



**Totaalleverancier  
van lasers en medische  
technologieën**



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# VIRTUE<sub>RF</sub>

Freeze pain, Enhance effect

Freeze pain, Enhance effect

# VIRTUE<sub>RF</sub>

SHENB's 20 years of know-how on RF noble technology  
Introducing the cleanest 4 innovative RF technologies.  
Less pain, Fast recovery, Higher effect, Longer sustainability,  
and Overall safety promised.

SMART

Smarter, Softer

DEEP

Cooler, Stronger

EXACT

More, Accurate, More Precise



VirtueRF pursues  
Maximum Effect, Safe Treatment Technology  
Basic and Technology Become Innovation

Innovative Beauty  
VIRTUE RF

**Freeze pain, Enhance effect**



Freeze pain, Enhance effect

**SMART**  
**DEEP**  
**EXACT**



## VIRTUE<sub>RF</sub>

Using RF energy generated by the microneedles induces tissue regeneration by coagulation in the tissue.

.....  
ACS (Advanced Cooling System), IPRS (Integrated Pulsed Radio Frequency System), IECS (Integrated Energy Control System), and MDCS (Minimum Depth Control System) technologies enables for more efficient and safe treatment.  
.....

VIRTUE is a medical device that has been approved for safety and effectiveness by the US FDA, and European CE, and Korea MFDS.

# FDA · CE · MFDS

VIRTUE is a medical device that has been approved for safety and effectiveness by the US FDA, European CE, and Korea MFDS.

FDA is the U.S. Food and Drug Administration (under the U.S. Department of Health and Human Services) and is responsible for controlling and approving all kinds of items produced, distributed, and sold in the U.S. for the purpose of consumer protection by stipulating detailed laws and regulations..



FDA ensures that food, drugs, cosmetics and medical devices are safe, hygienic and effective; FDA approval means that a product has been recognized for its safety and effectiveness, as it is recognized for its credibility by in-depth evaluation and investigation on harmfulness and also known as the worldwide organization the most stringent and judicious on approval decision.

# VIRTUE<sub>RF</sub>

Freeze pain, Enhance effect



# MNRF History

VirtueRF is SHENB'S 3rd generation MNRF system  
 SHENB'S MNRF technology is recognized worldwide.

\* MNRF: Microneedle Radiofrequency

## 1<sup>st</sup> Generation VIVACE

No. 1 sales for 3 consecutive years in US (MNRF)  
 2018-2021 Aesthetic Award Winner  
 2021 Best MNRF in US Award  
 Export to 64 countries around the world



FDA CE MFDS

## 2<sup>nd</sup> Generation ONIX

Approved treatment of Osmidrosis  
 and Hyperhidrosis  
 Supplied to Japanese Chain Clinics  
 Several journals published



CE MFDS

## 3<sup>rd</sup> Generation VIRTUE<sub>RF</sub>

The reputation of the first generation VIVACE  
 Completed based on the challenge of the 2nd  
 generation ONIX  
 Next-generation MNRF devices



FDA CE MFDS

# Technology

Freeze pain, Enhance effect



# Innovative Technologies

Installed Differentiated Advanced Technologies



## ACS

Advanced Cooling System

By controlling and maintaining the temperature of the cooling plate, it protects the epidermis and reduces pain, enable to deliver safer and more powerful energy.



## IPRS

Integrated Pulsed Radiofrequency System

IPRS implements a minimum pulse of 1,000 microseconds, and by selecting 1-10 pulse mode maximizes the treatment effect and less pain.



## IECS

Integrated Energy Control System

By setting the MHz mode according to the intention of the procedure with the same RF energy, various treatments are possible from a large area with low density to a narrow area with high density.



## MDACS

Minimum Depth Control System

The microneedle can be adjusted in 60 steps from 0.1mm to 6mm in 0.1mm increments, and the treatment can be performed at a desired depth from the epidermis to the dermis.

# Key Points

## Accurate and Safe Tx with Innovative Technology

### Technology

#### ACS

Advanced Cooling System

#### IPRS

Integrated Pulsed Radiofrequency System

#### IECS

Integrated Energy Control System

#### MDCS

Minimum Depth Control System

### Treatment

**Less Pain** (Pain reduction with ACS and IPRS)

**Fast Recovery** (Short Downtime) (Minimize skin damage with ACS and IPRS)

**Excellent Efficacy** (0.5 MHz mode delivers wider and stronger energy)

**Long-Lasting** (Regeneration effect that lasts for a long period by safe and powerful energy delivery)

**Safe Tx Safe Technology** (US FDA approved, EU CE approved)

From mild to strong energy control by IECS system



Pain reduction and Epidermal protection Effect by ACS system



Minimize tissue damage and deliver the energy to deep layers by IPRS energy split function.



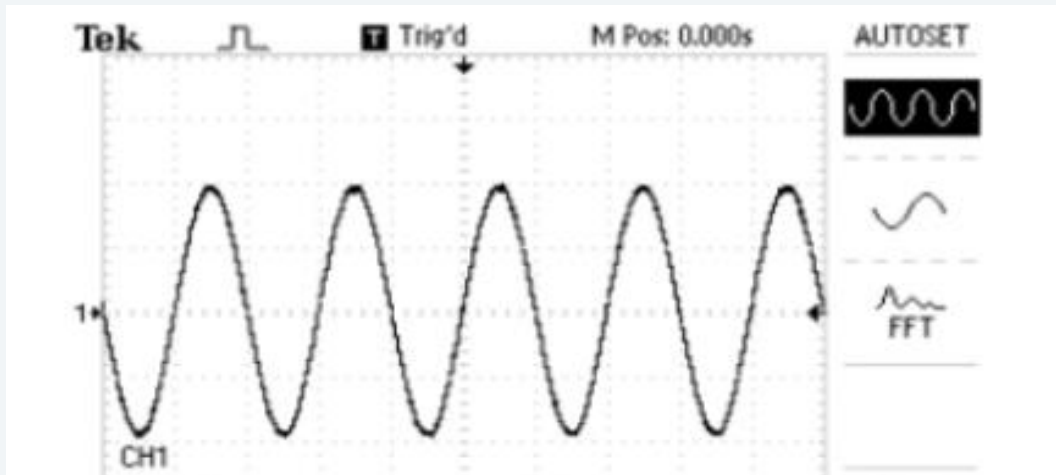
Optimal depth control and Delicate tx according to MDCS system

# Micro Needle

0.3mm Gold Plated Micro Needle



# Radio Frequency Energy



Radio frequency refers to electromagnetic waves with high frequency. Frequency has a certain vibration (period), and is expressed in Hz depending on how many times this vibration (period) is repeated in one second. Generally, it is classified as radio frequency when it repeats more than 100,000 times per second.

Radio frequency generates heat within a certain range of vibrations that occur in a short time. By transferring the generated heat into the skin, it can induce various skin regeneration.

# Handpieces

VirtueRF provides 3 types of handpieces for its skin type and indications.

## SMART<sub>RF</sub>

Smarter, Softer



SMART was designed to minimize the tissue damage and induce regeneration with IPRS technology to reduce pain, irritation, and various effect more safely.

## DEEP<sub>RF</sub>

Cooler, Stronger



DEEP was designed to deliver the energy powerful and deeper. By using ACS technology, it helps and safely minimizes the pain and tissue damage though delivering more powerful energy ever.

## EXACT<sub>RF</sub>

More Accurate, More Precise



EXACT was designed for more precise and accurate delivery. EXACT technology enables to deliver the energy to the desired depth and efficient treatments.



# SMART HANDPIECE



## SMART<sub>RF</sub>

Smarter, Softer

SMART was designed to minimize the tissue damage and induce regeneration with IPRS technology to reduce pain, irritation, and various effect more safely.

- Needle Depth (MDCS) available from 0.1mm to 3.5mm
- Sophisticated Energy Realization (IPRS) with Pulse Function
- Soft Needling and Less Pain
- Two types of needles (insulated, non-insulated)
- Two types of MHz (1Mhz, 2Mhz) (IECS)

# DEEP HANDPIECE

## DEEP<sub>RF</sub>

Cooler, Stronger

DEEP was designed to deliver the energy powerful and deeper. By using ACS technology, it helps and safely minimizes the pain and tissue damage though delivering more powerful energy ever.

- Needle Depth (MDCS) that can be used from a minimum of 0.1mm to a maximum of 6mm
- Sophisticated Energy Realization (IPRS) with Pulse Function
- Skin damage protection with unique Cooling (ACS) function
- Two types of Insulation Needle Tip (12pin, 36pin)
- Three types of MHz (0.5MHz, 1MHz, 2MHz) (IECS)



# EXACT HANDPIECE

## EXACT<sup>RF</sup>

More Accurate, More Precise

EXACT was designed for more precise and accurate delivery. EXACT technology enables to deliver the energy to the desired depth and efficient treatments.

- Needle Depth (MDCS) that can be used from a minimum of 0.1mm to a maximum of 5 mm
- The First Adjustable Needle Length Tip.
- Sophisticated Energy Realization (IPRS) with Pulse Function

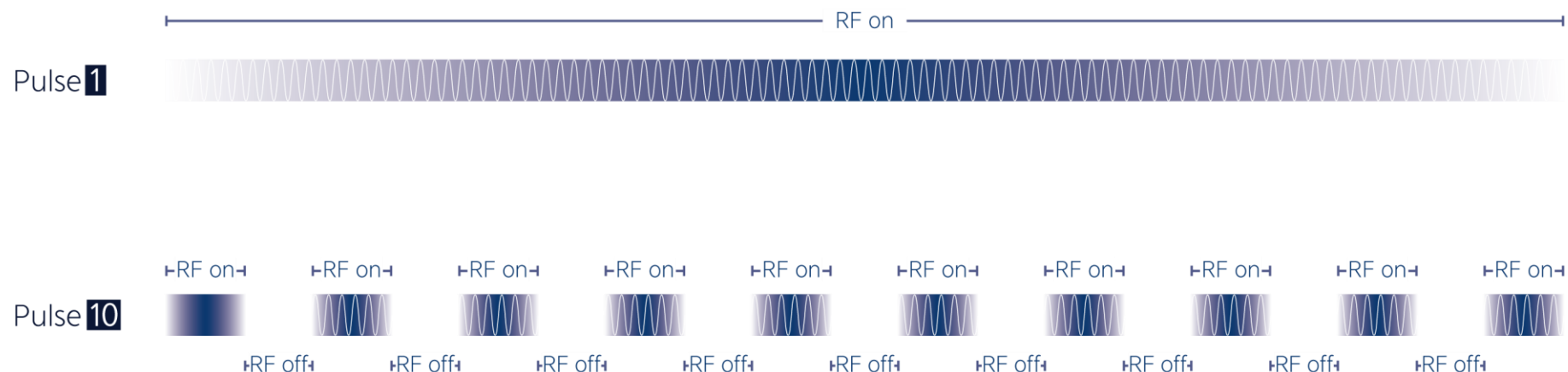




### Integrated Pulsed Radiofrequency System IPRS

IPRS implements a minimum pulse of **1,000 microseconds**, and by **selecting 1-10 pulse mode** maximizes the treatment effect and less pain.

- IPRS of VirtueRF consists of a total 10 steps which the most energy splitting function among the same products.
- The advantage of IPRS system is to deliver strong energy while minimizing tissue damage by dividing the energy.
- Through tissue experiments, it has been identified that IPRS has delivered more safely and deeply to the tissue, and new effects can be expected in many treatment areas in the future.



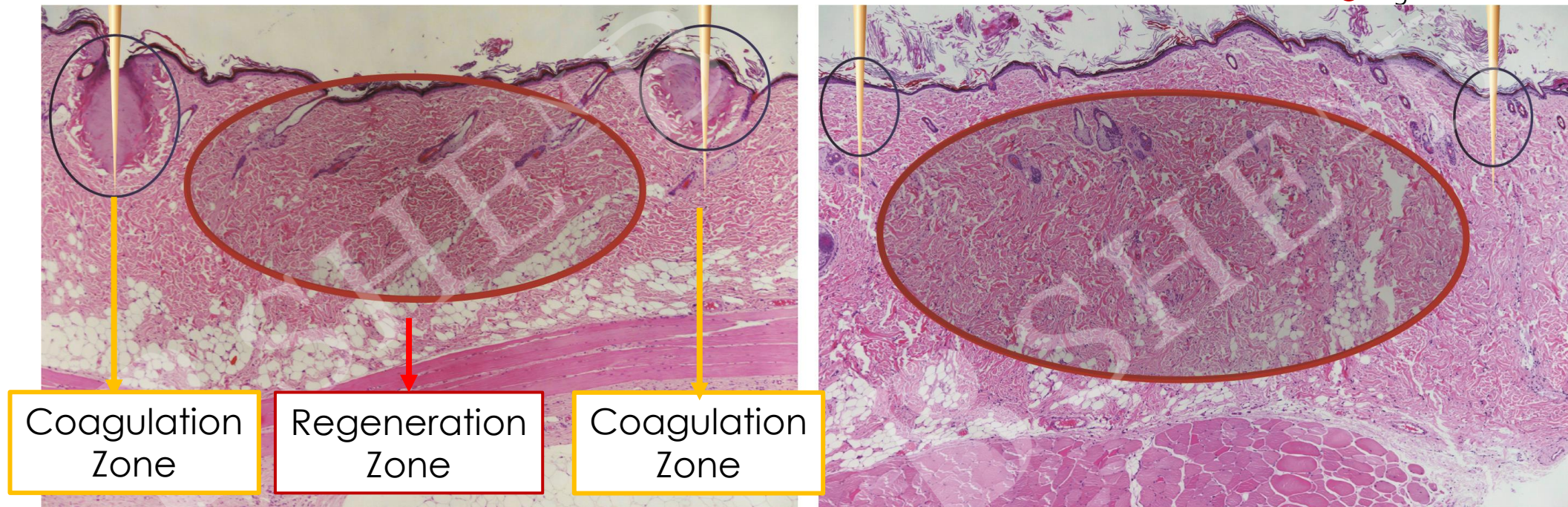


# RF Technology

20 Years Know-How of RF Technology

Through **IPRS** technology, it is possible to form a **coagulation zone** and **regeneration zone (thermal hugging)** at the same time, or only a regeneration zone can be formed depending on the **purpose of the treatment**. VirtueRF's IPRS technology not only delivers energy into the dermis **smoothly and evenly**, but also **broadly and deeply** to the lower dermis which leads more regeneration.

