PICOCARE

Beyond Nano, Experience Real PICO

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Picosecond laser 1064nm, 532nm, 595nm & 660nm

Benign Pigmented Lesion Treatment | Tattoo Removal For Various Colors

| Skin Rejuvenation

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Contents

Picocare

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Multiple Wavelength	HEXA MLA	Auto Calibration
1064nm 532nm L532nm 595nm 660nm	Scar Treatment Skin Rejuvenation	Convenient and Easy to Use System Stable Energy Output Effective & Safe Treatment

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01 Indications

Tattoos

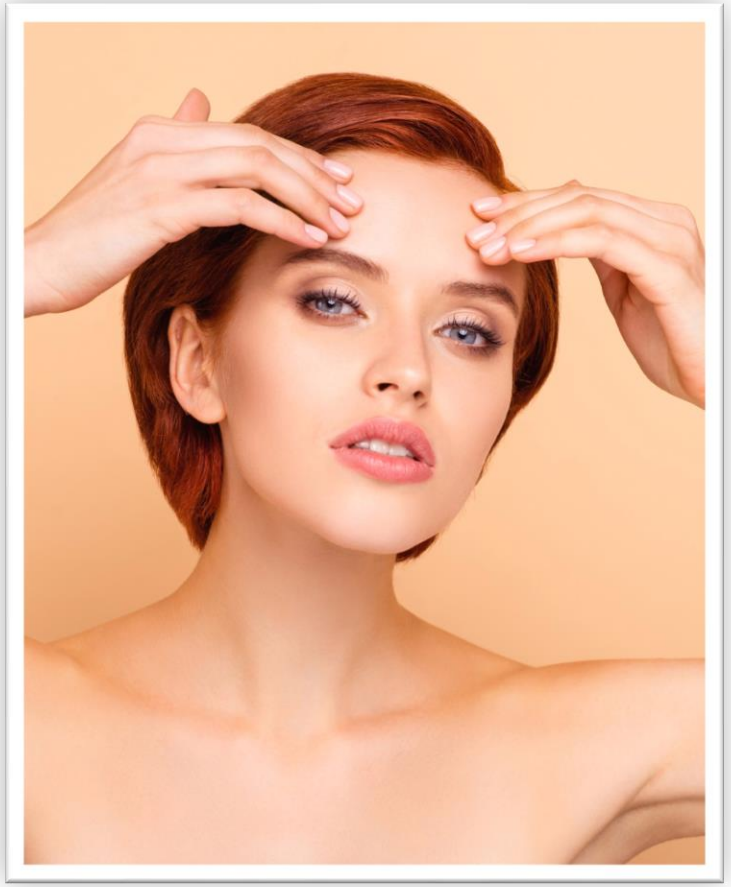
- Tattoo removal for various colored inks (wavelength specific)

Pigmented Lesions

- Sunspots, liver spots, seborrhea keratosis, lentigines, age spots, sunspots, caf-au-lait, melasma

Skin Rejuvenation

- Collagen and elastin remodeling for skin texture, pores, fine lines and wrinkles.



Pigmentation Treatment:

Pulse & Energy

- The 450 Pulse duration is related to stress relaxation time.
- The high peak power and picosecond pulse duration allows for a photomechanical impact (high pressure) instead of photothermal heat (Long pulse or Q-switch lasers).
- This leads to breakdown of pigmentation or ink into smaller particles (sand) allowing for easier clearance for the bodies lymphatic system.
- Lower fluence levels are used compared to Q-switch.
- Short pulse duration allows for clearance of stubborn or lighter pigment and tattoo ink particles.
- Light energy can reach the target without affecting the surrounding skin.

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Pigmentation Treatment: Treatment Sessions

Clinical Evidence

STUDY

ONLINE FIRST

Removal of Tattoos by Q-Switched Laser

Variables Influencing Outcome and Sequelae in a Large Cohort of Treated Patients

Pier Luca Bencini, MD; Simone Cazzaniga, PhD; Athanasia Tourlaki, MD; Michela Gianna Galimberti, MD; Luigi Naldi, MD

- 10 sessions: 47.2%
- 15 sessions: 74.8%

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02 Picosecond Pulse Duration

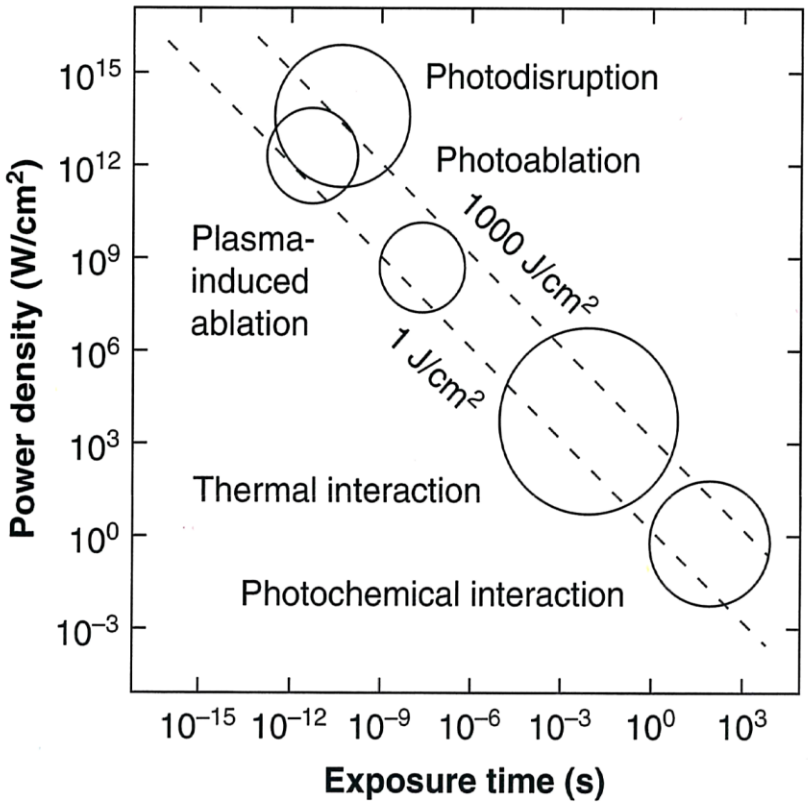


Figure 1.7 The relative mechanisms of action as a function of power density range. Source: Modified from Ref. 157.

NANOSECOND PULSE

- One BILLIONTH of a second
- 0.000000001

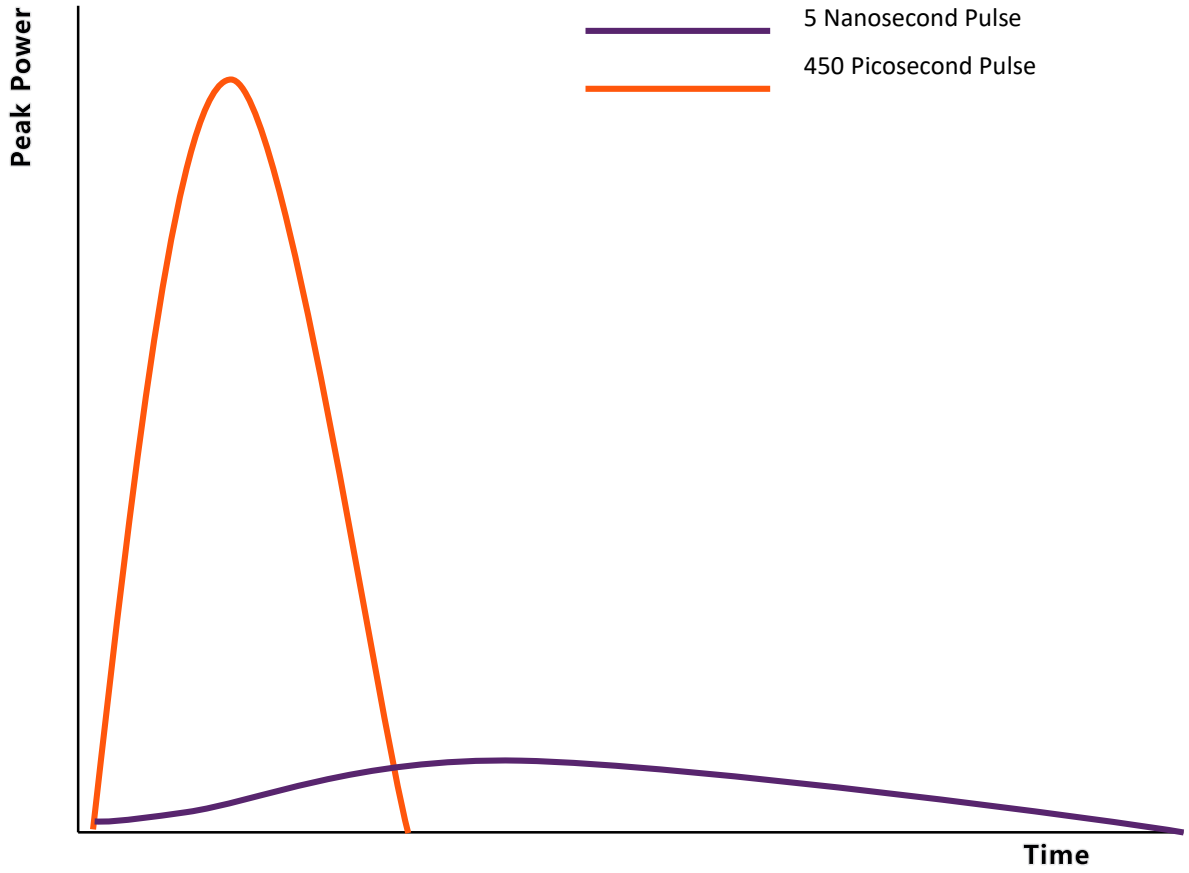
10^{-9}

PICOSECOND PULSE

- One TRILLIONTH of a second
- 0.000000000001

10^{-12}

Picosecond Pulse: Peak Power



Peak Power (W) = Energy (J) / Pulse Duration (S)

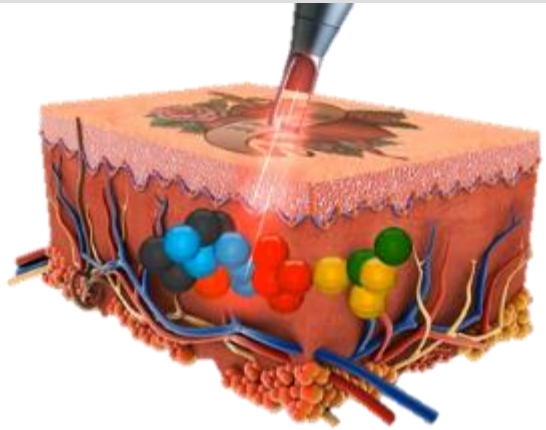
5 Nanosecond Pulse

- A photomechanical effect occurs when tissues are rapidly heated by short pulse duration. High energy power hitting the target causing shock wave reaction.

