TOPICAL PHOTODYNAMIC THERAPY FOR TREATMENT OF ACNE VULGARIS : COMPARISON OF TWO IPL APPLICATORS AND TWO APPLICATION TIMES OF ALA

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Introduction

Photodynamic therapy (PDT) is increasingly used for treatment of acne. PDT involves the application of a photosensitizing chemical , aminolevulinic acid (ALA) which, when exposed to various lights, results in excitation of the photosensitizer (protoporphyrin, PpIX) and consequent production of a reactive oxygen species that leads to cytotoxicity.

PpIX has a large absorption peak in the Soret band (400~430nm) and smaller absorption peak at longer wavelengths (509, 544, 584, 630, 690nm), which enables us to utilize many different light sources for ALA-PDT. Shorter blue light wavelengths are most effectively absorbed by ALA, but has limited ability to penetrate skin. On the other hand, the longer red wavelengths can activates ALA deeper in the skin. In brown Asian skin, hyperpigmentation reported during PDT using blue light may be diminished with the use of longer wavelengths.

Intense pulse light (IPL) therapy as a light source of PDT may provide an easier, faster method of treating inflammatory acne, with a low risk of side effects. The IPL (Ellipse®, DDD, Denmark) provided wavelengths of VL (555~950nm) and HR (600~950nm). We compared the efficacies of two light spectra of IPL to find out if longer wavelength is more effective in ALA-PDT.

Topical application of 20% aminolevulinic acid (ALA) initiates time-dependant accumulation of the endogeneous photosensitizer protoporphyrin IX (PpIX) in sebaceous gland and P.acnes. We determined the safer and efficacious incubation time of ALA (Levulan®)-PDT for treatment of acne vulgaris in Asians. In addition, we assessed risk factors for hyperpigmentation in Asians.

Materials and Methods

Study populations

- Twenty nine volunteers 19 females and 10 males (mean ages = 24.1 years)
- moderate acne vulgaris : Cuncliffe grading 1.5 ~ 5. skin phototypes III~IV.

Treatment

Application of Levulan ®

Levulan® was applied on one half face for 1 hour and the other half face for 4 hours in all volunteers.

IPL

IPL (Ellipse®, DDD, Denmark) applicator : IPL wavelengths of VL (555~950nm) and HR (600~950nm).
The one group randomly had been treated with the VL (555~950nm) and the other with the HR (600~950nm) applicator.

- Fluence of 8J/cm^2 with 13ms pulse width and one pass over the entire treatment area.
- 1 treatment session
- F/U at 1wk ,4th, 14th, and 24th weeks after treatment.

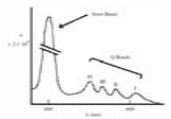


Fig. 1. Typical UV visible absorption spectrum of a porphyrin

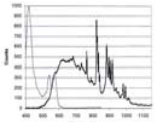


Fig. 2. VL applicator emission spectrum of the 555-950nm wavelength band (blue) at an output of 15J/cm2

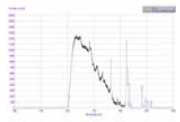


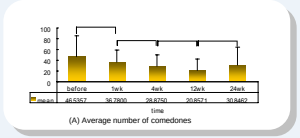
Fig. 3. HR applicator emission spectrum of the 600-950nm wavelength band (blue) at an output of 21J/cm2

Efficacy and Statistics

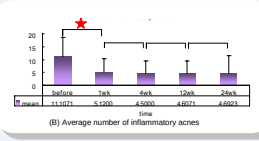
- change of mean number of acne over time (paired t-test; significance at the level of p ≤0.05, sas 8.1)
- comparison of VL/HR applicator and incubation time of Levulan (t-test; significance at the level of p≤0.05, sas 8.1)
- risk factor analysis of a hyperpigmentation (multiple logistic regression, sas 8.1)

Results

1. Change of average number of comedones and inflammatory acnes over time



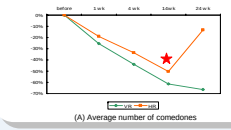
(A) Average number of comedones



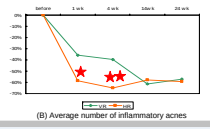
(B) Average number of inflammatory acnes

◆ After 1 week, inflammatory acnes decreased significantly compared to before (★: 95% Wald confidence limits 3.52904~8.44524). Reduction of inflammatory acnes continued to 24 week.

2. Comparison of HR and VL applicator



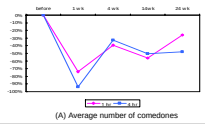
(A) Average number of comedones



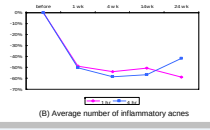
(B) Average number of inflammatory acnes

◆ HR applicator is more efficient than VL at 1 week and 4 weeks in reduction of inflammatory acnes (★ : p=<.0001, ★★: p=<.0001 respectively).

3. Comparison of 1 hr and 4 hrs incubation time of Levulan®



(A) Average number of comedones

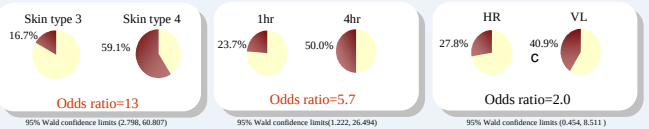


(B) Average number of inflammatory acnes

◆ Both in comedones and inflammatory acnes, there was no significant difference between 1hr and 4hrs of application time.

		before	1 wk	4 wk	14 wk	24 wk
Comedones applicator						
	VR	54.7	40.8	30.7	21	18.3
	HR	42	34.1	27.9	20.8	36.4
	p		0.3105	0.9027	**0.0436**	0.0599
application time						
	1 hr	51.4	38	31.3	22.5	38.1
	4 hr	37	34.7	24.9	18.4	19.2
	p		0.248	0.4405	0.9813	0.2391
Inflammatory acnes applicator						
	VR	6.8	4.4	4.1	2.6	2.9
	HR	13.5	5.6	4.7	5.7	5.5
	p		**<.0001**	**<.0001**	0.057	0.059
application time						
	1 hr	12.2	6.2	5.6	6	5
	4 hr	12.4	6.2	5.1	5.4	7.2
	p		0.903	0.878	0.6	0.404

4. Risk factors and each odd ratio of hyperpigmentation



5. Clinical photographs

Before treament After 4weeks

Before treament After 4weeks

Discussion

◆ Change of average number of comedones and inflammatory acnes over time

Just single ALA-PDT led to visible improvement of inflammatory acne that lasted at least 5 months. Treatment was more efficient in inflammatory lesions than in comedones.

◆ Comparison of HR and VL applicator

The HR applicator was more efficient than VL in reduction of inflammatory acne. In same energy dose, longer wavelengths penetrate deeper to 6mm in 635nm compared to 1~2mm in 415nm. Longer red 635nm wavelength has anti-inflammatory properties by influencing cytokine release from macrophages. However, destruction of sebaceous glands seems to require more stronger PpIX sensitivity and more treatment sessions.

◆ Comparison of 1hr and 4hrs incubation time of ALA

There was no difference of treatment effects in comparison of 1 hr and 4 hrs of the application time of Levulan®. However, hyperpigmentation or thin crust are more pronounced in longer incubation time of Levulan®.

◆ Risk factors and each odd ratio of hyperpigmentation

In order to avoid a hyperpigmentation, Levulan® should be applied for a short time in Asians. In addition, the complete cleansing of Levulan® with alcohol decreased the hyperpigmentation before an exposure of light.

References

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