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## Background

### Pathophysiology of scar formation

- Scars arise from proliferation of fibrous tissues replacing normal collagen
- 3 distinct phases: **Inflammation, proliferation, and remodeling**
- Hypertrophic scars and keloids develop from aberrant wound healing process

### Prevention and treatment of keloids have been reviewed widely

- No methodology has been yet emerged as "gold standard" of clinical care

## Objectives

To evaluate the safety and efficacy of combining repeated fractional ablative and non-ablative lasers with **cryotherapy** and **intralesional triamcinolone injection** in treatment of keloid scars

## Methods

### Study patients

- 35 Korean keloid patients (12 males, 23 females)
- All patients with Fitzpatrick skin types II-IV
- 7 patients had a previous history of intralesional TA injection → **Unsatisfactory improvement** in scars and symptoms.

### Combination therapy proposed in this study

- Cryotherapy**
- Triamcinolone 10-40mg/ml intralesional injections**
- eCO<sub>2</sub> laser (High-speed fractional ablative CO<sub>2</sub> laser)**
- Mosaic® laser (Micro-fractional non-ablative Er:Glass laser)**



### Repeated treatment with regular follow-up

- Repeated, regular follow-up treatment was recommended
- Study patient were arranged to visit the clinic **every 4 weeks**

### Objective/subjective assessments of clinical improvement

- Vancouver scar scale (VSS) and patient self-assessment (PSA) score

Vancouver scar scale (VSS)			Patient self-assessment (PSA) score		
Scar characteristic	Score	Category	Score	Description	
Vascularity	Normal	0	Complete	0	100% improvement from baseline (All signs and symptoms of disease resolved)
	Pink	1			
	Red	2			
Pigmentation	Purple	3	Excellent	1	90% improvement from baseline (Nearly all signs and symptoms cleared)
	Normal	0			
	Hypopigmentation	1			
Pliability	Hyperpigmentation	2	Marked	2	75% improvement from baseline (Majority of the signs and symptoms resolved)
	Normal	0			
	Supple	1			
Height	Yielding	2	Moderate	3	50% improvement from baseline (Significant, but many signs remain)
	Firm	3			
	Ropes	4			
Contracture	Flat	0	Minimal	4	25% improvement from baseline (Slight overall improvement)
	<2 mm	1			
	2-5 mm	2			
Total score	>5 mm	3	No change	5	Overall severity similar from baseline
		4			
		5			
		6	Worse	6	Worse than baseline

## Results

### Investigator-assessed improvement of keloid scars based on VSS

	Improvement (%)	Pre-treatment Mean ± SD	Post-treatment Mean ± SD	p value
Total VSS	40.2	8.7 ± 1.8	5.2 ± 1.9	<0.0001*
Pigmentation	10.5	1.9 ± 0.3	1.7 ± 0.4	0.043*
Vascularity	30.0	2.0 ± 0.5	1.4 ± 0.7	<0.0001*
Pliability	53.8	2.6 ± 0.8	1.2 ± 0.8	<0.0001**
Height	63.6	2.2 ± 0.6	0.8 ± 0.6	<0.0001**

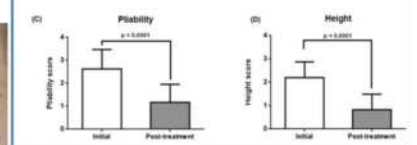
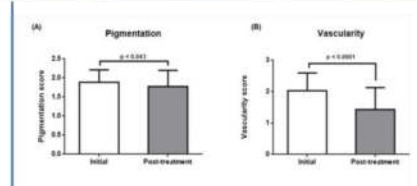
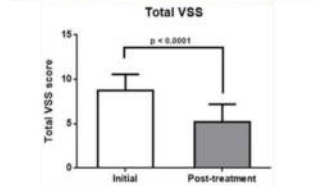
\* p < 0.05, Mann Whitney U test

- Number of treatment sessions: **average of 5 sessions** (ranged 1-12 sessions) in 4-week interval
- Median follow-up treatment period was **12 weeks** (3 treatment sessions)
- Overall significant improvement of total VSS after the combination treatment
- Subgroup analysis showed significant improvement in vascularity, pliability, and height
- Notably, **height and pliability** had the greatest and quickest responses to the treatment (\*\*)

### Total VSS and the subgroup analysis before/after treatment

Statistically significant improvement in total VSS score

All subcategory of VSS shows statistically significant improvement

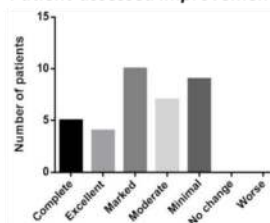


### Addition of vascular laser at the end of the combination treatment



- 7 Patients showed remaining telangiectasia after the 5<sup>th</sup> combination treatment session
- Average of 4 sessions of 595nm Vbeam® (Candela Corp) added: 7mm, 8J/cm<sup>2</sup>, 3ms pulse duration → 85% of patients reported remarkable improvement in scar vascularity

### Patient-assessed improvement of scar based on PSA score



- 69% reported itching, pain, limited motion before treatment
- 19 patients reported **more than marked improvement** after Treatment
- Remarkably, 6 patients reported a marked relief of symptoms immediately after 1 session of Treatment

### Follow-up evaluation and safety assessment

- 20 patients followed up for 12 months → silicone gel sheeting only → Only 1 recurrence (5%)
- No secondary wound infection occurred
- <10% patients reported atrophy, hypopigmentation, and persistent telangiectasia

## Discussion and Conclusion

### Intralesional steroid is the 1<sup>st</sup> line treatment, but high %recurrence / side effects

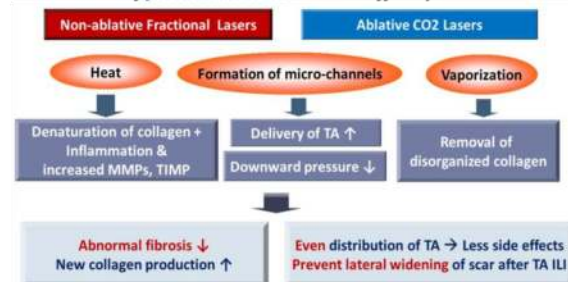
### Combined cryotherapy → More effective tissue destruction and rejuvenation

- Microcirculatory damage and tissue necrosis by cryotherapy

→ Inhibition of fibroblast growth by TA ↑

- Cryotherapy induces edema → Steroid injected more efficiently

### Combination of fractional lasers increase efficacy and reduce side effects



### Conclusion

Combination treatment in scar treatment is **safe and effective**

- Each treatment modalities **targets different mechanisms** of scar formations
- Combination approach using **multiple laser modalities, cryotherapy, and intralesional corticosteroid injection** may be **more safe with reduced side effects** from an intensive single modality treatment, and **effective with faster response** onset in treatment of keloid scars