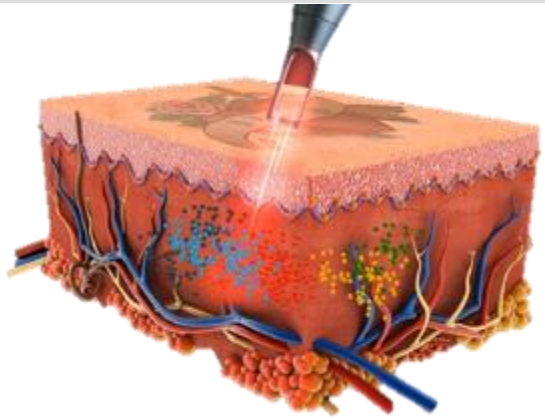
450 Picosecond Pulse

- The higher peak power of ultrashort pulses creates safer treatment for pigmented lesions, colored tattoos and skin rejuvenation.

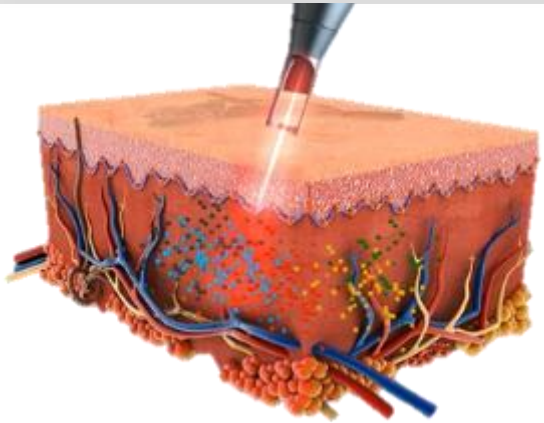
Principle of Tattoo Removal



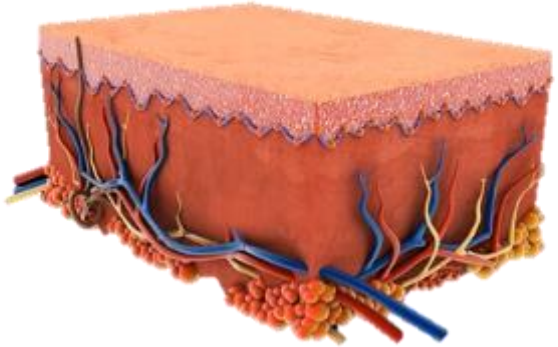
1. Laser Radiation



2. Collapse



3. Collapse



4. Tattoo Particle Removal

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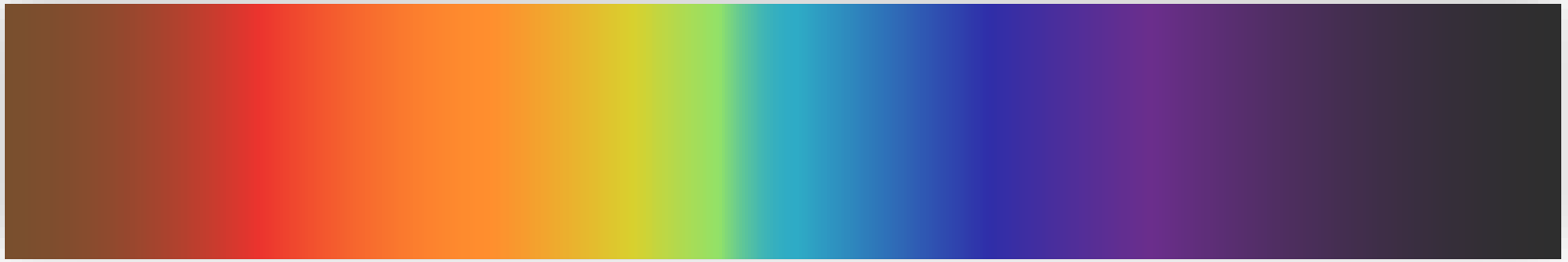
Wavelength Absorption of Tattoo Ink



	Brown	Red	Orange	Yellow	Green	Blue	Purple	Black
532nm	✓	✓	✓	✓				
1064nm	✓						✓	✓
595nm						✓		
660nm					✓			

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Tattoo Removal Treatment

- Upon the impact of the laser, tattoo particles are fragmented into smaller particles.
- Some tattoo ink is stored in lymph nodes, some of the ink is cleared and excreted throughout the bodies lymphatic system.
- Factors that affect desired results of tattoo removal include tattoo size, depth of ink, density, age of patient, location of the tattoo, and condition of the skin.
- Test results are always suggested to see clinical endpoint before treatment.
- Cosmetic ink may oxidize, darken, or change color from laser light.
- Multiple wavelength are always best to use for certain ink colors.

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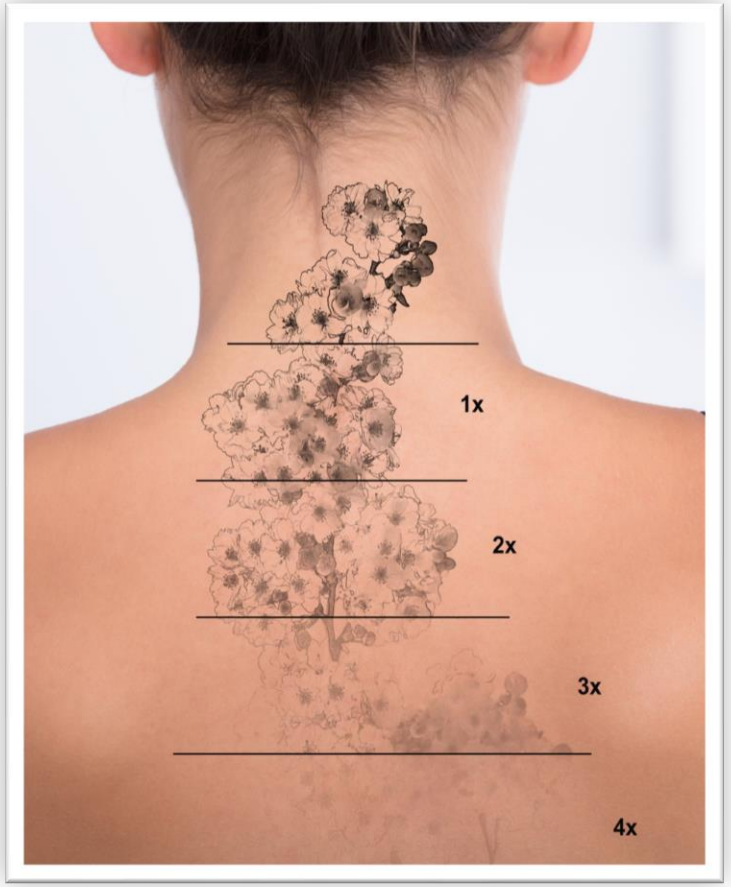
Tattoo Removal Best Practices

- Handpiece should be kept perpendicular to the skin.
- 1-2 test shots should be administered in an area prior to treatment.
- Slight epidermal whitening should occur (frosting), it may not be as evident on tattoo's that have had multiple treatment sessions.
- Area should be treated with one pass, tight, interlocking patterns. Stacked pulses is not a recommended technique. Up to 20% overlap pattern is recommended.
- Erythema and edema are common. If bruising or pinpoint bleeding occurs during treatment, fluence levels may be too high.
- Test spots are recommended for skin types IV- VI. Evaluate it to see any pigment changes.

*Suggested Tx parameters are based on information provided by physicians, published articles, and or clinical studies. Every patient is evaluated prior to treatment.



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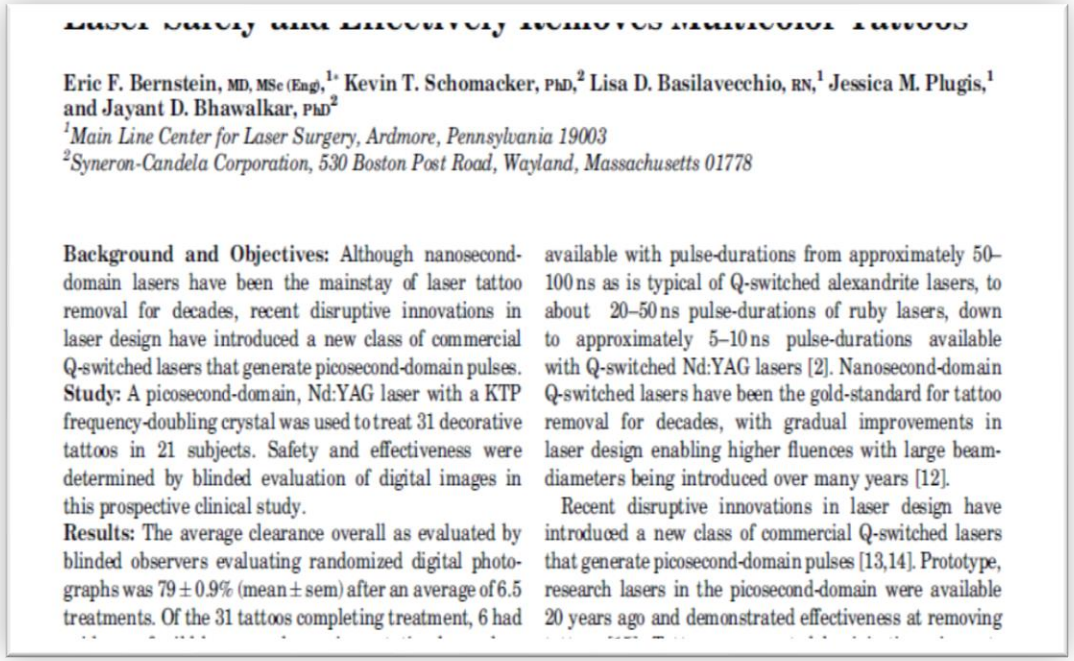
Clinical Evidence



