

MTS (Microneedle Therapy System)

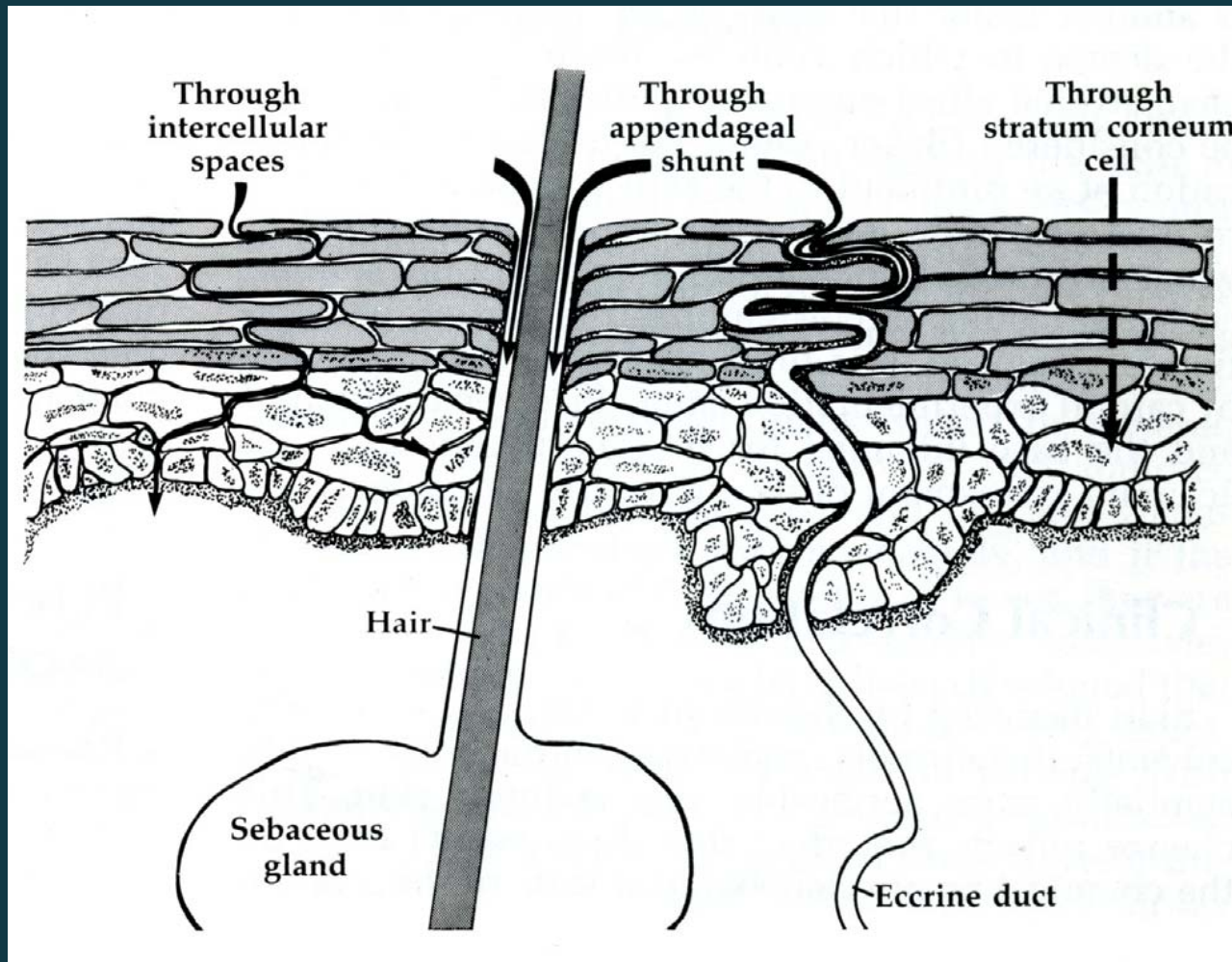
Prof. Kim Beom Joon

**Department of Dermatology
Dongguk University International Hospital**

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1. TDDS (transepidermal drug delivery system)
2. Introduction of Microneedle
3. Clinical experiments

TDDS (Transepidermal drug delivery system)



TDDS

Positive effects

: low toxicity ↓, GI trouble ↓, bypass of hepatic metabolism

Limits

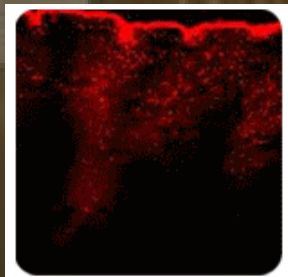
–low concentration of delivered drug ($< 10\text{mg/day}$)

–should be lipophilic ↑, low molecular weight ↓

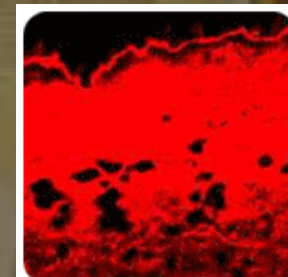
Several trials for enhancing TDDS

–Occlusion, Stripping, Iontophoresis, Electroporation,

Microneedle therapy system (MTS)

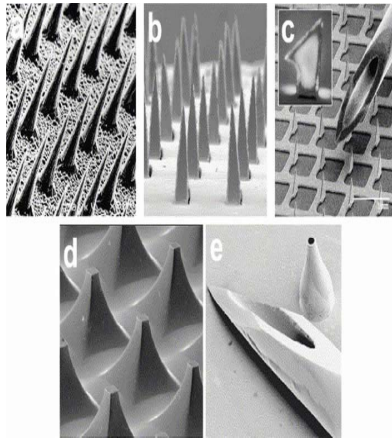


With normal creaming not more than 0.3% of liposomes can penetrate into the skin



With the MTS up to 40times of liposomes can be infiltrated through the stratum corneum

New Needle Devices



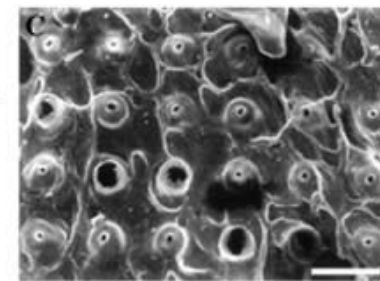
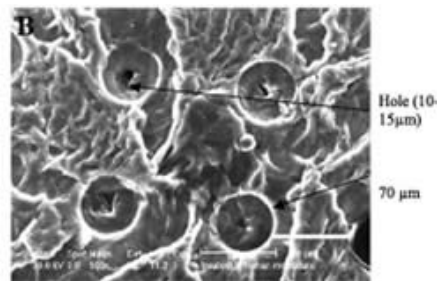
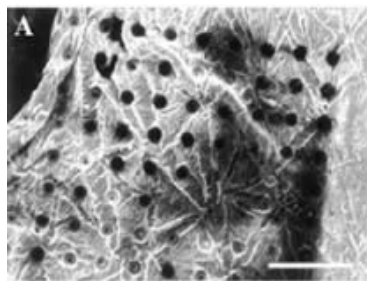
Microfabricated Needle Patch



Microneedles Stamp



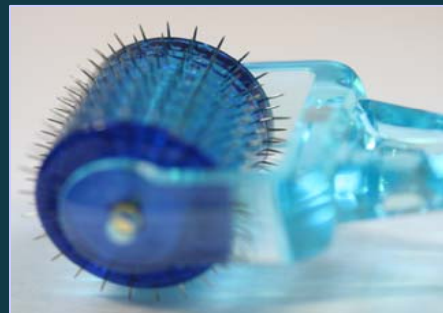
Micro Needle Roller



Micro-Channel photo

Introduction of Microneedle

- Body : Diameter(20mm) X Width(21.5mm)
 - DISC : 9ea/ Angle : 14.5°
 - A Disc : 25ea (Total needles : 200ea)
 - Material :
High – Quality Swedish Steel **Rustproof**
–Special a method of construction
15% improvement of needle's strength
 - Process:
Cutting, Grinder, Harden steel,
Extremely low Temper.
- Body : Diameter(20mm) X Width(21.5mm)
 - DISC : 8ea/ Angle : 15°
 - A Disc : 24ea
(Total needles : 192ea / 96ea)
 - Material :
High – Quality Swedish Steel
 - Process:
Cutting, Grinder, Harden steel,
Extremely low Temper.



