A New Technology for Painless and Fast Tattoo Removal

Primary Point of Contact

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The problem – Please define the dermatologic clinical problem worth solving, the current solutions, and the strengths and weaknesses of the current solutions.

Over 45 million US adults have at least one tattoo and 20% of them ultimately regret their tattoo. Currently tattoo removal is performed with Q-switched lasers which emit high energy pulses in the nano-second duration range. This energy destroys the ink using the principle of selective photothermolysis, which uses a specific wavelength of light to selectively target a chromophore, producing sufficient heat to damage the chromophore. Even the newest tattoo removal laser, which has a pulse duration of 0.6-0.9 nsec, uses this same mechanism. However the heat generated by this tissue interaction spreads into the surrounding tissue, causing pain and unintended tissue damage. After each treatment, the tissue damage heals over the next several weeks. Therefore nsec tattoo removal lasers require anesthesia, repeated treatments occurring over many months and years, and risk permanent scarring. Also, current lasers using thermal ablation rely on specific wavelength absorption necessitating multiple lasers to target different colors in multicolored tattoos. This results in an inefficient, lengthy, expensive, often incomplete and unsatisfactory tattoo removal process.

Your solution – Describe how your solution is different and why is it valuable.

PRINCETON FEMTOLASE, LLC offers a novel method for tattoo removal, which avoids problems of thermal photoablation using nsec-type lasers. By applying ultra-short and ultra-intense laser pulses of relatively low energy, our method, which is based on multiphoton processes, is highly effective and fast. The laser interacts with the tattoo ink by a precise multiphoton process. By focusing ultra-short laser pulses (more than 10,000 - 100,000 times shorter than laser pulses in current use) to a small spot size, ultra-high intensities in the range of 1013 - 1015 Watts/cm2 are being attained. There is practically no
heating or damage to the skin, and consequently no pain, trauma or scarring. The tattoos are removed by multi-photon ablation whereby powerful electric fields break up the ink molecules without generating any significant heat. Far fewer treatments over a much shorter period are required to safely and completely remove the tattoo. Because our laser uses the multiphoton process which is wavelength independent, our one single laser can effectively remove every color of ink.

Clinical hypothesis Summarize the scientific or technical basis of the drug/device/diagnostic/other technology you are developing, and briefly provide evidence that support its approach as useful and feasible.

THE MULTIPHOTON PROCESS utilized by our invention is readily directed below the skin with sufficient intensity and is independent of the laser wavelength, in contrast with current methods that use thermal photoablation. By adjusting the laser power and pulse duration, the intensity within the focal volume can be made to exceed the threshold intensity necessary for the multiphoton processing while the intensity near the skin surface may be kept below the level for multiphoton processing to occur. Consequently, the pigment may be multi-photon ablated while the surface of the skin remains undamaged.

DEMONSTRATION: In Fig. 1 are shown separate two multi-color well cured professional tattoos removed from the forearm of a human subject using describing method. The tattoos were about 1 cm2. Four to five treatments were required. In our current technique the skin becomes opaque after a few minutes, hiding the rest of the tattoo, hence it takes a few hours before the skin clears and another treatment can be performed. There is no pain, scarring or epidermal damage. After treatment is completed the area tans normally. Fig. 1: Tattoo removal using Princeton Femtolase technology

Product profile and development plan- Describe the product (i.e. some information of what it is) and what stage it is in (e.g. concept, preclinical, prototyped, closed beta, etc. as applicable). Also please include the next major milestone (and costs to that milestone) in the product’s development.

PATENTS: Patent #8,187,256, May 29, 2012 “Tattoo removal and other dermatological treatments using multiphoton processing”. Improved technology: Patent #8,915,907, Dec 23, 2014 “Tattoo removal with two laser beams via multi-photon processes”.DEVELOPMENT: Prototype laser has completely removed multiple well-cured multicolored professional tattoos from human arm. Currently designing a compact and inexpensive laser that we plan to utilize for FDA approval process. MILESTONES/COSTS: Milestone 1: Rent office, order laser, search for engineer, sub-total $300-400K; Milestone 2: Purchasing laser, employing engineer, setting up system1 (single beam), search for scientist, partnership on FDA approval of Tattoo1, sub-total $600-700K; Milestone 3: FDA approval of Tattoo1, volunteers for tattoo removal, modification of Tattoo1 system for Tattoo 2 option, partnership on FDA approval of Tattoo2, laser scientist starts, order for Tattoo1 system received, sub-total $500-600K(decrease due to revenue); Milestone 4: FDA approval of Tattoo2, volunteers for tattoo removal, order for Tattoo2 system received, sub-total $300-400K(larger revenue); Estimated cost for 24 months: $1.7 – 2.1M.

Value of your solution – What is your rough estimate of the yearly market revenue potential (and what are some for the basic assumptions underlying that estimate, e.g. this product could be used by X individuals per year, etc.).
MARKET: A conservative estimate of the market for tattoo removal of $100M annually. Our penetration into existing US market would yield ~$40M/year and a similar number for the rest of the world. As the number of people with tattoos, currently estimated at 45 million Americans alone, continues to increase dramatically, the tattoo removal market is growing in proportion. With much better therapy, the existing market will expend due to the untapped segment of individuals who presently forego treatment because of the pain, duration and ineffectiveness of current laser therapy, reaching about $300M/year worldwide. Furthermore, based on our initial experiments, we are extremely optimistic that the femtosecond laser and the multiphoton process will be equally effective at treating other dermatologic conditions, such as lentigenes and actinic damage for example.