A study case in photoepilation, the HPPL™ and IFL™ technologies

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Abstract

The High Power Pulsed Light™ [HPPL™] and Incoherent Fast Light™ technologies [IFL™, Novavision Group S.p.A., 20826 Misinto (MB), Italy] are recent innovations in the field of unwanted hair removal with intense pulsed light devices. IFL™ is a further improvement over the already advanced characteristics of the HPPL™ technology. A selection of photoepilation case histories with the HPPL™ and IFL™ technologies is presented; a short introduction highlights the main features of the two technologies. All study materials were appropriately peer-reviewed for ethical problems.

The development of intense pulsed light photoepilation

Selective photothermolysis, meaning *selective damage to pigmented structures, cells, and organelles in vivo with suitably brief pulses of selectively absorbed radiation* is the goal of any application of pulsed light sources to unwanted hair removal.[1] All technologies developed since the mid-eighties after the introduction of the selective photothermolysis concept have aimed to a single goal: establishing the most efficient

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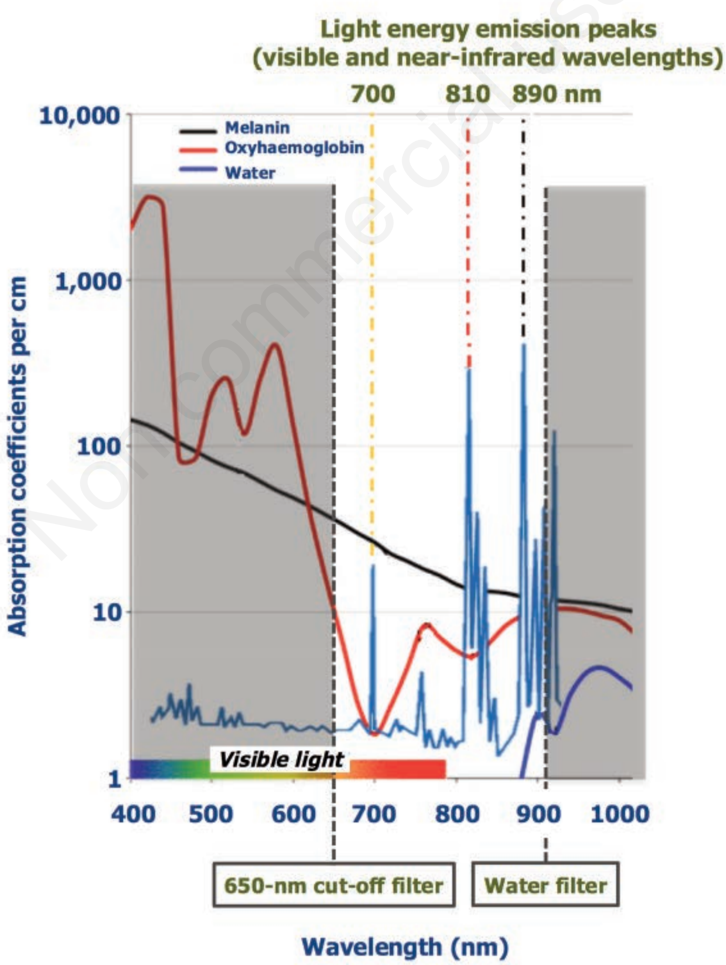

Figure 1. Light absorption spectra of skin chromophores (melanin and oxyhemoglobin) and water in visible and infrared wavelengths with evidence (shaded areas) of the IPL xenon flash lamp wavelengths eliminated by the built-in water filter and the movable 650-nm cut-off one.

compromise between skin penetration and energy absorption by melanin leading to thermal destruction of the hair shaft, hair follicle and matrix. All that with minimum energy absorption and thermal damage to other skin chromophores like oxyhemoglobin and water.[2]

Second-generation devices for unwanted hair removal based on high-intensity pulsed flashes of multi-chromatic light (intense pulsed light, IPL) are equipped with closed-loop cooling systems with ultra-transparent water bi-distilled to less than 0.0001% particulate residue. The cooling system acts as a water filter that absorbs most infrared radiation, especially wavelengths longer than 900 nanometers (nm), thus minimizing the risk of infrared-related local side effects. In the most advanced second-generation IPL technologies like High Power Pulsed Light™ (HPPL™) and Incoherent Fast Light™ (IFL™), the ultra-transparent cerium-supplemented borosilicate glass of the xenon flash lamp also filters off the ultraviolet radiation below 380 nm. A pre-installed 420-nm cut-off filter reinforces the suppression of ultraviolet wavelengths.