CR10 : Needle Length 1.0mm

CR20 : Needle Length 2.0mm

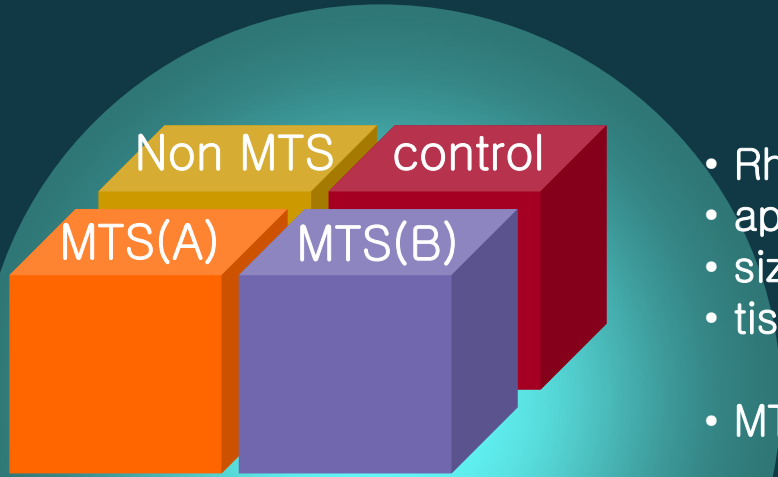


HF8 : Needle Length 0.2mm

ME8 : Needle Length 0.5mm

MD8 : Needle Length 1.5mm

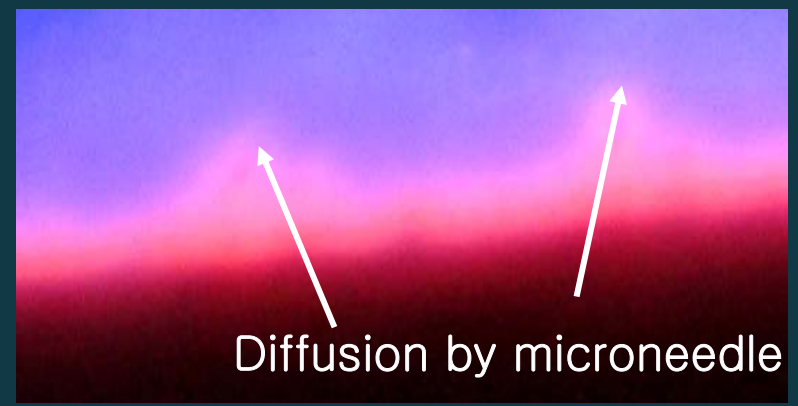
TDDS by MTS – How to use?



- Rhodamine B base (Aldrich) 0.005M
- applying condition : 100ul / cm² (nabulizing)
- size of field : 10 x 10 mm (total 36 pieces)
- tissue : Pig skin (dermal thickness 3.16mm)
- MTS apply : ↑↑ ↓↓ ↗↘ ↙↚ repeat twice

- ③ Control: None applied
- ③ Non MTS : simple apply
- ③ MTS(A) : apply after MTS
- ③ MTS(B) : apply → MTS → apply
→ occlusion

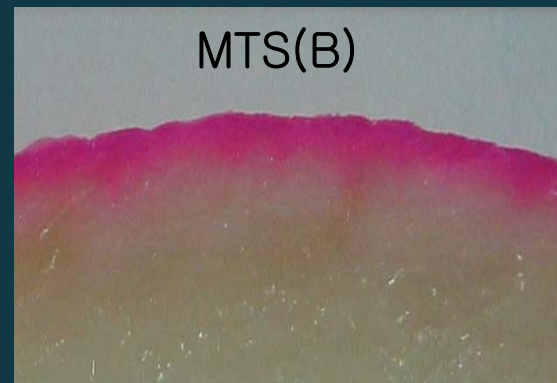
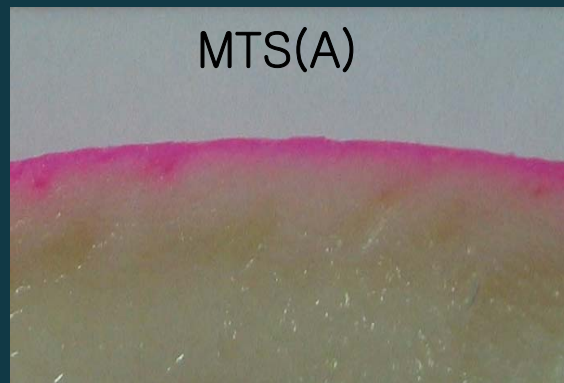
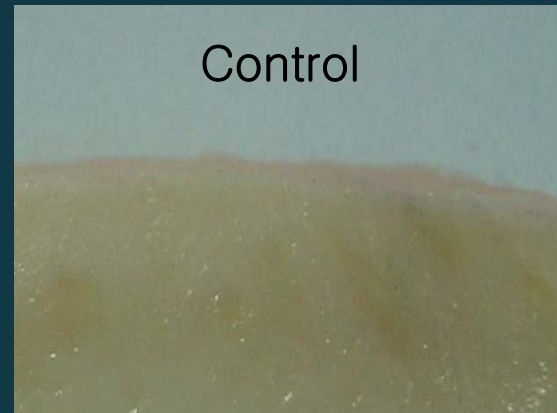
→ Wait for 20 min



