

In vivo assessment of skin burn in animal burn model

Skin burn

Caused by excessive thermal invasions
Most common and significant injury in skin.

Classification of skin burn

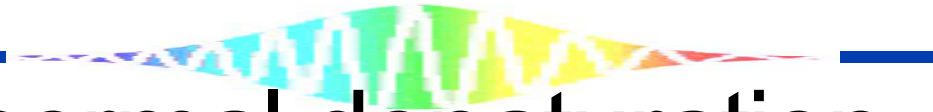
Degree of burn		Invasion depth	Treatment
1st		Epidermis	Not necessary
2nd	SDB	Superficial dermis	Monitoring of healing process (Low risk of infection)
	DDB	Deep dermis	Careful monitoring of healing process (High risk of infection)
3rd (DB)		Subcutaneous	Skin graft

Since treatment plan for the burn differs depending the degree of the burn, an assessment of burn depth is important to determine clinical treatment.

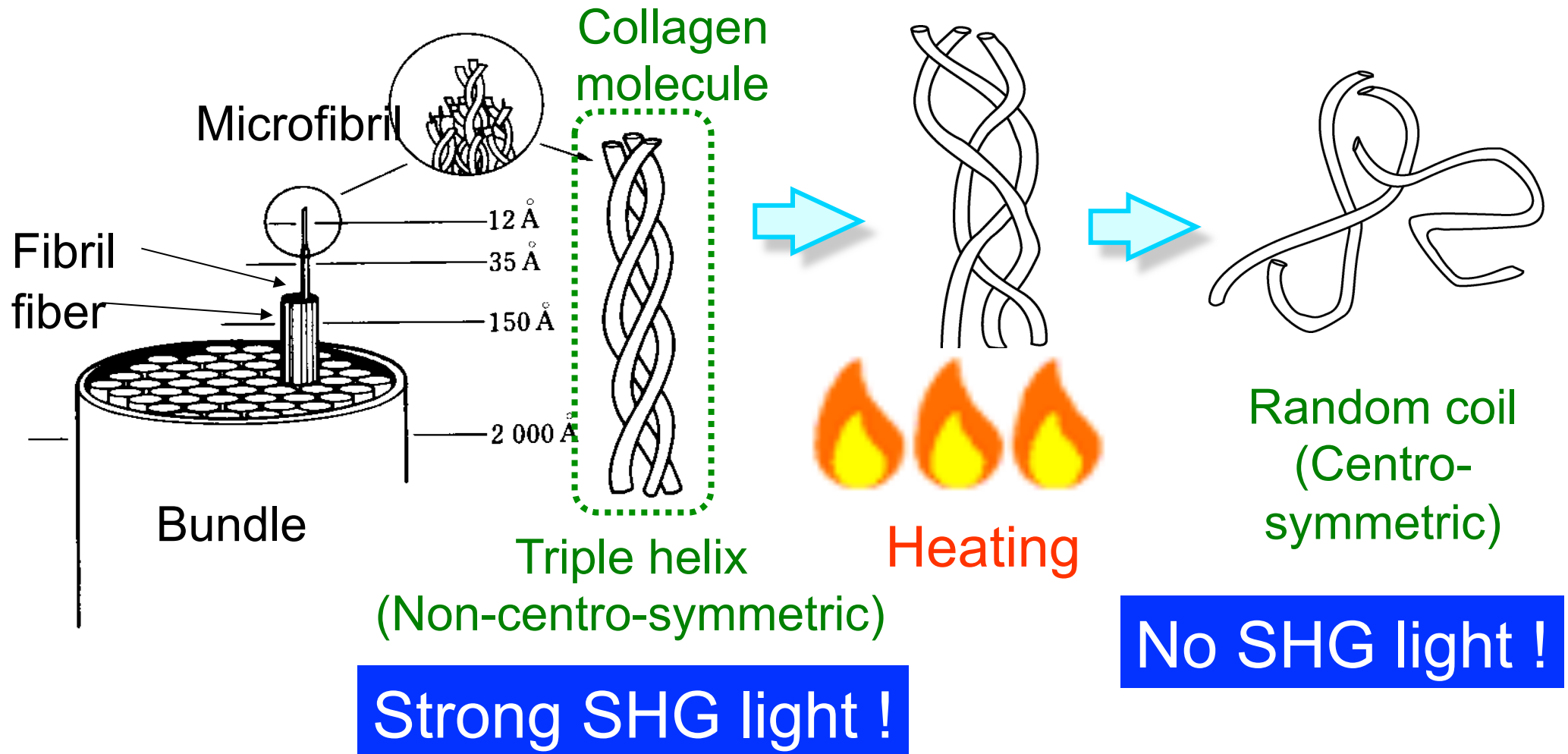
Conventional method

Method	Principle	Invasiveness	Quantitativeness
Visual inspection	Estimation from damage of epidermis	No	Depend on doctor's skill
Tactile (Pinprick) test	Check extinction of nerve cells	High	Only detect DB
Laser Doppler	Hemoperfusion in blood vessel	Low	Low

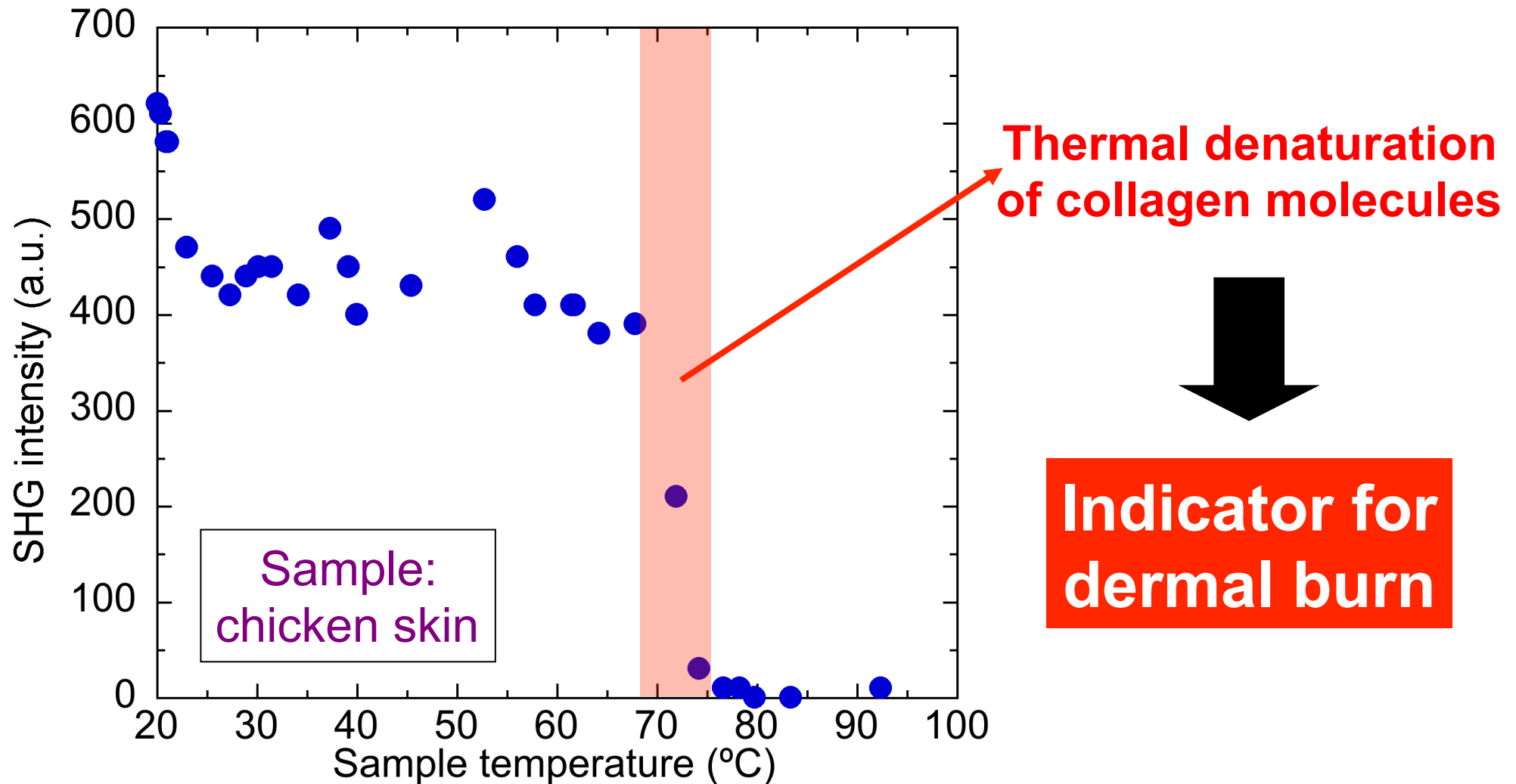
Significant need for a non-invasive, reliable, quantitative monitoring method for skin burn



