Montrouge, le 11/05/2012

Rania M. Abdel Hay

Vous trouverez ci-après le tiré à part de votre article au format électronique (pdf) :
The efficacy of laser-assisted hair removal in the treatment of acne keloidalis nuchae; a pilot study

paru dans
European Journal of Dermatology, 2012, Volume 22, Numéro 5

John Libbey Eurotext

Eur J Dermatol 2012; 22(5): 645-50

Samia M. ESMAT[1]
Rania M. ABDEL HAY[1]
Ola M. ABU ZEID[1]
Hala N. HOSNI[2]

[1] Dermatology Department,
[2] Pathology Department,
Faculty of Medicine,
Cairo University,
13th Abrag Othman,
Kornish El Maadi,
Cairo 11431, Egypt

Reprints: R. M. Abdel Hay
<omleila2@yahoo.com>

The efficacy of laser-assisted hair removal in the treatment of acne keloidalis nuchae; a pilot study

Background: Laser-assisted hair removal causes miniaturization of hair shafts which are the principal contributors to inflammation in acne keloidalis nuchae (AKN). *Objective:* To assess the efficacy of hair reduction by long pulsed Nd-YAG laser as a therapeutic modality for AKN. *Methods:* This interventional pilot trial included 16 patients with AKN who received 5 sessions of long pulsed Nd-YAG laser. Lesions were objectively and subjectively assessed at the third and fifth laser sessions, and 1 year after. Global response to treatment was rated using a quartile grading scale regarding the percentage improvement in the count of papules and the size of the plaques. Biopsies were taken before and 2 weeks after the fifth session to evaluate the pathological changes associated with improvement of the treated lesions. *Results:* All patients showed a significant improvement. The percentage of improvement in the early cases was significantly higher when compared to late cases. Two weeks after the fifth session, all biopsies showed a significant decrease in the inflammatory infiltrate except one case. Sclerosis was markedly decreased. Complete absence of hair follicles and adenexa was observed, apart from in 2 cases. *Conclusion:* Laser hair depilation can significantly improve this disfiguring chronic disorder. Starting treatment as early as possible achieves the best results and can stop the disease process if followed by maintenance sessions.

Article accepted on 6/13/2012

Key words: acne keloidalis nuchae, hair reduction, Nd-YAG laser

Acne keloidalis nuchae (AKN), also known as folliculitis keloidalis, is a chronic inflammatory process involving the hair follicles of the nape of the neck that persists for many years and heals leaving hypertrophic or keloidal papules [1].

Acute inflammation, whether it begins in the sebaceous gland or elsewhere in the region of the deep infundibular or isthmus levels could be the cause of or the result of a weakened follicular wall which enables the release of hair shafts into the surrounding dermis. The "foreign" hairs incite further acute and chronic granulomatous inflammation. Fibroblasts lay down collagen and scars form in the region of the inflammation. Distortion and occlusion of the follicular lumen by fibrosis leads to hair retention in the inferior follicle and further granulomatous inflammation and scarring, which manifests clinically as keloid-like scars and plaques [2].

Many treatment modalities have been tried, with some success [3]. Laser-assisted hair removal, which causes coagulation necrosis of the viable hair follicles and fragmented hair shafts present in the deep dermis, was expected to improve scarring in AKN once the growing hairs are removed from the inflammation site [4]. The aim of this study was to assess the efficacy of laser-induced hair reduction using long pulsed Nd-YAG laser as a therapeutic modality in the treatment of AKN.

Materials and methods

This study is a prospective interventional pilot trial conducted on 16 patients suffering from AKN attending the outpatient Dermatology clinic from January 2008 till May 2010. The study was approved by the Dermatology Research Ethical Committee, Dermatology department, Cairo University. ClinicalTrials.gov Identifier: NCT01548898.

Each patient signed an informed written consent then was subjected to history taking, clinical assessment, photography, skin biopsy, laser treatment, and follow up.

