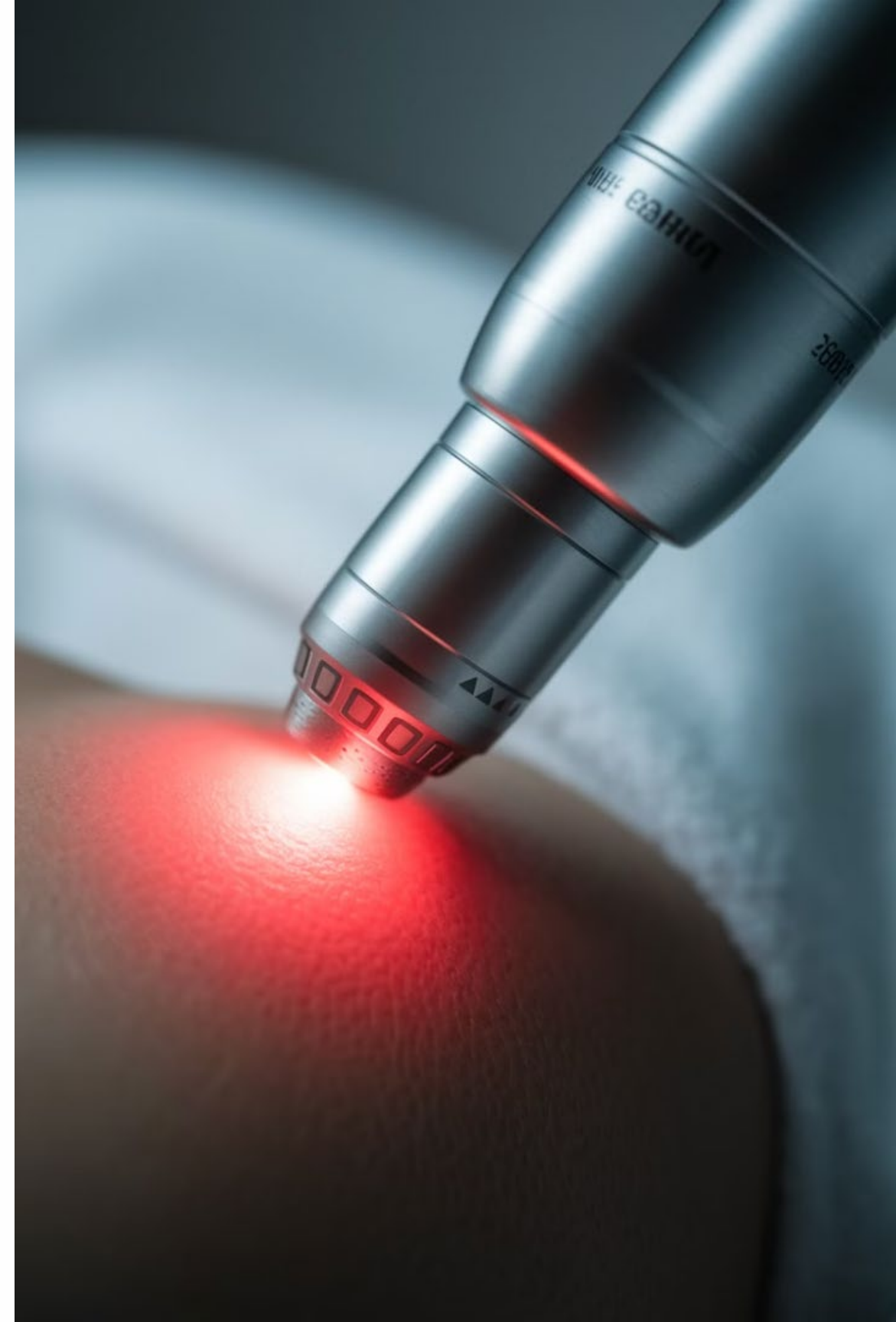
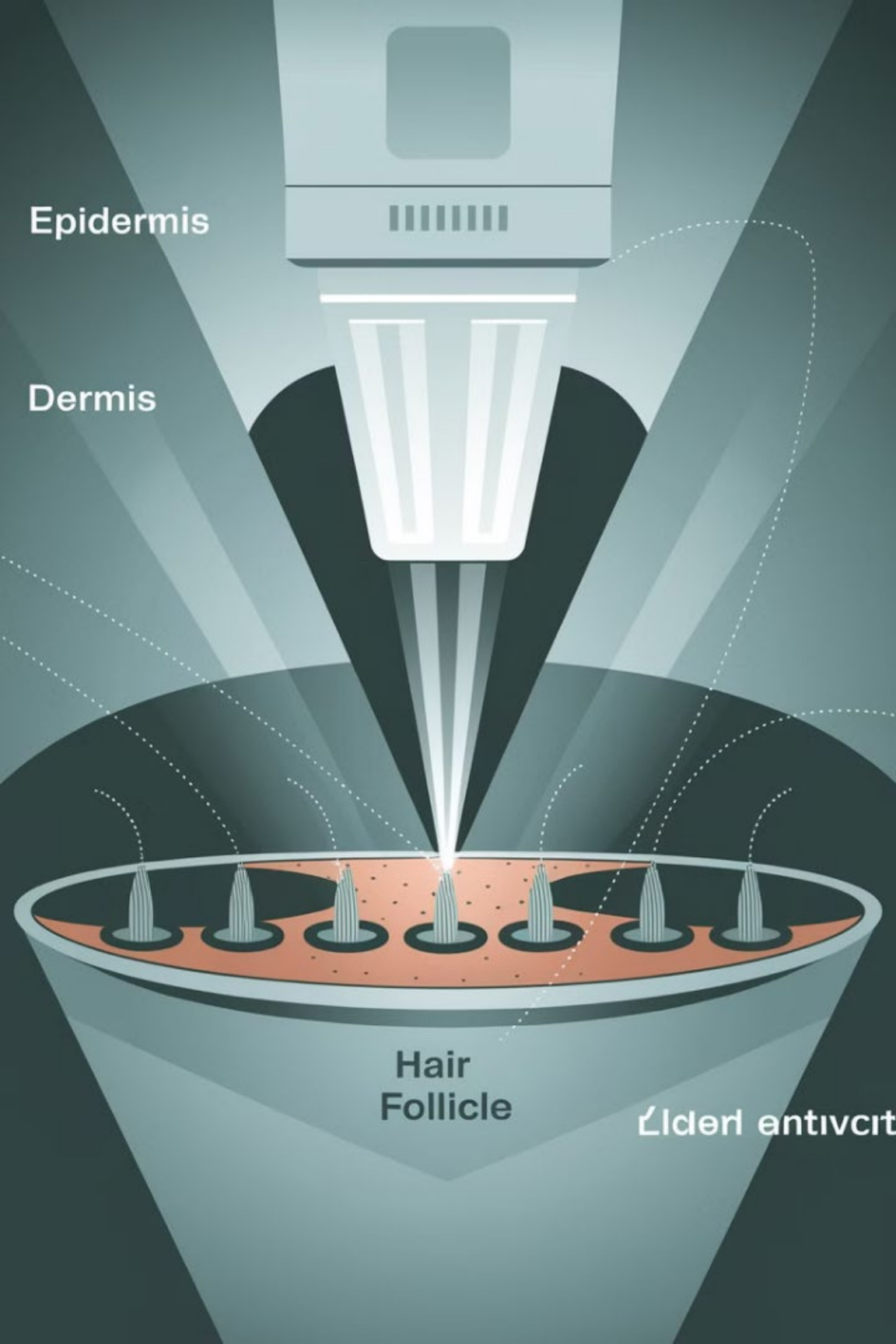


