neoV1064 for Increase of Clear Nails in Patients Having Onychomycosis

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Abstract

The neoV1064 (neoLaser, Caesarea, Israel) is a diode laser at 1064nm, capable of transmission of up to 20Watts of laser power through a focusing hand piece. The laser was used for a study of safety and efficacy for increase in clear nails in patients with onychomycosis. Over the course of 12 months, 9 consecutive patients with 11 toes diagnosed as suffering from Onychomycosis were treated in a leading clinic in Zurich, Switzerland (Dr. Bettina Rummelein, Lake Medical Center Hospital Kilchberg/Zurich, Switzerland). Data was collected, coded and sent for blinded assessment by an independent physician (Dr. John Hilinski, San Diego, CA, USA). Data was analyzed for safety and efficacy including percentage of cases seeing improvement in clear nails, and clear nail growth rate and compared to published results of the state of the art laser system (PinPointe FootLaser, NuvoLaser, CA, USA). Results demonstrate success rate of 81.8% in line with state of the art published results (79%) and clear nail average growth rate of 1.23mm/month which is similar to the comparison baseline (1.3mm/month). No adverse events were reported and treatments were well tolerated. The conclusion is that the neoV1064 system is a safe and effective tool for increase in clear nails in patients with Onychomycosis and has results similar to those published for the predicate system.

Introduction

Onychomycosis is a chronic fungal nail infection that affects a significant portion of the population and can have serious consequences to the elderly, diabetic, and immunocompromised individuals.[1]

Current treatment options for Onychomycosis include a wide array of potential therapies including nail excision, chemical or surgical avulsion, topical treatments, oral treatments as well as device based approaches. Treatment approaches may combine one or more of these regimes. Topical drug treatment for Onychomycosis is not usually successful because of difficulty to penetrate the nail plate and rapid recurrence can occur after discontinuing use. Oral systemic interventions may be more effective yet may present side effects, such as liver related toxicity, loss of taste, and potential interactions with other drugs, thus limiting its use. Contraindications prohibit the use of medication in numerous cases.[2]

In recent years, the use of lasers, and specifically the 1064 Nd:YAG laser for the increase of clear nails in patients suffering from Onychomycosis has been suggested and reviewed in literature with positive pre-clinical and clinical results.[3] Several commercial laser systems at 1064nm have been cleared by the FDA (PinPointe FootLaser K093547, Cutera GenesisPlus K103626) for the indication of increase in clear nails in patients with Onychomycosis. All the systems mentioned share common characteristics including transmission of energy at 1064nm, concentration of energy with a focusing hand piece to a 1mm spot size and fluence of 25.5J/cm^2 for treatment. All the systems have claimed equivalence to the PinPointe laser system as the predicate device and have relied on clinical data submitted by PinPointe.[4]

The neoV1064 laser system contains a semiconductor diode laser capable of power generation at 1064nm, a wavelength equivalent to standard Nd:YAG laser systems. The laser enables power of up to 20Watts of continuous transmission, as well as single pulse, and repeat pulse transmission. It is foot activated and can be delivered through a reusable fiber and focusing hand piece for dermatology applications. The delivery system enables focusing to a 1mm spot size and precise energy density of 25.5J/cm^2, equivalent to all predicate devices. The system is CE marked for treatments in Europe and is cleared in Europe for aesthetic indications including increase in clear nails for onychomycosis patients.

The goal of the analysis described in this paper was to assess whether the neoV1064 system can also be used for increase of clear nails in patients with Onychomycosis, with the same safety and efficacy reported by predicate systems which are FDA cleared and presently on the market in the US. To achieve this goal, data relating to patients treated in one clinic in Zurich Switzerland was collected over a period of 7 months and analyzed to establish the key outcome parameters of safety and efficacy. The data was then compared to published results of the baseline PinPointe system, to establish performance in line with the state-of-the-art cleared predicate system.