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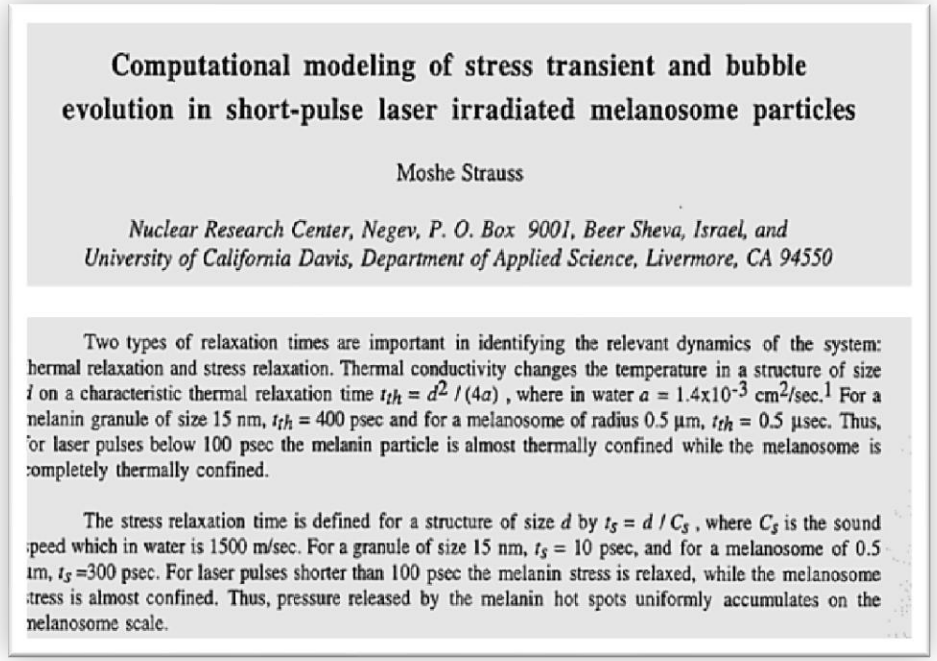
Background and Objectives: Although nanosecond-domain lasers have been the mainstay of laser tattoo removal for decades, recent disruptive innovations in laser design have introduced a new class of commercial Q-switched lasers that generate picosecond-domain pulses. **Study:** A picosecond-domain, Nd:YAG laser with a KTP frequency-doubling crystal was used to treat 31 decorative tattoos in 21 subjects. Safety and effectiveness were determined by blinded evaluation of digital images in this prospective clinical study. **Results:** The average clearance overall as evaluated by blinded observers evaluating randomized digital photographs was 79 ± 0.9% (mean ± sem) after an average of 6.5 treatments. Of the 31 tattoos completing treatment, 6 had

available with pulse-durations from approximately 50–100 ns as is typical of Q-switched alexandrite lasers, to about 20–50 ns pulse-durations of ruby lasers, down to approximately 5–10 ns pulse-durations available with Q-switched Nd:YAG lasers [2]. Nanosecond-domain Q-switched lasers have been the gold-standard for tattoo removal for decades, with gradual improvements in laser design enabling higher fluences with large beam-diameters being introduced over many years [12].

Recent disruptive innovations in laser design have introduced a new class of commercial Q-switched lasers that generate picosecond-domain pulses [13,14]. Prototype, research lasers in the picosecond-domain were available 20 years ago and demonstrated effectiveness at removing



Computational modeling of stress transient and bubble evolution in short-pulse laser irradiated melanosome particles

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Two types of relaxation times are important in identifying the relevant dynamics of the system: thermal relaxation and stress relaxation. Thermal conductivity changes the temperature in a structure of size d on a characteristic thermal relaxation time $t_{th} = d^2 / (4a)$, where in water $a = 1.4 \times 10^{-3}$ cm^2/sec.[1] For a melanin granule of size 15 nm, $t_{th} = 400$ psec and for a melanosome of radius 0.5 µm, $t_{th} = 0.5$ µsec. Thus, for laser pulses below 100 psec the melanin particle is almost thermally confined while the melanosome is completely thermally confined.

The stress relaxation time is defined for a structure of size d by $t_s = d / C_s$, where C_s is the sound speed which in water is 1500 m/sec. For a granule of size 15 nm, $t_s = 10$ psec, and for a melanosome of 0.5 µm, t_s =300 psec. For laser pulses shorter than 100 psec the melanin stress is relaxed, while the melanosome stress is almost confined. Thus, pressure released by the melanin hot spots uniformly accumulates on the melanosome scale.

- Typically 5-10ns pulse duration with Q-switch ND:Yag has been the gold standard for tattoo removal.
- Now a picosecond domain, ND: Yag with a KTP is determined to be the new generation of tattoo along with being safe and effective treatment.

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Clinical Evidence

Clearance of Yellow Tattoo Ink With a Novel 532-nm Picosecond Laser

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Background and Objectives: Although technology and tattoo removal methods continue to evolve, yellow pigment clearance continues to be challenging and usually unsuccessful. We describe a case series of six tattoos containing yellow ink, successfully treated with a frequency-doubled Nd:YAG 532-nm picosecond laser.

Study Design/Materials and Methods: Case series with six subjects participating for the treatment of multicolored tattoos that contain yellow pigment. Treatments performed with a frequency-doubled Nd:YAG 532-nm picosecond laser at 6–8 week intervals.

Results: One subject achieved complete clearance of the treated site after one session, and five subjects required 2–4 treatments to achieve over 75% clearance. Minimal downtime was experienced, and no scarring or textural skin changes were observed in any of the treated sites.

Conclusions: This is the first case series that demon-

any given tattoo [6]. However, complete removal can never be guaranteed and residual pigment often remains after multiple sessions.

Tattoo color is one of the main predictors of clearance, and with the introduction of the alexandrite picosecond laser [1,2], blue and green pigments can now be effectively cleared with few treatments. On the other hand, there is no established and definitive treatment for yellow pigments, as the dye is not well absorbed by the current available wavelengths. Yellow dyes are typically made of cadmium sulfide, ochre, Pigment Yellow 74, chrome yellow, or curcuma yellow, and are currently treated with the Q-switched frequency doubled Nd:YAG laser with a nanosecond pulse duration, but clearance remains difficult and inconsistent. A study by Ferguson on treating multicolored tattoos with an Nd:YAG Q-switched device with a nanosecond pulse width demonstrated an improvement

RESULTS

We describe the findings of six subjects with multicolored tattoos that contain yellow pigment. The average age was 36 years (range: 25–44 years), three males and three females participated, three with Fitzpatrick skin type II and three with skin type III. The average subject tattoo size was 197 cm^2 (range 27–324 cm^2), and the median tattoo age was 13 years (range 7 weeks to 20 years).

One subject achieved complete clearance of the yellow pigment after the first treatment, and five of the subjects required between 2 and 4 treatments to achieve over 75% clearance of the yellow ink (Table 1). Anticipated events were mild to moderate in severity and included edema, erythema, pain, and crust formation. Blister formation was reported by three of the subjects, and transient hypopigmentation was noted in one subject. Of significance, no scarring or skin textural changes were seen on follow up. All of the subjects required anesthesia with an average pain score of 1.3/10 (range 0–6/10). One subject elected to use topical anesthesia, reporting a maximum pain score of 6/10 during treatment.

- Picosecond laser at 532nm wavelength is effective in clearance of yellow tattoo ink

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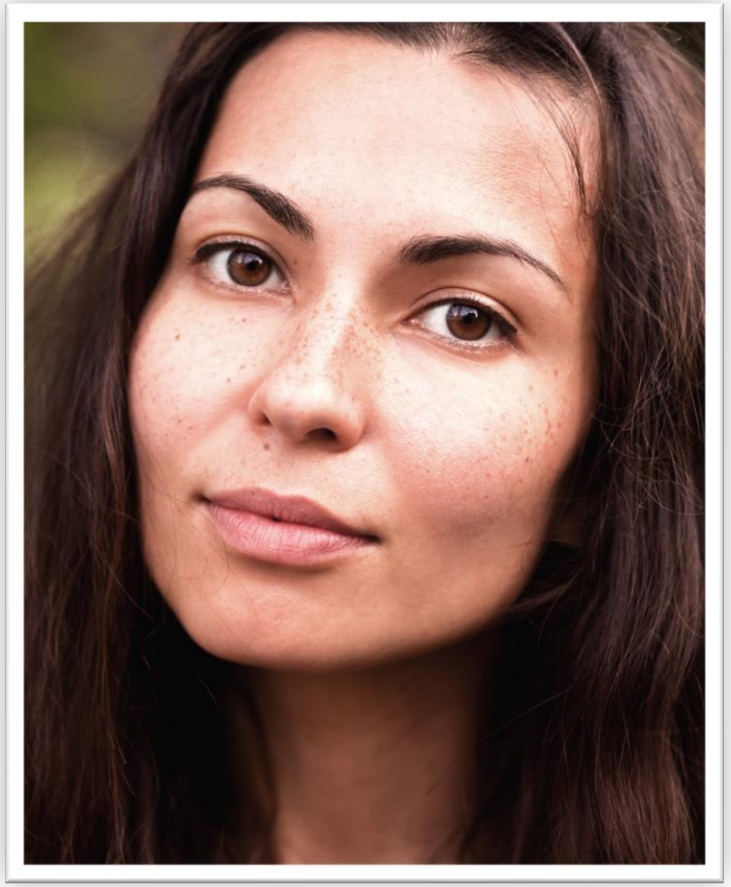
Epidermal/Dermal Lesions Treatment

- Tissue responds with an immediate color change of a darkening, light frosting or whitening effect to lesion.
- Clinical endpoint or reaction can be peri-lesional erythema and/or edema.
- Skin cooling is recommended during and/or after treatment ex. cooled air or gel packs. Over-cooling could affect desired treatment results.
- Hyper and hypopigmentation can occur with higher fluence levels. Test spot is always recommended.
- Hyperpigmentation can be resolved in a 6-12-month period.
- Large spot sizes and lower fluence may be selected for darker skin types to decrease any risk of side effects.