The residual operating range of wavelengths in second-generation IPL devices

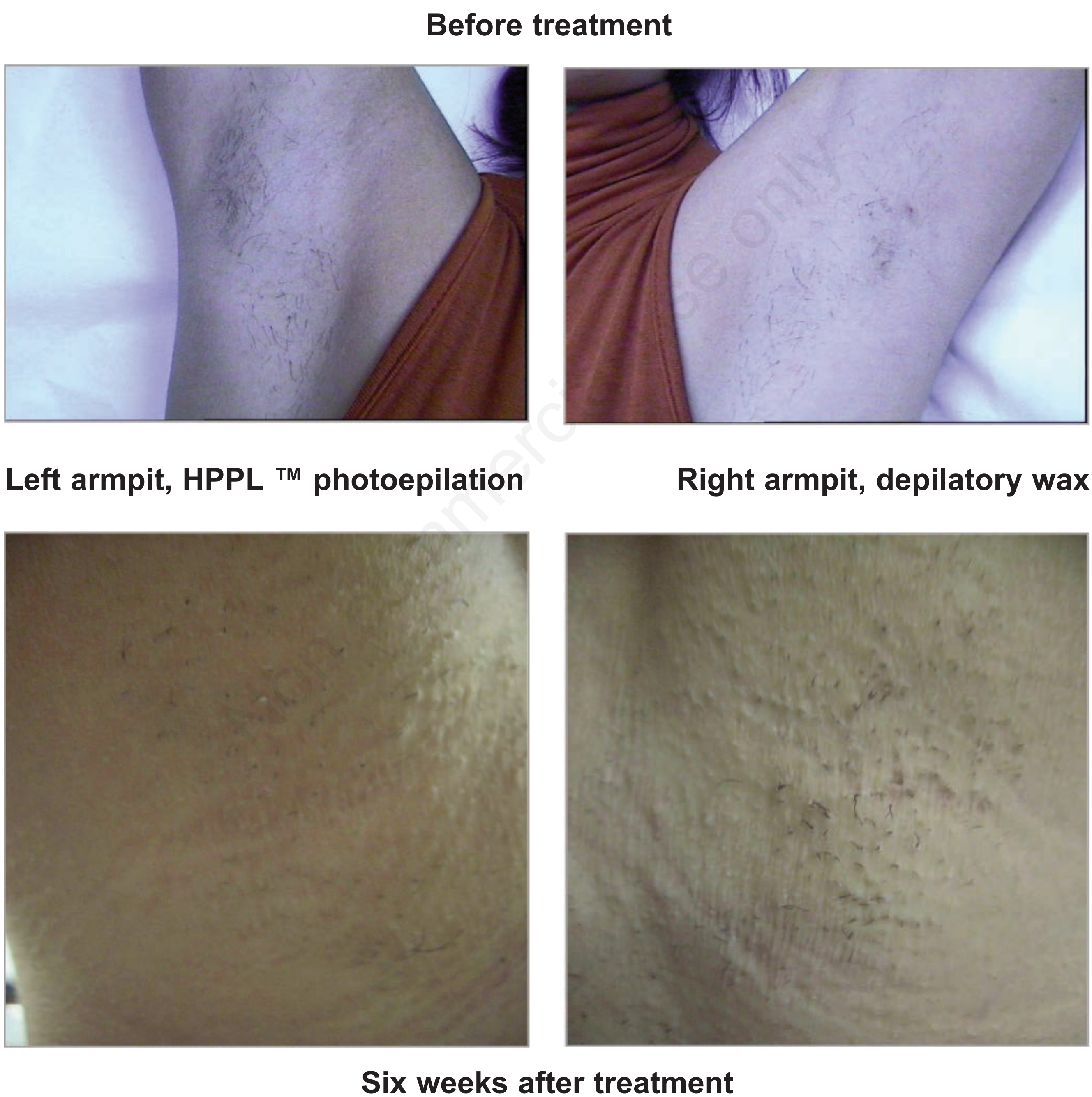

Figure 2. Short-term efficacy of photoepilation *vs* wax epilation, intra-individual evaluation. Clear evidence of recent folliculitis in the right armpit treated with a depilatory wax.