○ Coagulation zone  
○ Regeneration zone



**IPRS Technology OFF**

Form of Coagulation Zone and  
Regeneration Zone in the tissue

**IPRS Technology ON**

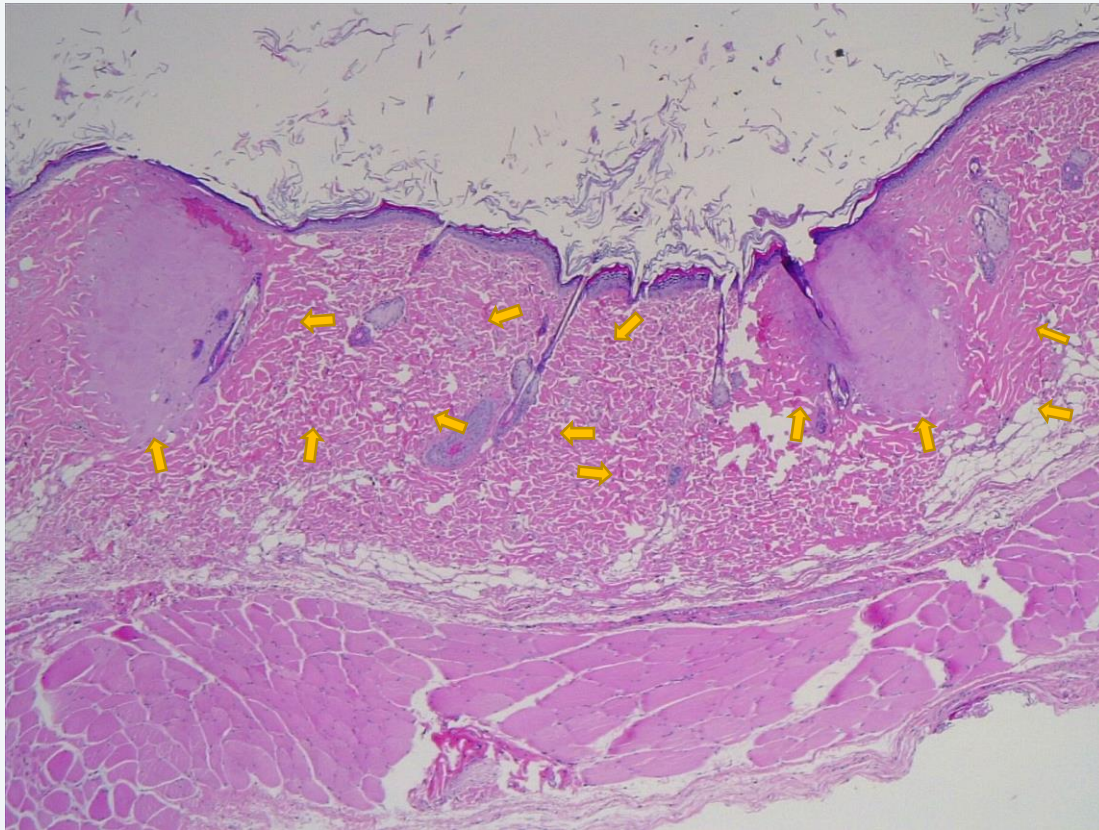
Form of Regeneration Zone without  
Coagulation Zone in the tissue



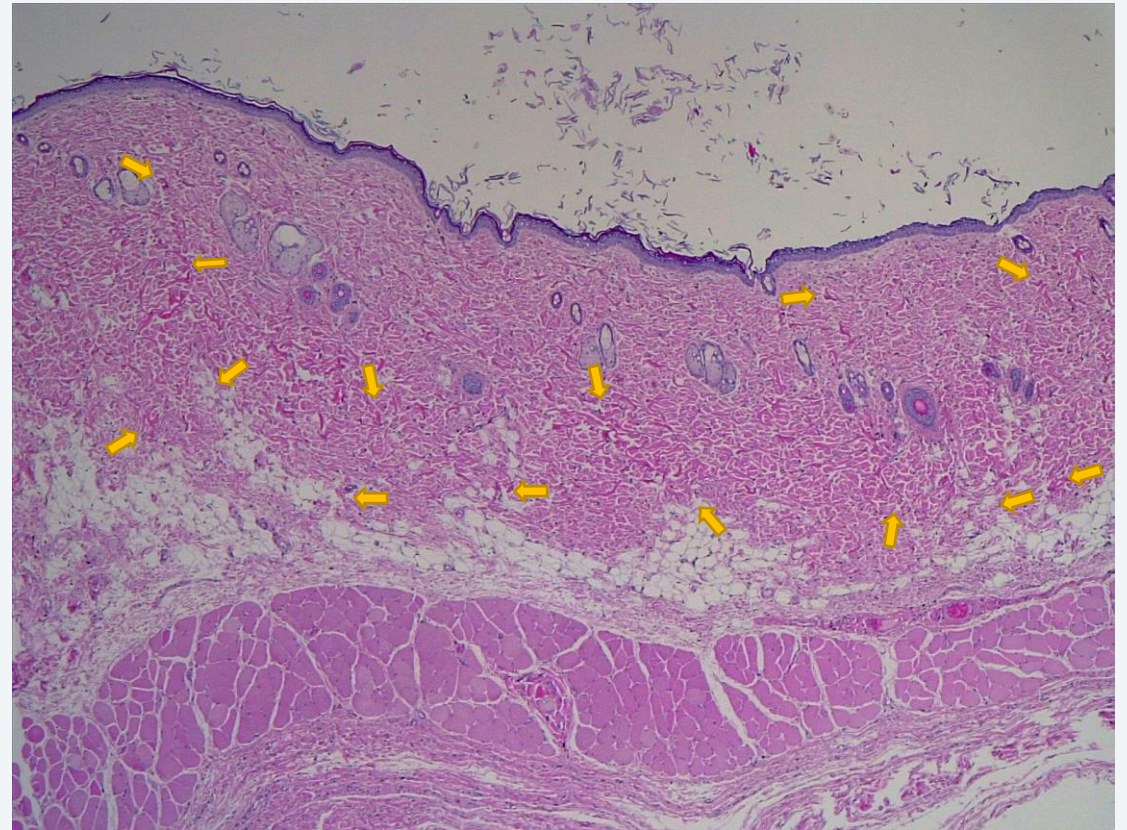
# VirtueRF Technology

## Sub Pulse and Energy Delivery Depth

Even the same energy and time, as the number of sub pulses increases, it can be seen the **energy spreads to a wider and deeper area**, which can be understood as showing a **similar depth and energy delivery tendency to monopolar**.



Lv 10, 800ms, **1pulse**, (Immediately after Tx)



Lv 10, 800ms, **10pulse**, (Immediately after Tx)



# Innovative Technology

## Advanced Cooling System (ACS)



### Advanced Cooling System ACS

ACS controls and maintains the temperature of the cooling plate to **protect the epidermis** and **reduce the pain**. It also enables **safer and more powerful energy delivery**.

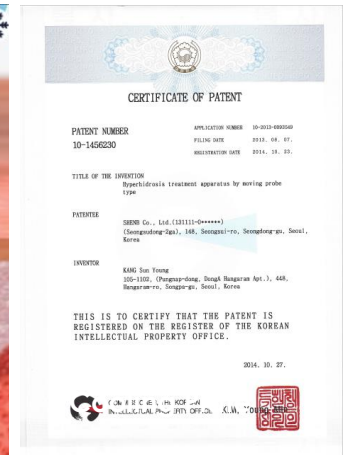
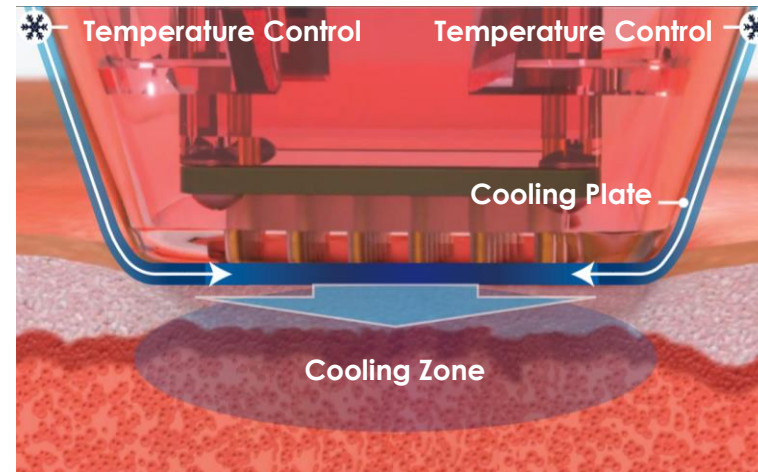
Temperature Control

DEEP RF Handpiece

Needle Tip

Cooling Plate

Temperature Control



※ ACS Patent in Korea & US

ACS (Advanced Cooling System) is a special technology of Virtue RF.

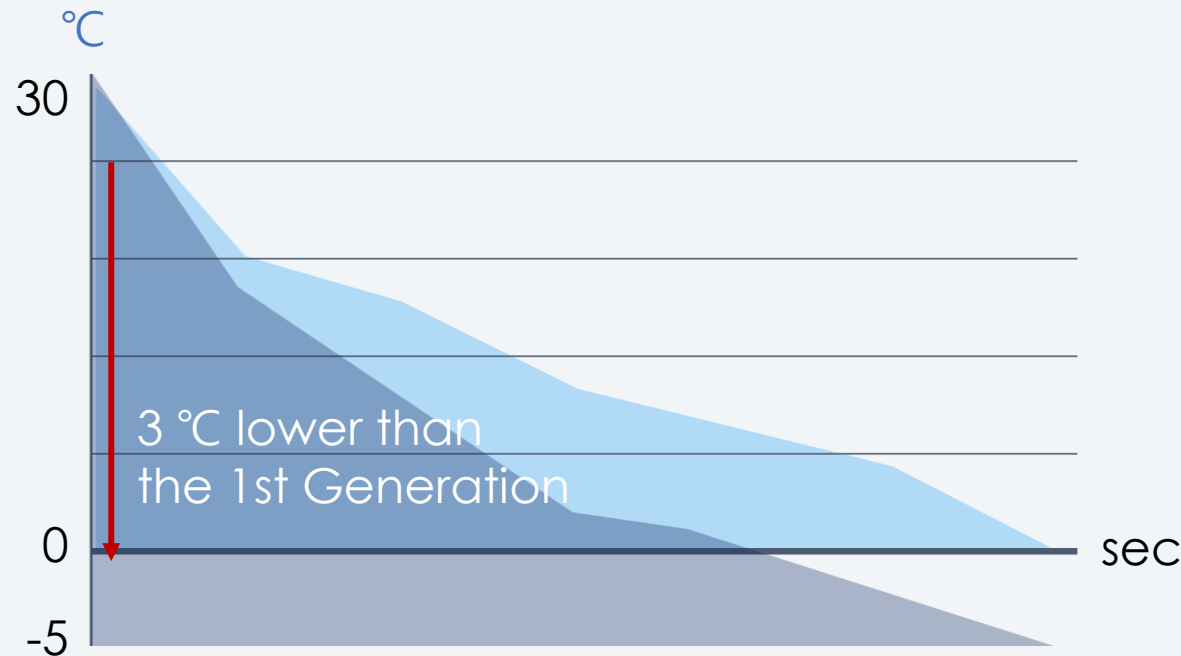
Enable to reduce the pain with ACS dramatically,  
Prevents side effects of powerful RF energy delivery.

ACS provides safer and better treatment effect.

# Innovative Technology

Advanced Cooling System (ACS)

ACS, the second-generation cooling system, provides a faster and more powerful cooling function than the existing cooling system.