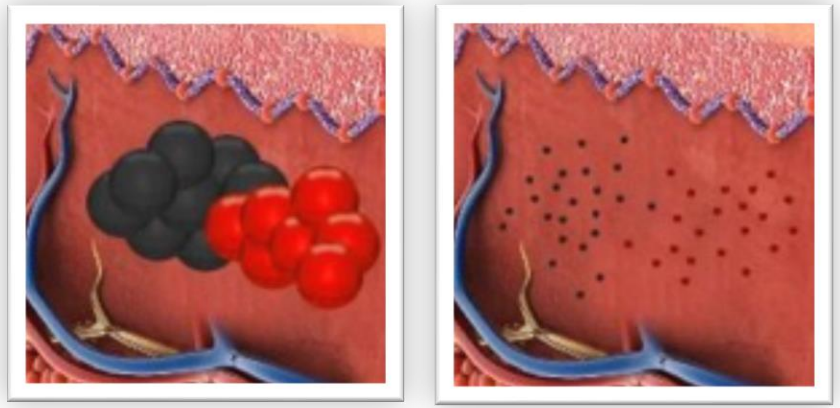
*This is a guideline and should not replace any professional knowledge or training you may have.



03 Nanosecond vs. Picosecond

NANOSECOND PULSE

PICOSECOND PULSE



More Side Effects	→	Less Side Effects
More Discomfort	→	Less Discomfort
More Treatment	→	Fewer Treatment
Nano Pulse Width	→	Pico Pulse Width
First Generation for Tattoo Removal	→	Advanced Treatment for Tattoo Removal and Pigmentation Removal

Nanosecond Laser vs. Picosecond Laser

Nanosecond Laser (Q-switch)	Picosecond Laser
Q-Switched Nd:YAG 532nm & 1064nm Q-Switched Alexandrite 755nm Q-Switched Ruby 694nm	Picosecond 450ps Pico Alexandrite 755ps
Photothermal	Photomechanical (Photoacoustic)
↑ Thermal Effect	↓ Thermal Effect
↓ Fragmentation (pebbles)	↑ Stronger Mechanical Fragmentation (sand)
Thermal Relaxation Time (TRT)	Stress Relaxation Time (SRT)

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Q-switched Laser vs. Picosecond Laser

Lasers	Pigmentation	Tattoo	Depth
Q-Switched Nd:YAG (532nm)	Freckles, Solar Lentigo, ABNOM	Red, Orange Yellow	Epidermal to Superficial Dermal
Q-switched Nd:YAG laser (1064nm)	Melasma, ABNOM, PIH	Black, Dark Blue, Purple	Epidermal to Deep Dermal
Picosecond Laser	Freckles, Melasma, Nevus of Ota, ABNOM, CAL, PIH	Various colors	Epidermal to Deep Dermal

04 Tissue Phantom Test

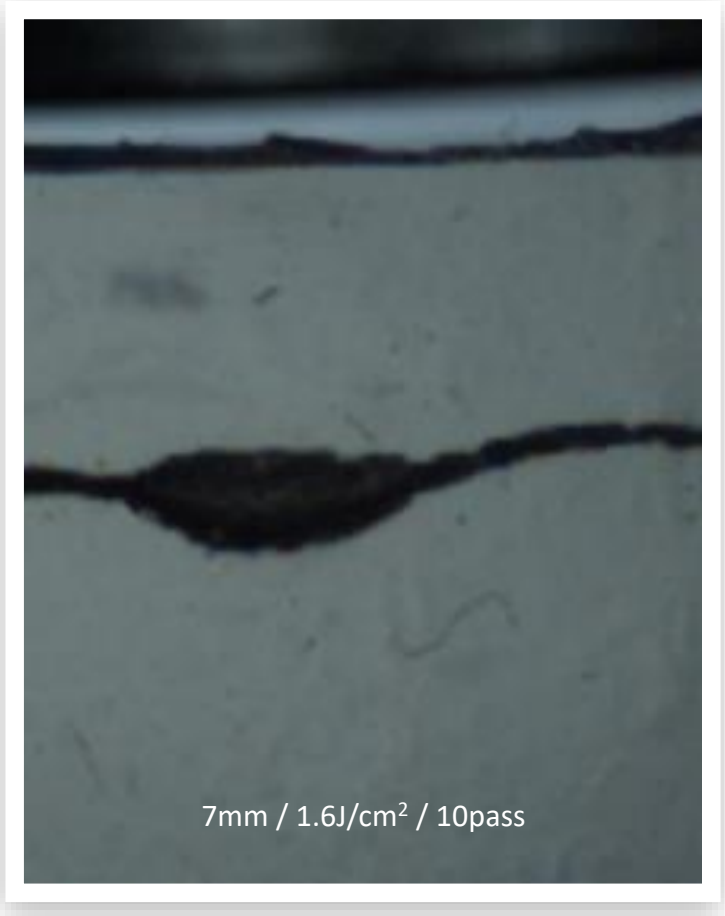
5 NANOSECONDS
Conventional Q-switched Laser

450 PICOSECONDS
Picocare 450

Videotaped by ultrahigh-Speed Digital Camera (Phantom V2512 Model)

04 Tissue Phantom Test

5 NANOSECONDS
Conventional Q-switched Laser



450 PICOSECONDS
Picocare 450

Videotaped by ultrahigh-Speed Digital Camera (Phantom V2512 Model)

PICOCARE 450

01 Main Features

PICOCARE

Multiple Wavelength	HEXA MLA	Auto Calibration
1064nm 532nm L532nm 595nm 660nm	Scar Treatment Depigmentation Skin Rejuvenation	Convenient System Stable Energy Output Effective & Safe Treatment

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02 Specifications

Specification	PicoCare	
Wavelength	532 nm	1064 nm
Max. Energy	300 mJ	600 mJ
Pulse Duration	450 ps	
Peak Power	0.8 GW	1.33 GW
Spot Size	2~10 mm	
Repetition Rate	Single, 1 ~ 10 Hz	
Delivery	Articulated Arm	
Dimension	450W x 939D x 908H mm	
Weight / Power	90kg / 4kVA	

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03 Composition

Zoom Handpiece

2~10mm

Collimation Handpiece

7mm

HEXA MLA (Micro Lens Array)

3~5mm

6~10mm

Optional Dye Handpieces

595nm

660nm

3mm

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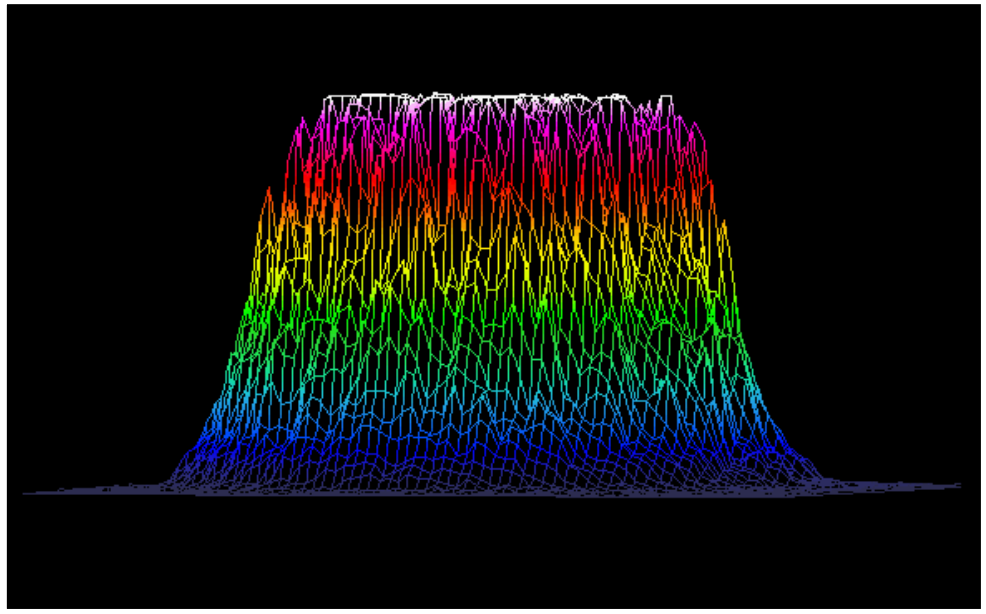
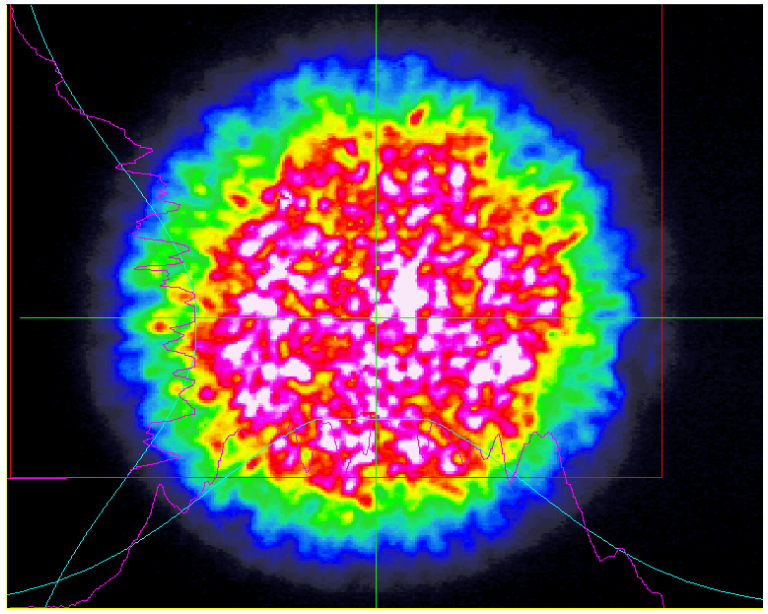
Beam Profile – Zoom Handpiece