like HPPL™ and IFL™ (*i.e.*, between about 420 and 900 nm) includes the three energy emission peaks of xenon flash lamps at 700, 810 and 890 nm. Movable filters cutting off all radiation below the 520/550/590/650/720 nm orange-red or 650-nm red wavelengths allow to concentrate all the emitted light energy in a narrow window of highly penetrating wavelengths. The visible and near-infrared radiation in this narrow waveband is able to reach the lower dermis and includes the three major energy emission peaks (Figure 1).

IPL devices based on the HPPL™ and IFL™ technologies have been extensively used and tested by the main author in his everyday hospital and plastic dermatology private practice. A collection of photoepilation case histories, collected over the last several years, is herein presented.

Clinical outcomes of second-generation intense pulsed light technologies

The application of pulsed light sources for long-term epilation was a definite progress over previously available techniques. The most recent refinement of the HPPL™ technology, known as IFL™, allows to focus the energy on three wavelengths corresponding to the three energy emission peaks, 700, 810 and 890 nm. The number of spots is also increased up to 210,000 and there is no contact of the photoepilation device with the skin.

Figure 2 illustrates the higher efficacy 6 weeks after treatment with a Novavision Group HSL 120 IFL device compared with wax epilation. Much less hair is growing again in the light-epilated left armpit and, differently from the wax-epilated right armpit, there is no evidence of folliculitis. IPL-treated skin areas should overlap by about 10% to avoid leaving non-epilated areas that will give a very unpleasant *zebra effect* (Figure 3). The safety of the technology allows for multiple treatments in the same individual in the same session, as shown by the very good results reached in groin, leg and face with 7 photoepilation sessions over 5 months with the HSL 120 IFL device (Figure 4). Higher levels of fluence allow a lower number of photoepilation sessions (Figure 5).

Frank hirsutism associated with endocrine disorders is a reliable test for the effectiveness of the new IFL™ technology in a condition that is both challenging and discriminating. Figures 6 and 7 illustrate the striking improvement of facial hirsutism associated with an increased function of the adrenal cortical tissue 6 weeks after a single session of HPPL™/IFL™ photoepilation; Figure 8 bears witness to the dramatic aesthetic improvement over 17 HPPL™/IFL™ photoepilation sessions every 6-7 weeks in a young woman with hormone disorders and a really severe clinical presentation of facial hirsutism. In this woman the unwanted hair growth was so severe to demand the daily use of a razor.

Figures 9 to 11 confirm the hair removal efficacy of the new IFL™ technology as the most recent step in the still on-going history towards ever more efficient photoepilation.

References

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Figure 3. ***Zebra effect*** **between contiguous skin areas of the thigh in a 30-year old woman 4 weeks after single-flash HPPL™/IFL™ photoepilation (settings: 50 msec, 60 J, cut-off filter 590 nm).**