Effective, Permanent Hair Reduction Using a Pulsed, High-Power Diode Laser

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 **por Gspeed Technologies**





Introduction

Study Focus

A solid-state, 800 nm pulsed near-infrared diode laser was studied for permanent hair reduction.

Key Factors Examined

The effect of laser fluence (energy per unit area), single vs. multiple treatments, and single vs. multiple pulses were determined in different skin types (Fitzpatrick's type I through VI).

Diode Laser Advantages

Semiconductor diode lasers are considered the most efficient light sources available and are particularly well suited for clinical applications.



Key Parameters for Laser Hair Removal

1

Wavelength

Ideal wavelength is 700-1000 nm, strongly absorbed by melanin but not surrounding tissue, reaching deeply into the dermis.

2

Pulse Width

Optimum pulse duration matches thermal relaxation time (TRT) of hair follicle, about 10-100 milliseconds for human terminal hair.

3

Fluence

Stronger laser treatments using highest tolerable fluence produce better hair reduction results, but risk of side effects increases.

4

Cooling

Active cooling of epidermis is crucial to protect skin while delivering sufficient energy to damage hair follicles.

Study Design

Objectives

Investigate effectiveness and safety of pulsed diode laser in permanent reduction of pigmented hair. Study fluence-response relationship, one versus two treatments, and single versus multiple pulses.

Participants

92 patients (45 males, 47 females) with varying hair colors and skin types (Fitzpatrick's skin type I to VI; predominately II to III)

