TREATMENT OF NAIL DISORDERS WITH LLLT (2) CHRONIC PARONYCHIA AND INGROWN NAIL

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A diode laser system (Mochida Luketron 150 Model 1003, Matsushita Electrical Company, Tokyo, Japan) was used for the treatment of 17 patients with nail disorders: nine patients with chronic paronychia and eight patients with ingrown nail (onychocryptosis). We treated stage I of ingrown nails (following the classification of Zaias N) or subcutaneous ingrown toe nails (after the classification of Baran R & Dawber RPR) with LLLT. The system emits a 150 mW continuous wave beam at 830 nm in the near infrared on a small round spot of approximately 1 cm in diameter, delivering an incident dose of approximately 45 J/cm² per spot. We applied the laser beam to six spots on the fingers of the chronic paronychia patients and to fifteen spots on the fingers of the patients with ingrown nails for fifteen seconds per point. The effect was evaluated and marked by the patients themselves according to the clinical findings on a scale of from zero to ten where ten represented the clinical findings at the first visit and zero represented complete recovery. The final post-LLLT scores of 9 patients with chronic paronychia were as follows: 2, 3 and 7, one patient each; 0, 4 and 5, two patients each. Out of 8 patients with ingrown nails, the scores were as follows: 3, 5 and 7, one patient each; 0, five patients. To reach the treatment endpoint, meaning complete cure or the point after which further LLLT produced no significant improvement, chronic paronychia required on average 20.4 ± 18.32 (mean ± SD) days of therapy (range 5 days to 62 days) and ingrown nail required 5.0 ± 4.1 days (range 2 days to 14 days), respectively. No adverse side effects were reported for any patient. From this preliminary study, the authors conclude that 830 nm diode LLLT applied at the parameters in the present study is effective for chronic paronychia and particularly effective for the therapy of early stage ingrown nails.

Key words: Diode LLLT, chronic paronychia, ingrown nail, onychocryptosis

Introduction

A GaAlAs 830 nm diode laser system (Mochida Luketron 150 Model 1003, manufactured by Matsushita Electric Company, Tokyo, Japan) has been used for the treatment of many kinds of pain,(1-3) cutaneous ulcers(4,5) and skin eruptions associated with atop dermatitis.6) We reported that LLLT was useful and a preferable therapeutic modality for nail disorders such as a trachyonychia (twenty nail dystrophy), green nails and longitudinal ridges with DTP arthritis.6) The aim of our present study was to evaluate the practical efficacy of LLLT in the treatment of paronychia and ingrown nail (onychocryptosis).

Patients and Methods

Laser system

Diode LLLT, was applied in 17 patients with nail disorders: 9 cases of paronychia (1 male, 8 female; mean age 43.7 yr, range 24 yr to 75 yr) and 8 cases with ingrown nails and longitudinal ridges with DTP arthritis.6) The aim of our present study was to evaluate the practical efficacy of LLLT in the treatment of paronychia and ingrown nail (onychocryptosis).

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Fig 1: Schematic for application of an 830 nm, 150 mW continuous wave diode laser system on nail folds of fingers and/or toes with ingrown nail. The beam was applied on the 15 points as illustrated for 15 sec per point.

Table 1: Chronic paronychia: Patient demographics, and efficacy of LLLT.

<table>
<thead>
<tr>
<th>Case No</th>
<th>Age</th>
<th>Sex</th>
<th>Duration</th>
<th>Topical agent</th>
<th>Aggregate days of LLLT</th>
<th>Effect</th>
<th>Sites</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28</td>
<td>M</td>
<td>9 years</td>
<td>steroid</td>
<td>15 days</td>
<td>0</td>
<td>right hand</td>
<td>taking itraconazole for tinea unguium</td>
</tr>
<tr>
<td>2</td>
<td>28</td>
<td>F</td>
<td>unknown</td>
<td>steroid</td>
<td>7 days</td>
<td>3</td>
<td>both hands</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>75</td>
<td>F</td>
<td>3 months</td>
<td>steroid</td>
<td>8 days</td>
<td>7</td>
<td>bilateral I fingers right V finger</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>48</td>
<td>F</td>
<td>7 years</td>
<td>steroid</td>
<td>11 days</td>
<td>4</td>
<td>right II finger</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>32</td>
<td>F</td>
<td>2 years</td>
<td>non-steroid</td>
<td>30 days</td>
<td>4</td>
<td>all fingers, both hands</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>64</td>
<td>F</td>
<td>18 years</td>
<td>steroid</td>
<td>32 days</td>
<td>0</td>
<td>all fingers, both hands</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>25</td>
<td>F</td>
<td>1 year</td>
<td>non-steroid</td>
<td>5 days</td>
<td>5</td>
<td>all fingers, both hands</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>24</td>
<td>F</td>
<td>5 years</td>
<td>steroid</td>
<td>14 days</td>
<td>2</td>
<td>all fingers, both hands</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>27</td>
<td>Unknown</td>
<td>62 days</td>
<td>steroid</td>
<td></td>
<td>5</td>
<td>all fingers both hands</td>
<td></td>
</tr>
</tbody>
</table>

† Graded by patients themselves: grades from 10 (initial condition on presentation) to 0 (complete cure)
Table 2: Ingrown nail: Patient demographics and efficacy of LLLT.