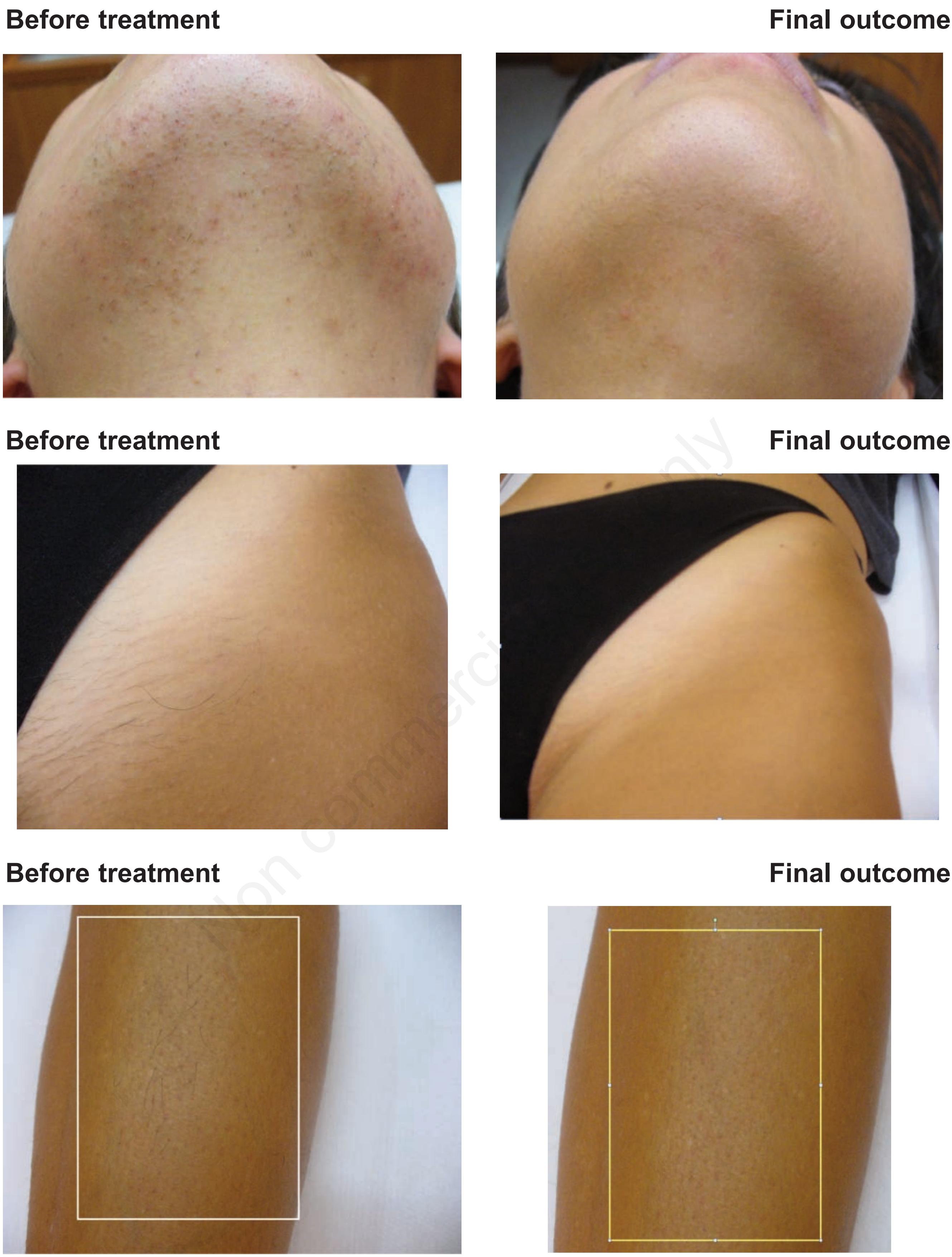

Figure 4. Multi-site HPPL™/IFL™ photoepilation (face, groin, leg; settings: 50 msec, 80-100 J, cut-off filter 650 nm); 7 sessions over 5 months.

