

Introduction to Diagnostic Thermology

가

가

가 가

2001 9 가 .

, :

/

part 1

I.

1.

2.

3.

(1)

(2)

(3)

(4)

4.

(1)

(2) I- /

-

(3) II

-

(4) III

Thermatome

5.

(1)

(2) (負荷)

II.

- 1.
- 2.
3. (脊髓)
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

III.

V.

IV.

Part 2

I.

I.

1. 1)

. B.C17
. , B.C. 400
1°C
1592 Galileo Galileo가
17 1654
Ferdinand II Grand Duke of Tuscany
17 , 1871 Carl
Wunderlich Leipzig
10,000 "On the Temperature in Disease: A Manual of
Medical Thermometry"
가
1825 Seebeck 19
. 1934
J. D. Hardy (Emissivity) 1 가
가 , 2 가
가 가
1948 Leo Massopurt
가
. 1970 가 1985
Mills (Spinal Stenosis) (Low Extremities)
. 1980
0.02°C 가 가
가
1990
가 가 가
가 가 가

2.

2)

(Digital Infrared Thermography Imaging, Tele-infrared Thermography Imaging)

(光學系)

(,) .>?

(1)

(黑□)

(力學)

()가 0 K° 가 (結晶格子) 가 가

(入射)

(黑□)

1)

() , 1 (Kirchhoff)

가

가

1.0

2)

가 가 가 T(K°) 가 , W) λ(μm) 가 (Plank Equation)

$$W = \varepsilon \frac{2\pi h c^2}{\lambda^5} * \frac{1}{\exp(hc/\lambda kT) - 1} \text{ ----(1) 식}$$

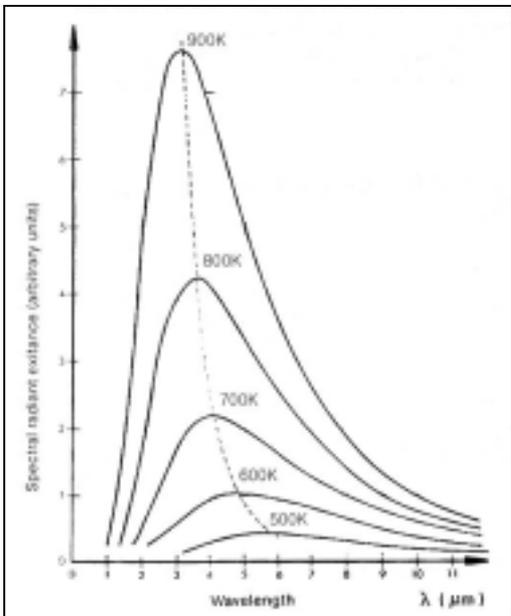
ϵ , h (6.63×10^{-34} Js), c , k
 (1.38×10^{-23} J/K)

3)

M_λ 가 가 λ_{max}

$$\lambda_{max} = 2,898 \times 10^{-6} / T \text{ (m)} \quad \text{--- (2)}$$

, (1)



(1) The spectral distribution of radiating energy from black body

4)

, 가 T(K)
 M

$$M = \sigma T^4 \text{ (W}\cdot\text{m}^{-2}) \quad \text{--- (3)}$$

(Stefan - Boltzmann) , σ Stefan - Boltzmann
 $\sigma = 5.673 \cdot 10^{-8} \text{ (W}\cdot\text{m}^{-2}\cdot\text{K}^{-4})$

M 가 T
 가

5)

가 ,
 가 . ϵ
 $\epsilon(\lambda)$
 $\epsilon \neq \epsilon(\lambda)$, $\epsilon = \epsilon(\lambda)$
 (1) (3)
 $\epsilon(\lambda)$, ϵ
 0.98~1.0