Beam Shape – Top Hat Beam





- Uniform beam profile over various spot sizes and fluence
- Good for efficacy and safety for treatment

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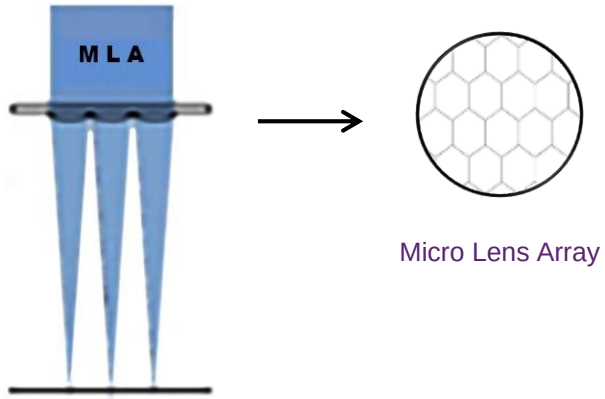
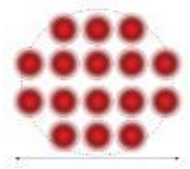
04 HEXA MLA Micro Lens Array

- HEXA MLA uses multiple focusing elements that are refractive. They are known as MLA (Micro Lens Array)
- The MLA energy intensifies and concentrates at the center of each dot.
- These MLA energies creates high fluence regions separated by low fluence backgrounds to produce focal areas of ablation or non ablation injuries to the skin.
- The energy intensity of HEXA MLA is up to 15 times higher than the zoom handpiece. Its energy is intended for scar treatment and skin rejuvenation
- The laser beam produces closely packed hexagonal shapes.



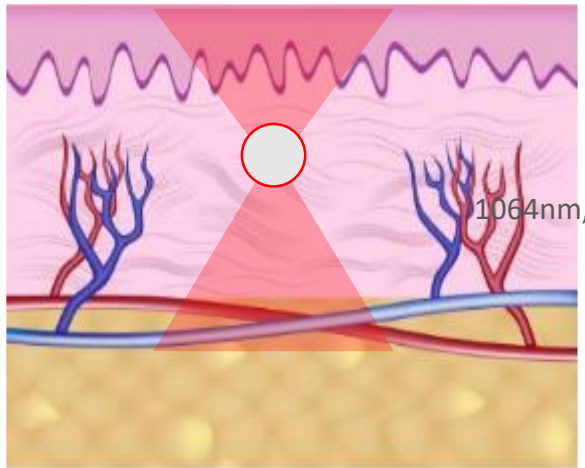
Micro Lens Array



The energy intensity focused in the center

Principle of LIOB

- Picosecond Injury uses the principle of Laser Induced Optical Breakdown (LIOB) to the target area (epidermis or dermis) with melanin being the primary target.
- The injury creates the production of dermal collagen, elastic tissue, and mucin with minimal post treatment downtime
- The LIOB process created by fractional laser energy appears to be absorbed by melanin creating a situation in which one or more free electrons are generated and creates an avalanche of free electrons, creating plasma which generates heat and then creates vacuoles (steam bubbles) or cavitation bubbles underneath the skin.
- As cavitation is formed, the stratum corneum layer is preserved, post recovery time is shortened, and results leads to improvement of scars, skin rejuvenation and depigmentation.



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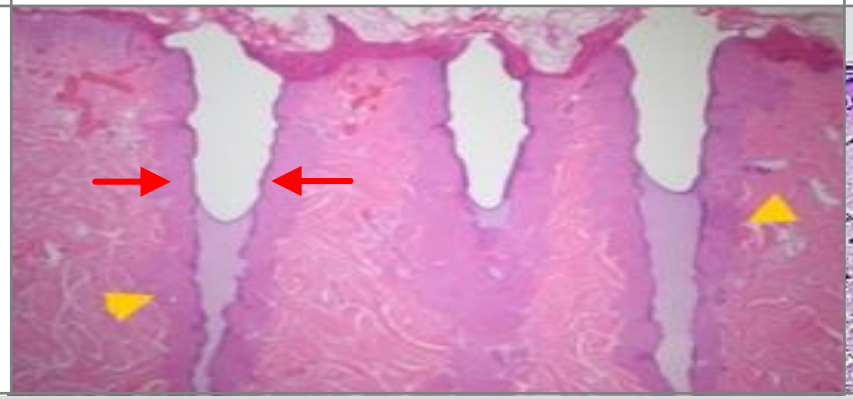
Replacement of Traditional Scar Treatment

	Fractional Ablative Treatment	HEXA MLA Treatment
Mechanism	Thermal Ablation Residual thermal damage along tissues	LIOB(Laser Induced Optical Breakdown) No residual thermal damage
Operation	Topical anesthesia cream required Procedural time – Over an hour	Topical anesthesia cream as needed Procedural time – Less than an hour
Downtime	Crusting up to 2 weeks after treatment Discomfort Higher chance of side effect such as PIH	Micro-crusting up to 2 to 7days after treatment Tolerable pain with management Less risk of side effects
Result	Improves fine wrinkles, large pores, acne scars and skin texture with several treatments and with downtime	Improves fine line, wrinkles large pores, acne scars, skin texture and pigment with little to no downtime
Histological Date		

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Replacement of Traditional Scar Treatment

	Fractional Ablative Treatment
Mechanism	• Ablation using 18G injection needle to damage scar tissues
Strength	• It is effective in round scar treatment with fewer number of sessions
Weakness	• Pain is severe during the procedure • Recovery period is longer with bruises • Adverse effects can lead to hypertrophic scarring
Replacement of Subcision	• HEXA is less painful and shorter recovery period from treatment • Incidence of side effects are low (such as hypertrophic scar formation) • Chicken pox, acne scars can be treated efficiently

Subcision Procedure

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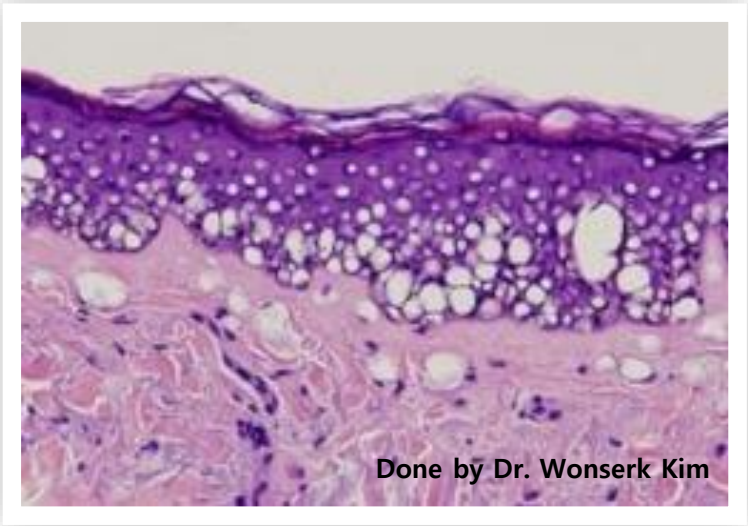
Histology of HEXA MLA

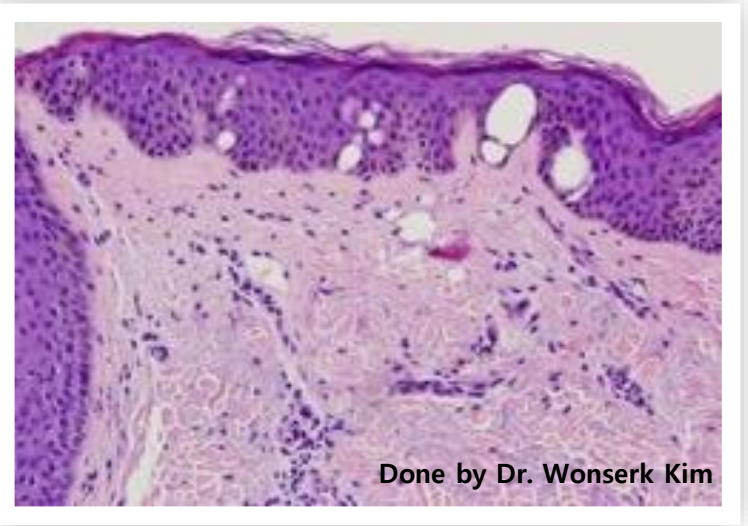


L532nm, 4mm spot, 0.8J/cm^2

Preserving two layers intact:

Superficial barrier and epidermis/dermis junction

- Treat pigmentation with lower energy
- Relatively low incidence of PIH



1064nm, 4mm spot, 3.5J/cm^2

Using higher fluence in 1064nm and high Hz

Can leads to bigger cavitation

- Treats pigmentation & tattoo ink
- Skin rejuvenation, fine lines and scars

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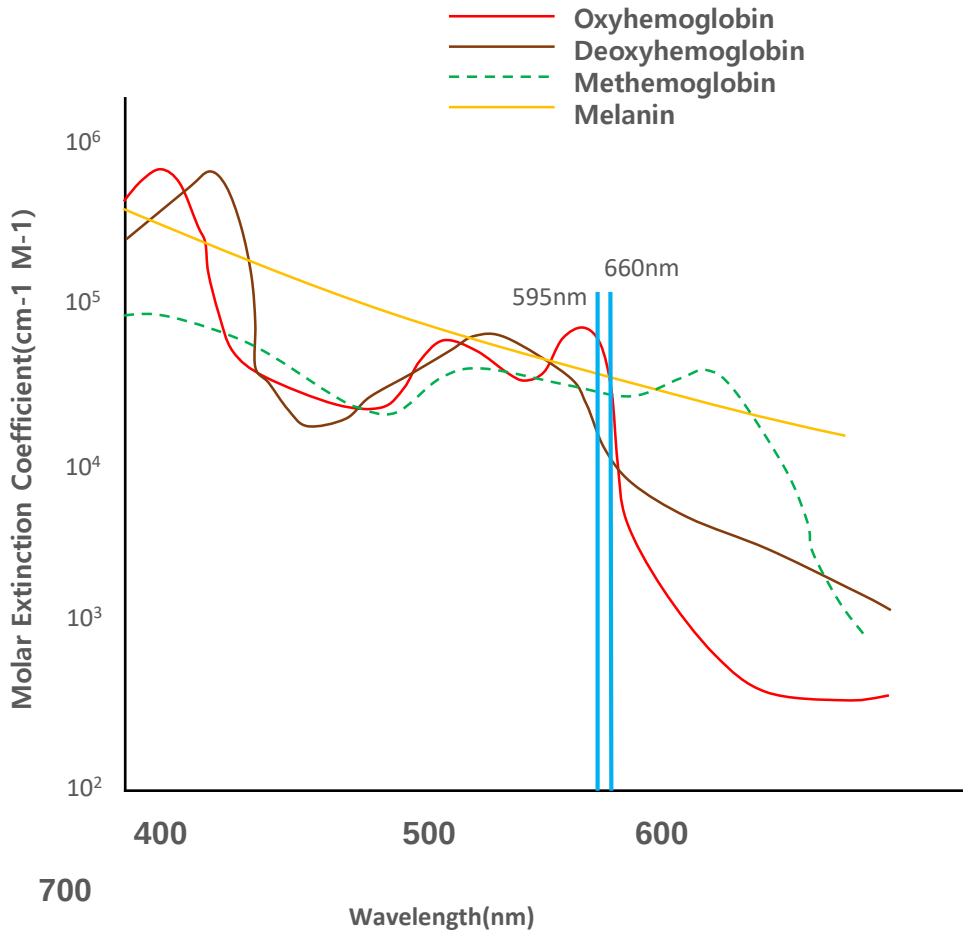
05 Dye Handpieces



595nm

Low absorption of Melanin and high absorption of Hg. Intended for rosacea, inflammatory acne, flushing, and blue tattoo ink.

660nm

High absorption of Melanin and low absorption of Hg. Intended for epidermal pigmentation and green tattoo ink.

06 Indications

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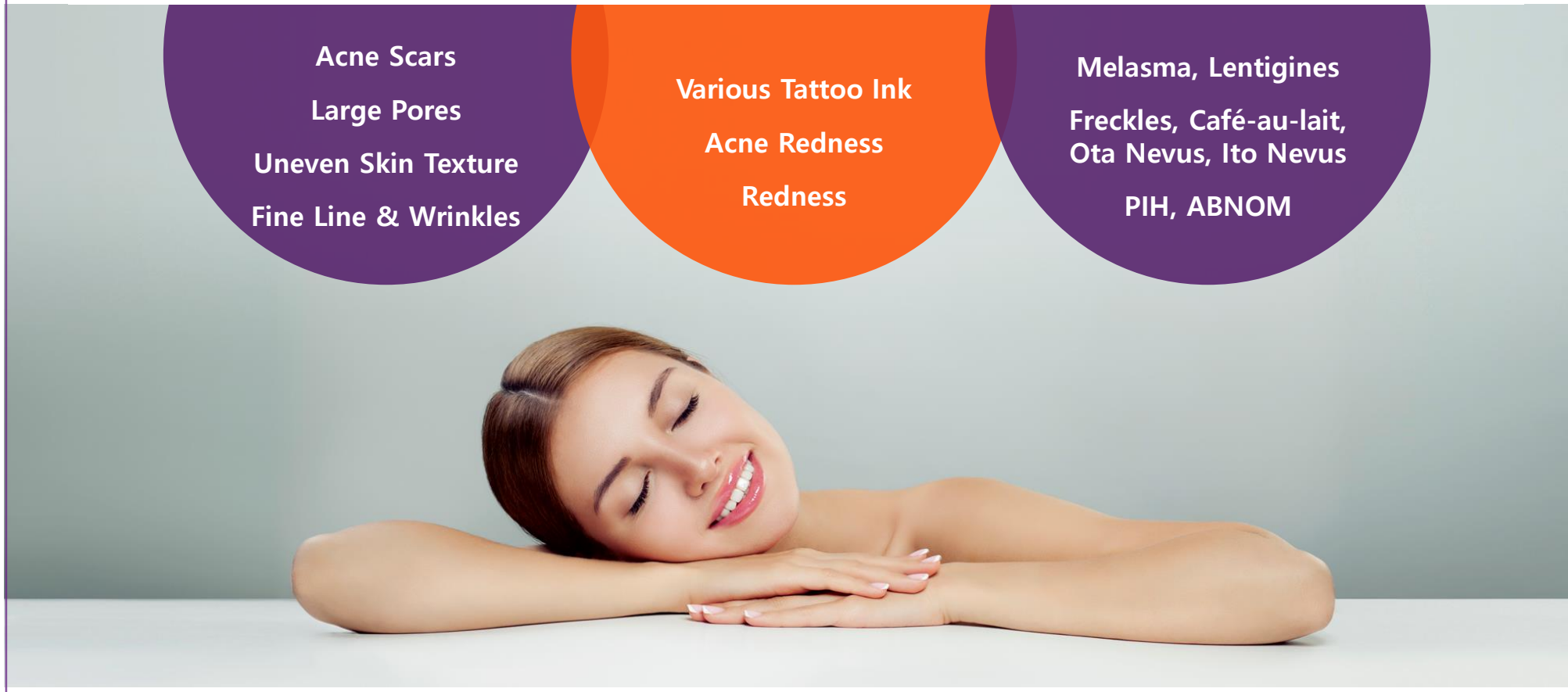

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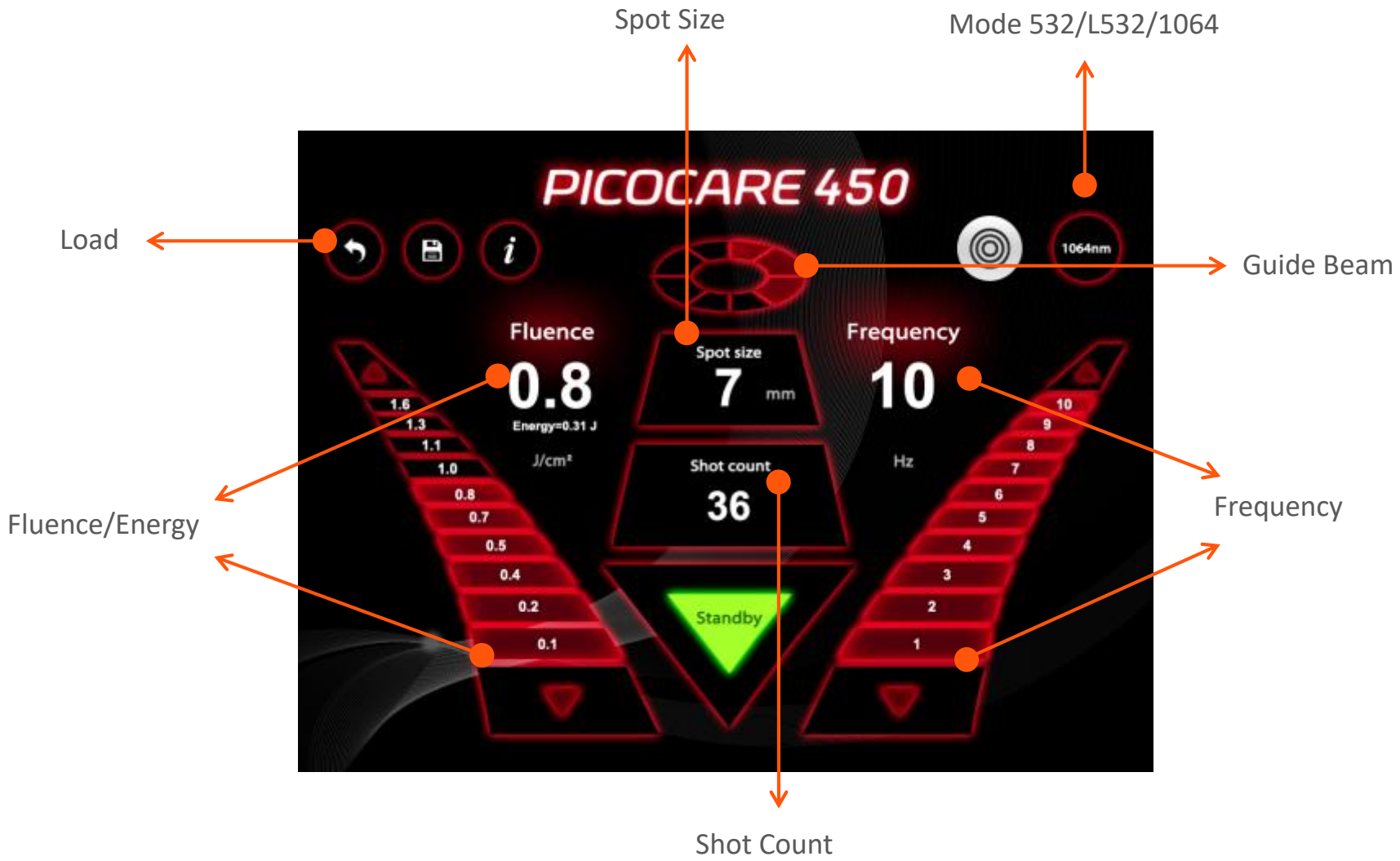
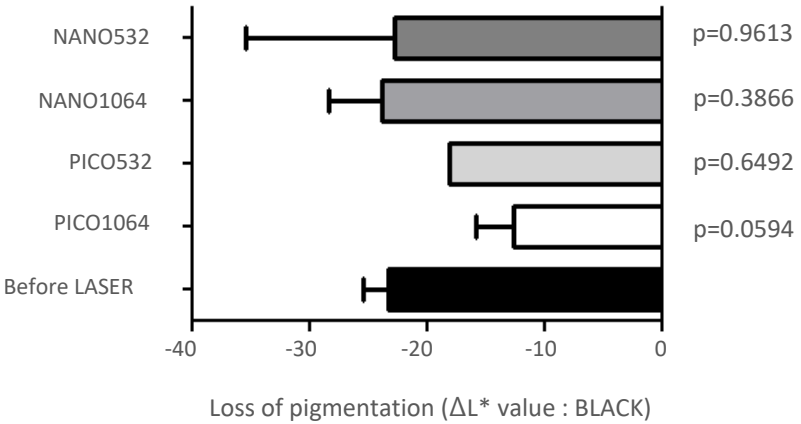
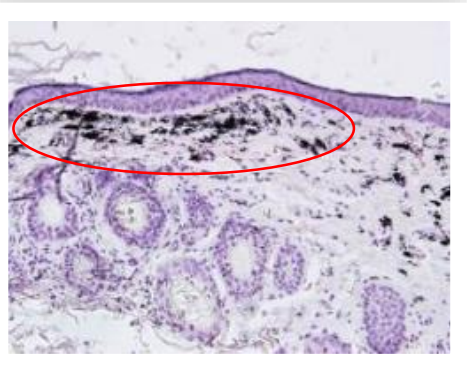
07 Real-time Auto Calibration

