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Novel Treatment of Acne Keloidalis Using Long Pulsed Nd: YAG Laser in Dark Skinned Patients

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Abstract:

Background and Objectives:

Acne Keloidalis nuchae (AKN) is a chronic inflammatory process involving the hair follicles of the nape of the neck. It initially manifests as mildly pruritic follicular-based papules and pustules. As folliculitis persists, keloidal plaques eventuate.

This study was performed to evaluate the therapeutic effect of long pulsed ND: YAG laser in treatment of different lesions of AKN.

Patients and methods:

Twenty-five male patients were complaining of AKN. Inflammatory papules and keloidal plaques were treated using long pulsed ND: YAG 1064 nm. Sessions were performed at monthly basis for 6 sessions. Evaluation included papule count, keloidal plaque size and pliability assessment before, every two sessions and at the end of treatment. Patient self- assessment included evaluation of pain, pruritus and cosmetic appearance at the end of treatment. Follow up was carried out for 3 months.

Results:

A 31% reduction in the mean papular lesions count were observed as early as the 2nd laser sessions with, 68.2% reduction after the 4th laser session and 90.9 % reduction at the end of treatment $p < 0.0001$. Significant reduction in the mean area

of keloidal plaque size was initially seen after the 4th laser session and 70.4% reduction was obtained at end of laser sessions. Significant keloidal plaques softening versus baseline was demonstrated after the 4th laser session ($p<0.0001$). Improvement of subjective symptoms was elicited. The only side effect was temporary hair loss in five patients where lesions occurred above the hairline.

Conclusion:

Long pulsed ND: YAG laser (1064nm) is an effective treatment of both papules and keloidal lesions of AKN where significant reduction in papule count, size, softening of keloidal plaques obtained with no recurrence in the three months follow up period.

Introduction:

Acne keloidalis nuchae (AKN), also known as folliculitis keloidalis, is a chronic inflammatory process involving the hair follicles in the occipital region of the scalp and posterior aspect of the neck. It is characterized by the presence of follicular papules and pustules which enlarge forming confluent thickened keloid-like plaques [1]. The condition occurs mainly in post pubescent males between the ages of 14 and 25 years, however, a few female patients have also been reported [2,3]. AKN occurs most frequently in individuals of African descent [2]. The cause of AKN remains unclear; however, penetration of cut curved hairs into the skin in genetically predisposed individuals is the most accepted theory [4]. The notion that AKN lesions are caused by ingrowing hair is analogous to the situation in pseudo- folliculitis barbae [4,5]. Although various treatment modalities have been used in the management of AKN such as topical and intralesional steroids, antibiotics, retinoids, surgical excision with primary closure and excision with grafting, the disease is often refractory with reported recurrence [6]. Laser technology such as CO₂ and long pulsed diode laser has been used in treatment of AKN [7,8]. Based on the postulation that the pathogenesis of AKN is similar to pseudo- folliculitis barbae, long pulsed diode laser 810 nm has been used to treat papular and nodular lesions of AKN [8]. Long pulsed ND: YAG laser 1064nm has been proven to be a safe and effective option for treatment of pseudo-folliculitis barbae in dark skinned patients with no pigmentary changes [9]. This study was designed to evaluate the efficacy of long pulsed ND: YAG laser in treatment of different lesions of AKN; papular and keloidal plaques.

Patients and methods:

Study design:

Twenty-five male patients who were clinically diagnosed as AKN with Fitzpatrick skin types IV (n=19), V (n=4), and VI (n=2). Their ages ranged from 17 to 42 years. The disease duration ranged from 5 months to 10 years. Exclusion from the study was limited to individuals with current use of isotretinoin or previous laser therapy. Before starting treatment patients gave their informed consent. Patients presented with different stages of AKN; five patients presented

with papules only, three patients with keloidal lesions and seventeen patients presented with both papules and keloidal lesions.