Treatment Schedule

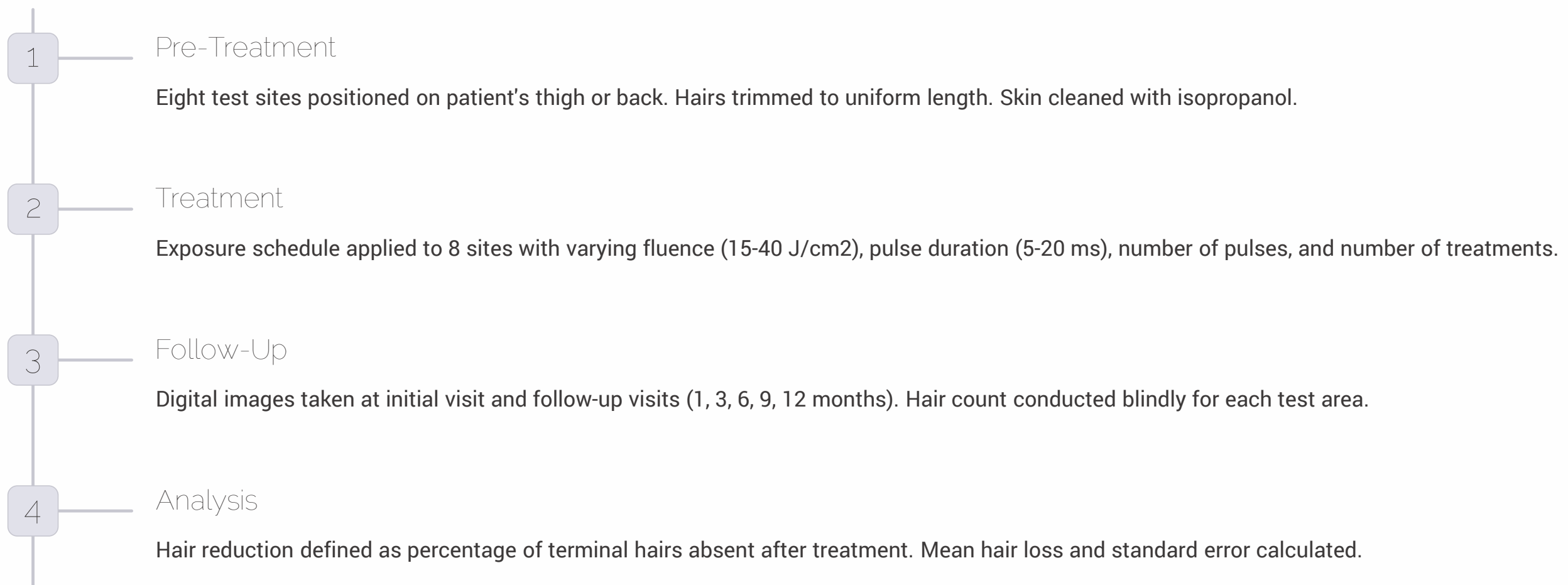
All patients treated and examined at 0, 1, 3, 6 and 9 months.
35 patients followed up at 12 months.

Device Used

Semiconductor diode laser system delivering pulsed, infrared light at 800 nm wavelength, 5-20 ms pulse duration, 15-40 J/cm² fluences



Treatment Protocol



BEFORE +



Results: Hair Reduction

100%

Growth Delay

All patients showed measurable hair growth delay at all fluence/pulse width configurations, sustained for 1-3 months.

46%

Permanent Reduction

Average permanent hair reduction after two treatments at 40 J/cm² (20 ms pulse duration).

89%

Significant Reduction

Percentage of patients exhibiting significant permanent hair reduction at all configurations.

Hair regrowth stabilized at 6 months at all fluences; no further regrowth between 6, 9 and 12 months.



Results: Hair Characteristics

Diameter Reduction

Regrowing mean hair diameter decreased by 19.9%

Color Change

Optical transmission at 700 nm of regrown hair shafts was 1.4 times greater than pre-treatment

Cosmetic Benefit

Thinner, lighter hairs add to the appearance of hair reduction

Histological Findings

Mechanisms of Hair Reduction

- Miniaturization of coarse hair follicles to vellus-like hair follicles
- Destruction of follicle with granulomatous degeneration and fibrotic remnant

Observed Effects

- Immediate thermal damage in follicles with large, pigmented shafts
- No effect on follicles with small vellus shafts
- Thermal coagulation necrosis in both pigmented and non-pigmented areas of terminal hair follicle epithelium
- Minimal or no damage to adjacent dermis

Side Effects and Safety



Fluence Dependent

Side effects increased with higher fluence and darker skin type



Typical Response

Perifollicular erythema and edema, subsiding within a few hours



Pigment Changes

20% of patients exhibited transient pigment changes resolving in 1-3 months



Triple Pulsing

Increased incidence of hyper- or hypopigmentation compared to single pulsing

When fluence and skin type were matched to optimize efficacy and safety, incidence of side effects was less than 1%, limited to transient changes in skin pigmentation.



Conclusions

■ Efficacy

The pulsed diode laser provides safe and effective treatment for both temporary and permanent reduction of unwanted, pigmented hair.

■ Cosmetic Benefits

Regrowing hair is typically thinner and lighter in color, enhancing the overall effect.

■ Permanent Reduction

On average, about half of the hair had permanent reduction after two treatments at 40 J/cm² fluence.

■ Optimization

In clinical practice, fluence and pulse width should be adjusted for skin type to balance efficacy and safety.