가

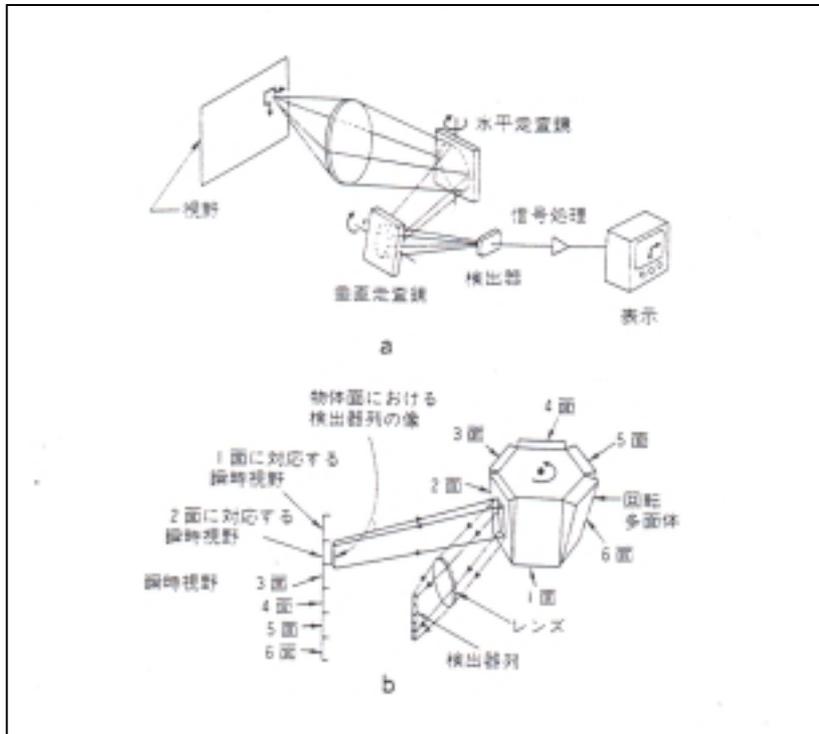
(2) (Infrared Thermography Imaging System)

1 FRAME TIME 1

1/20 - 1/60

(Infrared detector) HgCdTe(MCT: Mercury Cadmium Telluride) InSb(Indium Antimonide)가 가 (Photon detector)

(Peltier Effect) 가 ,
 (TEC) 가 ,
 (Sterling Cooling)



(2) (a) (b)
 (a: Friedrich, 1980, b: Wooddrough, 1982)

2-a , (走査, Scanning)

(Signal)

CRT

2-b

(走査)

가

(Multi-element)

가

(Uniformity)

SPRITE (Signal Processing in the Element)

3)

가

(3)

Infrared FPA(Focal Plane Area)

Area Sensor

(Scanning)

InSb

가 512x512

1 30

μ -bolometer FPA가

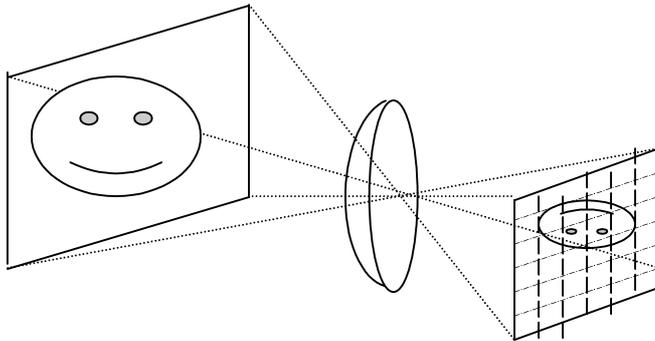
327x245,

(NETD; Noise Equivalent Temperature Difference, Temperature Resolution) 0,05 °C

(Frame Rate) 1 30

가

가



(3) FPA

1) 1 1 , “Physical Properties of Infrared Light in Biomedical Application”.

2) Transactions on Medical Imaging Vol.17 No.6 December 1998, “A Reappraisal of the Use of Infrared Thermal Image Analysis in Medicine.

3.

(1)

:

25°C

(가), 가

가

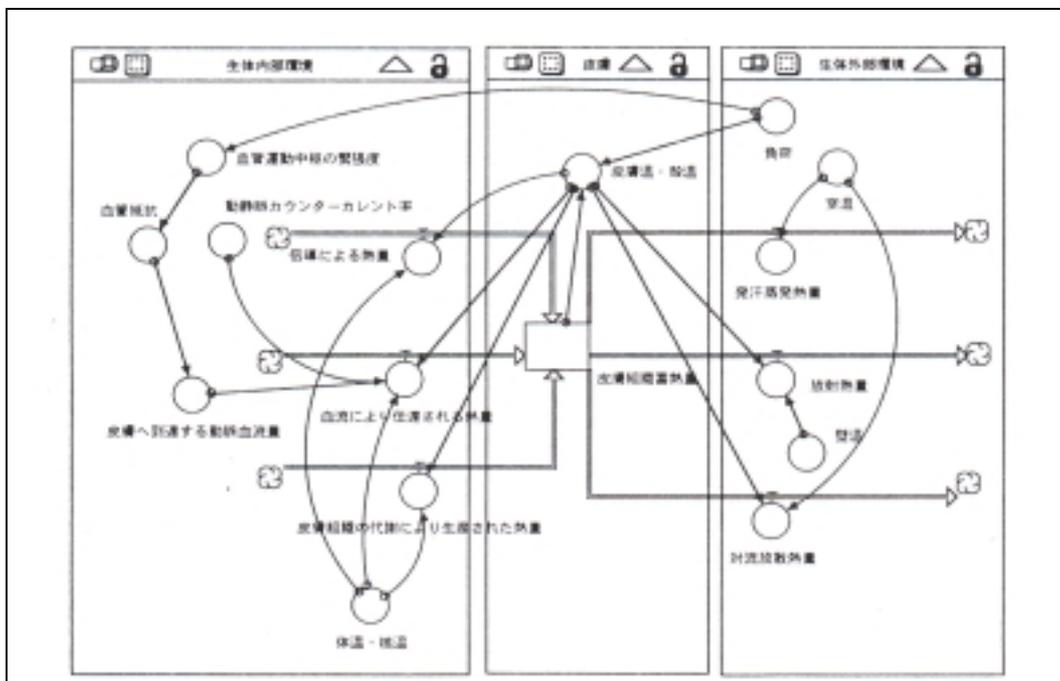
(), (

(

), (), ()

가

(1).



1.

(STELLA Research : High Performance Systems, Inc.

)

(2)

(heat stripe)

(heat stripe)가

()
가 가

가

(

가

가).

가

1)

가

가

가
가

(以上)

가

가

가

가

()

2)

가

3)

가)

(cutaneous vasodilator, CVD) (cutaneous vasoconstrictor, CVC)
CVC CVD CVC
CVD non-adrenergic, purine, ATP,
non-cholinergic Substance P, 가 , 가

) (Humoral factor)

가 가 , 가

a.

* Epinephrine norepinephrine -

* Renin -angiotensin - norepinephrine

b.

가

가

bradykinin

c.

) 가 가 .
 42 42
 40-42 가 15 가
 가 가

4) (CVC)

가) CVC

1. , CVC 가 1)
 CVC , (PaO₂, 20 Torr),
 가

1.

(PaO ₂ >30 Torr)	(PaO ₂ <20 Torr)	
()	()	

CVC , (PaO₂, 30 Torr),
 (, PaO₂,), (,)
 가 가
 CVC

)

가
 1905 Muller가 가
 가

Walther

2)

가
 (regional differentiation of sympathetic efferents)

가 가

가

가

(CVC), (CVD) (sudomotor nerve: SM) CVC CVC
 (pilotomotor nerve: PM) SM
 SM, PM
 microneurography 가
 J. nig (spinal functional unit) 가 가
 CVC , SM , CVC ()
 J. nig 가 가 가
 3)

(3)
 가 가 (sudo-motor) 가
 가 가
 가

1) ()
 (37) 「Jar」 + 「radiator」 가
 가
 가 ()
 가 (가 가) 가 가
 가 가 가

가)
)
) ()
)
)

異常 異常 ()

2) . .

가) ()
(ASO, TAO) ()

Taylor³⁾ angiosome 가 가 가
가 가 level

) 가 () , 가 ,

a)

b)

1 , 2

가 가

c)

(dermatome) 가 가

ㄱ)

ㄴ)

가

1 (Th1 L3) 2.3 가

가 가 가

Th1 , L3 , a) 가 (global)

4). b) 가 가

d) 가

) 가

motor neuron disease 가

dermatome 가 가 가

(, ,) 가

3)

(4)

0.98
 (較正) ()
 3
 6
 5)
 가 가 가 가 가
 가 11 가 가 가
 가
 (發汗)
 25

核溫)
 가 가

1) Thermatome :

가 (異常)
 ()
 (1).