Laser treatment:

Each lesion was treated with 1064nm Long-pulsed Nd: YAG laser (Cool Glide Excell; Altus Medical Burlingame, CA) with a 10mm spot size, 35-50J/cm² fluence and 30-40 msec pulse duration. The fluence and pulse duration differed for each patient, dependent upon skin type and previously performed spot test. Patients with skin type IV were treated with fluencies in the range 40- 50 J/cm² and 30 msec pulse duration while patients with skin type V and VI were treated with lower fluencies in the range of 35- 40 J/ cm², 40 msec pulse duration. No anaesthesia was used. Pre-cooling of the lesion was achieved by contact cooling using the gold plated cooling head of the laser's hand piece for 3-5 seconds. The laser pulse was delivered followed by cooling for additional 2 seconds. The technique was repeated until the entire lesion was treated. Sessions were performed monthly for six months. A lipid cream (fusidic acid 2% + betamethasone 0.1% preserved with chlorocresol) was prescribed to patients for two to three days following each session. Sunscreen creams were prescribed according to patients' daily activity.

Evaluation procedures:

Clinical assessments and photographic documentation with digital camera; Kodak DX 3700, 3.1 Mega pixels, 3xs zoom, were conducted before treatment, and repeated each session until the end of the treatment. Patients were asked to report any adverse effect.

Papules count: Evaluation included papule counting at baseline that was established before starting the laser sessions and every 2 sessions until the end of treatment. The cut off between papule and plaque is 1 cm [10].

Keloidal plaque size: Keloidal plaques size was determined by measuring the width and length using a special calliper. Surface area was then calculated and recorded in squared centimetres.

Pliability: Keloidal plaque pliability assessment was graded according to a standard scale to assess functional mobility of keloids and scars [11] where 0 indicated normal skin; 1 designated supple skin that yielded with negligible resistance; 2 indicated a yielding scar that give way to pressure with moderate resistance; 3 designated a firm scar that moved as a solid inflexible unit; and 4 indicated banding that produced a rope- like scar tissue with blanching.

Evaluation was done at baseline and every 2 sessions to the sixth session. Follow up was carried on for 3 months.

Patient self assessments: All patients were asked to grade the overall percentage satisfaction with treatment one month after the sixth session. The percentage satisfaction scale simply asked each patient whether they were very satisfied, satisfied or not satisfied with the degree of lesion regression by

comparing pre and post treatment photos of the lesions and symptoms alleviation as pain and pruritus.

Statistical analysis:

Mean values were calculated for papule count, keloid size (surface area), and pliability rating and was considered significant when the P value < 0.01. The percentage of reduction of papule count, keloidal plaque size (area) and pliability were defined after treatment compared to the baseline. Paired t-test and Analysis of Variance (ANOVA) were done for comparative purpose between mean reductions of lesions at baseline, every 2 sessions and at the end of treatment.

Results:

Baseline characteristics

The mean age of the patients was 27 ± 3.6 years (range 17- 42 years). The mean of disease duration was 5.7 ± 2.1 (range 5 months -10 years). Baseline data were 484 (range 4-56) papules, 25 keloid plaques of different sizes (range 1-35cm²). Keloid plaques pliability was of grade 3 in eleven plaques, grade 2 in twelve plaques and grade 1 in one plaque. Patients showed different degrees of improvement during treatment and at the end of sessions in papules count (**fig 1a, b**), keloid plaque size (**fig 2a, b**), and pliability. Improvement of subjective symptoms such as pruritus, pain, regression of lesions and cosmetic appearance were elicited. Temporary hair loss occurred in five patients in Nd: YAG treated sites above the hair line after the 4th session. Re- growth of thinner hair occurred 3 months after the 6th sessions in every case. Follow up period showed no recurrence of lesions in the laser treated sites



Fig 1a: Before treatment; inflammatory papules and keloidal plaques can be noticed.



Fig 1b: After 4 sessions; improvement of both papular and keloidal plaques with loss of hair in treated sites.



Fig 1c: End of treatment regrowth of hair in the treated sites.



Fig 2a: Keloidal plaque lesion before treatment.



Fig 2b: Flattening of the keloidal plaque with reduction in size after treatment.

Papules count:

Significant reduction ($P < 0.0001$) in the mean papule count lesions after Nd: YAG laser treatment was observed compared to the baseline (**fig 3**). A 31% reduction in the mean papular lesions count were observed as early as the 2nd laser sessions with, 68.2% reduction after the 4th laser session and 90.9 % reduction at the end of treatment.