Clinical assessment

Each patient was assessed clinically before treatment and on the third and fifth sessions of treatment and also 1 year after the last session, for the response and the complications. The clinical assessment included:

1. Papule and plaque counting.
2. Determination of keloidal plaque sizes by measuring the width and length, using a special caliper (Anyi Instrument Co. Ltd, China). Surface area of the plaque was then calculated and recorded in cm^2.

doi:10.1684/ejd.2012.1830

To cite this article: Esmat SM, Abdel Hay RM, Abu Zeid OM, Hosni HN. The efficacy of laser-assisted hair removal in the treatment of acne keloidalis nuchae; a pilot study. *Eur J Dermatol* 2012; 22(5): 645-50 doi:10.1684/ejd.2012.1830

3. Other clinical parameters (consistency, height, erythema and hair density) using the following designed parameters. Parameters were examined on a scale of 0 to 3 (low score was better):

- Consistency: firm (3), firm to soft (2), soft (1).
- Height: thick plaques (3), intermediate thickness plaques (2), thin plaques (1).
- Erythema: severe (3), moderate (2), mild (1), no erythema (0).

4. Tenderness of the lesions and the pain during the laser procedure were assessed using a visual analogue scale of 0 (none) to 3 (maximum) [5].

All patients were further subdivided into early cases that had only papular lesions and late cases that had evolved into plaque lesions. The global response to treatment was then rated using a quartile grading scale regarding the percentage of improvement in the count of papules and the size of the plaques as follows; 0. no improvement (<25%), 1. mild improvement (25%-50%), 2. moderate improvement (51%-75%), 3. excellent improvement (>75%).

5. Complications: Acute (crusts and burn), chronic (hyperpigmentation, scarring, change in hair density). Change in hair density (compared to patient's own hair density over lesions before treatment): more, the same, less, no hair.

Patients were asked to assess their degree of satisfaction as very satisfied, satisfied, or not satisfied, through a questionnaire completed at the end of the study. Photography was carried out for each patient, using the same camera and the same camera settings, before treatment and at each session.

Skin biopsy and histopathological examination

A 4 mm punch biopsy was taken before and 2 weeks after the fifth session to evaluate the pathological changes associated with improvement of the treated lesions. The area to be biopsied was cleaned with alcohol and local anaesthesia was achieved, then the punch biopsy instrument was directed to penetrate the skin till its hub and the biopsy was cut free from the SC tissue using a scalpel blade. The biopsies were stored in formalin 10% and were fixed in paraffin. Sections were cut transversely and stained with hematoxylin and eosin. Histopathological examination was blinded for the stage of the disease.

Laser treatment

All patients received 5 sessions (4 weeks apart) of long pulsed Nd-YAG laser assisted hair removal on the affected area, emitting 1064 nm, with a fluence of 35-45 J/cm^2 and pulse duration 10-30 msec adjusted to skin type and hair thickness. Laser was applied to all papules and plaques. After each treatment the patients were given ice compresses for 10 minutes and were advised to use a sunscreen with SPF 50+ during the daytime. Topical cream (Fusidic acid 2% combined with betamethasone vaierate cream 0.1%) was prescribed to patients for 2 to 3 days only following each session at night to avoid its clinical response on the AKN.

Statistical analysis

Data was coded and entered using the statistical package SPSS version 15. Data was summarized using mean ± SD and median for quantitative variables and percentage for qualitative variables. Comparisons between groups were done using non-parametric tests *e.g.* Mann-Whitney, and Wilcoxon Signed Ranks for quantitative variables with distributions other than normal.

Results

All the patients included were males with Fitzpatrick skin types III (n = 6) and IV (n = 10), their ages ranged from 22-54 years (mean ± SD, 31.88 ± 9.24). Their disease duration ranged from 0.7-8 years (mean ± SD, 2.79 ± 1.89). All patients completed the study apart from 2 patients who dropped out after the third session and they were included in the statistical analysis as intention to treat. Five patients (31%) presented with only papular lesions (early cases) and 11 patients (69%) presented with both papular and plaque lesions (late cases).

Papule count

There was a significant decrease in the papule count in all patients at the third and fifth laser sessions compared to baseline values (P<0.001 and 0.001 respectively) with a mean of 82% improvement at final evaluation and a significant improvement in the fifth session when compared to the third session (P = 0.029), *(table 1*, *figures 1* and 2*)*.