Before treatment

Final outcome

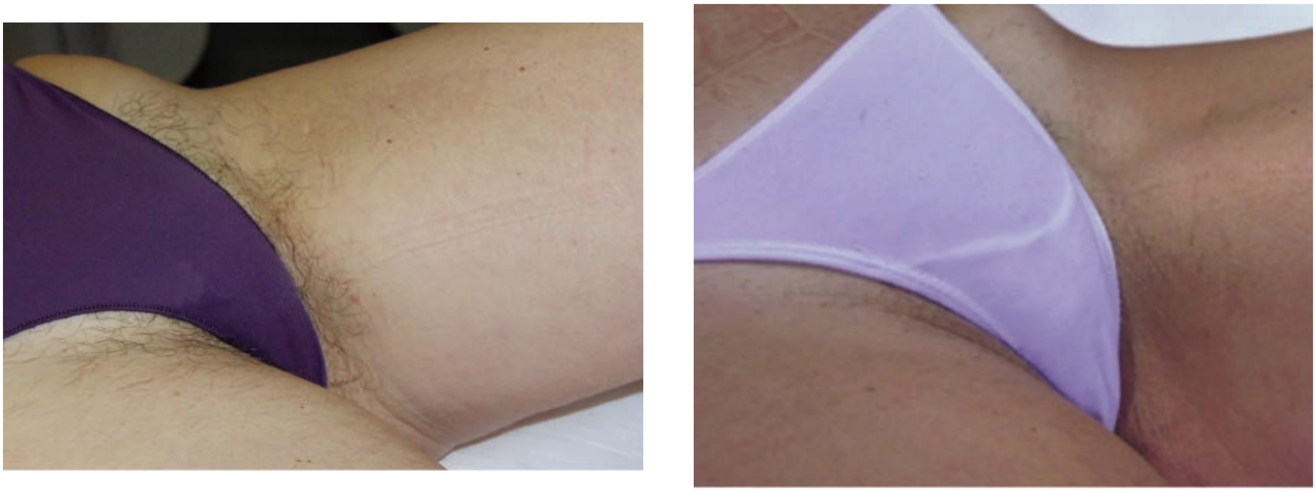

Figure 5. Repeated-passage groin HPPL™/IFL™ photoepilation in a phototype-III woman, 4 sessions every 6 weeks (settings: 60-65 J; 2 sessions: 30-msec flash, 650-nm cut-off filter; 2 sessions: 30-msec flash, 590-nm cut-off filter).

Before treatment

Figure 6. A-C) Facial hirsutism as symptom of hyperactivity of the adrenal cortex in a 18-year old woman; D) dermoscope evidence of the abnormal facial hair growth before HPPL™/IFL™ photoepilation (microphotograph, 20X).