Relationship between thermal denaturation of collagen molecule and SHG light



Change of SHG light intensity with respect to sample temperature



Rat burn model

Burn was made by immersing rat dorsal skin in hot water at a temperature of 70 degree (SDB), 78 degree (DDB), and 98 degree (DB) for 10 sec, following Walker-Mason template.



Male wistar rat
(8-10 weeks, 250-300 g)

Experimental protocol



Experimental protocol was approved by Bioethics Committee for Animal Experiment at the Osaka Univ.

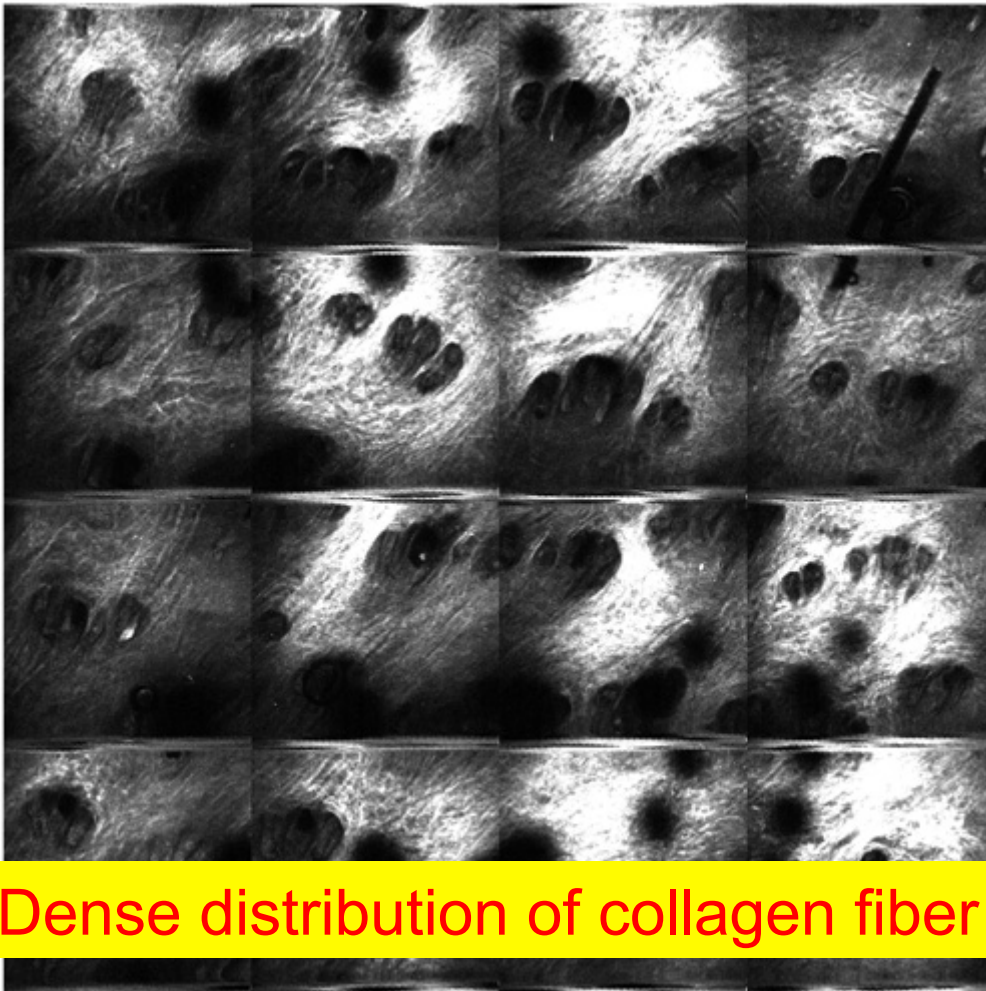
Ref.) Walker. HL *et al.*, *J. Trauma*, **8**, 1049 (1964).