Image 1 - neoV1064 Laser System

Image 2 - 1mm Focusing Hand Piece

Study Design

Patients with Onychomycosis of one or both great toes were treated in a private clinic in Zurich, Switzerland. Presence of Onychomycosis was verified by processing of cell culture samples. All patients were assigned treatment which included laser sessions for primary treatment and application of topical nail softening cream (Cremolan, Moberg Pharma, Sweden, same formulation sold in US under brand name Kerasal Nail[6]). The Kerasal Nail cream, which is an OTC cream in the US, contains propylene glycol, urea and lactic acid, and is used to soften the nail and rehydrate the tissue. The laser utilized was the neoV1064 system for all patients [see Image 1].

The nail was debrided prior to treatment to improve energy transmission into the nail plate. The laser was set to 10 Watts peak power, 20msec pulse on time, 10msec pulse off time, resulting in a repeat pulse transmission of 33.3Hz, and effective average power of 6.7Watts to the nail. Energy was delivered to the patient via a dual connector, 400 micron core, silica/silica fiber with 1mm spot size at the focal plane, insuring a repeatable and controllable power density of 25.5J/cm^2 to the nail at the setting provided above. The power density of 25.5J/cm^2 used in this study is identical to the 1064nm power density Numerical Aperture (NA) of 0.22, proximally connected to the laser and distally connected to a treatment focusing hand piece [see Image 2]. The focusing hand piece, utilizing distance setting stainless steel prongs, provided was used by other cleared predicate devices for nail fungus treatment at the 1064nm wavelength. In each treatment session the beam is scanned in constant motion across the nail until the patient declares s/he has reached her/his pain tolerance limit. The treating physician maintains constant motion over the nail as to avoid local heating of a specific nail area. Motion includes both vertical passes and horizontal passes across the nail. This procedure is repeated between 3-6 times per nail, depending on how long the patient may tolerate each pass. The entire nail area is irradiated as well as the surrounding border of the nail. Most toes (9 out of 11) received 4 laser treatments each, 2 toes had 6 laser treatments. Time spacing of laser treatments was typically 1-2 weeks when patients were available (53%), and 3-4 weeks in most other cases (38%).

Images of fungal involvement of the nails were documented before the treatment sessions as well as after completion of the full treatment cycle, either after last laser session or 2-4 months following last treatment during a follow up visit, depending on availability of patients for follow up and tracking. Documentation included high resolution images of the involved nails allowing estimation of nail fungus involvement and clear nail measurement. See Images 3-6 for example of before/after images of Patient #6 with bilateral disease.

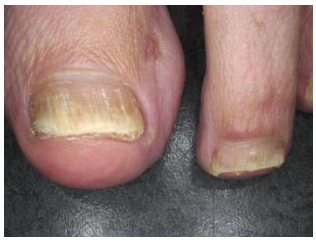

Image 3 - Patient#6, Toe A, Before Treatment

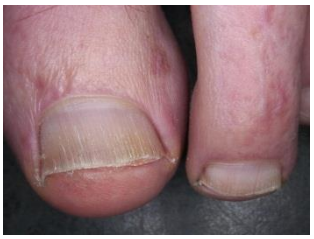

Image 4 - Patient#6, Toe A, After Treatment

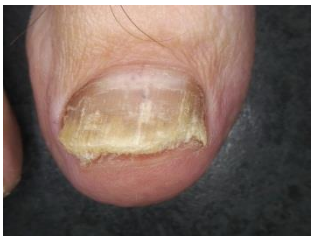

Image 5 - Patient#6, Toe B, Before Treatment

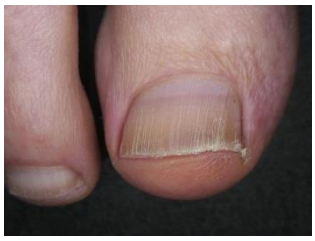

Image 6 - Patient#6, Toe B, After Treatment

All images were assigned a random identification number and were sent for independent, blinded assessment, by a trained Plastic Surgeon, knowledgeable in the domain of dermatology treatments including Onychomycosis (Dr. Hilinski, see Appendix for credentials). Dr. Hilinski rated all images as they relate to the primary efficacy outcome measure. Primary outcome was defined as his assessment of the amount of clear nail in millimeters, starting from the nail bed. Ratings for all images on primary outcome were collected, decoded and analyzed to allow comparison of pre and post treatment outcome. Secondary outcome endpoint was defined as average growth of clear nail in mm/month and is deduced from the primary outcome endpoint results and the information relating to length of time between first treatment and final observation. Safety endpoints were defined as occurrence of any adverse events and inability to complete treatments due to patient discomfort.