08 Intuitive User Interface

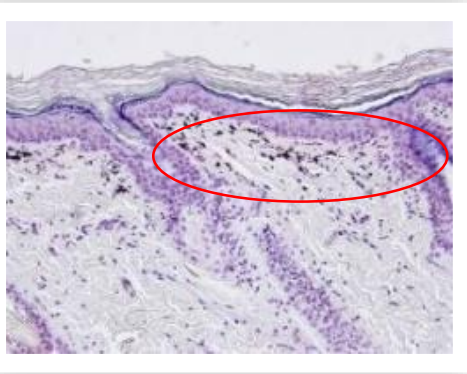


09 Clinical Data: 1064nm Wavelength





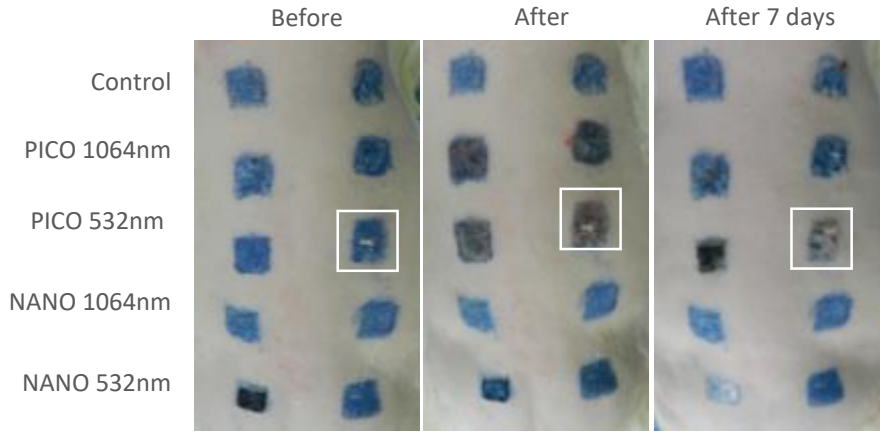
Control

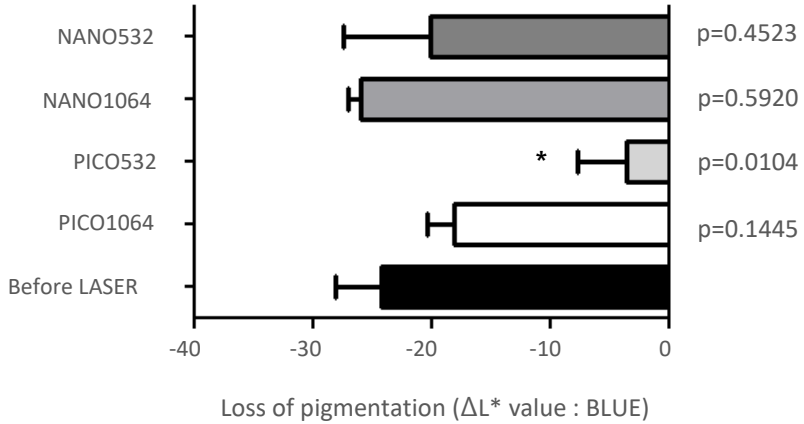


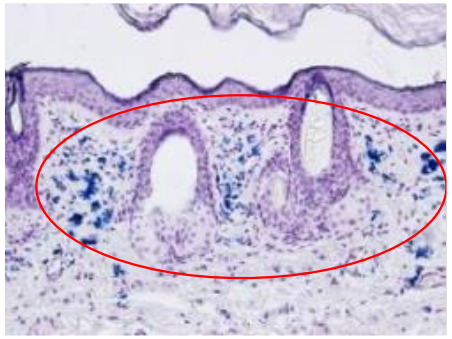
After 3 weeks

PICO1064nm, which decreased from -22.73 to -12.625, showed significant reduction in black ink.

Clinical Data: 532nm Wavelength







Control

After 3 weeks

PICO532nm, which decreased from -24.18 to -3.55, showed significant reduction in blue ink.

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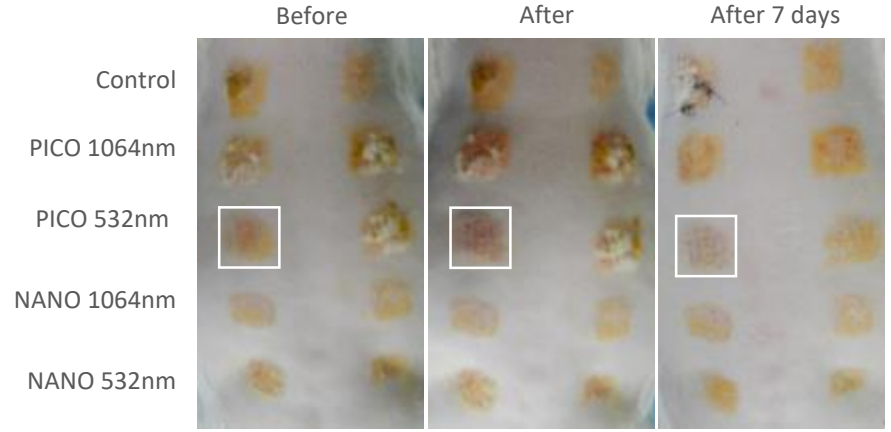
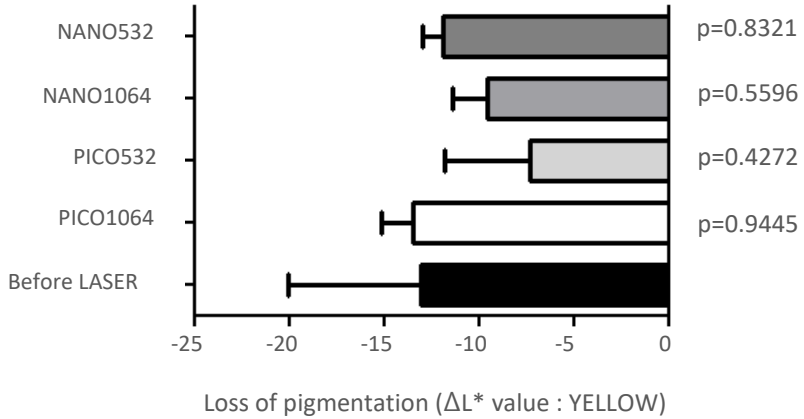
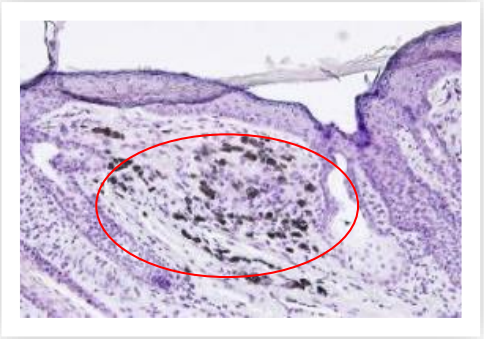
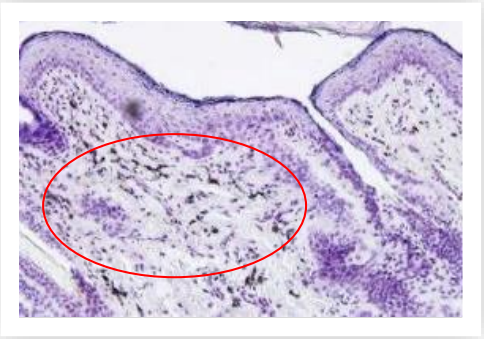
Clinical Data: 532nm Wavelength







Control



After 3 weeks

PICO532nm, which decreased from -13.08 to -7.27, showed significant reduction in yellow ink.