Within 60 seconds can lower 13 °C start at 25 °C.  
Compared to the 1st generation , the performance improved 3°C lower

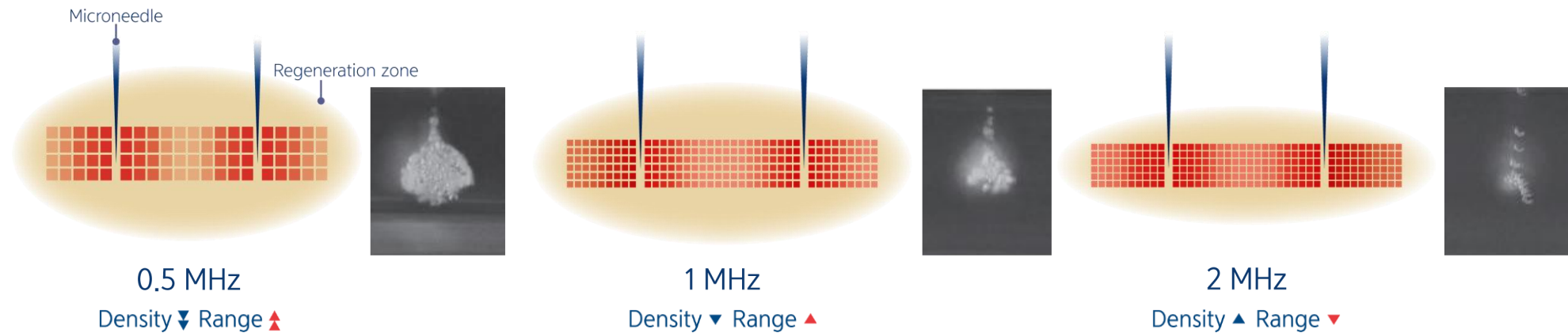
After 140 seconds, the temperature decreases about 10°C in the first generation, but Virtue' ACS cooling function decreases to 1 °C.

The more robust ACS maintains a constant temperature and function throughout the treatment process.

36.5도에서 10-15도 떨어짐

### Integrated Energy Control System IECS

By setting the MHz mode according to the intention of the procedure with the same RF energy, various treatments are possible from a **large area** with **low density** to a **narrow area** with **high density**.

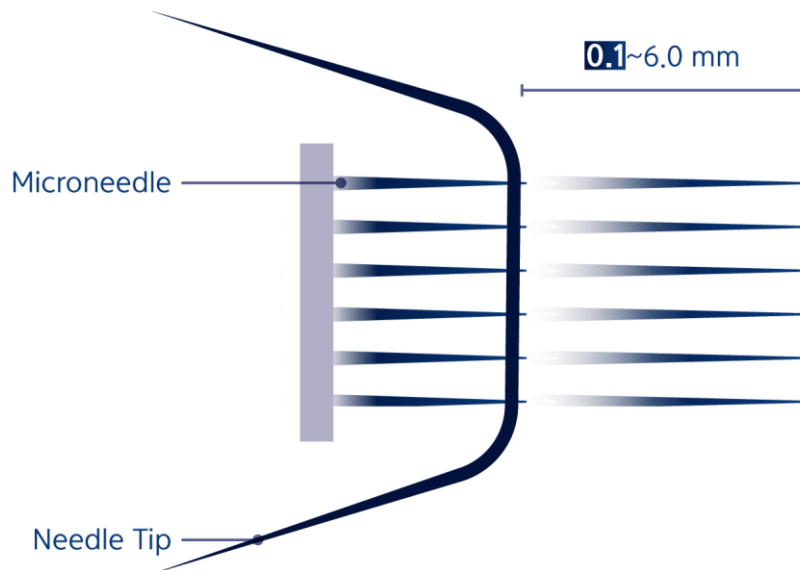


IECS provides all energies of 0.5MHz, 1Mhz, and 2MHz.

Each MHz forms a different size of a coagulation zone, by using difference size of coagulation zones optimal options are possible for various treatments such as the composition of regeneration zone according to the treatment purposes.

### Minimum Depth Control System MDCS

Minimum Depth Control System with **60 steps** from **0.1mm** to **6mm** depth



The third-generation Virtue RF has lowered the existing minimum depth of 0.5mm to a depth of 0.1mm.

Now Superficial treatment is possible through the MDCS function provided from a depth of 0.1mm.

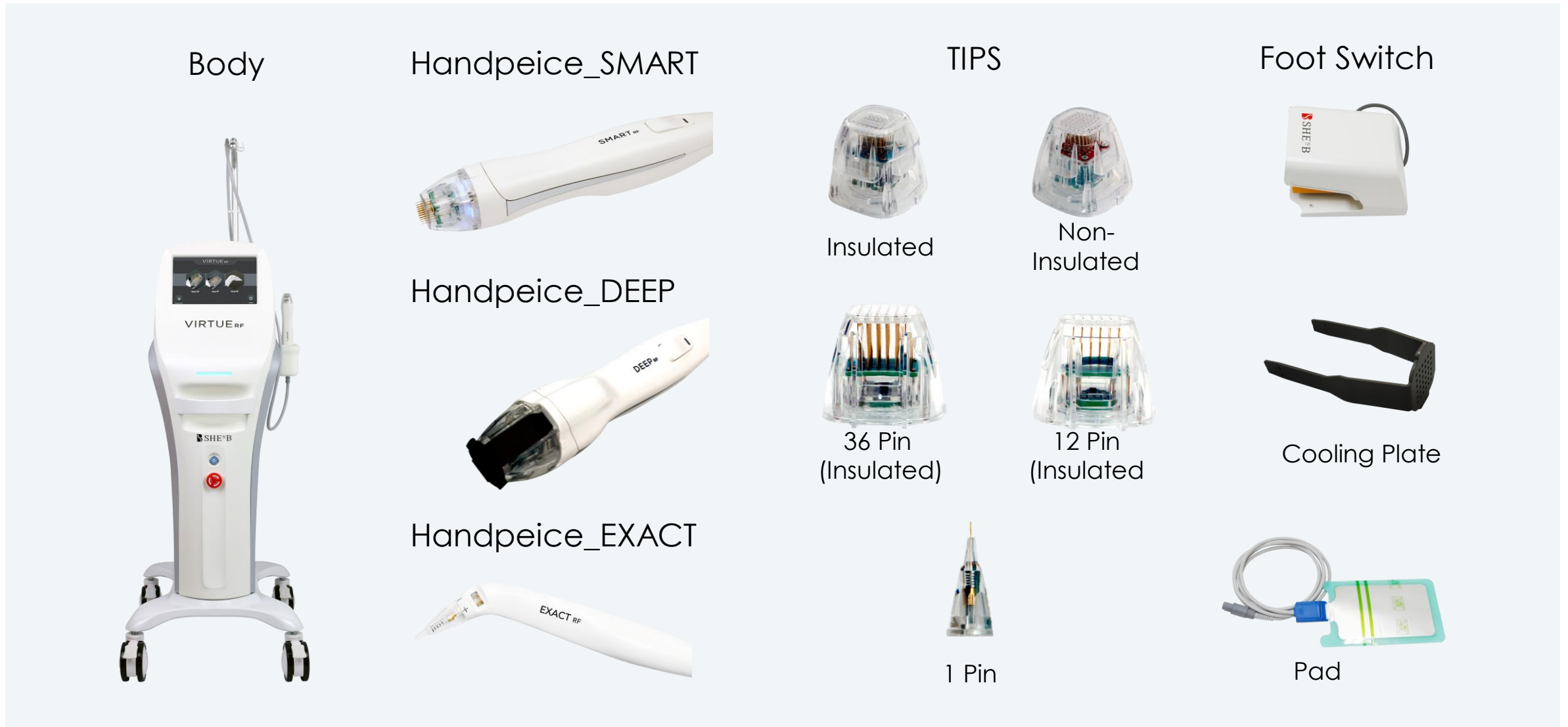
The MDCS function, which can be adjustable in a total of 60 steps from 0.1mm up to 6mm, enables safe and effective treatment by targeting more diverse depths.



# Specifications

Category		VIRTUE RF		
Energy Type	Radio Frequency			
RF Level	0 – 10			
HP Name	SMART	DEEP	EXACT	
Depth	0.1 – 3.5 mm	0.1 - 6 mm	0.1 - 6 mm	
Frequency	1 MHz, 2 MHz	0.5 MHz, 1 MHz, 2 MHz	1 MHz	
Tip Type	Insulated (36 pin), Non-Insulated (36 pin)	Insulated (36 pin), Insulated (12 pin)	Non-Insulated (1 Pin)	
RF-Time	100-800 ms	100-7000 ms	100-800 ms	
Diode Color	PINK (660 nm), Blue (470 nm)	PINK (660 nm), Blue (470 nm)	-	
Cooling Mode	-	Cooling Mode	-	
pulse	1-10			
Memory	1 – 5			
Switch	Foot, Hand			
Display	10.2 inch Wide LCD Touch Screen			
Consumption	80 VA			
Dimension	473 x 612 x 1,130 (mm)			
Weight	32 (kg)			
Consumable	Microneedle Tip			

# Composition



# Advantage

Freeze pain, Enhance effect

# Advantages

VirtueRF is the latest system reflects various **treatment trends** that respond to doctor's and patient's **concern**.

## Treatment Trends

No pain  
Short Downtime  
Good Effect  
Long Maintainance  
Minimal Side Effect  
Safe Treatment

## VirtueRF

- Less pain by using advanced technology (Advanced Cooling System)
- No scars or wounds, allowing immediate return to daily life
- Improvement of wrinkles and elasticity through RF energy
- Regenerate tissue at the desired depth and area
- Minimally invasive procedure using microneedles
- Completed safety tests through approx. 20,000 clinical experiences of FDA certification

# Advantages

VirtueRF Pursues

**Maximum Effect, Minimum Pain**  
**Safe Treatment Technology**



**IPRS**

Minimize tissue damage and deliver energy to deep layers through energy split delivery by IPRS mode

**ACS**

Pain reduction and epidermal protection effect by ACS

**IECS**

From strong to mild energy by IECS mode

**MDCS**

Optimal depth control and delicate treatment according to the MDCS

# Global VirtueRF

VirtueRF is FDA approved and clinically applied more than 20,000 cases worldwide.





# Global VirtueRF

VirtueRF is FDA approved and clinically applied more than 20,000 cases worldwide.







# Testimonials by Global partners

"It was a priority to partner with SHENB and add this newest technology because VIRTUE RF is the only RF Microneedling platform on the market and we pride ourselves on always offering exclusive and premium treatments to our patients"

- Alina Sholar, MD -

Our VIRTUE RF Microneedling treatment allows us to give our clients the best possible canvas where we can then either stop with beautiful skin, tone & texture or build up into.

- Ariya Aesthetics -

The ability to break up the energy with the Sub-Pulse feature has definitely helped decrease the patient's discomfort without having to lower the energy level. This means we can administer higher energy levels to get great results but give the patient a better overall experience.

- Bobby Awadalla, MD -

# Testimonials by Globe

"VIRTUE RF is my #1 no downtime treatment option for fine lines, anti-aging, and acne scars!. I honestly suggest the Virtue to just about every person that walks through my door because it is, hands-down, incredible for everyone."

- Emily Frost, RN, LE, CLT –

I chose VIRTUE RF because of its ability to deliver great results without the downtime associated with fractionated lasers. Many of our patients cannot tolerate discomfort and do not want downtime. We've found VIRTUE RF to deliver on both patient experience and results. The availability of both 1 MHz and 2 MHz plus sub-pulse gives us the opportunity to deliver more aggressive treatments with increased patient comfort. No other RF microneedling device has this"

- Jordana Herschthal, MD. Dermatologist -

# Testimonials by Globe

"The VIRTUE RF blows my mind. It is extremely precise, it really hits your collagen and elastin stimulation DEEP down. As a provider, this device is incredibly comfortable and easy to use given it's ergonomic design. There is no fatigue."

- Joshua Davis, RN -

I chose VIRTUE RF because of the ability to break down the energy into sub-pulses - it makes the treatment even more comfortable. The enhanced ability to customize treatments with VIRTUE RF is a big win. Every patient is different and this feature allows us to address each unique skincare goal and concern.

- Leslie Apgar, MD -

"I barely feel anything! A little sting, but nothing major, I could almost take a nap right now!"

- Patient at Joel B Beck, MD -

# Testimonials by Globe

"The microneedling game has been changed"  
- Renee Moran Aesthetics -

"It doesn't matter time of year or whether my patient is a light or darker skin type, VIRTUE RF is a treatment for everyone. Virtue is a tremendous tool as a drug delivery system. The RF sub-pulse technology with VIRTUE RF gives us the ability to put more energy into the skin, more comfortably. We can now perform better treatments without sacrificing patient experience."