Large-area SHG imaging (1)

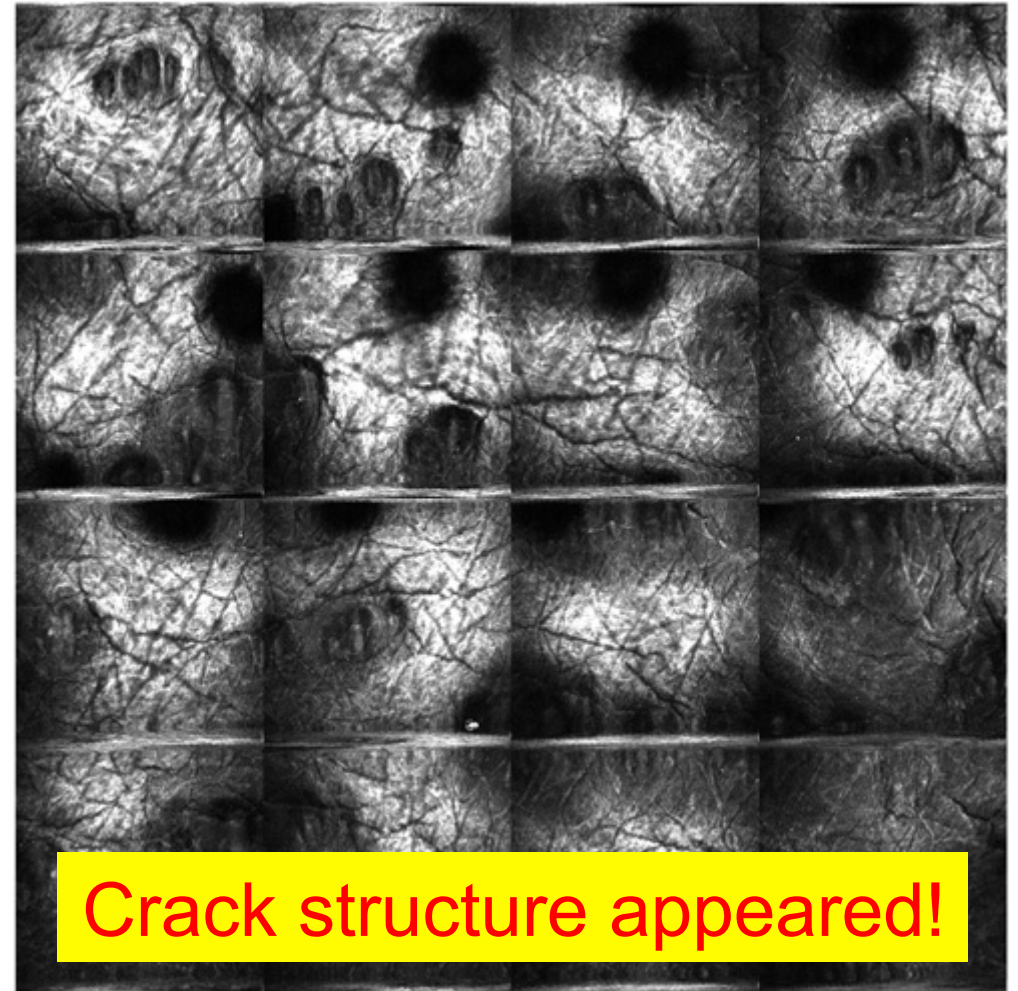
Image size
2.4mm*2.4mm

Control (no burn)

SDB (Superficial Dermis Burn)