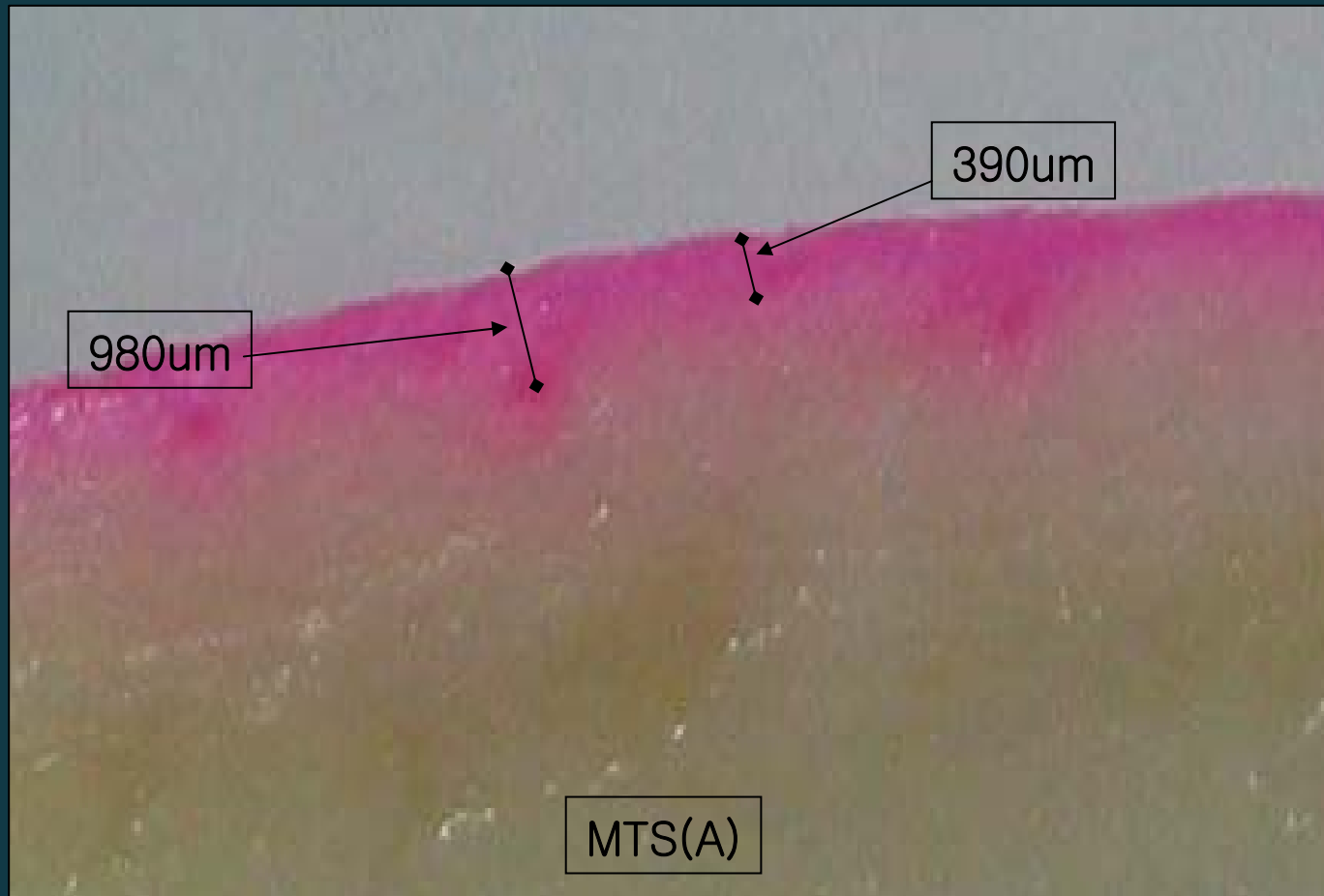
Diffusion by microneedle

형광촬영 (16배)
(Olympus CKX41)

Rhodamine B base – Pig skin



Rhodamine B base – Pig skin



Fluorescent image capture



Control



MTS(A)

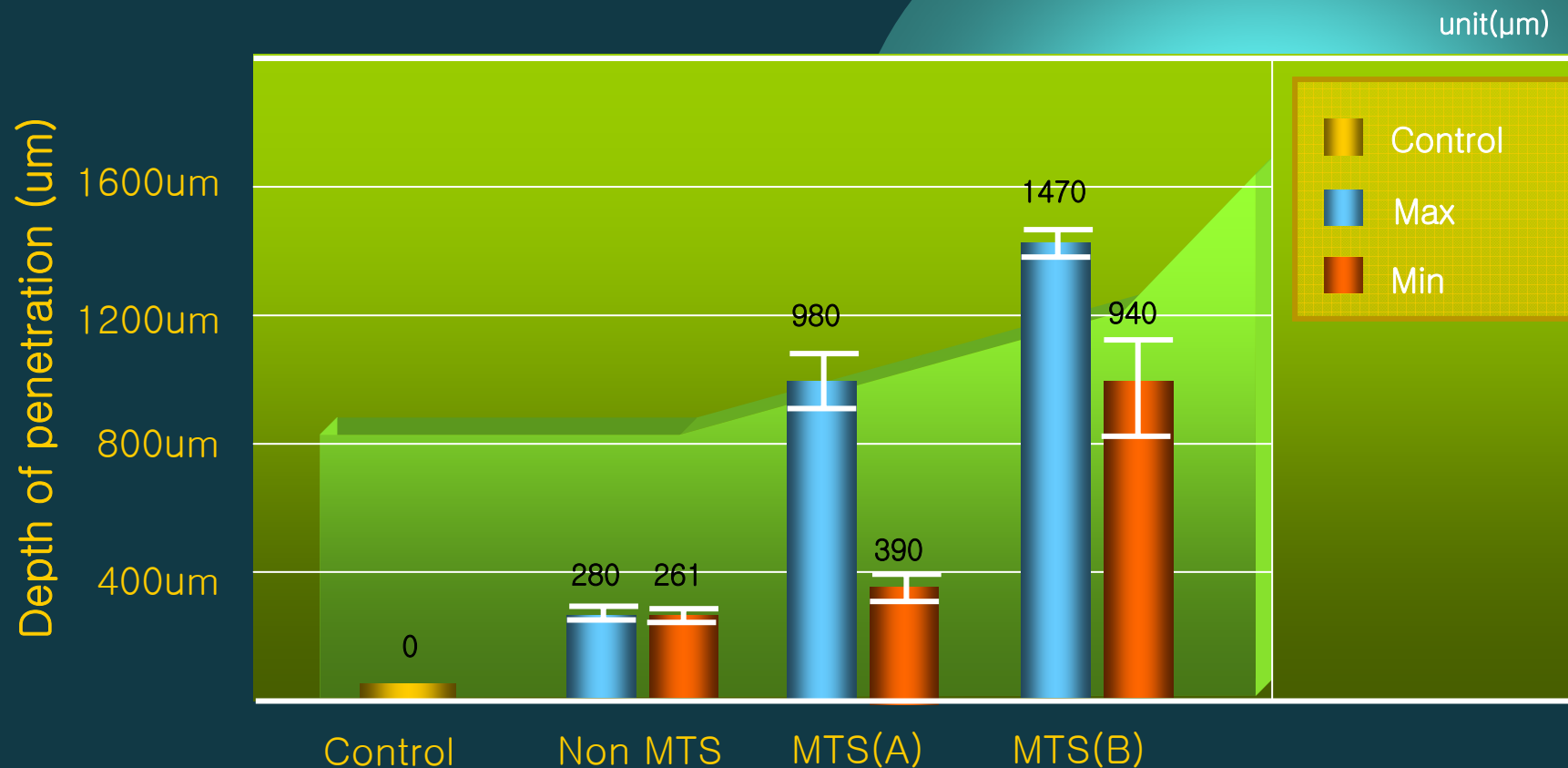


MTS(B)

	Min	Max
Reference	-	-
Control	$\cong 280\text{um}$	
MTS(A)	$\cong 390\text{um}$	$\cong 980\text{um}$
MTS(B)	$\cong 940\text{um}$	$\cong 1470\text{um}$

Drug delivery by MTS

Simple apply(1/2) → MTS → simple apply (1/2) : Best way

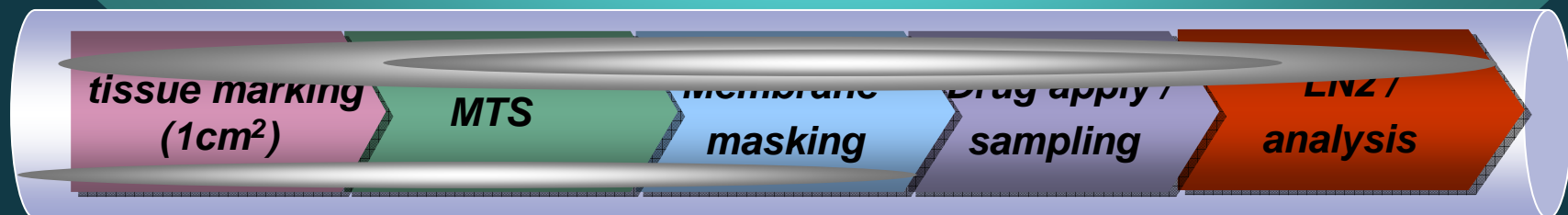


TDDS by MTS – Time course

Same condition with previous experiment

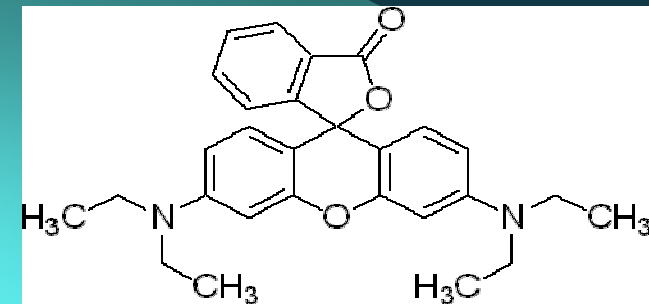
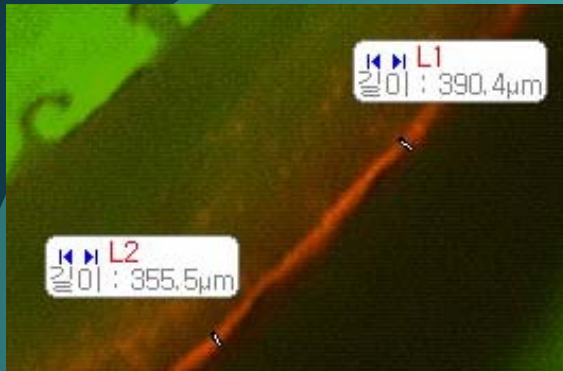