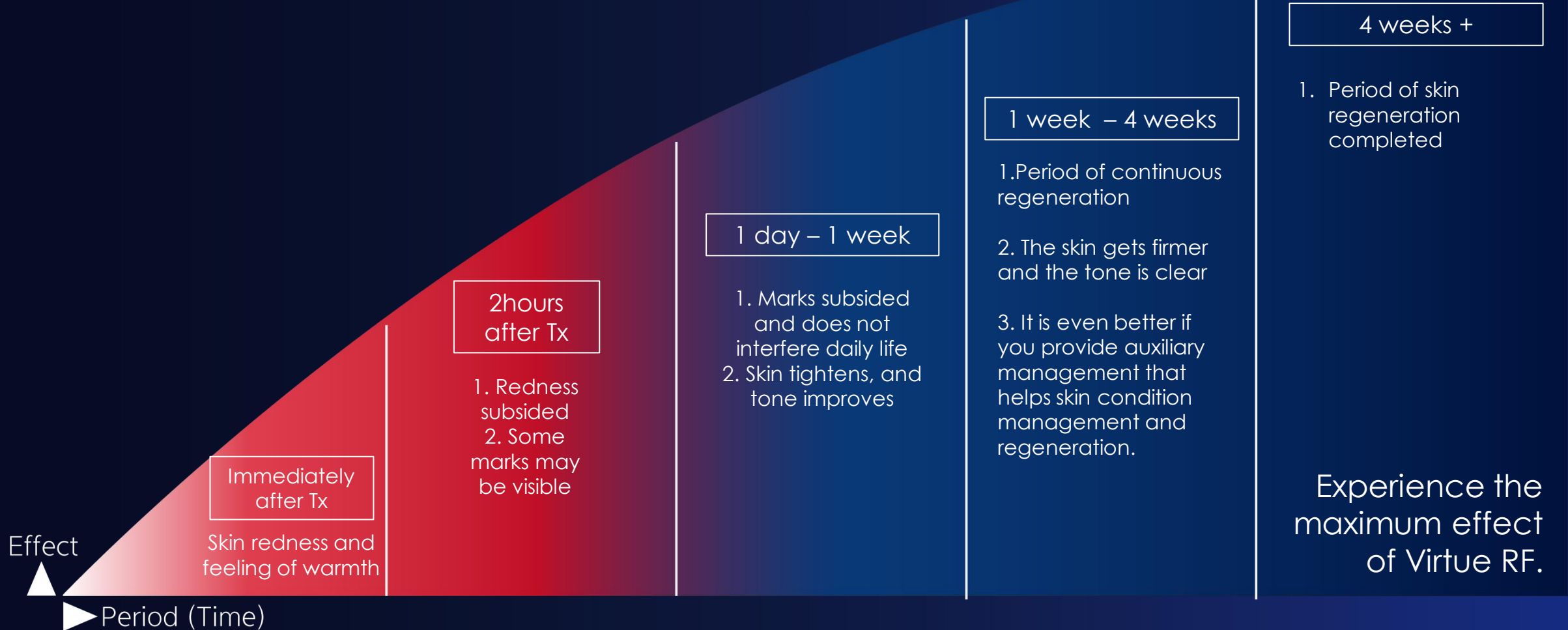
- Thomas Griffin Jr., MD. Dermatologist -

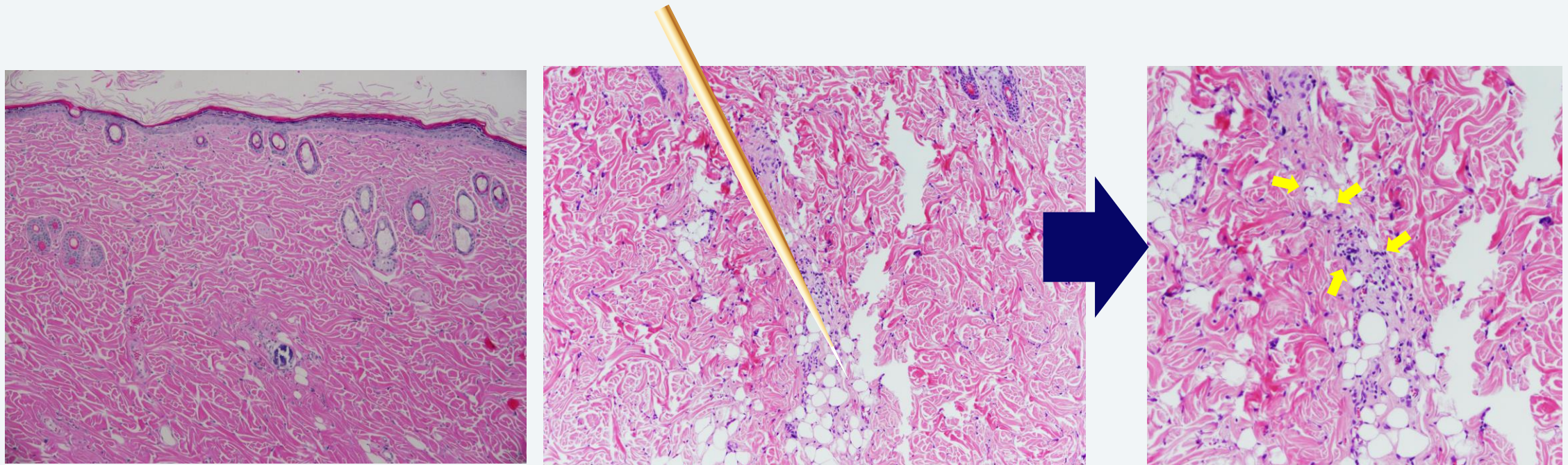


# VirtueRF Tx Effect

The maximum effect of Virtue RF  
After 4 weeks

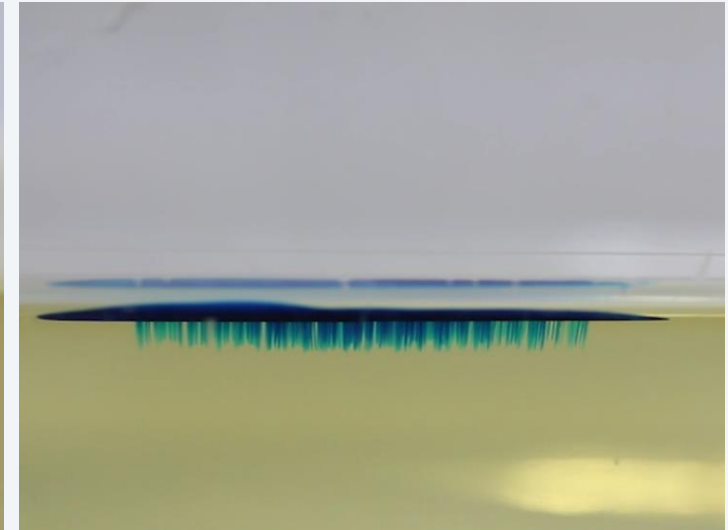
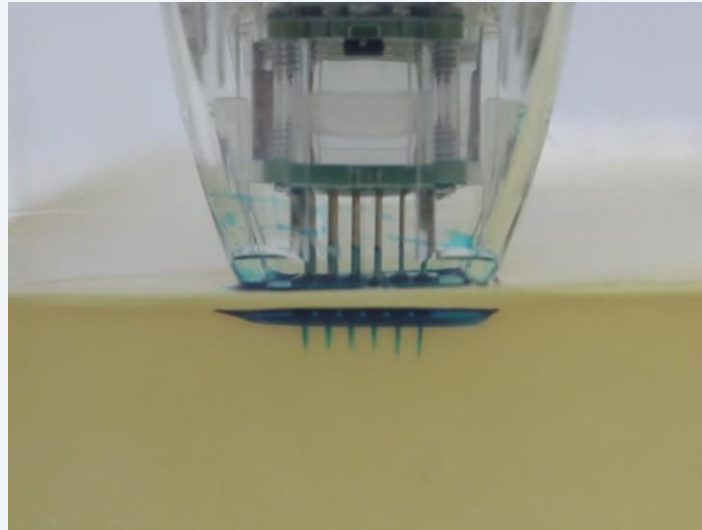
## VirtueRF Skin Regeneration Graph



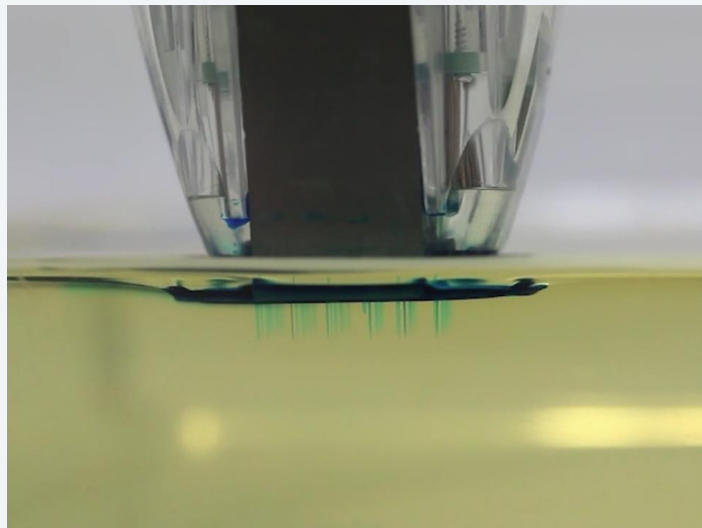


After applying PDLA (PLA+HA hybrid), PDLA is well injected during the needling.

**SMART RF**



**DEEP RF**



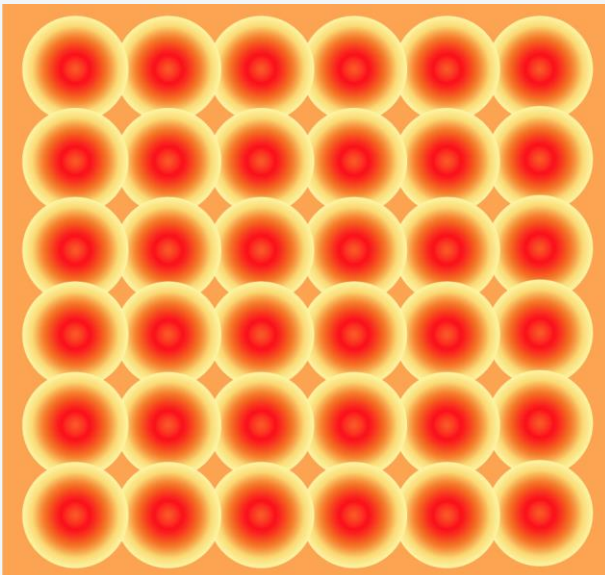
Indication

# Face Contouring

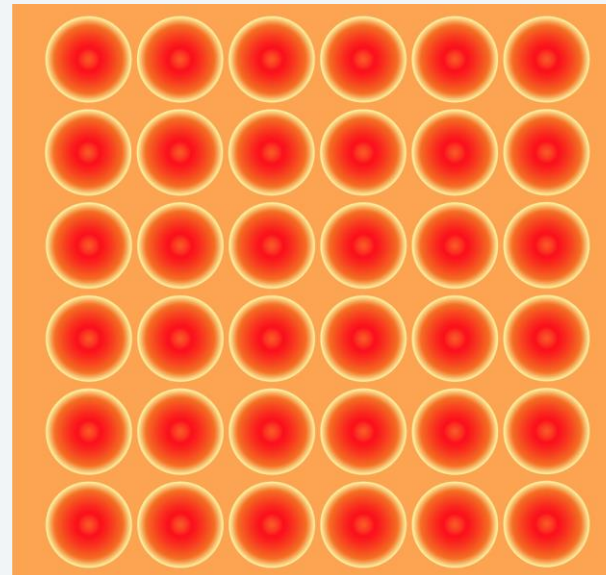
Freeze pain, Enhance effect



**Long Time & Low Level**



**Short Time & High Level**



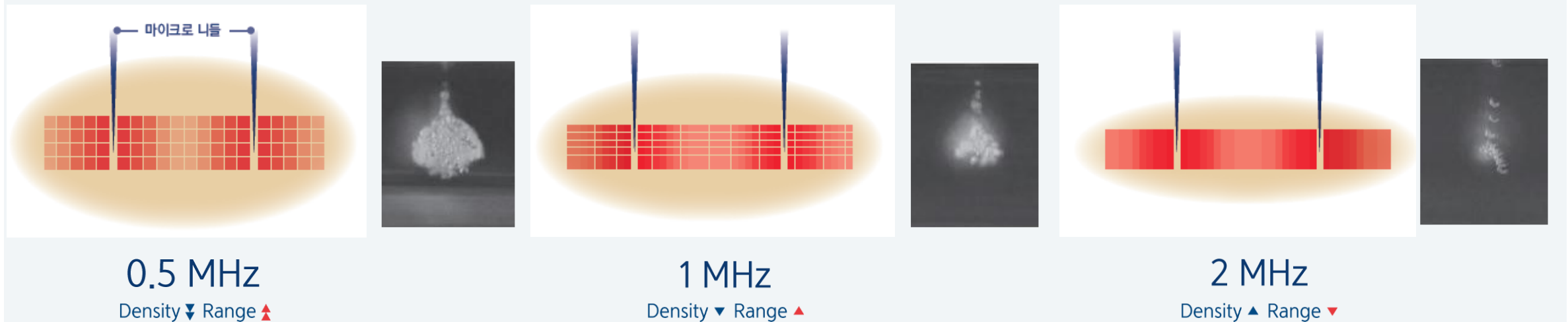
### **Between Time and Energy (1)**

1. The characteristics of RF energy varies by depending on the intensity and time of the transmitted energy.
2. Low energy is transmitted for a long time, a wider thermal zone is formed, and when high energy is transmitted for a short time, a coagulation zone is formed.
3. The practitioner must consider this theory to choose desirable method on its indications.

### The role of Virtue RF's 0.5MHz (2) - 0.5MHz, 1MHz, 2MHz Gelatin Phantom Experiment

The gelatin phantom experiment comparing the energy transfer range of each MHz, you can get the same result as above.