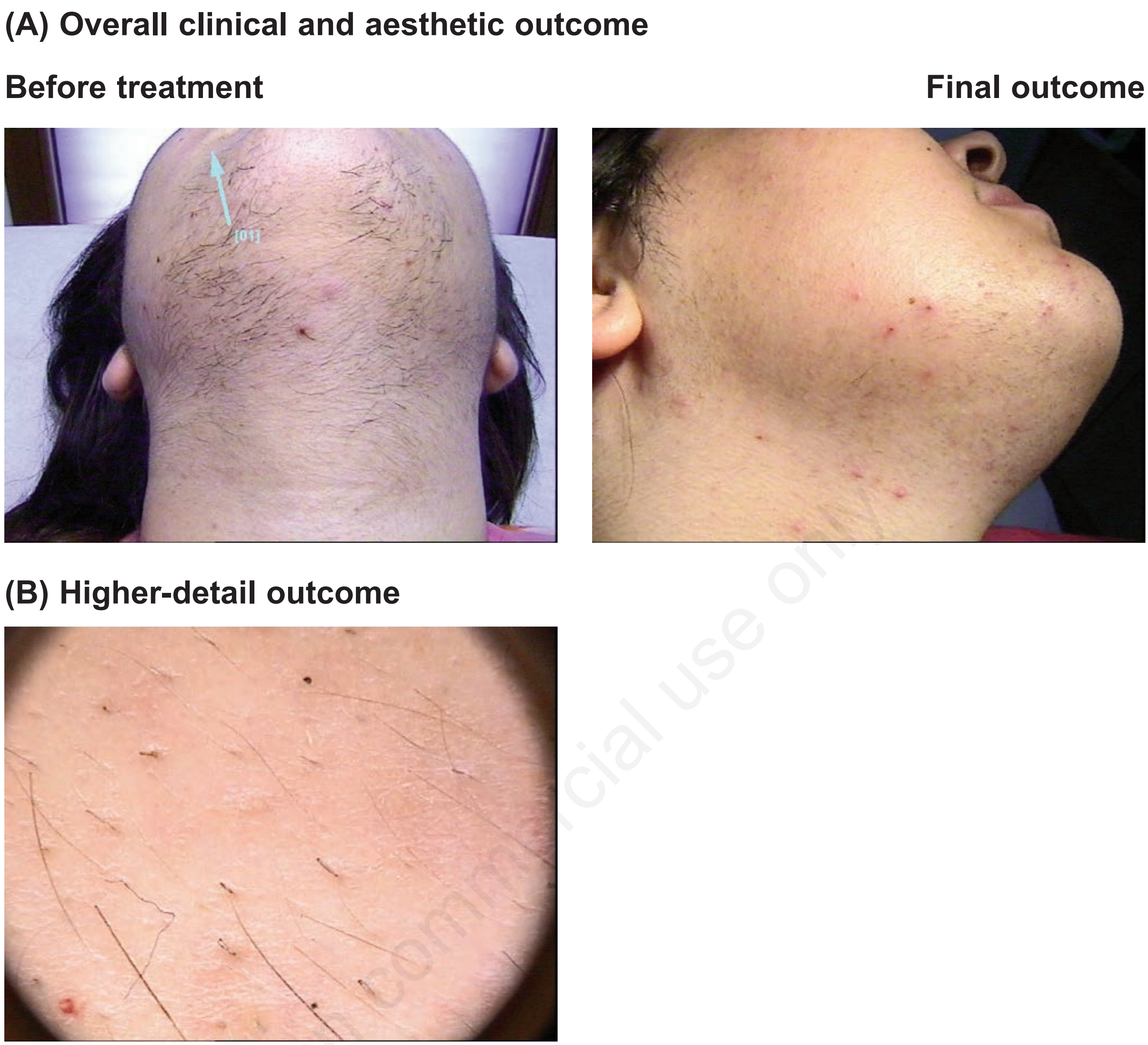

Figure 7. **A) Clinical and aesthetic efficacy 6 weeks after a single session of HPPL™/IFL™ photoepilation in a 18-year old woman with severe facial hirsutism due to hypercorticosurrenalism; B) very sparse growth of pale, thin and rudimentary hair 6 weeks after treatment (dermoscope image, 20X). Settings: 50-msec single flash, 50 J, cut-off filter 590 nm.**