Dense distribution of collagen fiber

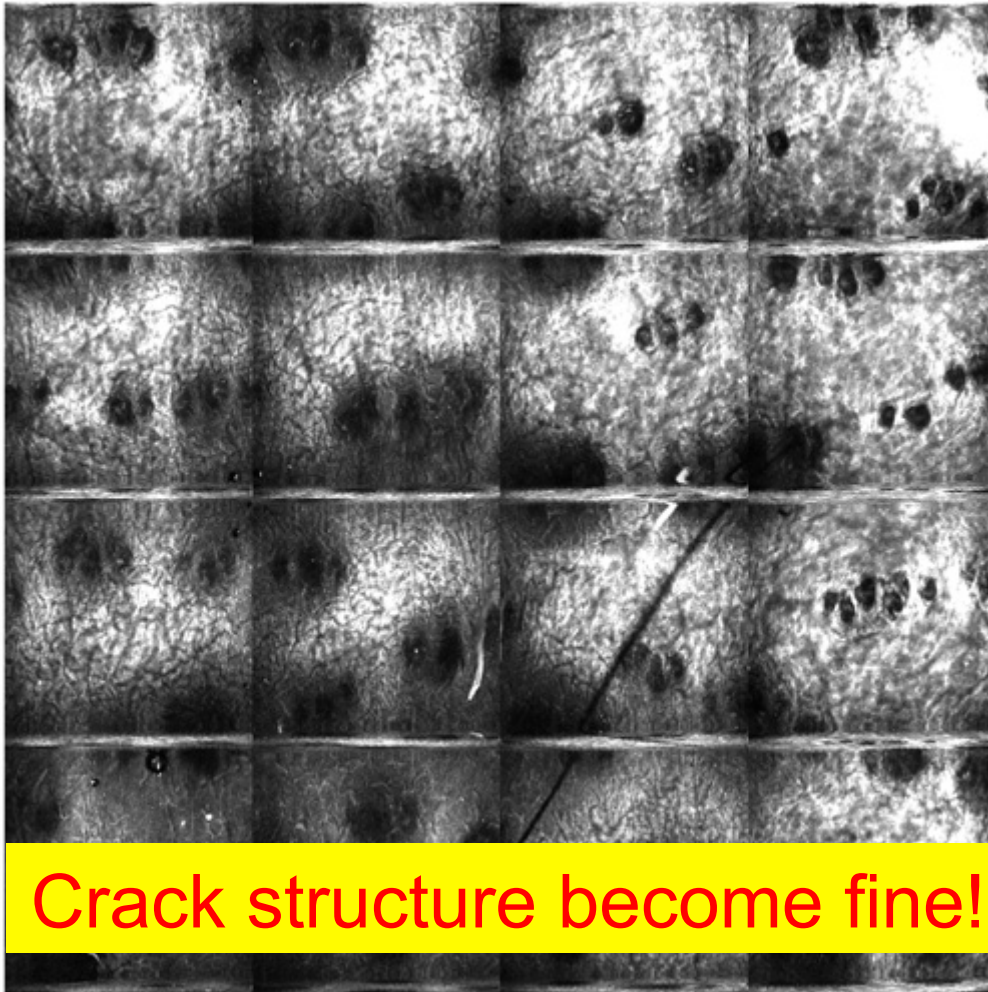


Crack structure appeared!

Large-area SHG imaging (2)