- Moticam 100(Image sensor) & Image analysis program for penetration depth
- Light source : 365nm (VL-4.LC)
- Rhodamine B base

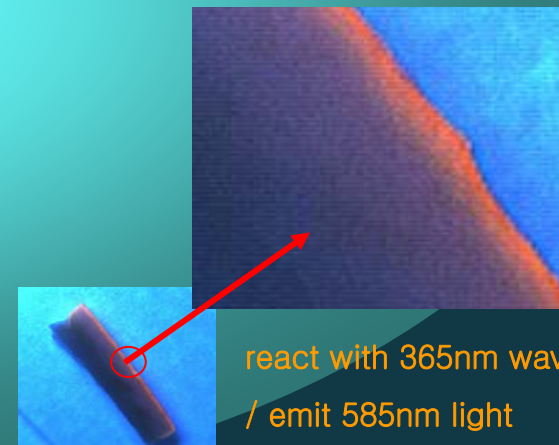


Penetration by MTS

Fluorescence image capture & analysis program

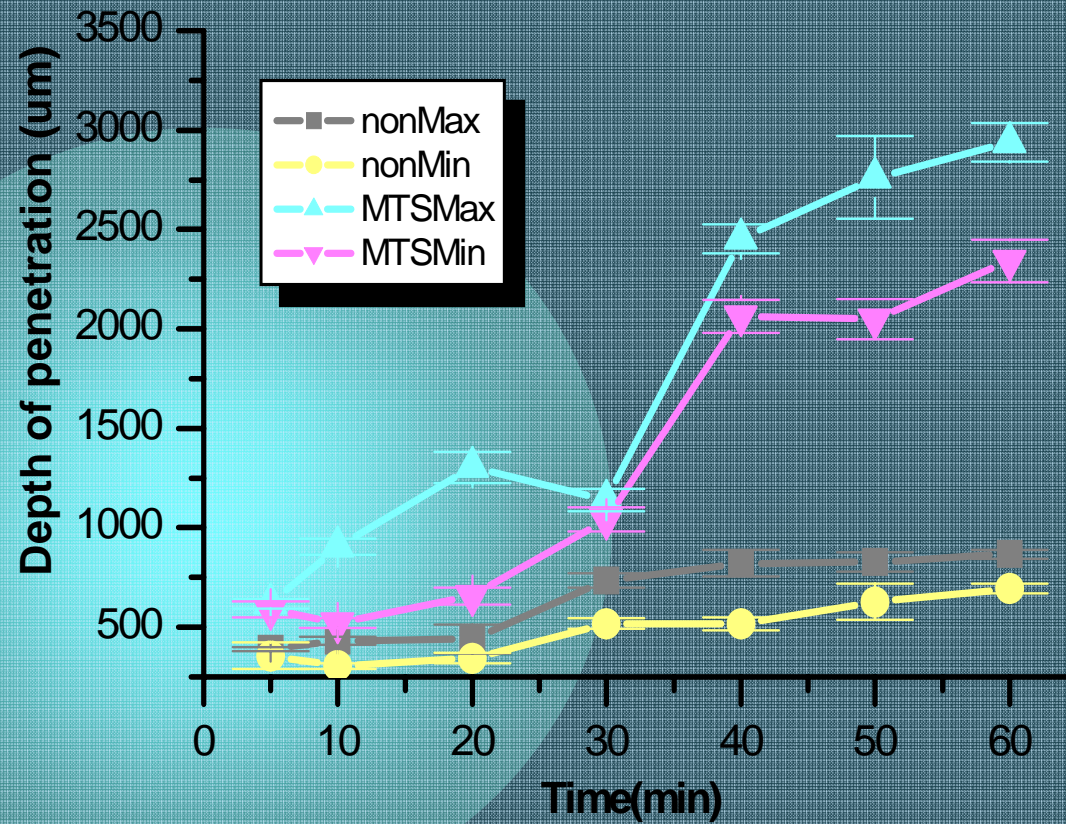


Rhodamine B base



react with 365nm wave light / emit 585nm light

TDDS by MTS – Time course

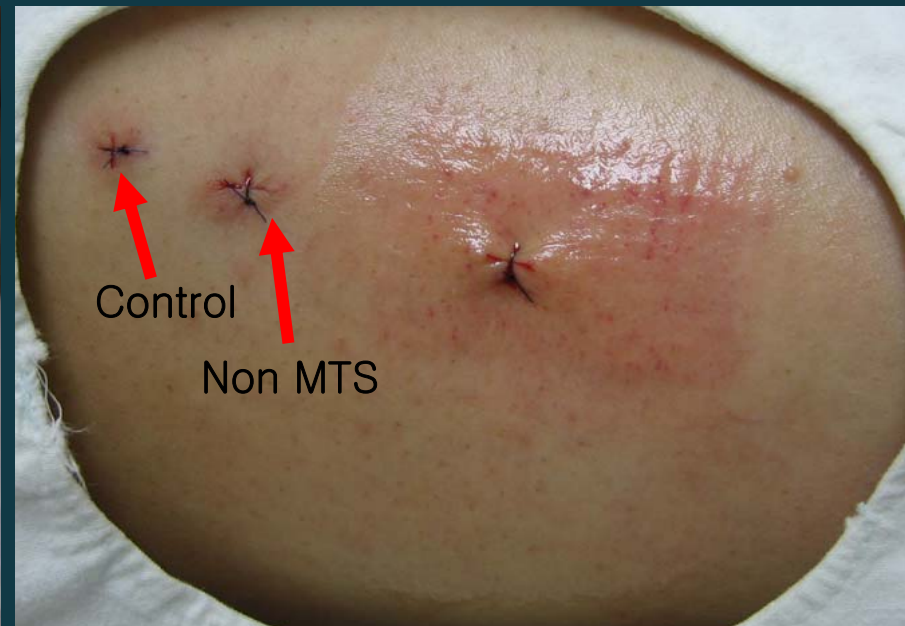
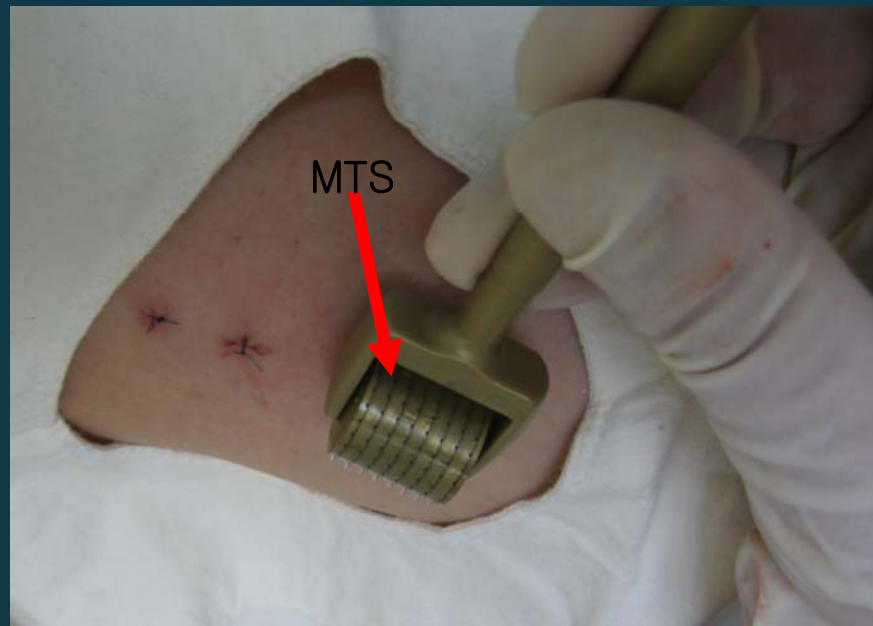