<table>
<thead>
<tr>
<th>Case No</th>
<th>Age</th>
<th>Sex</th>
<th>Duration</th>
<th>Aggregate days of LLLT</th>
<th>Effect†</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>70</td>
<td>F</td>
<td>a few days</td>
<td>4 days</td>
<td>0</td>
<td>right I toe</td>
</tr>
<tr>
<td>2</td>
<td>59</td>
<td>M</td>
<td>3 years</td>
<td>7 days</td>
<td>5</td>
<td>right I toe</td>
</tr>
<tr>
<td>3</td>
<td>47</td>
<td>F</td>
<td>19 days</td>
<td>2 days</td>
<td>0</td>
<td>left I toe</td>
</tr>
<tr>
<td>4</td>
<td>57</td>
<td>M</td>
<td>unknown</td>
<td>2 days</td>
<td>0</td>
<td>both I toes</td>
</tr>
<tr>
<td>5</td>
<td>64</td>
<td>M</td>
<td>a few years</td>
<td>2 days</td>
<td>?(5)‡</td>
<td>left foot</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
<td>F</td>
<td>2 days</td>
<td>3 days</td>
<td>0</td>
<td>left I toe</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>M</td>
<td>unknown</td>
<td>6 days</td>
<td>3</td>
<td>right I toe</td>
</tr>
<tr>
<td>8</td>
<td>68</td>
<td>M</td>
<td>unknown</td>
<td>14 days</td>
<td>0</td>
<td>right I toe</td>
</tr>
</tbody>
</table>

† Graded by patients themselves: grades from 10 (initial condition on presentation) to 0 (complete cure).
‡ The numeral in parenthesis is the effect of the inflammation.

Clinical evaluation pre-and post-LLLT

The evaluation of paronychia and ingrown nail was conducted by comparing the symptoms before and after LLLT. The clinical findings were graded by the patients themselves using a score of from 10 to 0, where 10 was the condition on presenting before LLLT and 0 was a complete cure. The end point for each patient was either complete cure (0) or that point beyond which LLLT failed to produce significant improvement in the condition.

Results

Table 1 summarizes the chronic paronychia patient demographics (9 patients) and the treatment results. One patient each scored the efficacy of LLLT at 2, 3 and 7, and two cases at 0, 4 and 5. The ingrown nail patient demographics (8 patients) are similarly summarized in Table 2. Five patients scored the efficacy of the LLLT at zero (complete recovery), and one each at 3, 5 and 7. Figure 3 compares the efficacy of the results which we graded overall as follows: score 0-2, excellent; score

Fig 3: Efficacy of LLLT compared for all cases of chronic paronychia (n = 9) and ingrown nail (n = 8).

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3-5, good; score 6-7, fair; score 8-10, poor; beyond 10, exacerbation. The excellent and good scores were combined to give the overall efficacy. For paronychia, three patients were 'excellent', five 'good' and one 'fair'. No patient scored 'poor', and no patient got worse. For ingrown nail, five patients scored 'excellent', two 'good', and one 'fair'. Overall, 15 of the 17 patients (88%) demonstrated overall efficacy.

Case Reports

Case 1: (Patient 8, Table 1), chronic paronychia
A 24-year-old Japanese female visited the Department of Dermatology, Osaka Kaisei Hospital on May 8, 1991, with an approximate 4-month history of recalcitrant pruritic eruptions with nail deformity on the nail folds of all fingers, diagnosed by us as chronic paronychia. She was treated with 0.064% betamethasone dipropionate ointment, minocycline 200 mg/day and oxatomide 60 mg/day from May 8 to June 24, 1991. From June 25, 1991 to April 11, 1992, we changed the application to a stronger combination of 0.3% prednisolone valerate-acetate and tosufloxacin tosilate 450 mg/day because no improvement could be seen. From April 12, 1992, the eruptions were treated with topical steroid applications such as 0.05% budesonide ointment, 0.064% betamethasone dipropionate ointment, 0.3% prednisolone valerate-acetate and 0.05% clobetasol propionate. From May 6th 1995 we continued to prescribe the application of the topical steroid ointment mixture in
combination with 2% ketoconazole cream. Despite this, the pruritic erythematous edematous eruptions with occasional pain had not improved sufficiently. On July 10th 1995 the pre-therapy findings were as seen in Figure 4. In the following two weeks, four LLLT sessions were given at the parameters described above, and the eruptions improved slightly. After a further 14 LLLT sessions over the next three months, the eruptions significantly improved (Figure 5). The patient was extremely satisfied.