1 異常 ()

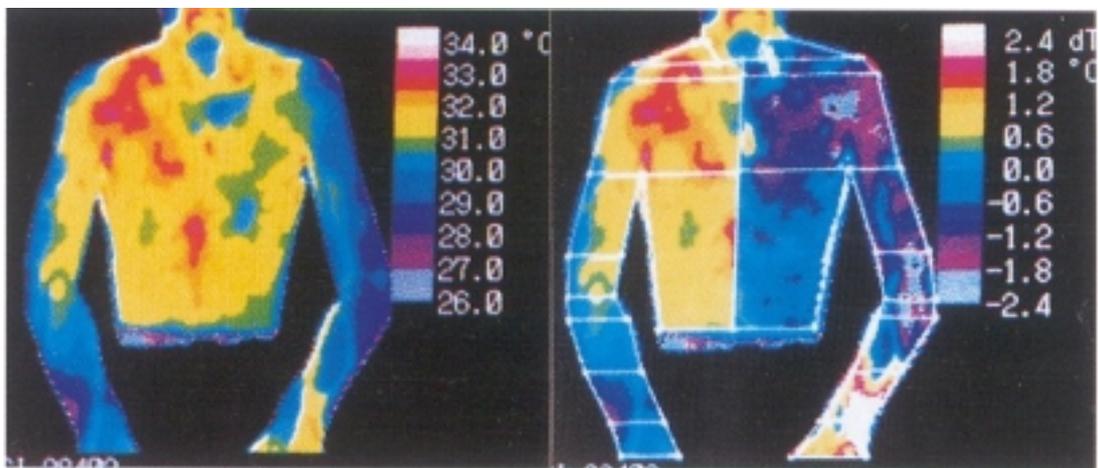
	(閉塞), ,	()
	(脊髓), ,	
	,	
	,	
(serial real time)	,	(Thermal recovery)

- 1) J nig W: Organization of the lumbar sympathetic outflow to skeletal muscles and skin of the cat hindlimb and tail. Rev Physiol Biochem Phamacol. 1985;102:119 -213
- 2) Walther OE, Iriki M. and Simon E: Antagonistic changes of blood flow and sympathetic activity in different vascular beds following central thermal stimulation.II. Cutaneous and visceral symphathetic activity during spinal cord heating and cooling in anesthetized rabbits and cats. Pflugers Arch.1970;319:162 -84.
- 3) - -Biomedical Thermography,6 1 -7,1986.
- 4) . Biomedical Thermography. 7(1),104 -107, 1987.
- 5) : Human physiology. 1 st ed. , , 1999;pp712 -718.

가 /
 (A) 가
 () , (B)
 가
 , (C)
 (Region of interest-ROI)

가
 가
 가
 가
 가
 false negative가

2. / (差) 3)



3)

/
 (/) 가 / 가
 가 가

Skin-temperature Differences between Sides of the Body			
Body segment	Cutaneous Sensory nerves and segments measured	Mean average temperature differences	
		(°C)	S.D.
Forehead	Trigeminal Nerve(V-1)	0.12	0.093
Cheek	Trigeminal Nerve(V-2)	0.18	0.186
Chest	Intercostal(T1-T7)	0.14	0.151
Abdomen	Intercostal(T7-T10)	0.18	0.131
Neck(Posterior)	Cervical(C2-C5)	0.15	0.091
Thoracic, paraspinal	Post-Cutaneous(T2-T12)	0.15	0.092
Lumber(Back)	Dorsal div.spinal(T11,12,L1,2,3,S1,2,3)	0.25	0.201
(Trunk Average)		(0.17)	(0.042)
Scapula	Dorsal div. spinal(T1,5)	0.13	0.108
Arm(Biceps)	Med. antebrachial(C8,T1)	0.13	0.119
(Triceps)	Dorsal antebrachial, axillary(C5-6)	0.22	0.155
Forearm(Medial)	Med. antebrachial(C8,T1)	0.32	0.158
(Lateral)	Lat.antebrachial(C5-6)	0.23	0.198
Palm(Lateral)	Median(C6,7,8)	0.25	0.166
(Medial)	Ulnar(C8,T1)	0.23	0.197
Thigh(Anterior)	Ant. fem. cutaneous(L2-3)	0.11	0.085
(Posterior)	Posterior cutaneous(S1,2,3)	0.15	0.116
Knee(patellar)	Ant. fem. cutaneous(L2,3)	0.23	0.174
Popliteal	Post. fem. cut., Com. Peron.(L4-5,S1-2,3)	0.12	0.101
Leg(Anterior)	Saphenous, sup. Peroneal(L3,4,S1-2)	0.31	0.277
Calf	Sural, Saphenous(L3,4,S1-2)	0.13	0.108
Foot(dorsal)	Peroneals(L4-5,S1)	0.30	0.201
Heel	Tibial(S1-2)	0.20	0.220
(Extremities,Average)		(0.20)	(0.073)
Finger(Tips),*Average	Median & ulnar(C5,6,7,8,T1)	(0.38)	(0.064)
Toe(Tips), **Average	Median, lateral, planter(L4,5,S1-2)	(0.50)	(0.143)