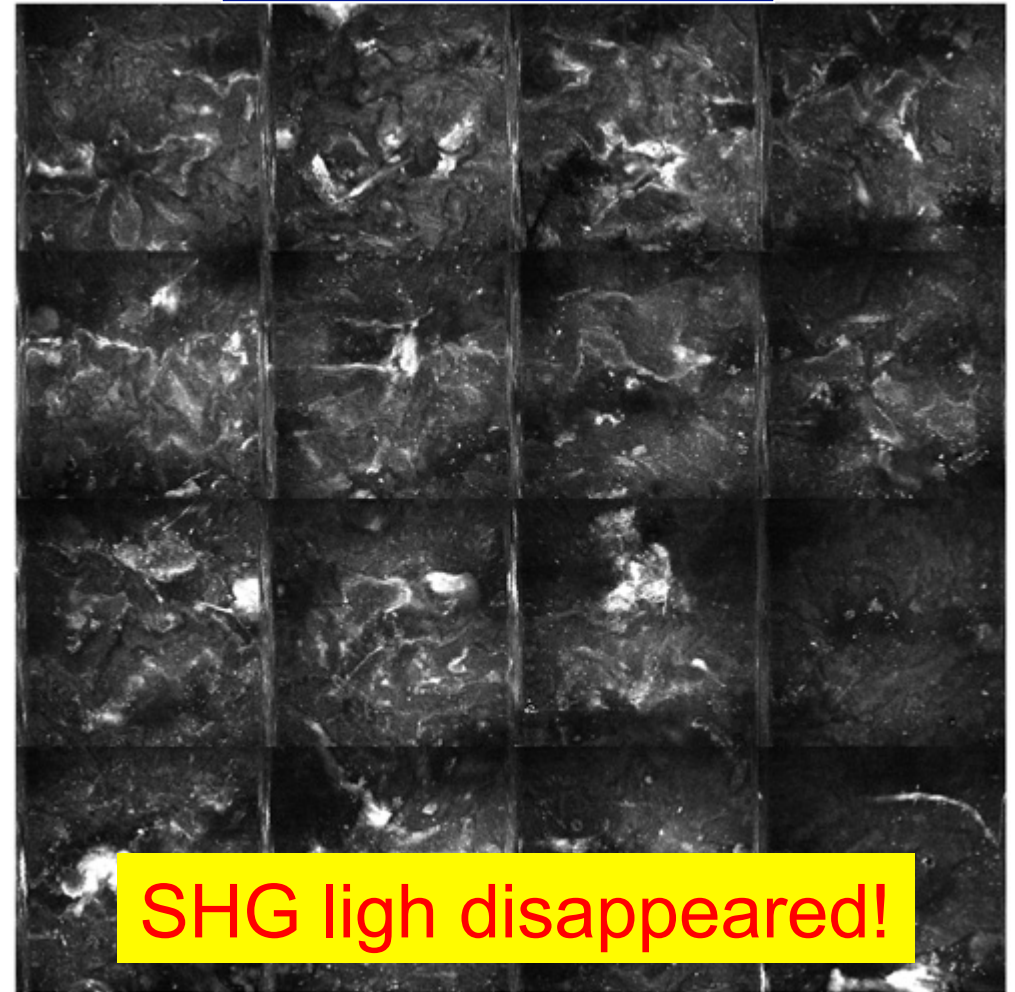
Image size
2.4mm*2.4mm

DDB (Deep Dermis Burn)



Crack structure become fine!

DB (Deep Burn)



SHG ligh disappeared!

Comparison with VG staining images

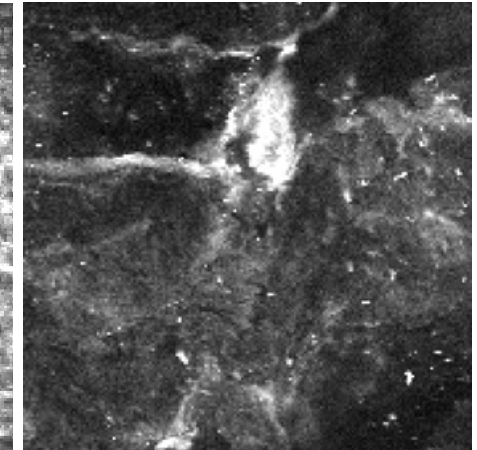
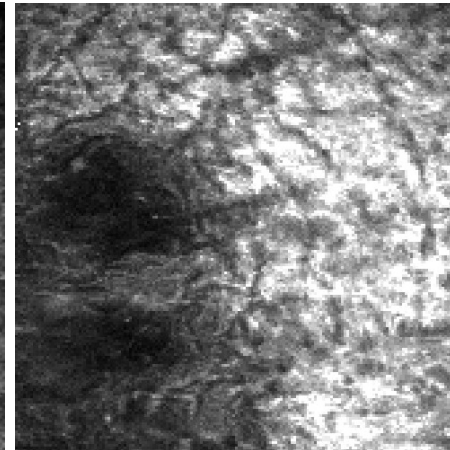
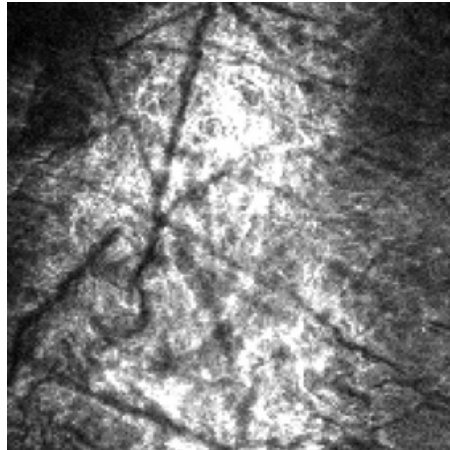
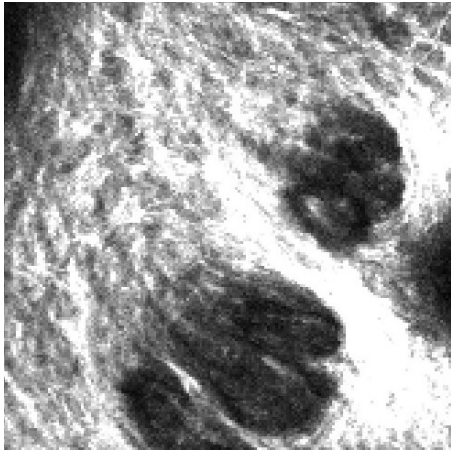
Control