Case 2: (Patient 6, Table 2), ingrown nail.
A 20-year-old Japanese female with a 5-year history of atopic dermatitis presented on September 3, 1993 at the Department of Dermatology, Osaka Kaisei Hospital complaining of an erythematous edematous eruption with slight tenderness on the lateral aspect of her left big (1) toe (Figure 6). Her skin condition was good with the atopic dermatitis well controlled by anti-allergy agents and non-steroid ointments. Two days before presenting at our clinic, she had noticed the tenderness and swelling on her left big toe. Diode LLLT was performed on 15 points around the nail of her left 1 toe as shown in Figure 2, 15 sec per point, once a day for a total of three LLLT sessions, to control the tenderness and swelling. Figure 7 shows the condition on October 20th, with remarkable improvement of the erythema, oedema and no pain.

Discussion

Chronic Paronychia

Paronychia may be divided into the acute and chronic types. Acute paronychia needs swift systemic antibiotic treatment which, together with removing pus from within the nail folds, takes precedence over other treatments such as LLLT, because the bacterial agents present in the acute stage are capable of damaging the nail apparatus resulting in permanent nail dystrophy and can cause food poisoning. We may define chronic paronychia as inflammation of the periungual soft tissues over a period lasting 6 weeks or longer, and which may be infectious or noninfectious in aetiology. The infectious type of chronic paronychia is usually caused by a combination of *candida* and low-grade bacterial infections. Clinically, *candida* and *bacterium* can be cultured from the lesions in most patients with untreated chronic paronychia. However, microbial agents which are the cause of chronic paronychia cannot be easily detected in patients who have previously received various treatments in dermatology clinics.

On the other hand, noninfectious chronic paronychia is commonly caused by frequent water contact and contact irritants, psoriasis, atopic dermatitis. Although we can remove microbial agents by treatment with antibiotics, it is very difficult to remove irritants and sensitizers when treating chronic paronychia. It seems to us, from our experience and that reported by others, that it is very hard to obtain complete healing in patients with chronic paronychia. For this reason, we decided to apply LLLT for treatment of chronic paronychia.

None of our nine cases showed any improvement after treating them with steroid or nonsteroid topical agents. They were diagnosed as having recalcitrant chronic paronychia, because these patients had already showed no improvement even after treatment with antimicrobial and/or anti-fungal topical agents. In these recalcitrant cases, we also directed the patient to wear cotton gloves under rubber gloves in order to avoid irritants and/or sensitizers which gave a positive skin reaction in the prick and/or scratch tests. We also treated the patients with anti-fungal topical agents for fungal infections such as the *candida* family, anti-bacterial topical agents for bacterial infections and with steroid and/or non-steroid topical agents for inflammation and pruritus. We also directed the patients to avoid slight injuries to the areas of interest, which has been one of the aggravators of this condition.

Skin manifestations around the nail of most of patients with chronic paronychia appear in repeated cycles of remission and aggravation, even if we treat the lesions with topical ointment and direct the patients to wear cotton gloves under rubber gloves as part of the skin care regimen. In the nine recalcitrant cases we have reported on herein, the duration of the disease was 3 months in only one case and more than 1 yr in the other cases up to a maximum of 18 yr. In all nine cases, skin manifestations were improved (3 excellent, 5 good, 1 fair) after the treatment with LLLT and without any adverse side effects. The authors therefore recommend LLLT as an adjunctive therapy in patients with the recalcitrant type of chronic paronychia.

Ingrown nails

Since the lateral and/or inner side of the 1 toe (big toe) nails are most often involved, this condition was named ingrown toe nail. A few cases, however, develop on those of the other toes and fingers. Therefore, in this study we used 'ingrown nail' to refer to this disease as we were able to successfully treat these mild cases of ingrown nail without infection and granulation tissue, and because these are usually mild in most patients with ingrown nail of the fingers or toes other than the big toe.

Zaias divided ingrown nails into three stages, and Haneke into five stages, according to the extent and/or serious condition of damage to the nail fold. Af-
In this patient with ingrown nail treated with LLLT were diagnosed as belonging to stage I of Zaias' classification and also having the subcutaneous ingrowing toenail of Hanek's classification. In Cohen et al.'s classification, we should treat subcutaneous ingrown toenail without granulation tissue. For most patients with ingrown nail, Lloyd-Davies and Brill recommended the following conservative treatment: soaking the feet in warm water twice daily followed by careful drying, the application of foot powder must be avoided, and a small piece of cotton wool rinsed with silver nitrate is then introduced gently to the corners of the nail to remove the apical of the nail and to cauterize the granulation tissue. Sonnex and Dawber reported that ingrown toenails were treated successfully with liquid nitrogen cryotherapy which was sprayed on the granulomatous and infected tissues, and the adjacent nail fold in twenty-four of the 44 patients in their study with ingrown toe nail (onychocryptosis).

LLLT enabled us to successfully treat our eight comparatively mild cases of ingrown nail without infection and granulation tissue. When ingrown nails are seen on the fingers, these symptoms are usually mild. For the mild cases we have treated, the duration of this disease was relatively short as was the case in most of our eight cases. After an average of 5 ± 4.1 days of LLLT (range 2 dy – 14 dy), the symptoms cleared up remarkably well in most cases. For this reason, we feel LLLT is a particularly useful tool for the treatment of patients with the early stage of ingrown nail, as LLLT is noninvasive, pain free, easily applied, well-tolerated by patients of all ages and is side effect free.

References