* Five segments, but only average is given here
** Five segments(big toe and four others), but only average is given here

/ 가 0.3~0.4 °C
. 2 Uematus /
4)5) / 가 가
0.32 °C
0.30 °C 가 0.30 °C (가 . 가),
가 0.277 °C 0.2 °C .

(3)

II

(Thermatome)

1) (angiologic thermatome)

(異常)
TAO ASO

가

가 가

가

가

가

(吻合) 異常 가 (吻合)
가

(Structural Angiologic Thermatome)

가

(functional angiologic thermatome)

가

가

2) (dermatomal thernatome)

(Dermatome) (帶狀) (neuro-dermatome)
가 가
(椎間板) 가 ,
< >
(手根管) (根)
(星狀) (空)
洞症) (空洞)
(crush injury)
가

3) (myotomal thernatome)

(myotome)
10mm
(穿通枝)

4) (metabolic thernatome)

異常 (Hyper-thermal Area)
5 가 가
가

가

5) (負荷)

가

가

가

異常

가

異常

가

異常

가

(serial real time)

(虛血)

가

가

가

가

3)

(負荷)

가 가

가

가

異常 가

→

(serial real time)

(serial real time)

가

가

가

4)

....

TV Frame rate

off -pump (

)

(coronary by -pass)

5)

→

()

가

(thermal recovery)

6) 가

가)

) 가

가

(開大) 가
가

)

)

()

(

) 가

- 1) Kunihiko Mabuchi, Hirokazu Genno, Kazuo Matsumoto, Tsuneo Chinzei, Iwao Fujimasa :
Autonomic thermoregulation and skin temperature : importance and role of deep body temperature in the determination of skin temperature. The Thermal Image in Medicine and Biology. (K. Ammer, E.F.J.Ring eds), UHLEN VERLAG VIENNA, Vienna .1995; 12-129.
- 2) 満洲邦彦, 池川志郎, 松永徹志, 藤正 巖, 渥美和彦 : 正常例における体表温の左右差の検討, **Biomedical Thermography** 17 (1) : 66-68, 1987
- 3) Kunihiko Mabuchi, Tsun Chinzei, Iwao Fujimasa, Shigehiko Haeno, Kiyoji Motomura, Yusuke Abe, Takumi Yonezawa : Evaluating Asymmetrical Thermal Distributions through Image Processing., IEEE Engineering in Medicine and Biology Magazine .1998;17(4) : 47-55.
- 4) Sumio Uematsu : Symmetry of Skin Temperature Comparing One Side of the Body to the Other., Thermology. 1985;1(1) : 4-7.
- 5) The Johns Hopkins Medical Institutions Sumino Uematsu M.D: Quantification of thermal asymmetry 1988
- 6) Park W and Bae D. K. : Comparisons of infrared thermogram, magnetic resonance imaging and eletro physiological test for patient to complain several types of pain . The Korean Society of Diagnostic thermology. In press.2001.

)



250ml
가
가
(fog)가
가 1/3
250ml 6~7 1/3
250ml 100ml
(350ml
(fog) 가
가 (: 100ml 5-6 /h)
PC

)

가
가
가 1)
24 ±1 60%

2)

가)

()³⁾

1.	가	,	,	,	,
2.	3	,	,	,	().
3.	2				
4.	30				
5.		20		25°C	
6.					