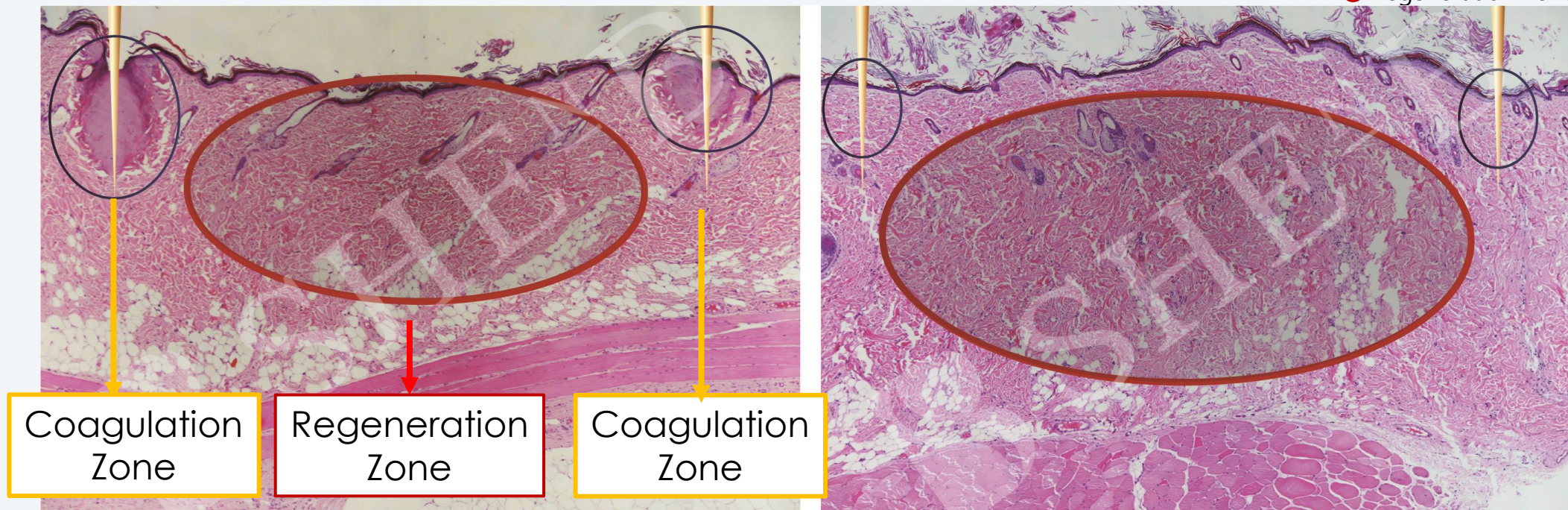
In the case of 0.5MHz, it can be identified that energy is transmitted over a wide range, and as the MHz increases, it can be confirmed that the energy is concentrated in the center..





### The Role of Sub Pulses in Energy Delivery

○ Coagulation zone  
○ Regeneration zone



**IPRS Technology OFF**  
Form of Coagulation Zone and  
Regeneration Zone in the tissue

**IPRS Technology ON**  
Form of Regeneration Zone without  
Coagulation Zone in the tissue

In a result of preclinical evaluation with VirtueRF, more sub pulses are used under the same parameter settings, the coagulation zone is reduced, and energy is delivered to a wider and deeper area.

### VIRTUE RF's FACE Contouring

Between Time and Energy : Time▲ Energy ▼ Forms a larger thermal zone



Between MHz and Transmission Region:

Compare to 1 or 2 MHz vs 0.5MHz, 0.5 MHz delivers wider range of energy.



Between Pulse and Energy:

When it is 10 pulses rather than 1 pulse, energy is delivered to a deeper and wider area.



Between FAT and Temperature \* Time:

If a certain temperature is maintained for a certain period of time, it induces an irreversible change in fat.



**VirtueRF DEEP Handpiece can use 0.5MHz, up to 10 pulses, and also control the transmit time up to 7 seconds. Furthermore cooling plate is adopted for prevention of skin damage while delivering heat for a long period of time.**

***The energy of 0.5MHz, 3Lv, 1000-1500ms, and 10Pulse of VIRTUE RF shows a very effective face contouring based on the above facts.***

## DEEP<sub>RF</sub>

Cooler, Stronger



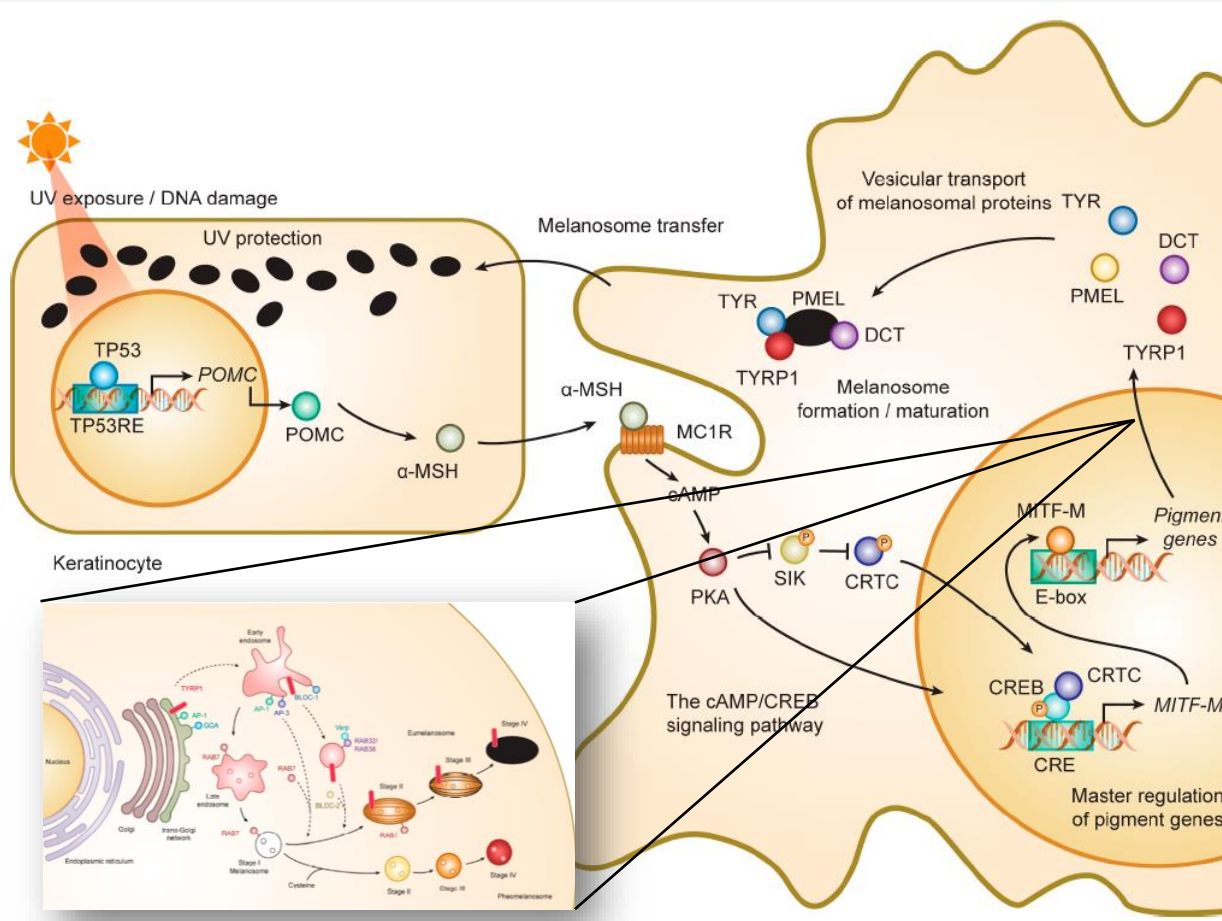
Indication

# Melasma

Freeze pain, Enhance effect



## Melanin Production Process: Summary



1. When **keratinocytes**, the outermost layer of the skin, are **exposed to UV light**, **α-MSH is produced**.
2. **Melanogenesis begins** when α-MSH binds to the melanocyte gateway with **MC1R**.
3. **MITF**, a transcription factor that regulates the expression and number of tyrosinase, **synthesizes the oxidizing factor, tyrosinase**.
4. This **tyrosinase plays an important role in the production of melanosomes**.
5. **Melanosomes mature in four stages: I, II, III, IV**. At this time, each maturation stage is progressed by the transfer proteins expressed in the Rab series, and **melanosomes finally migrate to the keratinocyte**.
6. When **melanosomes migrated to keratinocytes are degraded** within keratinocytes, **pigmentation like blemishes is generated**.

Reference  
Tokimasa Hida, Takafumi Kamiya, Akinori Kawakami, Jiro Ogino, Hitoshi Sohma, Hisashi Uhara and Kowichi Jimbow. Elucidation of Melanogenesis Cascade for Identifying Pathophysiology and Therapeutic Approach of Pigmentary Disorders and Melanoma. *Int. J. Mol. Sci.* 2020, 21(17), 6129; <https://doi.org/10.3390/ijms21176129>

## Characteristics of Melanin

### Role of semiconductivity and ion transport in the electrical conduction of melanin

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Edited by\* Brian M. Hoffman, Northwestern University, Evanston, IL, and approved April 6, 2012 (received for review December 3, 2011)

Melanins are pigmentary macromolecules found throughout the biosphere that, in the 1970s, were discovered to conduct electricity and display bistable switching. Since then, it has been widely believed that melanins are naturally occurring amorphous organic semiconductors. Here, we report on the first direct measurement of melanin's electrical conductivity, showing that the conductivity of melanin shifts as the environmental humidity is varied. We show that hydration of melanin shifts the composition equilibrium so as to dope electrons and protons into the system. This equilibrium defines the relative proportions of hydroxyquinone, semiquinone, and quinone species in the macromolecule. As such, the mechanism explains why melanin at neutral pH only conducts when "wet" and suggests that both carriers play a role in the conductivity. Understanding that melanin is an electronic-ionic hybrid conductor rather than an amorphous organic semiconductor opens exciting possibilities for bioelectronic applications such as ion-electron transduction given its biocompatibility.

bioelectronics | electrical properties | biomacromolecules | ionic conduction

The melanins are responsible for multiple critical functions in humans such as photoprotection and free radical scavenging (1). These molecules are also found in the substantia nigra of the human brain stem where their exact biological role is unknown; however, it has been speculated that neuromelanin may be involved in neural transmission (2). Melanin phototoxicity is also implicated in deadly melanoma skin cancer (3, 4). Despite decades of intense studies across biology, chemistry, and physics, the full details of the structure and functions of the melanins are still not clearly understood. Eumelanin, the major component in human skin pigment is viewed as the archetypal "true" melanin (here we adopt the standard nomenclature in which the terms "eumelanin" and "melanin" are used interchangeably). Eumelanin is composed of aggregated oligomeric and polymeric species based upon the indolic monomers 5,6-dihydroxyindole (DHI) and 5,6-dihydroxyindole-2-carboxylic acid (DHICA) and their various redox forms (1). These monomers are randomly cross-linked to form planar sheets, stacked via aromatic  $\pi$ - $\pi$  interactions and with varying conjugation length and character (5, 6, 7). For many years, melanins were considered as extended linear homo- or heteropolymers with a conjugated backbone (8). However, this view no longer has any credence and the disordered 2D photomolecular sheet model is now widely accepted. This sheet model has quite profound implications for the treatment of melanins within a conventional polymer framework, and many of the standard methods and theories for probing structure-property relationships in macromolecules are inadequate or simply do not apply.

Two properties of melanin have particularly intrigued physicists and chemists for decades: (i) Melanins are electrical conductors showing photoconductivity in the solid state; and (ii) melanins are black with broad featureless optical absorption and near unity nonradiative conversion of absorbed photon energy. The latter property is clearly linked to the photoprotective func-

tion. However, the biological need for the former is somewhat of a mystery, but may be linked to neurotransmission. More recently, other potentially useful properties of melanins and melanin-like materials have also been reported, such as multifunctional adhesives (9, 10), structural agents in the jaws of marine worms (11) and in cell walls of fungi (12) as well as protection against ionizing radiation (13).

For forty years, the accepted paradigm to explain electrical conductivity of melanins has been that they are amorphous organic semiconductors (14, 15). Important experimental evidence to support this model came from McGinness, et al. who observed electrical bistable switching between two resistive states (15), which, at that time, had only been seen in inorganic amorphous semiconductors. The model of melanin as an amorphous semiconductor also provides a possible explanation for the observed broad optical absorbance (14).

A critical point to note concerning McGinness, et al.'s observations is that switching was only seen when the melanin was hydrated (15). The authors argued that this observation could be rationalized in terms of the modified dielectric theory (16, 17) whereby the absorbed water lowers the activation energy for hopping transport. Following this seminal work, the amorphous semiconductor model became the accepted framework through which all electronic properties of melanin were interpreted (18–24). However, a small collection of electrical observations including electrochemical evolution of hydrogen during calorimetry (17), have cast doubt on this hypothesis. Also, it has been shown (25–27) that chemical disorder gives a natural explanation of the broad band optical absorption observed in eumelanin, particularly the absence of an optical gap. Finally, it is worthy of note that melanin chemistry is largely defined by its many ionizable moieties—carboxylic acids, amines and catechols in various states of oxidation within the macromolecular structure (1). One may therefore anticipate that melanin (like many other functional biomacromolecules) will exhibit generic polyelectrolyte behavior in which its weakly acidic nature plays an important role. This concept is yet to be explored within the amorphous semiconductor model, but certainly presents an alternative framework through which to interpret melanin structure-property relationships.

Given these inconsistencies and the clear role that hydration plays, we were motivated to undertake a carefully controlled study of the effect of humidity on the electrical properties of

Author contributions: B.J.P., I.R.G., G.R.H., and P.M. designed research; A.B.M., F.L.P., G.R.H., P.M., and T.S. performed research; A.B.M., B.J.P., F.L.P., G.R.H., T.S., I.R.G., and P.M. analyzed data; and A.B.M., B.J.P., G.R.H., and P.M. wrote the paper.

The authors declare no conflict of interest.