Table 1. The mean ± SD and the average of the papules counts, the plaque counts and the plaque sizes of the patients (across the patient group) before treatment, at the 3rd session and at the 5th session.

	Before treatment	3rd session	5th session	P value**
Papules count(mean ± SD, range)	44 ± 42.28 (5-150)	20 ± 27.22 (0-93)	7.937 ± 9.398 (0-35)	0.029
	P value*	<0.001	0.001	
Plaques count (mean ± SD, range)	1.818 ± 1.471 (1-6)	1.182 ± 1.471 (0-5)	0.818 ± 0.982 (0-3)	0.104
	P value*	0.011	0.008	
Plaques size (cm^2) (mean ± SD, range)	6.187 ± 4.114 (1-12)	2.437 ± 2.66 (0-9)	1 ± 1.826 (0-6)	0.001
	P value*	<0.001	<0.001	

** P value when compared to baseline values (before treatment)*
*** P value when comparing between the 3rd and the 5th session*
P<0.05 is significant

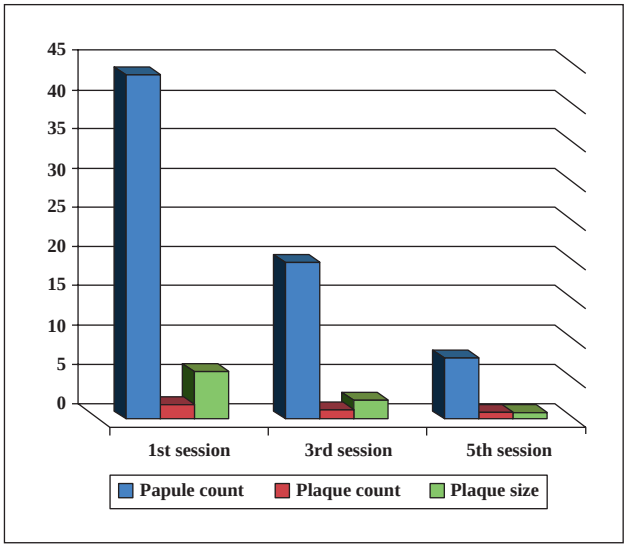

Figure 1. There was a significant decrease in papule count, plaque count and plaque size before treatment and at the third and fifth sessions.

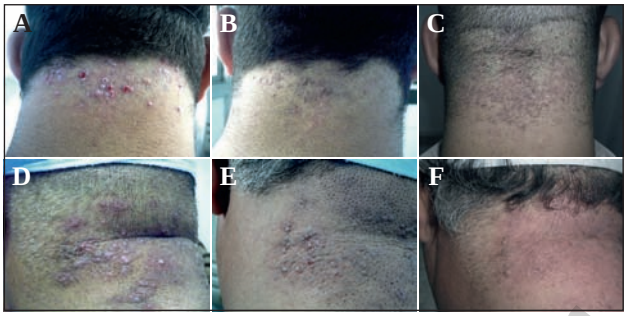

Figure 2. A,B,C) Patient 1 **A)** before treatment with papular lesions; **B)** after the third session with starting improvement; **C)** after the fifth session with complete clearance of the lesions. **D,E,F)** Patient 2: **D)** before treatment with papular and plaque lesions; **E)** after the third session with starting improvement; **F)** after the fifth session with marked improvement of both papular and plaque lesions.

Plaque count and size

There was also a significant decrease in the plaque count in all patients at the third and fifth laser sessions when compared to baseline values (P = 0.011 and 0.008 respectively). There was a significant reduction in plaque size in the third and fifth sessions compared to baseline values (P<0.001) with a mean of 84% improvement. This decrease in the plaque size was significantly detected in the fifth session when compared to the third session (P = 0.001) *(table 1, figures 1* and 2D-F).

The grading of improvement in the papules count and the plaques size at the final evaluation is shown in *table 2*. By comparing the 2 groups (early *versus* late cases), there was a statistically significantly higher percentage of improvement in the early cases (P = 0.009).