SDB

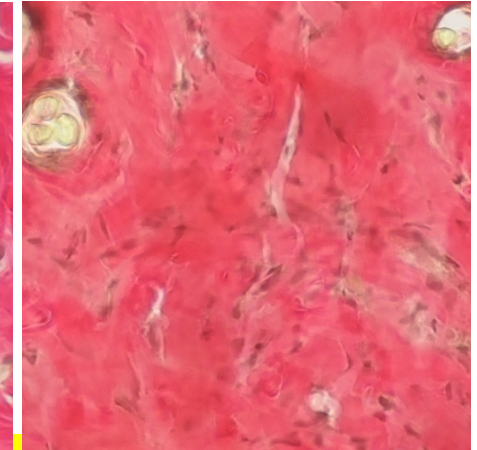
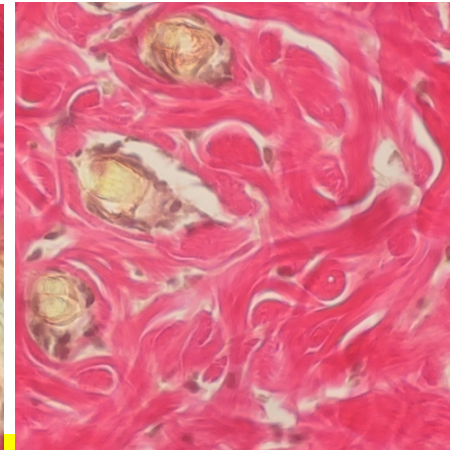
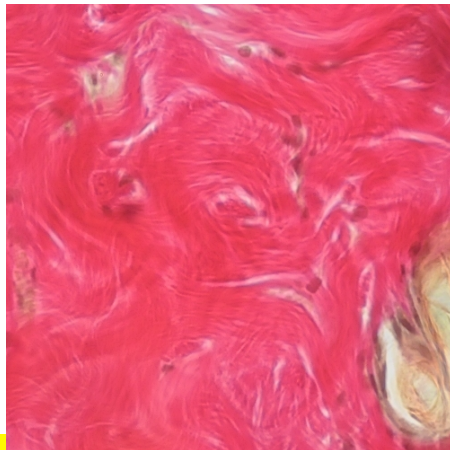
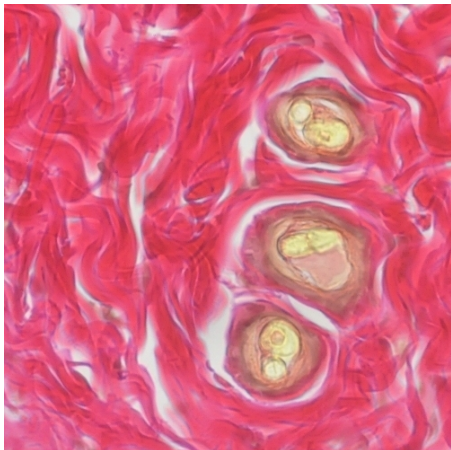
DDB