TDDS By MTS Using Ascorbic Acid

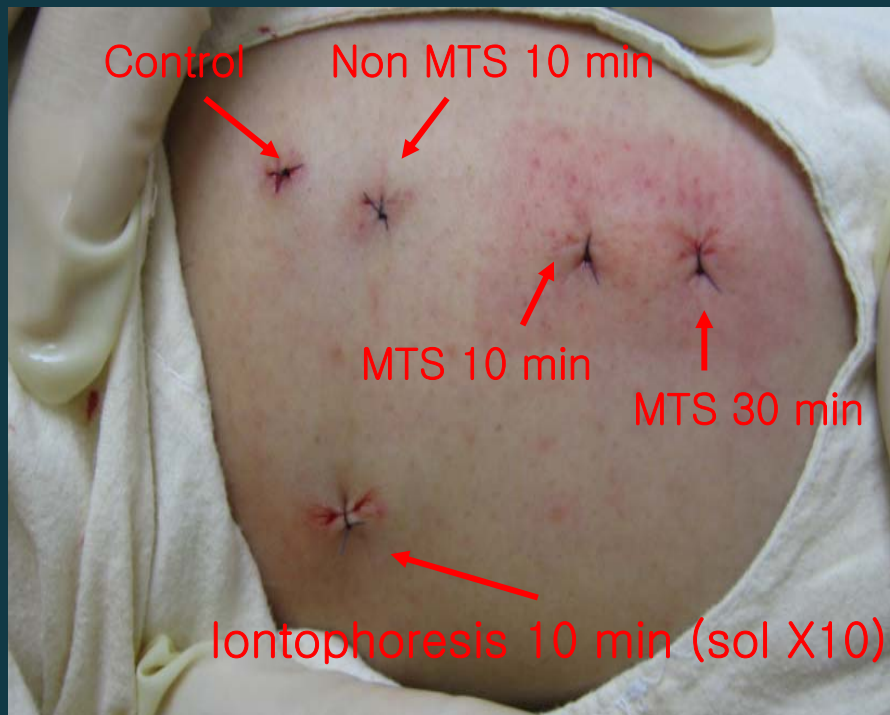
- Ascorbic acid : reacting with Sodium 2,6-dichloroindophenolate hydrate
- Bx : left forearm inner aspect (medial side)
- Control, non MTS(10 min), MTS(10min), MTS(30min),
- Ascorbic acid apply : 100ul/cm²



TDDS By MTS Using Ascorbic Acid



TDDS By MTS Using Ascorbic Acid



MTS using Ascorbic Acid



MTS 10min 1095.7um



MTS 30min 1652.5um

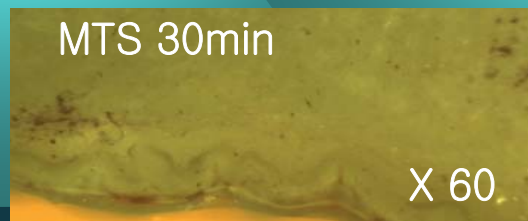


Control



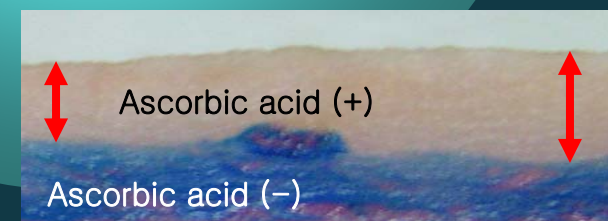
Control

X 60



MTS 30min

X 60



Ascorbic acid (+)

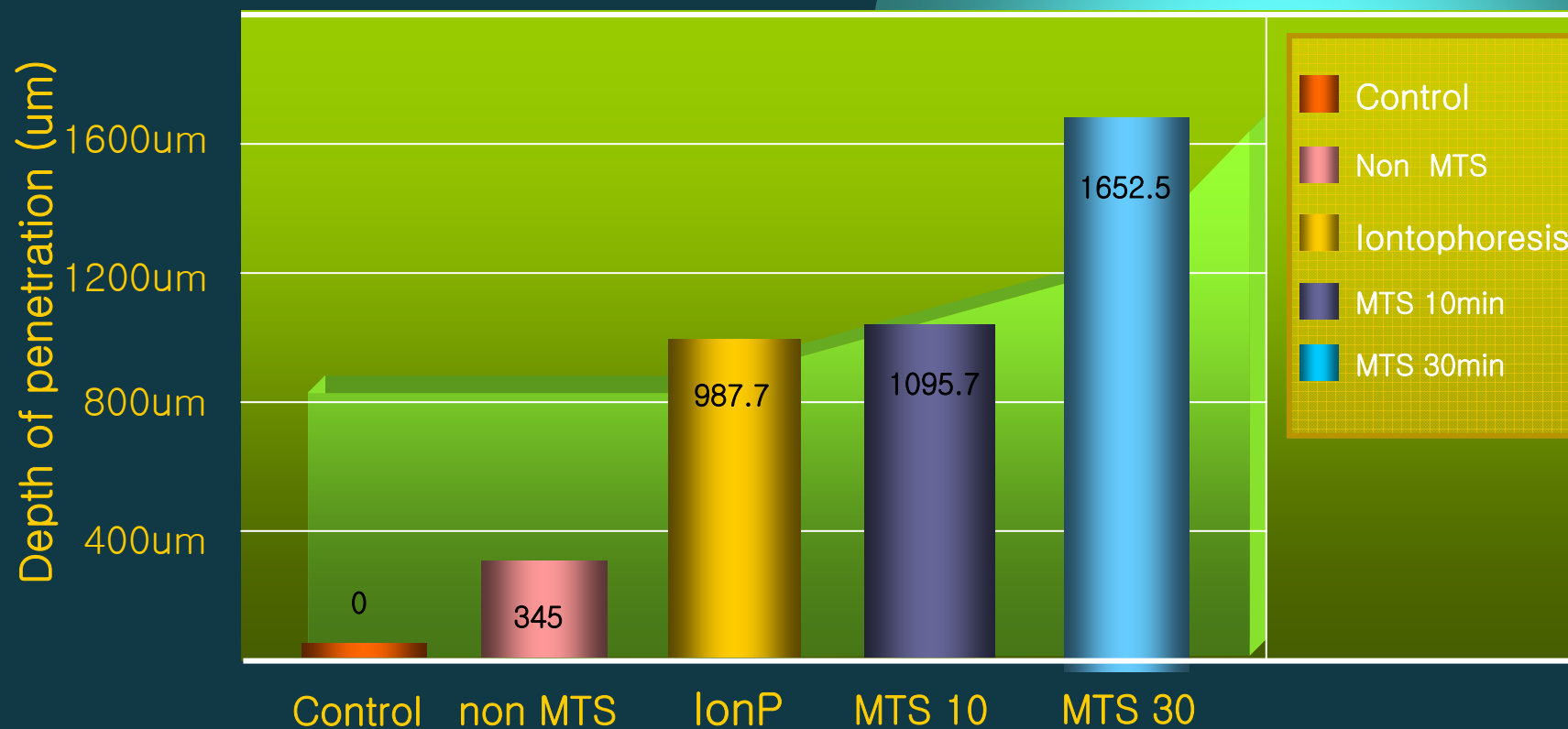
Ascorbic acid (-)

- Iontophoresis : 10min, (X10, 1000 μ l / cm²)

TDDS By MTS Using Ascorbic Acid

MTS using Ascorbic Acid in human skin

unit(μm)