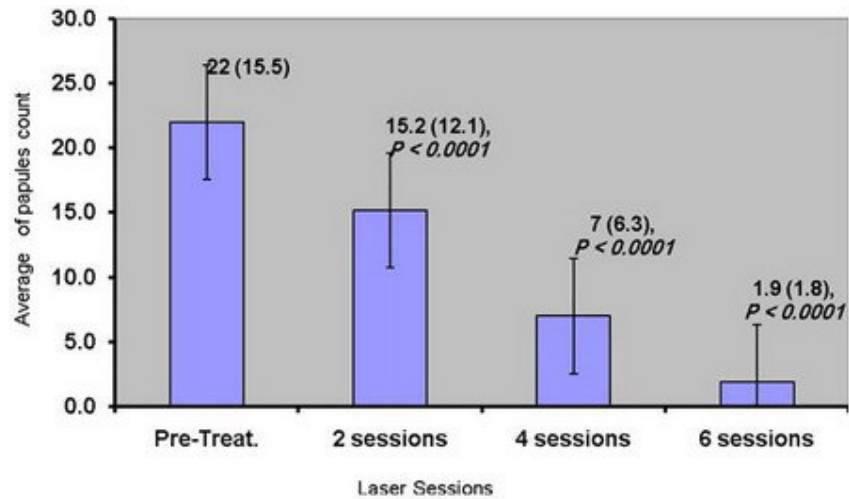


Fig 3: shows reduction in mean (SD) of papules count with progress of laser sessions.

Keloidal plaque size

Significant reduction in the mean area of keloidal plaque size was initially seen after the 4th laser session ($p < 0.0001$) compared with the baseline measurement (**fig 4**). A 5.9% reduction of keloidal plaque size was obtained after the 2nd laser sessions, 47.1% reduction after the 4th sessions and 70.4% reduction at the end of the treatment