DB

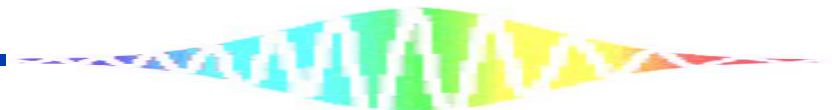
SHG
image



VG
image

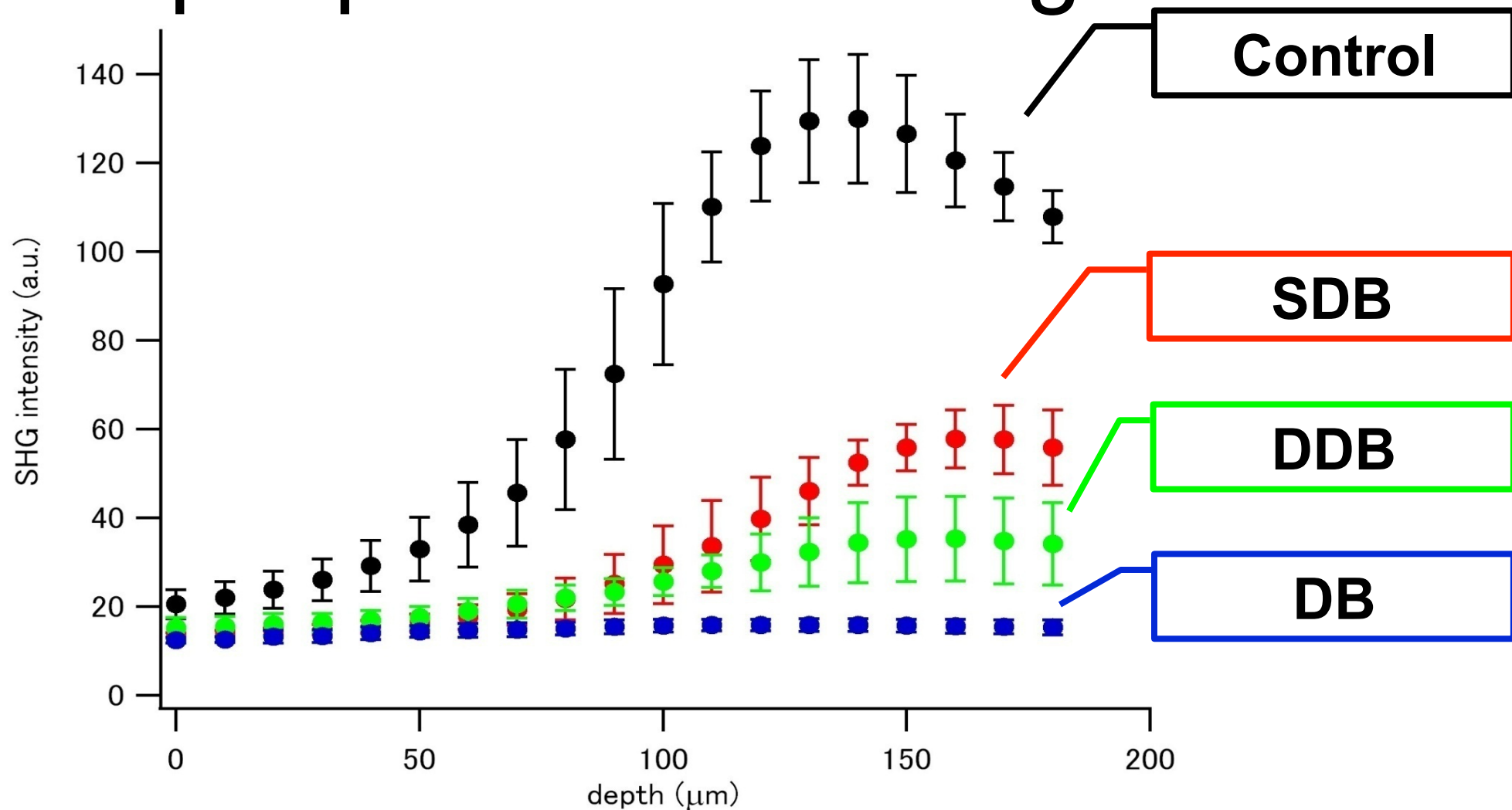


Change of SHG images reflects thermal shrinkage of collagen fiber



Depth profile of SHG light

N = 5



Available for a quantitative indicator of burn depth