Further Studies

Conclusion

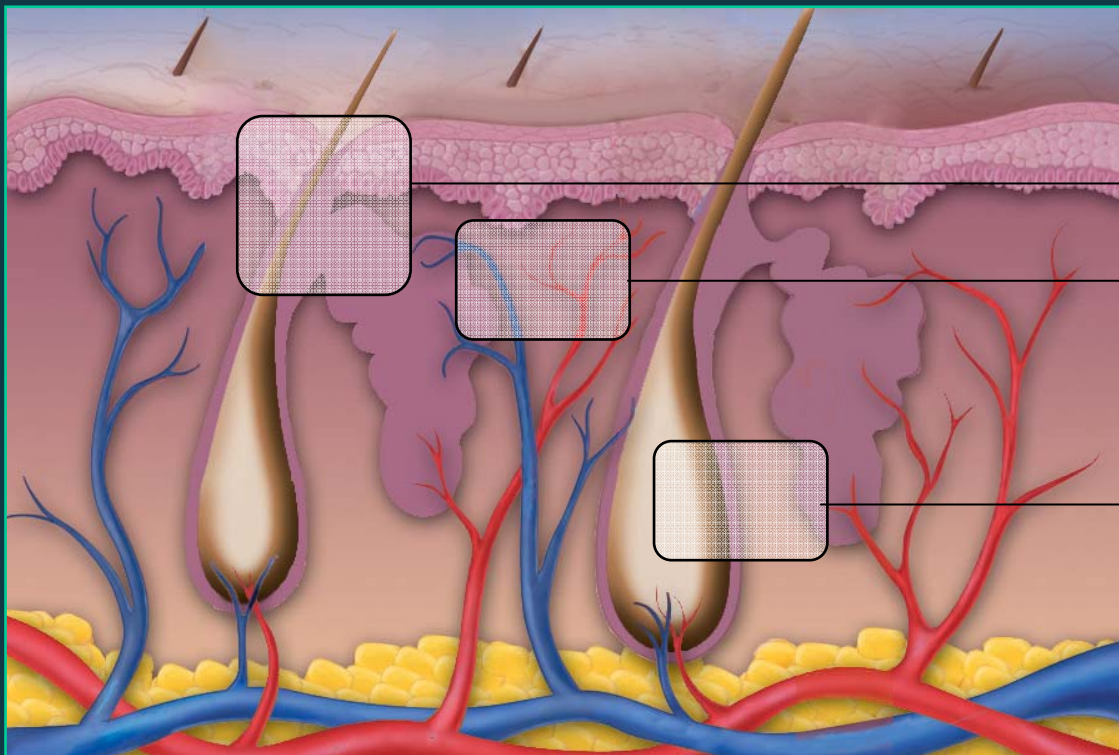
- TDDS : MTS > iontophoresis > simple application
- Time course : MTS >> simple application (steady at 30 min)

Ongoing & Future studies

- Hyperhidrosis, alopecia, gynoid lipodystrophy

Clinical Applications

Target Depth per Technology



PDL/IPL

Depth ~ 500 μm

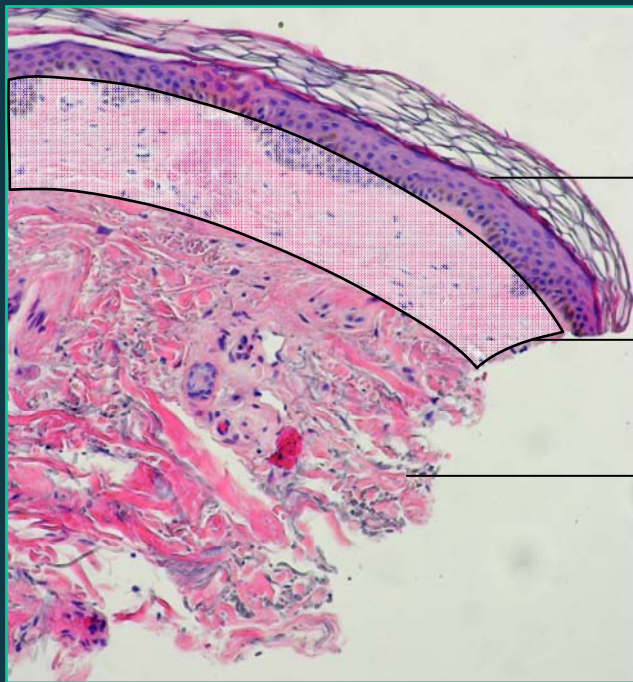
Fractional

Depth ~ 400 - 800 μm

Deep Heating

Depth ~ 1000 - 3000 μm

Photoaging & MTS??

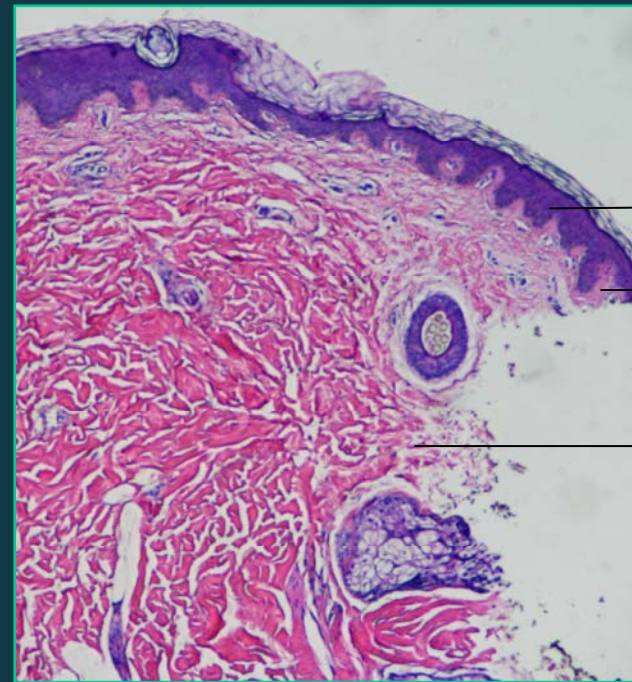


Epidermis

Photo aged skin
~300 μm (dermis)

Healthy skin
(dermis)