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www.pnas.org/doi/10.1073/pnas.1119948109

PNAS | June 5, 2012 | vol. 109 | no. 23 | 896–897

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Albertus B. Mostert, Benjamin J. Powell, Francis L. Pratt, Graeme R. Hanson, Tadeusz Sarna, Ian R. Gentle, and Paul Meredith. Role of semiconductivity and ion transport in the electrical conduction of melanin May 21, 2012 | 109 (23) | <https://doi.org/10.1073/pnas.1119948109>

### Mobility Gaps: A Mechanism for Band Gaps in Melanins

**Abstract.** The semiconductor behavior of melanins is reviewed and compared with quantum mechanical models of conduction in amorphous solids. The available data are consistent with extensions of Mott's basic model for amorphous semiconductors, whereas they are inconsistent with crystalline semiconductor models. An investigation of the specific conduction mechanisms operative in melanins in terms of the amorphous model should reveal important aspects of the band structure.

Melanins are good electron acceptors and have semiconductor properties (1), which appear to be important in the midbrain structures (2). In relation to these electronic properties, Cotzias et al. (2) noticed that both naturally occurring and drug-induced dyskinesia occur in species which possess visible melanin in the substantia nigra. Such data suggest that melanins have a more fundamental biological role than that of providing pigmentation or an ultraviolet sunscreen (3). For this reason a model of the electronic structure of melanins is of more than academic interest.

An analysis of data on melanins and melanin-containing systems suggests that the electronic properties of melanins can best be explained in terms of a band model for semiconductor in amorphous materials. The electronic

properties of melanins have been of considerable experimental interest. Blois (4), in addition to measuring other solid-state properties, investigated the possibility that melanins are intrinsic semiconductors. Blois (5) has pointed out that inconsistencies exist between the data on pure melanins and interpretations based on crystalline models of semiconductor behavior. Interpretation has, therefore, been ambiguous, even for the most elementary system, purified melanin. A quantum mechanical calculation based on the monomer unit indole-5,6-quinone was presented by Pullman and Pullman (1) in an effort to calculate the band structure of melanins.

It is necessary to differentiate between the melanin macromolecule and more complex systems, such as melanin-containing organelles. However, in some systems of greater complexity the

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### Reference

JOHN E. MCGINNESS  
*SCIENCE* • 8 Sep 1972 • Vol 177, Issue 4052 • pp. 896–897 • DOI:  
[10.1126/science.177.4052.896](https://doi.org/10.1126/science.177.4052.896)

It is a thesis that melanin is an electron acceptor and has semiconductor properties, and it can be assumed that melanin will be affected by RF with these properties.

Melanin = Semiconductor



## Characteristics of Cell

### THE SKIN EFFECT AND BIO-ELECTRICAL IMPEDANCE ANALYSIS

There has been a great deal of debate as to whether Dr. Rife's electrical frequencies can penetrate the human or animal skin via metal electrodes. The disagreement has been that the electrical frequencies will only travel along the outside of the body, never penetrating through the skin and entering the body tissue. This incorrect myth or understanding has come about because people are applying the "Skin Effect" of an electrical copper wire to human skin or tissue as though they are made of the same material. This "Skin Effect" myth was started by people who only believed that a plasma ray tube could deliver Dr. Rife's frequencies. This scientific report dispels this myth. Below we will start with the scientific definition of the "Skin Effect":

"Skin effect is the tendency of an alternating electric current to flow along the surface of the wire rather than through the middle, and the greater the resistance. Stranded wire produces more surface area. The skin effect enables copper wire to carry more current than solid wire of the same strength, and the current flows mostly through the surface of the wire."

The skin effect is due to opposing eddy currents from the alternating current. At 60 Hz in copper, the skin depth becomes much smaller. Increased skin depth is achieved by using specially woven litz wire."

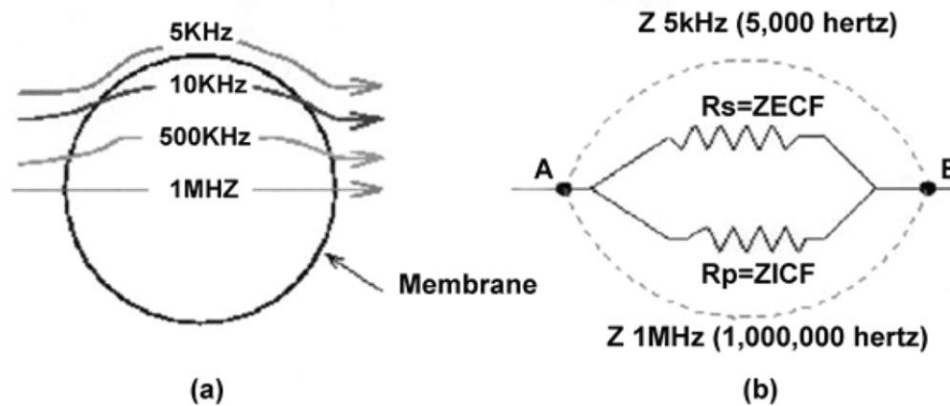
If you read carefully you will notice that this definition refers to human or animal skin or tissue. It only refers to the human or animal skin was made of metal then this definition and use it to describe how electrical current flows through the human skin.

Usually the people who misquote the "Skin Effect" are someone else. Then this false understanding justifies what they are told rather than checking it out. These scientific studies called "Bio-electrical Impedance Analysis" have been done which show how electrical energy penetrates the skin. These tests scientifically prove that the skin effect is much higher than those used by Dr. Rife.

Another education report that was published by Rife shows that lower frequencies are absorbed in the body. This report shows that at 100 MHz, electromagnetic energy can penetrate into more deeply situated tissues, making it especially desirable for therapeutic applications. The frequency of maximal absorption is called the resonance frequency and for humans it is between 70 and 100 MHz.

Dr. Rife worked with frequencies from the audio range up to about 18 MHz or 18 million Hertz. This range of frequencies is very low compared to the 70 to 3000 MHz range. These reports show that there is no "Skin Effect" in any of these ranges especially below 70 MHz. Below is the link to the Harvard report.

Figure 4.4: Path of the current through a cell



Capacitance reactance is inversely proportional to the frequency, and as the frequency increases, the overall impedance decreases, so that the current flows through the cell membrane without resistance.

Figure 4.4, able to see that RF passes through the membrane when it is above 1 MHz.

In other words, to pass electrical energy through the membrane, 1 MHz or more must be used.

## Melanin Treatment Effect




Article

### Radiofrequency Irradiation Mitigated UV-B-Induced Skin Pigmentation by Increasing Lymphangiogenesis

Hyoung Moon Kim <sup>1,2,4</sup>, Seyeon Oh <sup>2,4</sup>, Kyung-A Byun <sup>1,2</sup>, Jin Young Yang <sup>2</sup>, Hye Jin Sun <sup>3</sup>, Donghwan Kang <sup>3</sup>, Kuk Hui Son <sup>4,5</sup> and Kyunghye Byun <sup>1,2,4</sup>

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**Abstract:** Dermal macrophages containing melanin increase skin pigmentation since dermal melanin removal is slower than epidermal melanin removal. Lymphatic vessels are also involved in melanin clearance. We evaluated whether radiofrequency (RF) irradiation induced an increase in HSP70, which promotes lymphangiogenesis by activating the BRAF/MEK/ERK pathway and decreasing tyrosinase activity, in the UV-B exposed animal model. The HSP70/BRAF/MEK/ERK pathway was upregulated by RF. Tyrosinase activity and the VEGF-C/VEGFR-3/PDK/pAKT1/2/pERK1/2 pathway, which increase lymphangiogenesis, as well as the expression of the lymphatic endothelial marker LYVE-1, were increased by RF. Additionally, the number of melanin-containing dermal macrophages, the melanin content in the lymph nodes, and melanin deposition in the skin were decreased by RF. In conclusion, RF increased HSP70/BRAF/MEK/ERK expression, which decreased tyrosinase activity and increased lymphangiogenesis to eventually promote the clearance of dermal melanin-containing macrophages, thereby decreasing skin pigmentation.

**Keywords:** dermal macrophage-containing melanin; lymphangiogenesis; radiofrequency microneedling; ultraviolet-B; skin pigmentation

**1. Introduction**

Skin hyperpigmentation is usually accompanied by post-inflammatory hyperpigmentation or melasma [1]. In normal skin, melanin usually exists in the basal layer of the epidermis and is not exhibited in the dermis [2,3]. Skin inflammation induces either hyperplasia of epidermal melanocytes or increased function of epidermal melanocytes, which both result in enhanced melanogenesis and increased deposition of melanin in the epidermis or dermis [2–6]. Basement membrane damage induced by inflammation allows melanin to enter the dermis, where dermal macrophages phagocytose melanin through melanophagy [2,7]. Moreover, macrophages containing melanin travel to the epidermis, where macrophages further phagocytose melanosomes and then return to the dermis [2,7]. Through these processes, increased melanin deposition leads to hyperpigmentation [7]. It has not been fully revealed how melanin in the dermis is removed or what route is used to remove dermal melanin. However, the lymphatic system might be involved in the removal of melanin in the dermis. It was reported that hyperpigmented Kit<sup>1</sup>-Tg mice exhibited extreme proliferation of melanocytes in the epidermis, and their lymph nodes showed

in the melanin precursor L-tyrosine lysosome-like organelles [1]. Both hyperpigmentation in the skin: melanocytes for skin protection [2]; between melanin synthesis and by ultraviolet (UV) radiation, free x changes eventually result in rlin-1 receptor [6]. By binding the he melanocyte-inducing transcrip-

cosmetic problems. HSP70 upregulation (MITF) expression, which eventually de- (UV) radiation upregulates p53, which Furthermore, HSP70 decreases p53 and luated whether RF increased HSP70 and ase pathway and melanogenesis in UV-B 100 and 150 ms and 5, 10, and 15 W were for 28 d. When RF was performed with Masson staining, decreased without skin ted the effect of RF on decreasing melano- of 100 ms/10 W. HSP70 expression was y RF. The expression of p53, MC1R, and sed by RF. The expression of p53, MC1R, s decreased by RF. The decreasing effects ose of HSP70-overexpressed HEMn. The is appeared in the HSP70-silenced HEMn id by the p53 inhibitor in a MSH1-treated id MITF than the p53 inhibitor. Therefore, SP70 and decreasing p53, thus decreasing

ironmental stress and has the ability isorption of ultraviolet (UV) light in the disruption of skin integrity and ads to increased activity of the local on of various cytokines, corticotropin- in peptides, and enkephalins. Those elves into circulation and lead to the

1. RF reduces melanin without apoptosis (cell death) at 100ms, 10W.
2. Identified that it is **more effective to divide the energy twice** than to irradiate the energy once
3. RF reduces melanin content, inhibits melanin production, and prevents melanosomes from growing.

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## Melanin Treatment : Conclusion

# VIRTUE<sub>RF</sub>

Based on the above

1. Melanin is produced when the stratum corneum of the skin is exposed to UV rays.
2. Melanocytes are receptors and contain semiconductor properties.
3. When RF energy is above 1 MHz, it can pass through the cell wall.
4. When the energy of 2MHz, 100ms, and 10W was divided and delivered, a significant effect was shown.



When treating melasma using RF...

- Even if melanin does not burst, it is processed by redox reaction and becomes autophagocytosis.
- What some Langerhans cells (intra-epidermal macrophages) eat goes down to the dermis, differentiates into macrophages, and delivers them to lymphatics.
- When delivered to lymphatics, monocytes process and dispose of melanin in the lymph node for processing.
- Some of the melanin, which immediately falls into the dermis, is eaten and processed by macrophages.

# Indications

Melasma

Non-Insulation Tip, 2MHz, 10Pulse, Level 5, Depth 1.2-1.5mm, 200ms, 200-250 Shot, 1 month later



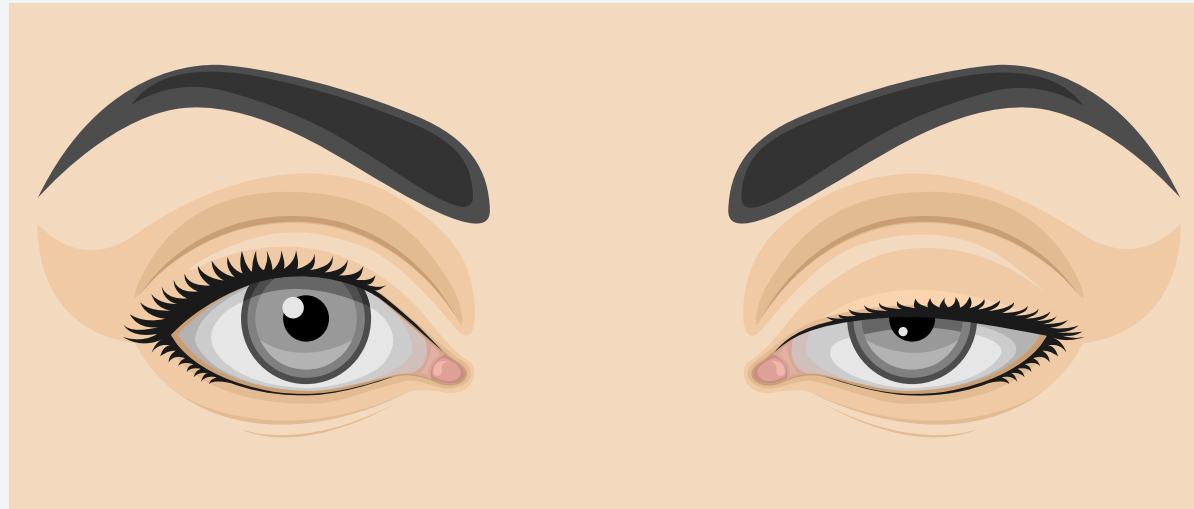
Indication

**Ptosis**

**Lifting of upper eyelid**

Freeze pain, Enhance effect





### Definition and Cause of Ptosis

#### Definition

Eyelid sagging is a condition in which the height of the upper eyelid is lowered due to various causes.

