven track record and be in the business of developing microcurrent. They should provide good customer education and service. There is normally a warranty issued with each device. All machines should follow regulations for safe operation as well as conform to FDA guidelines for manufacturing. A company will obtain FDA clearance for the intended use of their device. There are also some devices from Canada, Great Britain and Germany that have obtained clearances for use in the United States.

See *NCEA's Equipment Evaluation Form* for further questions that you can ask of a manufacturer or distributor prior to purchase of any device.

Self Assessment Test 3

- 1) Volts and amperes are (Circle all that apply)
 - a) a measurement of electron movement
 - b) a measurement a millionths of an ampere
 - c) important to regulating the function of nerve impulses
 - d) All of the above.
2. The bi-polar membrane surrounding cells
 - a) Separates the extracellular and intercellular areas of the cell
 - b) Selectively allows for the passage of certain molecules to enter
 - c) Contains sodium-potassium channel pumps to facilitate the movement of ions
 - d) All of the above.
3. Voltage difference in electrical across cell membranes is called _____.
4. Mitochondria
 - a) Sites for aerobic respiration and energy production.
 - b) Contain their own DNA.
 - c) Are found outside the cell.
 - d) Transfers energy in the form of ATP.
5. Clinical effects of microcurrent in tissue injury
 - a) Relieves pain.
 - b) Increases inflammation.
 - c) Increases circulation.
 - d) Stimulates ADP.
6. What occurs during chronic wounding?
 - a) The “current of injury” is lost.
 - b) Increased inflammation.
 - c) An inability for the wound to heal.
 - d) Impossible to treat.

NCEA's Equipment Evaluation Form

Equipment Identification and Information

Name of equipment: _____

Type of equipment: _____

Model number: _____

Price: _____

What is the manufacturers' Intended Use Statement? _____

Company profile information: _____

Sales Contact Information:

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Tel: _____

Fax: _____

Email: _____

Website: _____

Length of time in business: _____

Distributor Contact Information:

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Tel: _____

Fax: _____

Email: _____

Website: _____

Length of time in business: _____

Registrations / Certifications

Is the manufacturer registered with the FDA?

If yes, what is the registration number?

Is the equipment registered with the FDA?

If yes, what is the registration number and class?

Is the device registered with the state, if required?

Safety Considerations and Equipment Specifications

What safety certifications does this equipment have (i.e. UL, CSA, CE)?

What kind of power source does the equipment require?

Does the manufacturer carry liability insurance on this equipment?

Is a certificate of insurance available?

Does the equipment have any cross-contamination safeguards, if applicable?

What are the contraindications for use of this equipment?

If purchasing a used device,

a) What was the date of the last preventative maintenance?

b) Is the preventative maintenance report available?

Warranty and Service Policies

What are the terms of the warranty?

Is there an extended warranty available?

Is there an additional cost?

Do you have an equipment loaner program?

Are references available?

Training and Education

What type of training is included with purchase?

Where? Total hours?

Who are the educators?

Is there an additional cost?

Skin care professionals are required to check in their state as to whether training on the use of equipment is required prior to purchasing, and/or if they can use device under their scope of practice.