There was no statistical significant difference between patients with Fitzpatrick skin types III and IV in the final grading of improvement (P>0.05).

Table 2. Grading of improvement at the final evaluation in the early and the late lesions.

	Early lesions (presented as perifollicular papules without keloid formation, n = 16)	**Late lesions (presented as keloidal plaques, n = 20)**
Grading of improvement*		
No improvement	2 (12.5%)	4 (20%)
Mild improvement	0 (0%)	3 (15%)
Moderate improvement	2 (12.5%)	8 (40%)
Marked improvement	12 (75%)	5(25%)
P value	0.009**	

** Rated using a quartile grading scale regarding the % of improvement in the count of papules and the size of the plaques as follows; 0. no improvement <25%, 1. mild improvement 25%–50%, 2. moderate improvement 51%-75%, 3. excellent improvement >75% improvement.** P value significant*

Papule and plaque height

There was a significant decrease in height of papules at the third and fifth sessions (P<0.001) *(figure 3A)*, and in the height of plaques at the third and fifth sessions (P = 0.004 and 0.003 respectively) when compared to base line *(figure 3B)*. This reduction in the height of both papules and plaques was significantly detected at the fifth session when compared to the third session (P = 0.020 and 0.025 respectively).

Plaque Consistency

A significant softening of keloidal plaques vs. baseline was observed in all patients at the third and fifth sessions (P = 0.003), however this softening was not significant when comparing the third and the fifth sessions (P = 0.083) *(figure 3B)*.

Erythema score

A significant reduction was noticed in erythema score at the third and fifth sessions in all patients compared to baseline score (P<0.001). This reduction was also significantly detected at the fifth session when compared to the third session (P = 0.014) *(figure 3C)*.

Tenderness and pain

The laser sessions were well tolerated by all patients. Mild pain or discomfort, during and few hours after the procedure, was reported. The pain score significantly decreased at the fifth laser session when compared with the first session (P = 0.005). The tenderness scores significantly decreased at the third and fifth sessions *vs* baseline (P<0.001) *(figure 3C)*.

Histopathological evaluation

Before treatment, all biopsies showed dense chronic inflammatory infiltrates composed of lymphocytes, plasma cells,