#### Cause

The muscles that lift the upper eyelid are the levator aponeurosis, the conjunctival Muller muscle, and the frontal muscle. If there are factors that affect the function of these muscles, they can all cause drooping eyelids.

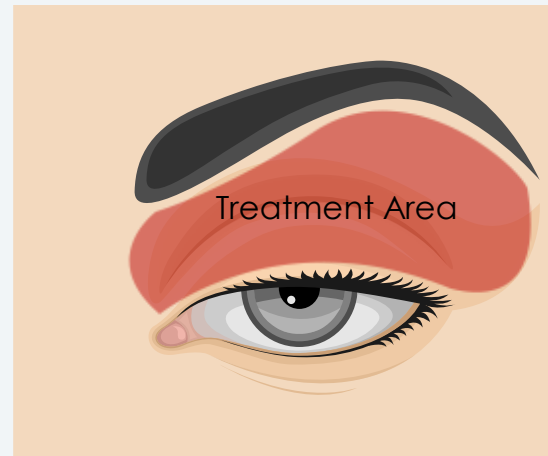
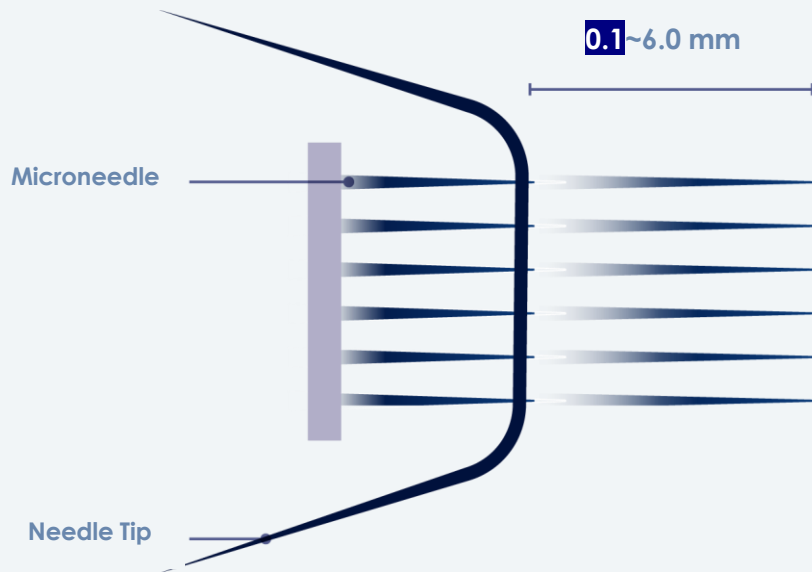
The main causes of eyelid sagging are congenital ptosis and senile ptosis, which occurs when the levator muscle weakens due to aging.

#### Symptom

Feels heavy opening the eyes, looks sleepy or eyelids are asymmetrical, feels comfortable when lifting a chin, and causes bad habit to use frontal muscle to lift the eyelids. In severe case, can deteriorate the eyesight.

# Indications

Ptosis – Lift of upper eyelid



DEEP 12Pin

## VIRTUE RF – Ptosis Treatment (1)

VIRTUE RF'S MDCS and ACS functions enables to treat ptosis which were difficult to treat in the past.

### Limitations of Conventional Treatment

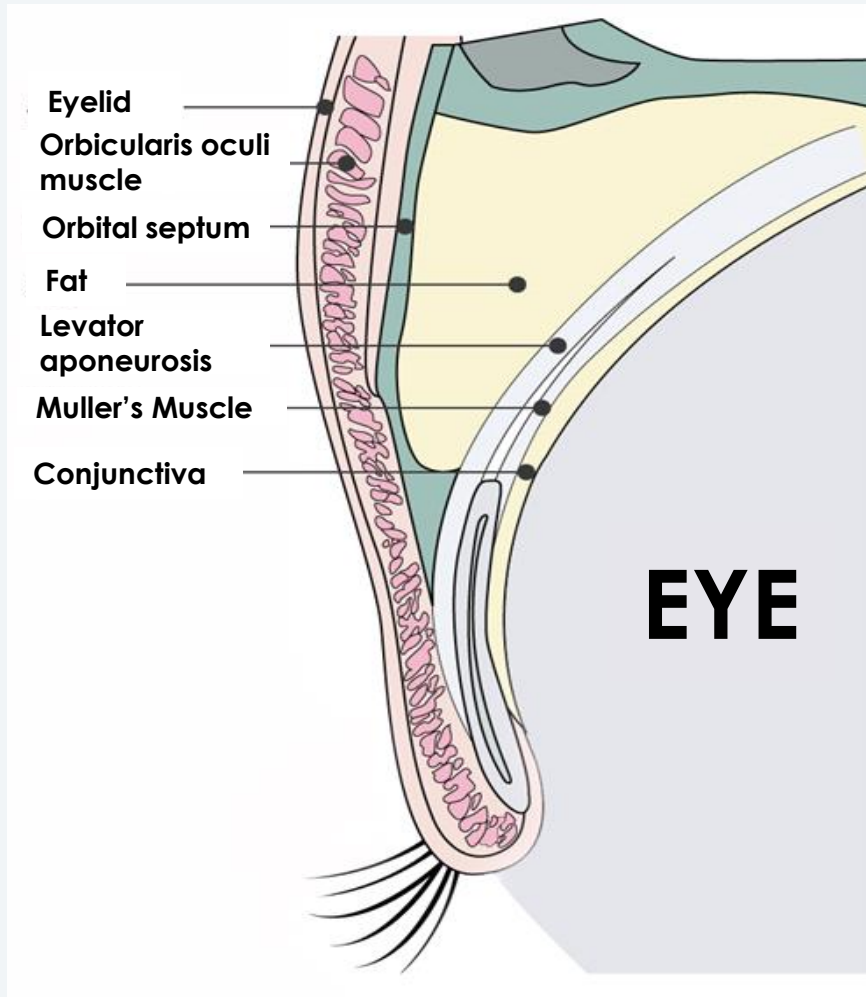
- Difficult to anesthetize the treatment area and vulnerable to pain
- Laser treatment causes pain and downtime
- Risk of eye
- Limitation of depth on microneedling treatment due to thin skin (existing technologies minimum depth 0.5mm)
- The shape of needle tip is not suitable for the site (square shape)

### VIRTUE RF Advantages

- Cooling function (ACS) decreases the pain (Anaesthesia X)
- 12Pin Needle Tip, easy to operate
- Minimum depth control (MDCS) can adjust from 0.1mm
- IECS (Integrated Energy Control System) function that can be used from 0.5 MHz to 2 MHz depending on the treatment area and range
- Extremely low downtime after the treatment

# Indications

Ptosis – Lift of upper eyelid



## VIRTUE RF – Ptosis Treatment (2)

### Target Patients

- Eyelid sagging due to aging
- Asymmetry
- Prefers non-surgical methods

### Treatment Methods

- Use DEEP Handpiece 12Pin Needle to treat the upper eyelid where sagging has occurred.
- The patient must close the eyes during the treatment, and pull up the sagging eyelid to the orbital bone to emit the needle.
- Deliver the thermal RF energy sufficiently to the Muller's muscle and upper eyelid.

### Cautions

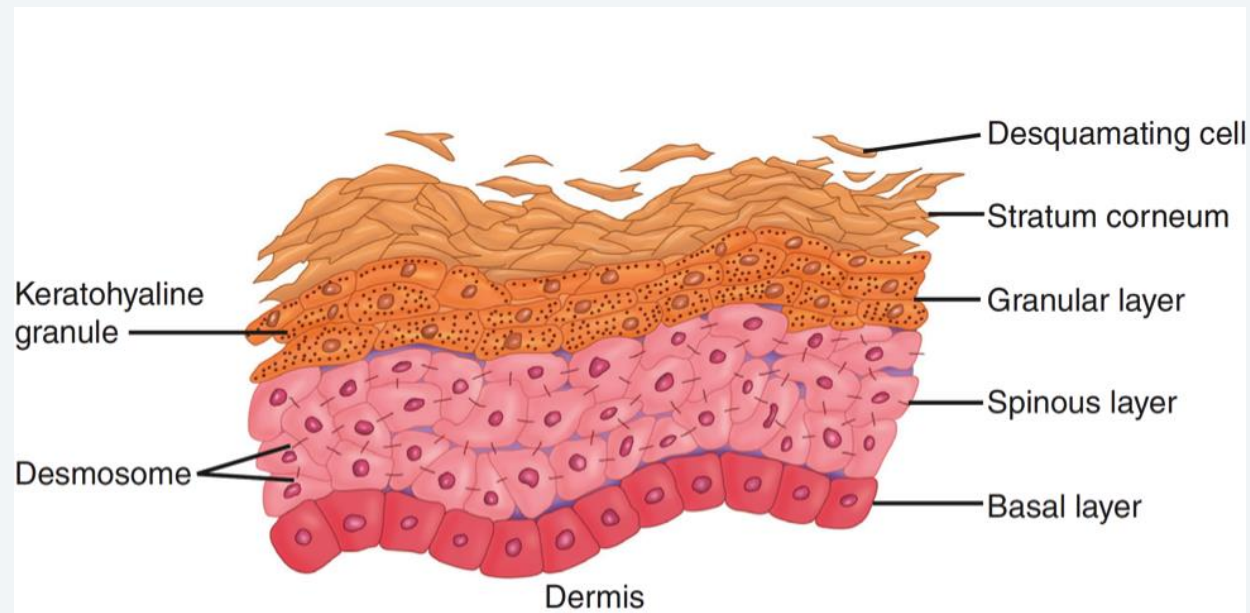
- Must not operate on the eyeball
- Avoid to press too hard on the eyeball and penetrate the eye during the treatment
- Make sure to check with the patient does not feel any discomfort during the treatment

Indication

# Micro Peeling

Freeze pain, Enhance effect

# Indications



Picture source: <https://lesliebaummd.com/the-5-layers-of-your-skin/>

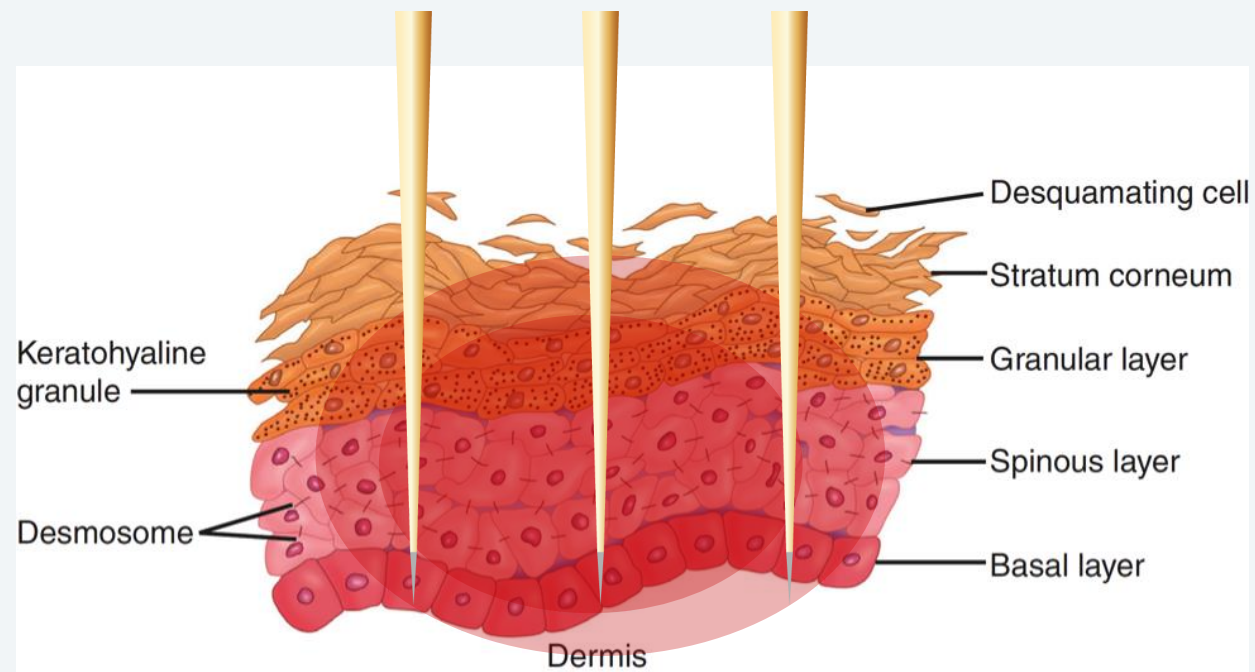
1. The stratum corneum of the skin consists of the stratum corneum, granular layer, spinous layer, and basal layer, and its thickness is 200 nm.
2. The basal layer is where new skin cells known as "keratinocytes" are created. As these new cells are created, they move upwards and "keratinize" as the old cells are pushed out. These skin cells reach the outer layer of the skin, pushing away dead keratinocytes and replacing them. This process takes about 26-40 days.
3. The stratum corneum is responsible for protecting the skin from the external atmosphere. However, if the exfoliation of the stratum corneum is not performed normally, it may cause skin troubles or make the skin surface rough.