Cross section of 50 year old skin



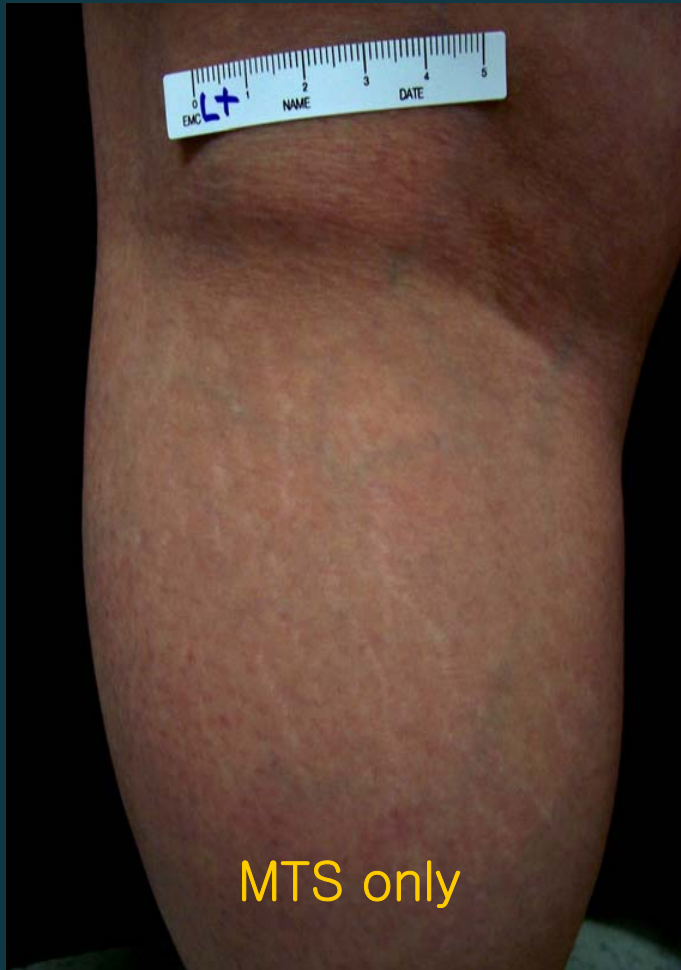
Epidermis

Photo aged skin:
minimal - none

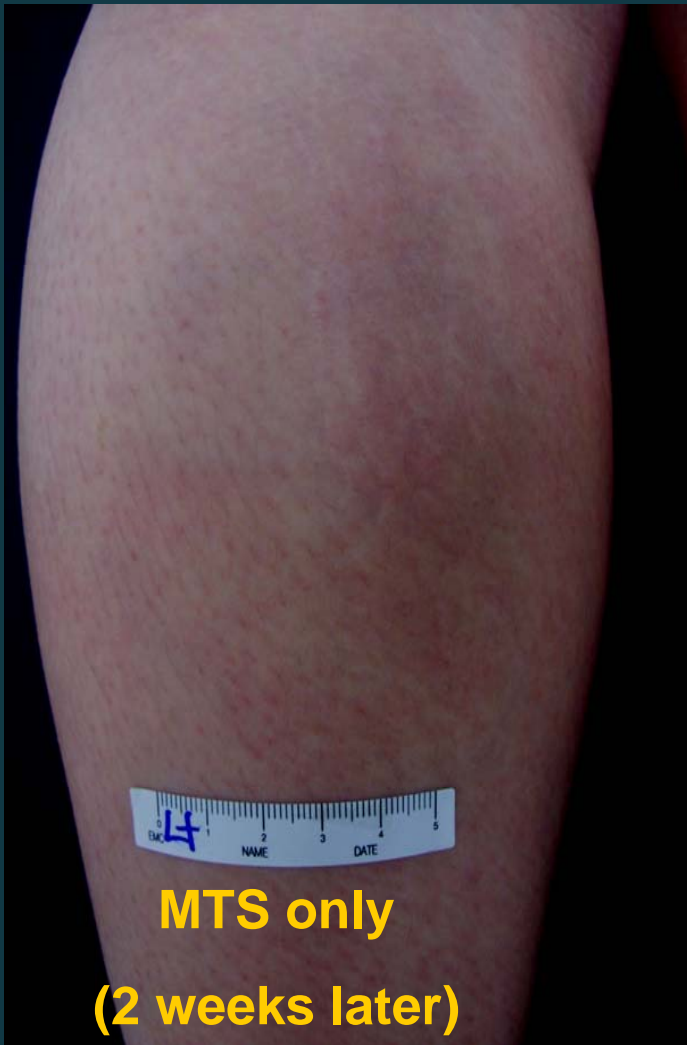
Healthy skin
(dermis)