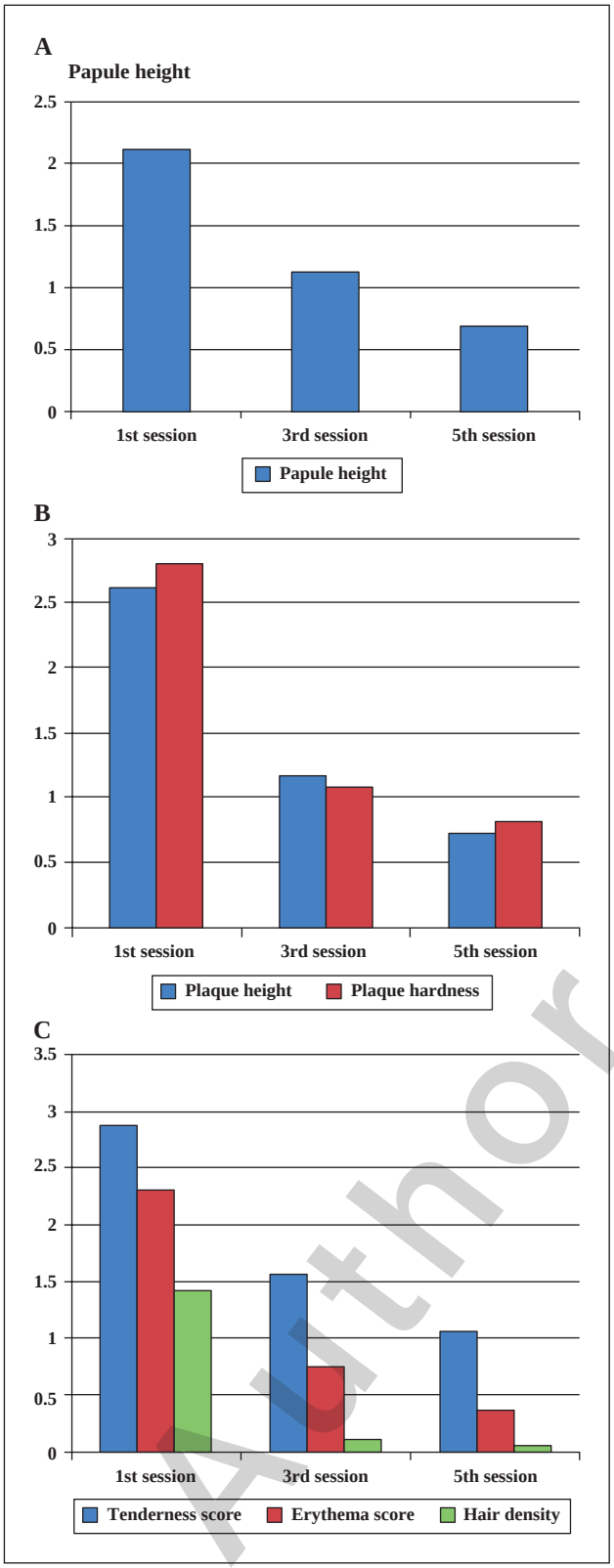

Figure 3. A) There was a significant decrease in height of papules at the third and fifth sessions (P<0.001). **B)** There was a significant decrease in the plaque heights at the third and fifth sessions (P = 0.004 and 0.003 respectively) and a significant decrease in the plaque hardness at the third and fifth sessions (P = 0.003) when compared to baseline values.

and histiocytes associated with marked sclerosis *(figure 4)*, one case showed cystic dilatation of the hair follicles.
Two weeks after the fifth laser session, all biopsies showed a significant decrease in the inflammatory infiltrate except one case. Sclerosis was markedly decreased *(figure 4)*. Complete absence of hair follicles and adenexa was observed except in 2 cases where they were still found.

Complications

Post laser crust formation was observed in 6 patients (37.5%) and it was completely cured within 2 weeks. No pigmentary changes were observed in the skin treated with Nd YAG laser in any patient. There was also a significant reduction in the hair density at the third and fifth sessions when compared to baseline (P<0.001). This reduction in hair density was not statistically significant when comparing the third and fifth sessions (P = 0.317) and was accepted by all patients *(figure 3C)*.
There was no statistically significant difference in the incidence of complications (pain and hair loss) between patients with Fitzpatrick skin types III and IV (P> 0.05). By the end of the study, 9 patients (64%) were very satisfied, 4 patients (29%) were satisfied and only one patient (7%) was unsatisfied.

One year follow up

Ten patients (63%) completed the one year follow up period, recurrence was observed in 2 of them (20%) in the form of a few papular lesions that disappeared after 2 laser sessions. Re-growth of hair which was thinner, softer and less dense than the original hair was observed 3 months after the fifth session in the areas of papular lesions and not on the plaque lesions.

Discussion

Treatment of AKN with the long pulsed Nd-YAG laser showed a significant decrease in the number of papules and plaques and the size of plaques which was associated with softening of the lesions and a decrease in the erythema score. This clinical improvement was associated with histopathological evidence of significant decrease in the inflammatory infiltrate and sclerosis with complete absence of hair follicles and adenexa. Transient loss of terminal hair was observed in the areas treated, with subsequent growth of hair that was thinner and softer than the original hair 3 months after completing the study. At the end of six months after starting treatment, our patients had cosmetically acceptable results.
The improvement observed in AKN lesions in our study was probably because of the coagulation necrosis effect of long

Figure 3. ***Continued.***
C) There was a significant decrease in the tenderness score at the third and fifth sessions (P<0.001), a significant decrease in the erythema score at the third and fifth sessions (P<0.001), and a significant decrease in the hair density at the third and fifth sessions (P<0.001) when compared to baseline values.