# Indications

## VIRTUE RF's SMART HP is ...

1. VIRTUE RF, which supports needle depth from 0.1mm, enables to target epidermis and stratum corneum.
2. SMART HP's Non-Insulated Tip targets the epidermal layer and induces less downtime while inducing the exfoliation of the stratum corneum and speeding up the skin regeneration cycle.
3. It eliminates the problems that cause rough texture, enlarged pore, and skin troubles, and provides effective treatment for the epidermal layer.

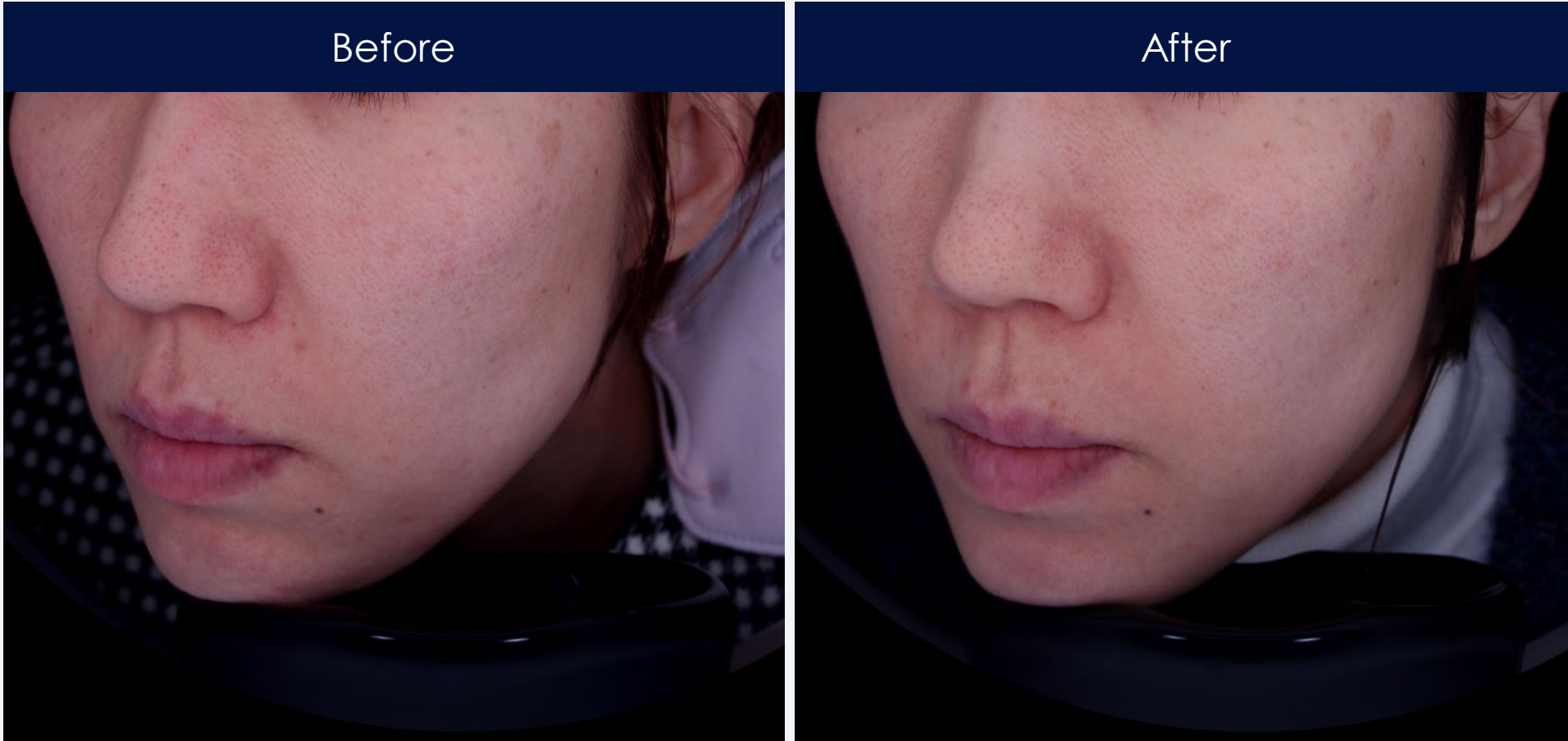


Picture source: <https://lesliebaumannmd.com/the-5-layers-of-your-skin/>

# Indications

Micro Peeling

Non-Insulation Tip, 1MHz, 7-8Pulse, Level 5, Depth 0.3mm, 400ms, 200-250 Shot, 1 week



# ⌘ Precautions

## Precautions During Tx

- Do not repeatedly overlap the same treatment area.
- Do not treat infected or inflamed areas.
- Do not move the handpiece while the needle is inserted and RF energy is delivered.
- Make sure microneedles are completely returned from the skin then move the handpiece.
- Always keep the handpiece perpendicular to the skin surface.
- Microneedle cartridge is disposable and must not be reused.

## Precautions After Tx

- Calm the treatment area with cooling pack after the treatment.
- Do not wash the treatment area with hot water within 24 hours.
- Immediately after the treatment, apply a solution or similar type of mist to moisture the treatment area.
- Avoid excessive exercise, alcohol, or sauna
- Do not use peeling or exfoliating products for one week after the treatment.
- Apply moisturizing and regenerating creams daily to increase recovery time and treatment results.
- Apply sunscreen when going out.
- Consult with a doctor immediately if the skin reactions that were not previously notified.

# Comparison

Freeze pain, Enhance effect

# VIRTUE RF vs Competitors

	VIRTUE RF	G	P	Ge	S	S(X)
Handpiece	SMART, DEEP, EXACT	Single HP	Main HP 1 pin HP	RM(RF-Microneedle) RN(RF-Needle) RV(RF-Venus) RC(RF-Circle)	SMART CURE NEEDLE 1 pin HP STEPPING MOTOR NEEDLE HP	Single HP
Frequency	SMART: 1 MHz, 2 MHz DEEP: 0.5 MHz, 1 MHz, 2 MHz EXACT: 1 MHz	0.46 MHz	1 MHz, 2 MHz	2 MHz	2 MHz	2 MHz
Penetration Depth	SMART: 0.1 – 3.5 mm DEEP: 0.1 - 4.0 mm EXACT: 0.1 – 4.0 mm	0.1 – 3.5 mm	0.5 – 3.5 mm	0.5 - 3.5 mm	0.5 – 3.5 mm	0.3 - 4.0 mm
TIP TYPE	SMART: Insulated, Non-Insulated (36 pin) DEEP: Insulated (12 pin., 36 pin) EXACT: Non-Insulated (1 pin)	49 pin (face) 49 pin (body) 14 pin 16 pin	21 pin, Insulated (16, 25, 49 pin) Semi Insulated (16, 25, 49 pin) 1 pin (8, 12, 15 mm)	RM: Non-Insulated(25 pin, 49 pin) Insulated (25 pin, 49 pin) RN: Insulated (1.2 mm, 2.5 mm, 1.8 mm)	1 pin, 4 pin 10 pin, 25 pin, 64 pin (Insulated, Semi Insulated)	X (25 pin), XE (25 pin), XA (25 pin), XW (18 pin)
Energy Type	SMART: Bi polar DEEP: Bi polar EXACT: Mono polar	Bi polar	Bi polar Mono polar	RM: BI Polar RN: Mono polar	Bi polar	Bi polar
Pulse	1 – 10 pulse	0, 200, 400, 600 ms	1-5 pulse	-	-	4 pulse (4 pulses Fixed ,msec can be adjusted)
Etc	DEEP RF Cooling System EXACT RF (Depth control by Scroll)	Intelligent System	Pumpling Tip	4 Kinds of HP Customer Management System	-	Continuous mode 4 kinds Pulsed mode 4 kinds



# Clinical Photos

Freeze pain, Enhance effect

# Clinical Photos

Wrinkles

3 Treatment

Deep, 36pin, 0.5MHz, 3 level, 1.5mm, 300ms, 8 pulse

Before



After



# Clinical Photos

Wrinkles

3 Treatment

Deep, 36pin, 0.5MHz, 3 level, 1.5mm, 300ms, 8 pulse

Before



After



# Clinical Photos

Wrinkles

3 Treatment

Deep, 36pin, 0.5MHz, 3 level, 1.5mm, 300ms, 8 pulse



# Clinical Photos

Acne

3 Treatment

Deep, 36pin, 1MHz, 6 level, 1.5mm, 300ms, 7 pulse

Before



After





# Clinical Photos

Acne

3 Treatment

Deep, 36pin, 1MHz, 6 level, 1.5mm, 300ms, 7 pulse

Before



After



# Clinical Photos

Melasma

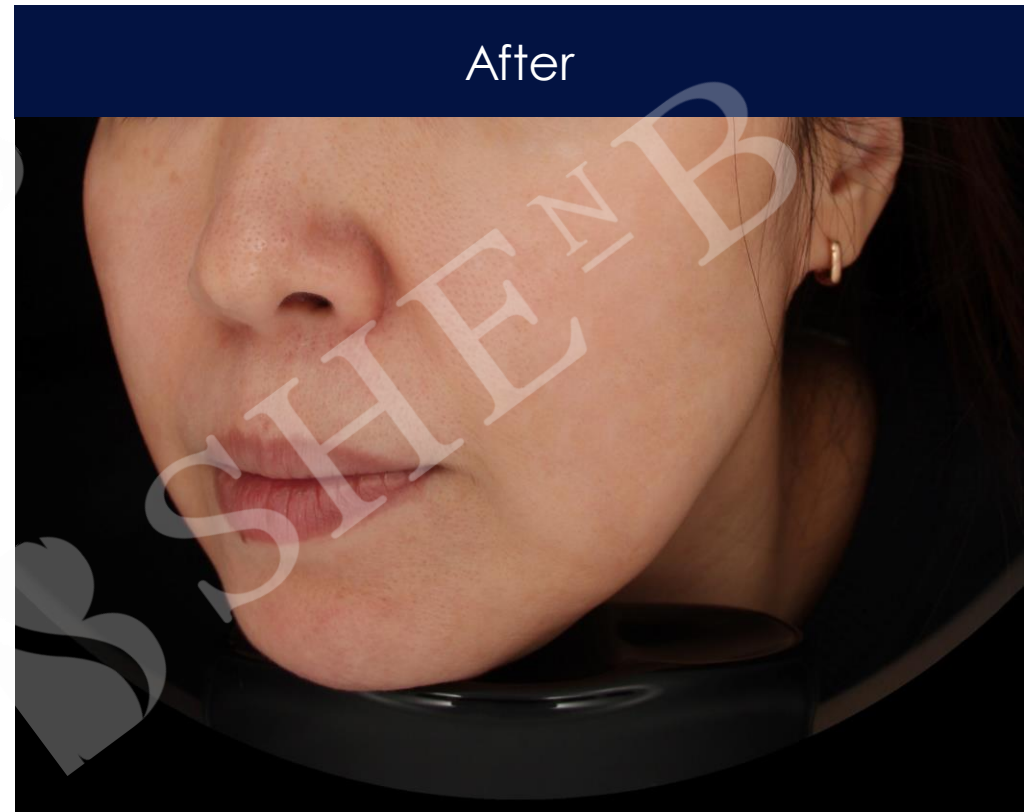
3 Treatment

Smart, Non-ins, 2MHz, 5 level, 1.2-1.5mm, 400ms, 7 pulse

Before



After



# Clinical Photos

Melasma

3 Treatment

Smart, Non-ins, 2MHz, 5 level, 1.2-1.5mm, 400ms, 7 pulse

Before



After





# Clinical Photos

Face Contouring(Lifting, Tightening)

1 Treatment

Deep, 36pin, 0.5MHz, 3 level, 1.3-2.0mm, 1000ms, 10 pulse

Before



After



# Clinical Photos

Face Contouring(Lifting, Tightening)

1 Treatment

Deep, 36pin, 0.5MHz, 3 level, 1.3-2.0mm, 1000ms, 10 pulse

Before



After





# Clinical Photos

Face Contouring(Lifting, Tightening)

1 Treatment

Deep, 36pin, 0.5MHz, 3 level, 1.3-2.0mm, 1000ms, 10 pulse

Before



After



# Clinical Photos

Face Contouring(Lifting, Tightening)

1 Treatment

Deep, 36pin, 0.5MHz, 3 level, 1.3-2.0mm, 1500ms, 10 pulse

Before



After



# Clinical Photos

Face Contouring(Lifting, Tightening)

1 Treatment

Deep, 36pin, 0.5MHz, 3 level, 1.3-2.0mm, 1500ms, 10 pulse

Before



After





# Clinical Photos

Face Contouring(Lifting, Tightening)

1 Treatment

Deep, 36pin, 0.5MHz, 3 level, 1.3-2.0mm, 1500ms, 10 pulse

Before

After



# Clinical Photos

12 Days Post, 3 Treatments





# Clinical Photos



# Clinical Photos

Post Three Treatments



# Clinical Photos





# Clinical Photos



# Clinical Photos

Post 1 Treatments





# Clinical Photos

Post 2 Treatments



# Clinical Photos

2 Weeks Post, 1 Treatments



# Clinical Photos

Before



After



# Clinical Photos





# Clinical Photos

4 Weeks Post, 1 Treatments

Before



After





# Clinical Photos

3 Months Post, 3 Treatments



# Clinical Photos



# Clinical Photos

Post 1 Treatment



# Clinical Photos

4 Months Post, 3 Treatment





# Clinical Photos





# Clinical Photos

4 Months Post, 4 Treatment



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