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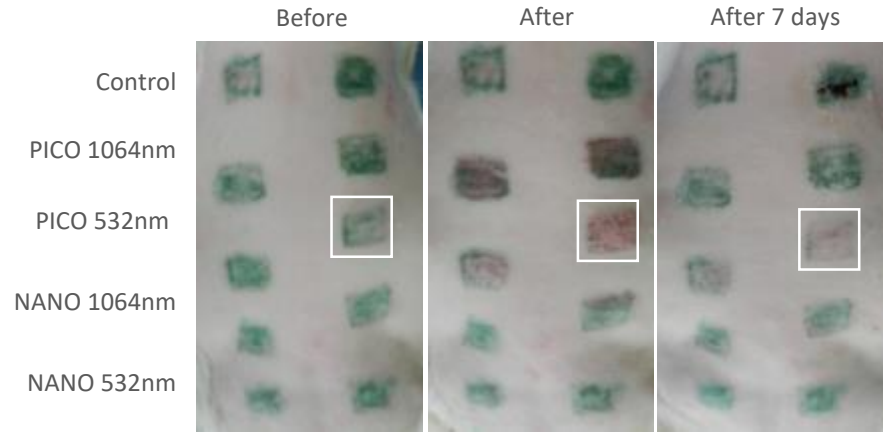
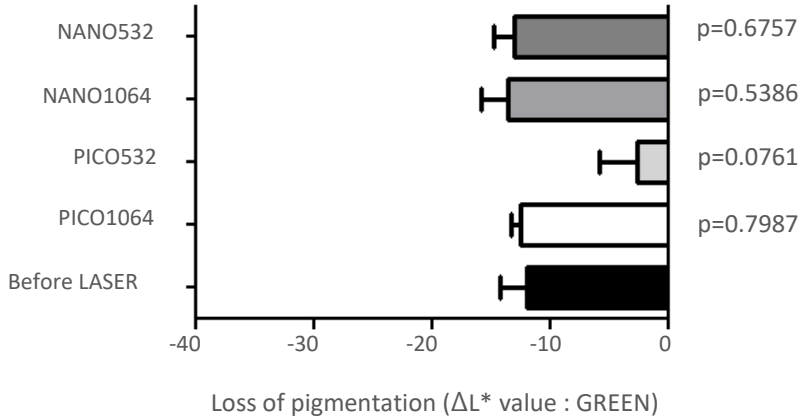
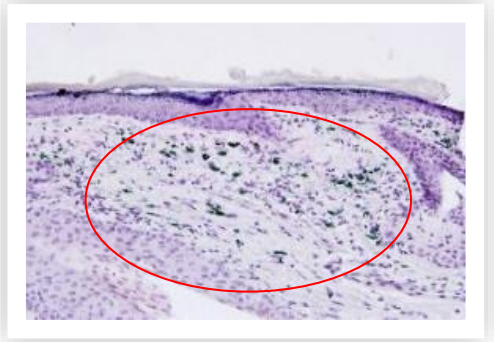
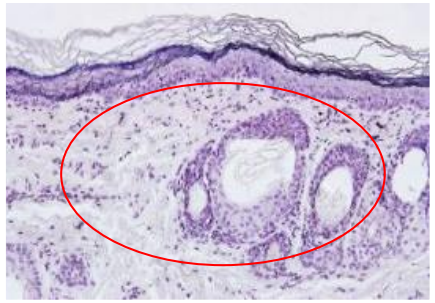
Clinical Data: 532nm Wavelength







Control



After 3 weeks

PICO532nm, which decreased from -12 to -2.6, showed significant reduction in green ink.

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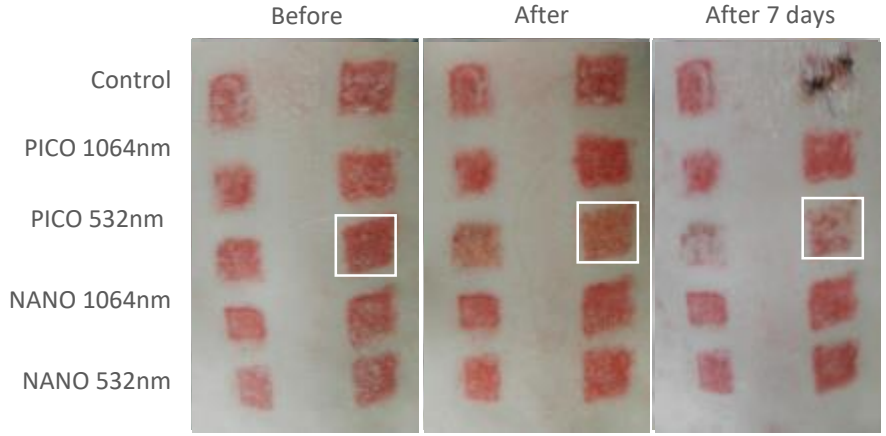
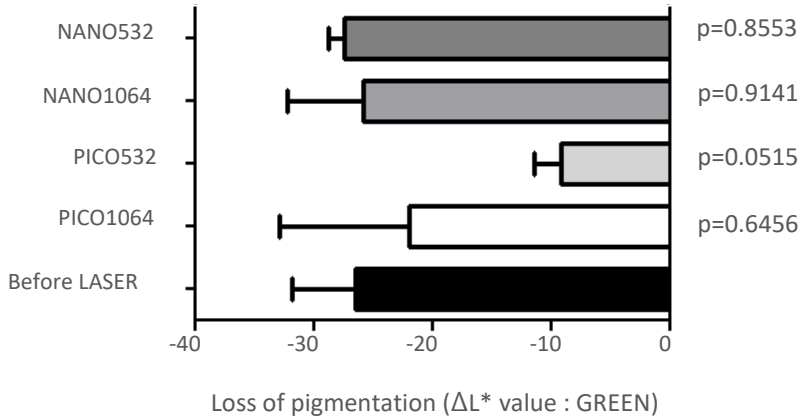
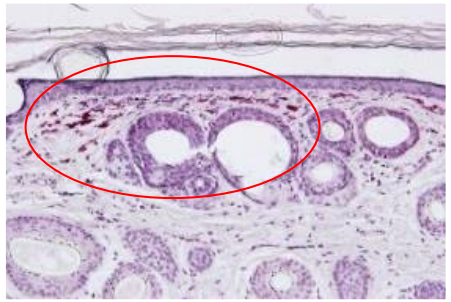
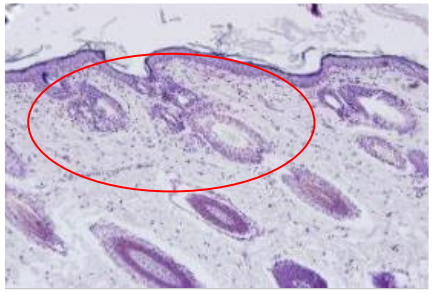
Clinical Data: 532nm Wavelength







Control



After 3 weeks

PICO532nm, which decreased from -26.51 to -9.15, showed significant reduction in red ink.

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10 Clinical Data

Before & After:

Before

Right After Treatment

1064nm, 3mm, 2.0J/cm^2, 2Hz | Photographs courtesy of Wid Win dermatology, Korea

Clinical Data

Before & After: Tattoo

Before

After 1 Tx Session

1064nm, 3mm, 2.0J/cm^2, 2Hz | Photographs courtesy of HN dermatology, Korea

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Clinical Data

Before & After: Tattoo

Before

After 1 Tx Session

1064nm, 3mm, 2.5J/cm^2, 2Hz | Photographs courtesy of HN Clinic

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Clinical Data

Before & After: Lentigines

Before

After 1 Tx Session

L532nm, 4mm, 0.4J/cm^2, 2Hz | Photographs courtesy of Wid Win Dermatology

Clinical Data

Before & After: Freckles

Before

After 2 Tx Sessions

L532nm, 3mm, 0.3J/cm^2, 2Hz | Photographs courtesy of S Dermatology

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Clinical Data

Before & After: ABNOM

Before

After 2 Tx Sessions

1064nm, 4mm, 2.5J/cm^2, 2Hz | Photographs courtesy of Dr. Kim's Skin & Laser Dermatology

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Clinical Data

Before & After: PIH

Before

After 2 Tx Sessions

1064nm, 6mm, 0.9J/cm^2, 10Hz | Photographs courtesy of HN Dermatology

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Clinical Data

Before & After: Melasma

Before

After 2 Tx Sessions

1064nm, 10mm, 0.8J/cm^2, 10Hz | Photographs courtesy of S Dermatology

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Clinical Data

Before & After: Melasma

Before

After 2 Tx Sessions

L532nm, 4mm, 0.3J/cm^2, 2Hz | Photographs courtesy of Dr. Kim's Skin & Laser Dermatology

Clinical Data

Before & After: Melasma

Before

After 6 Tx Sessions

1064nm, 10mm, 0.8J/cm^2, 10Hz | Photographs courtesy of Dr. Kim's Skin & Laser Dermatology

Clinical Data

Before & After: Large Pores

Before

After 1 Tx Session

1064nm, 10mm, 0.3J/cm^2, 10Hz | Photographs courtesy of BesTop Dermatology

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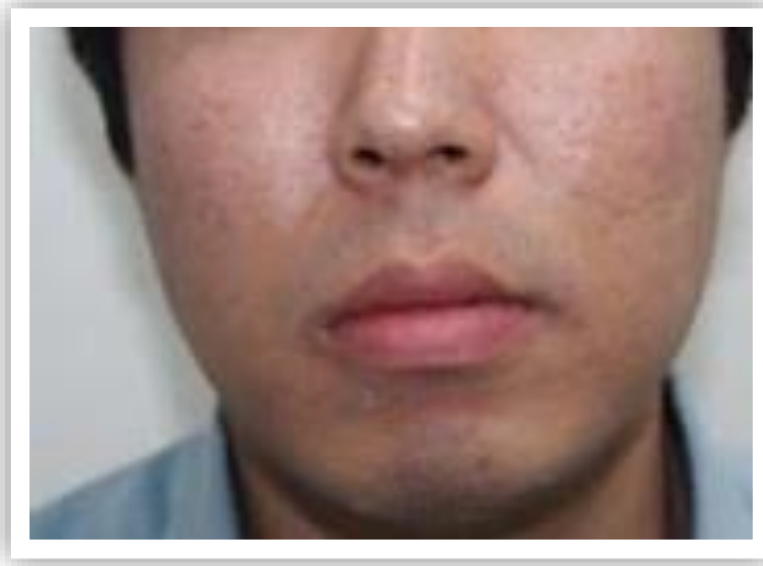
Clinical Data

Before & After: Acne Scars

Before



After 1 Tx Session

1064nm HEXA 3mm, 3.0J/cm^2, 1Hz | Photographs courtesy of BesTop Dermatology

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