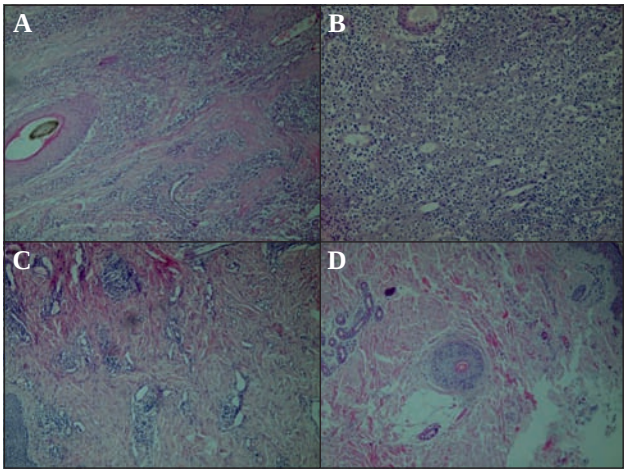

Figure 4. A,B) Before laser treatment. **A)** Low power view of skin biopsy, the dermis showing hair follicle, dense chronic inflammatory cells formed of lymphocytes, plasma cells and histiocytes associated with dense sclerosis (H&E stain, ×40). **B)** High power view of skin biopsy, the dermis showing heavy infiltration by lymphocytes, plasma cells and histiocytes. (H&E stain, ×200). **C,D)** After laser therapy **C)** Medium power view of skin biopsy, the dermis showing minimal infiltration by chronic inflammatory cells associated with less sclerosis. (H&E stain, ×100). **D)** Medium power view of skin biopsy, the dermis showing absence of inflammatory cells with less sclerosis. (H&E stain, ×100).

pulsed Nd-YAG on the hair follicles [4], which are the principle contributor to inflammation in AKN [2]. Moreover, the fragmented hair shafts released in the dermis following the acute inflammation that results in a granulomatous inflammation [2] are also destroyed by laser, thus reducing this chronic granulomatous inflammatory process and stopping further progression of the disease. It was previously shown that long pulsed Nd-YAG could potentially be used to reduce collagen deposition in conditions such as keloids and hypertrophic scars [6], which may explain the clinical improvement and softening in the keloidal plaques in our patients which was associated with histopathological evidence of decreased sclerosis.

Shah *et al.* [4] also expected improvement in AKN scars following laser-assisted hair removal and reported the use of diode lasers for the treatment of 2 cases of AKN with good results [4]. Moreover, previous investigators have used different types of hair removing lasers in the treatment of pseudofolliculitis barbae (PFB), which shares a similar hair-related pathogenesis with AKN, and they demonstrated some degree of improvement [7-11]. The histopathological changes in AKN lesions demonstrated in this work were similarly reported by others who studied the histopthological effect of laser epilation on pseudofolliculitis barbae [12, 13].

Early papular lesions responded significantly better than late cases with keloidal plaques. This means that starting laser treatment as early as possible would give better results. Early treatment with long pulsed Nd-YAG could prevent the development of keloidal plaques and could probably lead to the stoppage of the whole disease process.

Our results also revealed a significant improvement at the fifth session, when compared to the third session, regarding a decrease in the papule count, plaque size, papule and plaque height, erythema and tenderness scores, suggesting that at least five sessions are needed to obtain proper results in this disease.

Though laser treatment in dark skinned individuals can cause pigmentary changes, none of our patients presented with this complication, confirming that long pulsed YAG laser is safe for dark skin types [14]. This was also reported by Shah [4], who used long pulsed diode laser 810 nm in the treatment of AKN patients with dark skin.

Patient satisfaction was recorded in 93% of patients regarding the treatment procedure, as laser application was relatively tolerable compared to painful intra-lesional injections. Moreover laser hair epilation requires no post-procedure care, is minimally invasive, safe and effective when compared to surgical treatment [15] and carbon dioxide laser removal [16]. Apart from hair reduction, no complications were reported in our study and the treatment gave cosmetically acceptable results.

During the one year follow-up period, recurrence was observed in 20% of the 10 patients who completed the follow up, in the form of a few papular lesions that disappeared after 2 laser sessions. This was expected to occur as the hair started to become thick again. Thus repeated laser sessions each year are recommended to maintain the results.