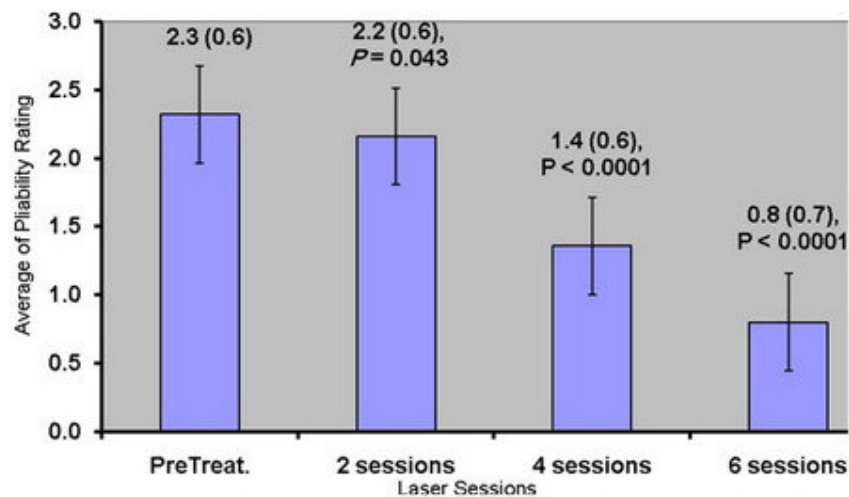
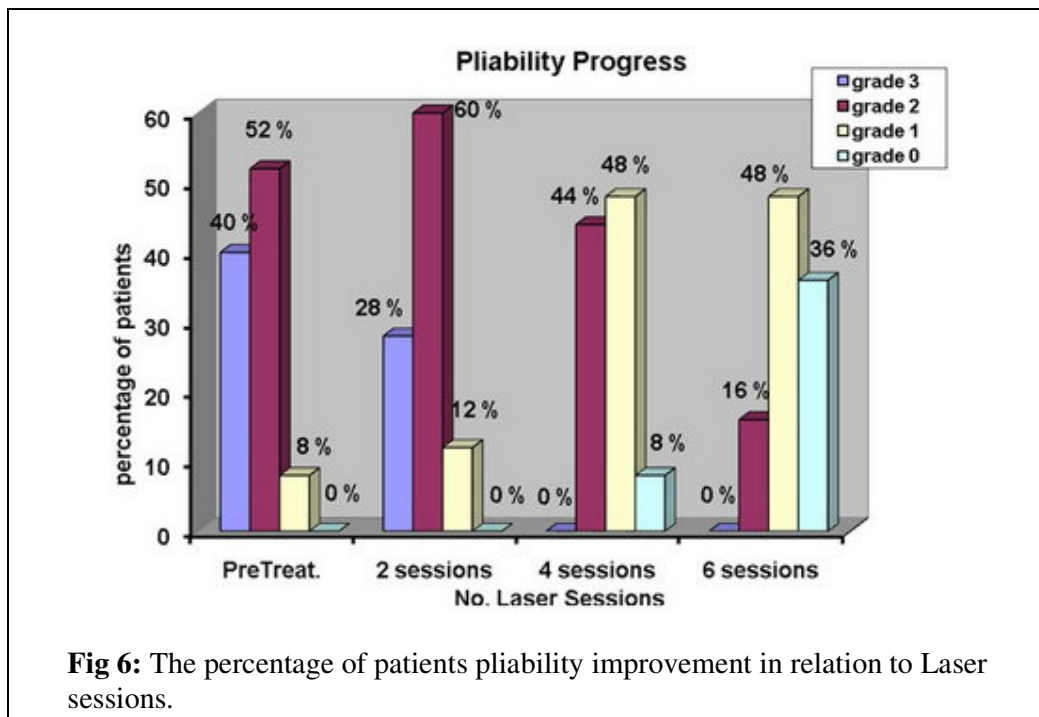
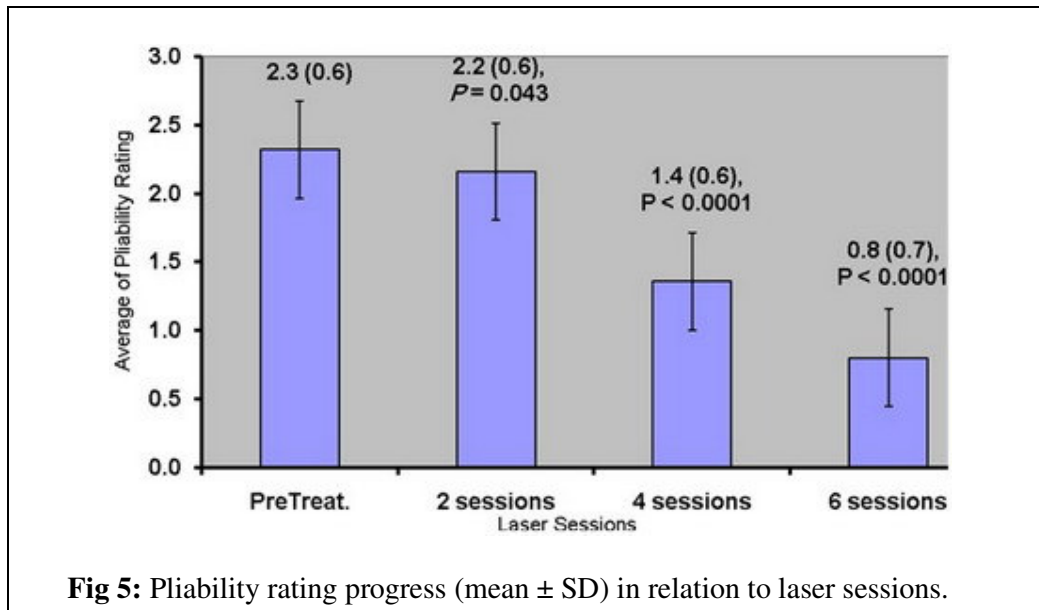


Fig 4: Keloid plaque size reduction (mean ± SD) in relation to laser sessions.

Pliability

Significant keloidal plaques softening versus baseline was initially demonstrated after the 4th laser session ($p < 0.0001$). Progressive reduction in pliability percentage was

seen from laser session to another as shown in (fig 5, 6). Grade 4 was not assessed in this study as it was not present in any of the patients.