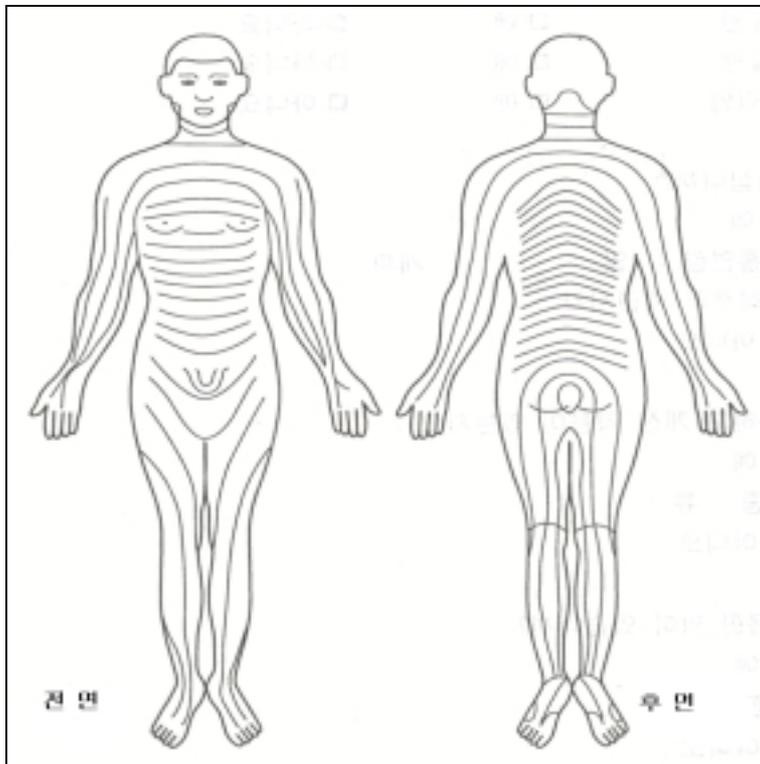
Draw chart of pain ()²⁾

: : : : :	: : : : :
-----------------------	-----------------------

: 200 . . .
:
:

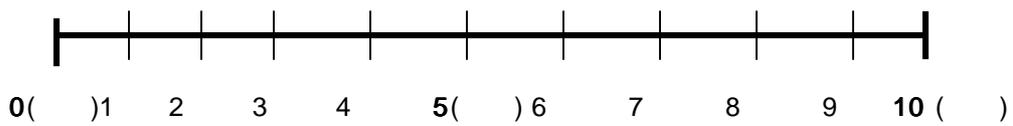
1. (: , ,)

2. 가 .



(: :)

1. , ?
2. × .) (?), (), ()

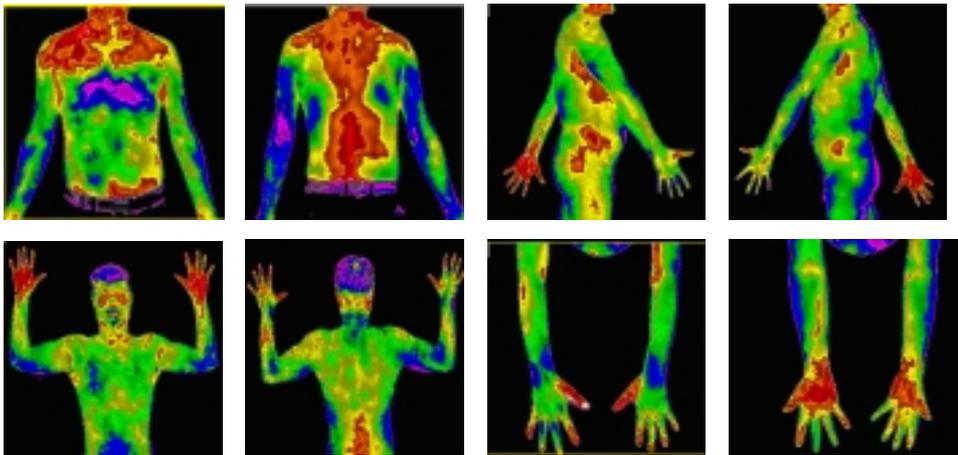


3)