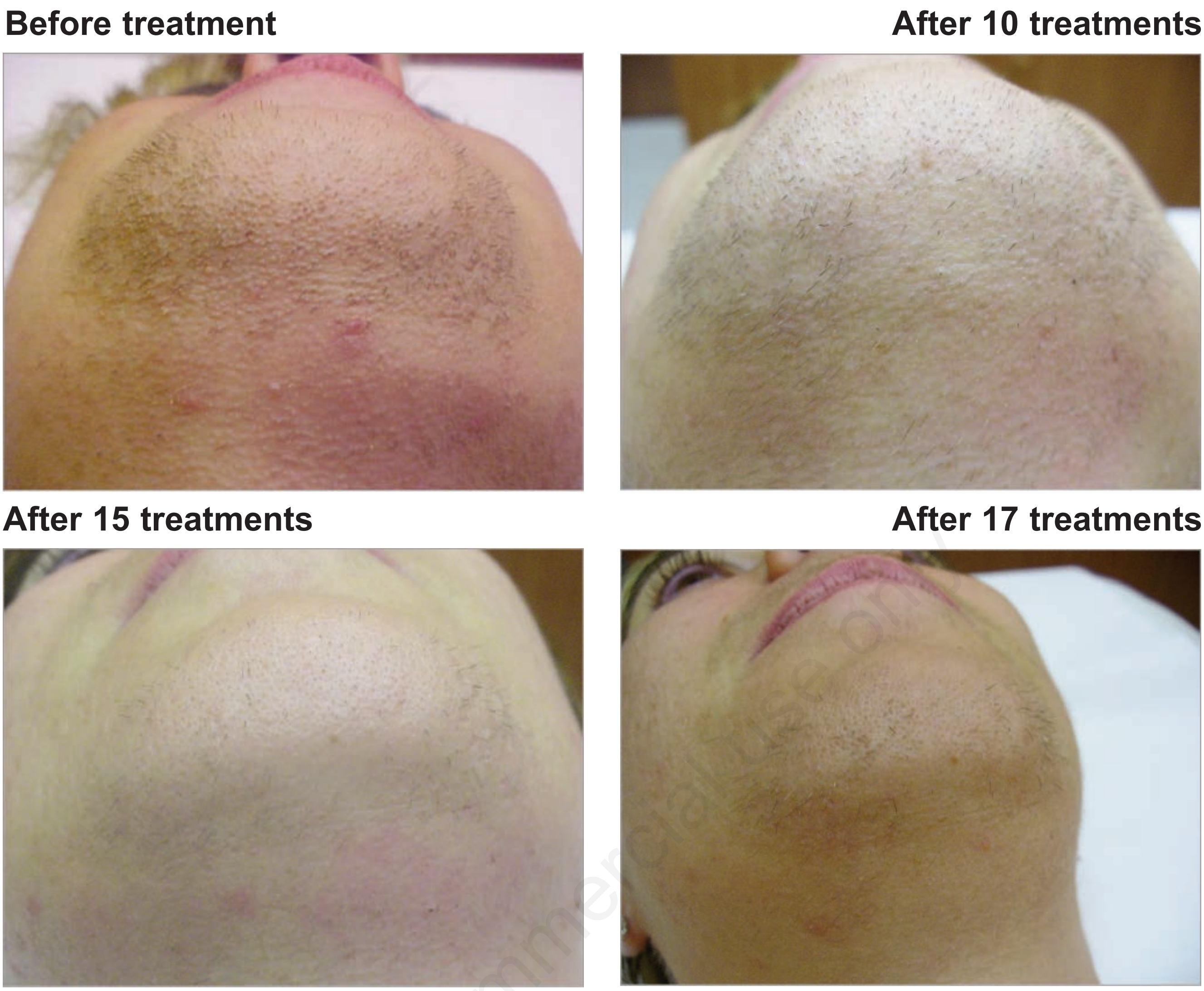

Figure 8. Time course of improvement over 17 HPPL™/IFL™ photoepilation sessions every 6-7 weeks in a young woman with severe facial hirsutism.

Figure 9. IFL™ photoepilation, armpit, 3 sessions.

Before treatment

After 2 sessions

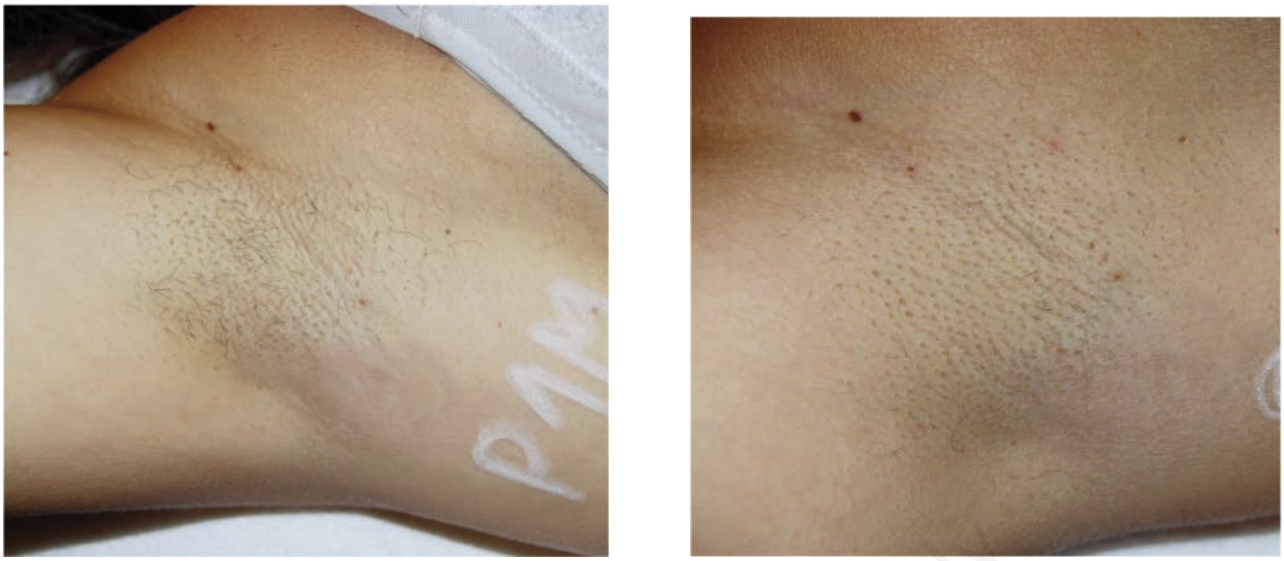

Figure 10. IFL™ photoepilation, armpit, 2 sessions.

Before treatment

After 4 sessions

Figure 11. IFL™ photoepilation, back and shoulder, 4 sessions.