Subjective self assessment:

Different degrees of satisfaction were obtained throughout sessions as shown in table 1. By the end of 6th session, 18 patients (72%) were very satisfied, 5 patients (38.46%) were satisfied and 2 patients (8%) were unsatisfied.

Improvement	Very		
	unsatisfied	satisfied	satisfied
2 sessions	11 (44%)	5 (20%)	9(36%)
4 sessions	5 (20%)	13(42%)	7 (28%)
6 sessions	2 (8%)	5 (38.46%)	18(72%)

Table 1: Improvement of subjective symptoms among patients (%) during treatment

Discussion:

Acne keloidalis nuchae (AKN) is initially manifest as mildly pruritic follicular-based papules and pustules on the nape of the neck. As folliculitis persists, keloid- like plaques eventuate [5]. Numerous therapeutic options are available for AKN; topical and systemic antibiotics, corticosteroids injections, surgical excisions and CO₂ laser [6].

Based on the histopathological characteristics of early lesions of AKN that show follicular and perifollicular inflammatory infiltration at the upper third of the hair follicle suggesting hair follicle involvement [12] and because of the proposed similarity in causes and occasional occurrence of pseudo- folliculitis barbae and AKN [1,13], we decided to use the long pulsed Nd: YAG for treatment of lesions of AKN. The 90.9% success rate in reduction in the papule count can be explained on the basis of selective photothermolysis theory [14], where the wavelength of long pulsed Nd: YAG laser (1064nm) penetrates far enough into the dermis to disrupt the follicle, while sparing the epidermis from heat absorption. This method reduces the formation of ingrown hair, thereby reducing the severity of the disease [15,16]. Although our patients were of dark skinned type IV, V and VI, no pigmentary changes were reported confirming that the Nd: YAG is safe for dark skin types [9]. The only side effect was temporary hair epilation in 5 patients due to fragmentation and destruction of diseased follicles however, re- growth of thinner hair was observed three months after the 6th laser session. Shah [8] reported marked improvement in papular and nodular AKN of three patients treated with long pulsed diode laser 810 nm. His findings agreed with our results however; our study was done on large sample size to improve the ability to evaluate results. Some authors stated that keloidal lesions of acne keloidalis is not keloid as it did not appear elsewhere in the body and the pathology is different from that of keloid [6,12]. In keloidal plaque, distortion and occlusion of the follicular lumen by fibrosis leads to hair retention in the inferior

follicle and further granulomatous inflammation and scarring [12]. Kanthak and Cullen [6] were the first to emphasize the significance of sub-follicular destruction. The reduction in the size of keloidal plaque (70.4%) after the 6th laser session and the improvement of pliability can be explained by the mechanism of action of long pulsed Nd: YAG laser in destruction of fragmented hairs at the inflammation site and subsequent improvement of scar tissue.

Glenn et al., who treated 6 patients with surgical excisions, explained that lesion recurrence in 20% of their patients was due to the incomplete removal of the ingrown hair or new lesions formation [6]. We prescribed fusidic acid 2% with betamethasone 0.1% topical cream only for patients who had crusts after laser sessions and for duration of 2 to 3 days, which was very short to have an influence on the clinical response. In our study follow up for three months after the end of treatment showed no recurrence, as the re-growing hairs were thinner and unable to re-penetrate the skin. All patients were satisfied regarding the treatment procedure as laser application was relatively painless on using pre cooling technique compared to painful intra-lesional injection or surgical excisions which require long post operative care since they are usually left to heal by secondary intention. Improvement of pain, pruritus and cosmetic appearance were satisfactory for all patients except two due to their high expectations of complete cure of keloidal plaques.

Conclusion:

Treatment of AKN in early and late stages is possible and effective. By using long pulsed Nd: YAG lasers for early papular, nodular and keloidal lesions, satisfactory results were obtained, as being assessed by a decrease in papular count, reduction of keloidal area as well as, the increase in tissue pliability with no pigmentary changes. These results encourage us to recommend this type of laser as an effective treatment modality in AKN for dark skinned patients.

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