As a second step, results of this analysis were compared to available public domain clinical data relating to the Pinpointe FootLaser system, as to establish performance in line with a state of the art cleared predicate system. Comparison included primary and secondary efficacy end points as well as safety related endpoints. The primary efficacy comparison was based on the percentage of toes treated having improvement in clean nail. The primary safety comparison was based on lack of adverse events as indication of safety.

Results

9 patients presented with Onychomycosis disease of 11 main toes, 2 subjects having bilateral disease. Mean age was 54.6 years (minimum 45, maximum 76). 56% (5/9) of the patients were female and 44% (4/9) were male.

Efficacy of treatment was measured by assessment of primary and secondary outcome. Primary outcome was improved in 9 out of 11 main toes (81.8%), which showed improvement in amount of clear nail based on the blinded measurements. Average improvement in area of clear nail for all toes was 4.7mm relating to elapsed time from first treatment to final assessment ranging from 1 month to 8 months. Average of clear nail monthly growth rate over all patients was 1.23mm per month. For the subset of toes showing improvement in clear nail, the average improvement was 6.0mm providing an average clear nail monthly growth rate of 1.56mm/month. Duration of follow up period from initial treatment to assessment of results ranged from 1 month, to 8 months depending on availability of patients for follow up. Toes associated with largest improvement in clear nail (8 to 12mm of improvement) were also associated with long follow up times (5-6 months).

Safety of treatment was assessed through occurrence of adverse events during treatment, such as burns, nail damage, and pain requiring cessation of treatment and/or medical intervention. There were no adverse events during any of the treatment sessions. The treatment was well tolerated by all patients without anesthesia or medication, and no treatment session had to be terminated due to patient discomfort.

Comparison to clinical data published on the PinPointe FootLaser includes success rate in terms of improvement in clear nails, and the growth rate of treated nails[4]. Published results of the PinPointe system present clear nail improvement in 11 out of 14 treated toes (79%), vs 9 out of 11 (81.8%) with the neoV system. Published results of the Pinpointe system on growth of area clear of lesion on treated toes was 3.9mm over 90 days or 1.3mm per month, compared to an average clear nail growth rate of 1.23mm/month with the neoV1064 system.

	neoV1064	PinPointe FootLaser[4]
Primary Efficacy Endpoint	9/11 (81%)	11/14 (79%)
Secondary Efficacy Endpoint	4.7mm at average of 1.23mm/month	3.9mm at average of 1.3mm/month
Safety Endpoint	No adverse events, all treatments completed	No adverse events, all treatments completed

Table 1 – Comparison of Results

Accordingly, the primary outcome metric chosen for comparison with the predicate device show identical results as they relate to safety and efficacy for increase in clear nails. A summary of results is given in Table 1 below.

Discussion

A data collection study was performed with blinded estimation of clear nail before and after treatment regime with the neoV1064 laser system. Both treatment and blinded estimation of outcome were performed by experienced physicians in the treatment domain. Treatment parameters in terms of type of energy, fluence (energy density), and method of laser treatment were identical to commercially available and cleared products, specifically the predicate PinPointe FootLaser system. Primary and secondary efficacy endpoints were defined, collected and analyzed, demonstrating the efficacy of the neoV1064 system for increase in clear nails. Safety endpoints including lack adverse events and patient toleration to treatment were demonstrated. Last, comparison to the state of the art predicate system for the same intended use demonstrated identical results as they relate to both safety and efficacy endpoints. **Accordingly, it is our conclusion that the neoV1064 system, when using the same energy level, fluence, spot size, and technique as described above, is a safe and effective system for increase of clear nails in patients with Onychomycosis**.

Recently, peer work has been published that supports the above highlighted conclusion.[5]

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