We therefore conclude that laser hair epilation could be considered an important line of treatment for AKN. It is minimally invasive, safe and effective with low recurrence rates. Starting treatment as early as possible achieves the best results and can stop the disease process if followed by maintenance sessions. At least five sessions are required to obtain a satisfactory response. Reduction of the hair density in the treated area is the only complication observed, which most patients accept. Laser hair depilation can significantly improve the quality of life of those patients suffering from this disfiguring chronic disorder. ■

Disclosure. *Financial support: none. Conflict of interest: none.*

References

1. Quarles FN, Brody H, Badreshia S, *et al.* Acne keloidalis nuchae. *Dermatol Ther* 2007; 20: 128-32.

2. Herzberg AJ, Dinehart SM, Kerns BJ, Pollack SV. Acne keloidalis. Transverse microscopy, immunohistochemistry, and electron-microscopy. *Am J Dermatopathol* 1990; 12: 109-21.

3. Vasily DB, Breen PC, Miller OF 3rd. Acne keloidalis nuchae: Report and treatment of a severe case. *J Dermatol Surg Oncol* 1979; 5: 228-30.

4. Shah GK. Efficacy of diode laser for treating acne keloidalis nuchae. *Indian J Dermatol Venereol Leprol* 2005; 71: 31-4.

5. Har-Shai Y, Amar M, Sabo E. Intralesional cryotherapy for enhancing the involution of hypertrophic scars and keloids. *Plast Recostr Surg* 2003; 111: 1841-52.

6. Castro DJ, Abergel RP, Meeker C, Dwyer RM, Lesavoy MA, Uitto J. Effects of the Nd:YAG laser on DNA synthesis and collagen production in human skin fibroblast cultures. *Annals of Plastic Surgery* 1983; 11(3): 214-22.

7. Nanni C, Brancaccio R, Cooperman M. Successful treatment of pseudofolliculitis barbae with a long pulsed alexandrite laser. *Lasers Surg Med (abstract)* 1999; Supplement 11:21.
8. Schulze R, Meehan KJ, Lopez A, *et al*. Low-fluence 1,064-nm laser hair reduction for pseudofolliculitis barbae in skin types IV, V, and VI. *Dermatol Surg* 2009; 35: 98-107.
9. Rogers CJ, Glaser DA. Treatment of pseudofolliculitis barbae using the Q-switched Nd:YAG laser with topical carbon suspension. *Dermatol Surg* 2000; 26: 737-42.
10. Chui CT, Berger TG, Price VH, Zachary CB. Recalcitrant scarring follicular disorders treated by laser-assisted hair removal: a preliminary report. *Dermatol Surg* 1999; 25: 34-7.
11. Kauvar AN. Treatment of pseudofolliculitis with a pulsed infrared laser. *Arch Dermatol* 2000; 136: 1343-6.
12. Ross EV, Cooke LM, Timko AL, Overstreet KA, Graham BS, Barnette DJ. Treatment of pseudofolliculitis barbae in skin types IV, V, and VI with a long-pulsed neodymium:yttrium aluminum garnet laser. *J Am Acad Dermatol* 2002; 47: 263-70.
13. Kato T, Omi T, Naito Z, Hirai T, Kawana S. Histological hair removal study by ruby or alexandrite laser with comparative study on the effects of wavelength and fluence. *J Cosmet Laser Ther* 2004; 6: 32-7.
14. Chan H, Ying SY, Ho WS, Wong DS, Lam LK. An in vivo study comparing the efficacy and complications of diode laser and long pulsed ND-YAG laser in hair removal in Chinese patients. *Dermatol Surg* 2001; 27: 950-4.
15. Glenn MJ, Bennett RG, Kelly AP. Acne Keloidalis Nuchae: Treatment with excision and second intension healing. *J Am Acad Dermatol* 1995; 33: 243-6.
16. Kantor GR, Ratz JL, Wheeland RG. Treatment of acne keloidalis nuchae with carbon dioxide laser. *J Am Acad Dermatol* 1986; 14: 263-7.