Cross section of 18 year old skin

Striae & MTS



Striae & MTS



Striae & MTS

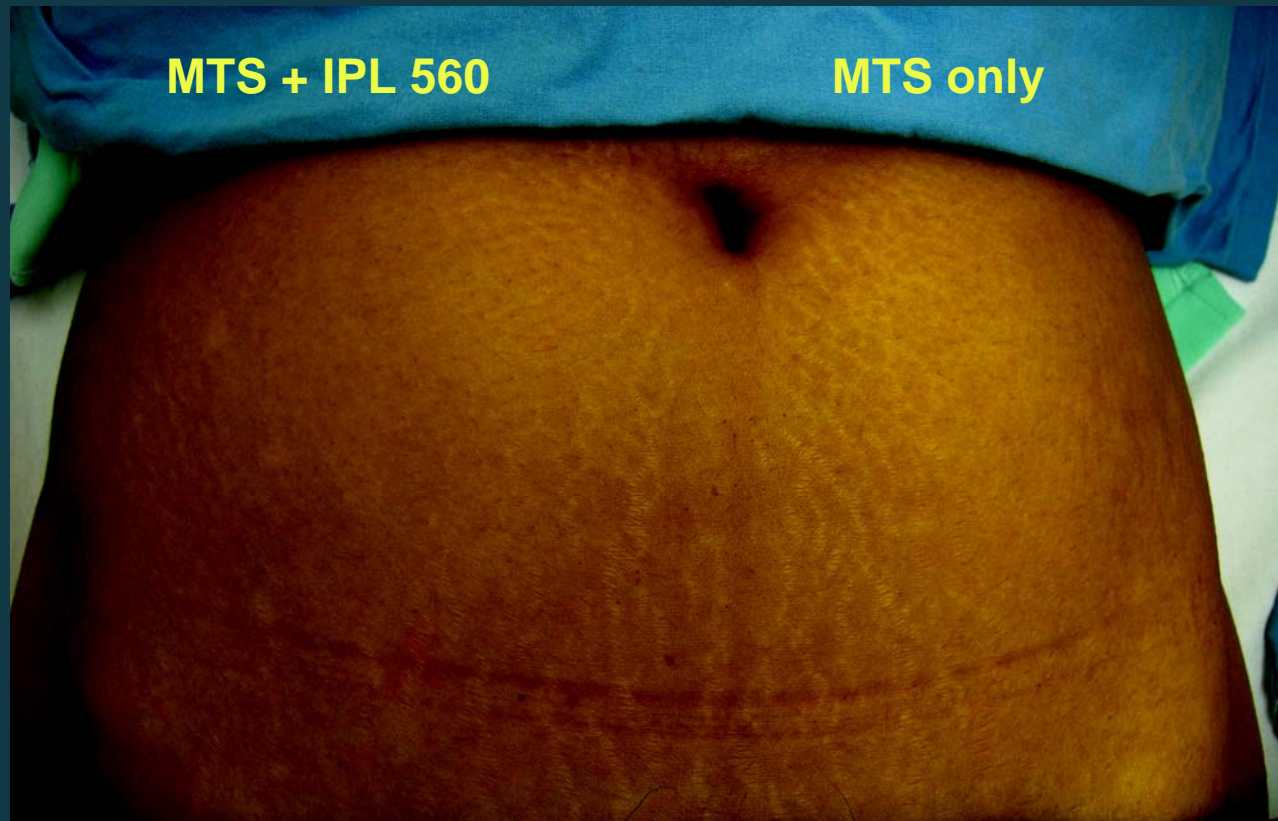


Before



After

Striae & MTS



Complications by IPL



Striae & MTS



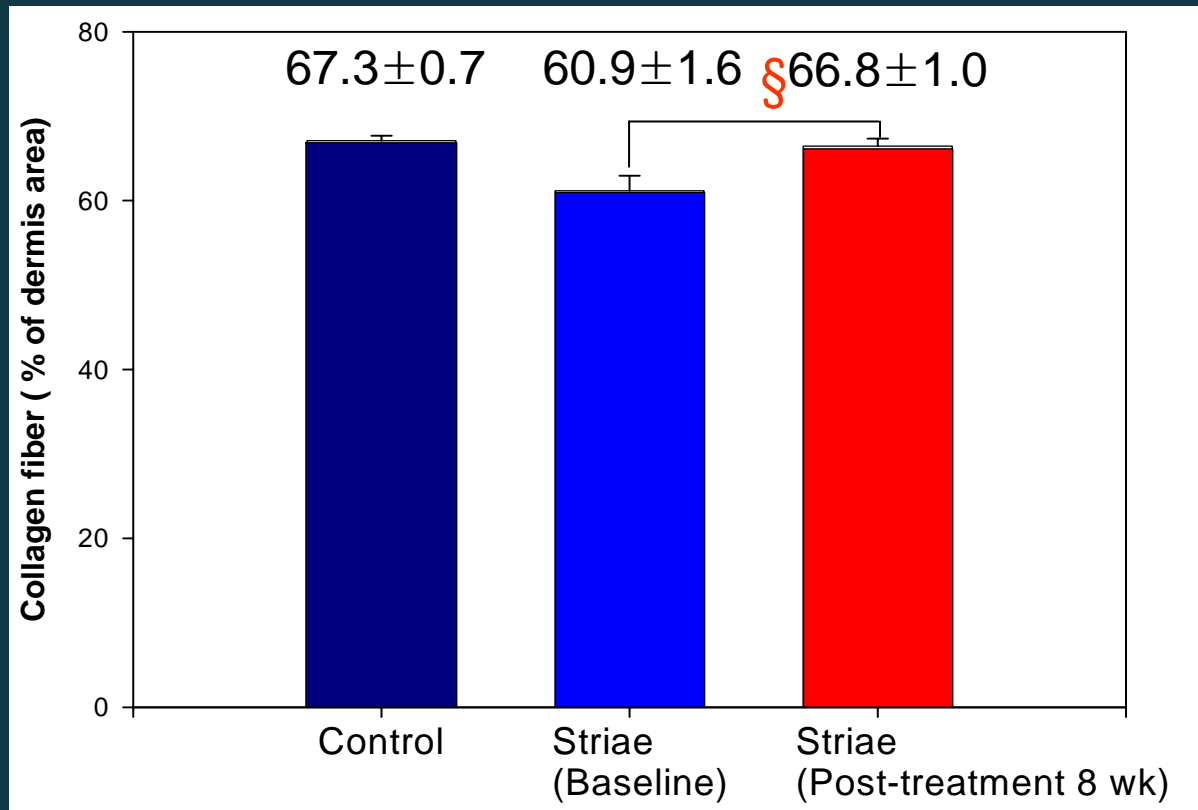
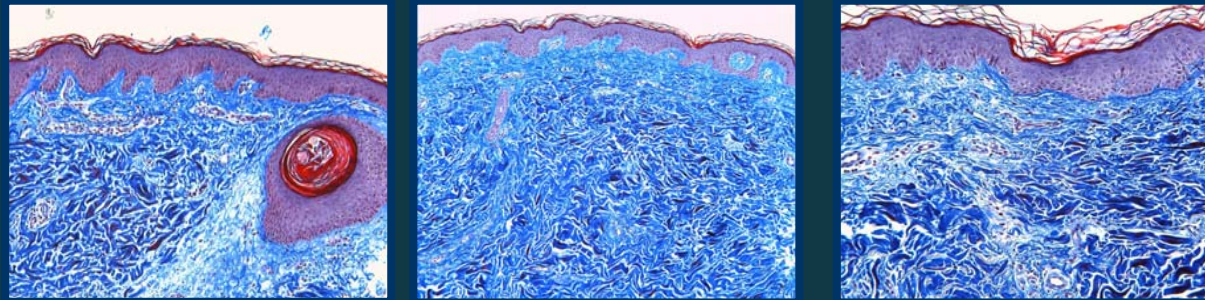
IPL + XEO



MTS

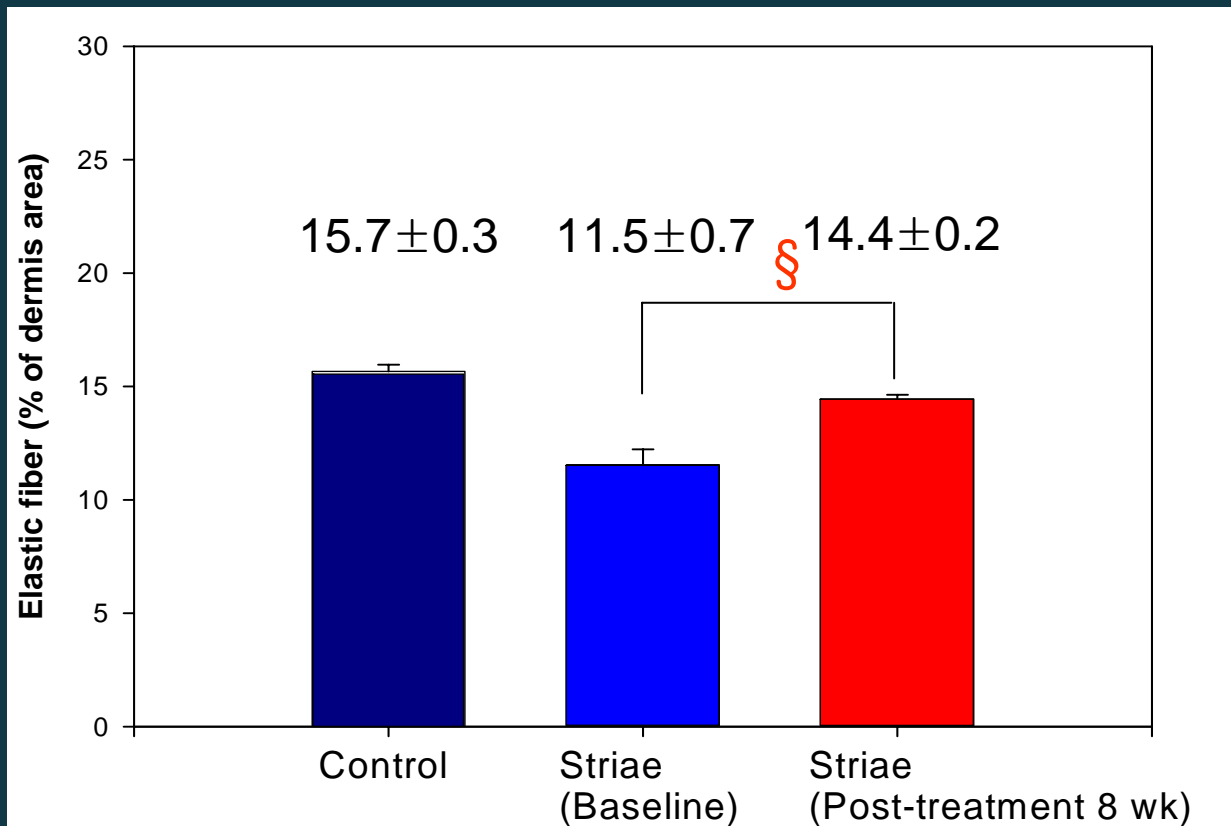
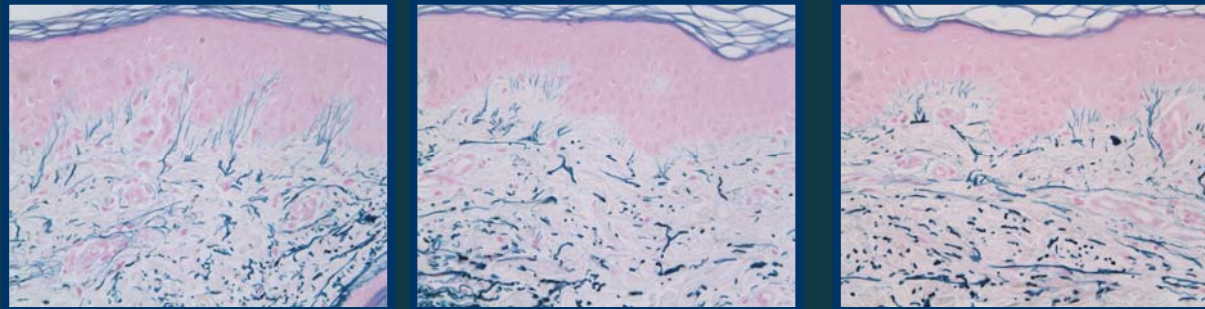
4 weeks

Collagen fibers (MT stain)



§ $P=0.063$ By
Wilcoxon signed
rank test

Elastic fiber (VB stain)



§ $P=0.063$ By
Wilcoxon signed
rank test



Scar revision by MTS



Clinical application of MTS

For striae

- 1) MTS + IPL : hyperpigmentation (less pigmentation when combined with MTS? Scattering of target chromophores?)
- 2) MTS + Affirm ? : less effective d/t depth?
- 3) MTS + aramis/polaris : too long
- 4) MTS + thermage / fraxel : too expensive
- 5) MTS + Xeo / titan / non-ablative laser



Hyperhidrosis : MTS + botox?

Melasma : MTS + vitamin/transamic acid

Alopecia : MTS + hair growth factors?

DDS : transepidermal drug delivery system (ex...slim patches)