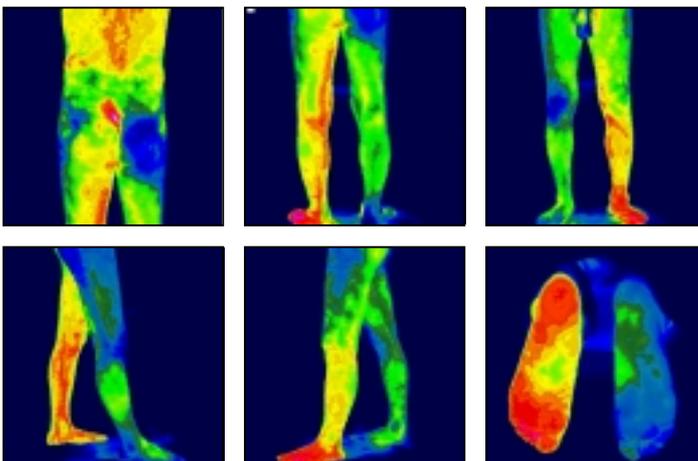
3)

가)

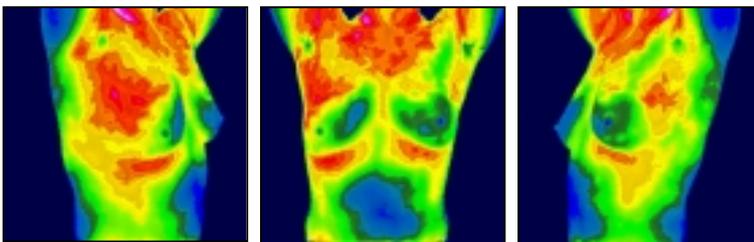
a. : / / , , / , , /
, / , / /



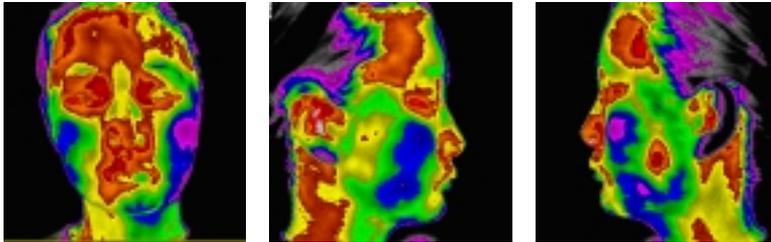
b. : / / / / /



c. 가 () : / (45) / (45)



d. (): / (90)/ (90)



)

a)

ㄱ. : 15~20 25 ± 1 °C
 ㄴ. : 2) 가 . Erikson 가
 30 가 26 ~28 °C 小川
 가 24~26 °C
 . 佐佐木 30 °C 가
 25~30 °C 가 .
 가 25 °C 가

b)

ㄱ. : 25°C 20
 ㄴ. : 가 가

c)

ㄱ. : 15~20
 ㄴ. :
 (Draw chart)

. VAS(Visual analogue scale) , Verbal Pain Score

d)

ㄱ. : 15~20

ㄴ. : 가

30~32

5 °C

가 가

e)

ㄱ. : 10~15

ㄴ. :

가

, 가 ,

가

, 가 , 가

4)

f)

ㄱ. : 15-20

가

가

ㄴ. :

g)

ㄱ. : (發汗)

가

20

5)

15

가

ㄴ. : 1 , /

(45

) 1

가

(噴霧)

가

(10 , 1 : 4 , 30)

(45 , 3)

ㅂ.

2

ㅅ.

가

(精索)

가

가

- 1) 入来正躬：生理機能画像診断 サーモグラフィ, 秀潤社：13-19
- 2) Wook Park M.D and Duck Koo Bae, M.D: Comparison of infrared thermogram, magnetic resonance imaging and eletro physiological test for patient to complain several types of pain . The korean society of Diagnostic thermology. In press..2001
- 3)
- 4) 藤正 巖：生理機能画像診断 サーモグラフィ, 秀潤社：36-39
- 5) :
: pp5 -10
- 6) 満洲邦彦 他：生理機能画像診断 サーモグラフィ, 秀潤社：32-35

(2)

1) (負荷)

가)

homeostasis

가

가

가 가

가

1.	5.
2.	6.
3. ()	7. (鍼灸)
4.	

a)

ㄱ. 25

ㄴ. 15~20

ㄷ.

ㄹ. 가

b)

(無)

가

가

c) 1)

가

가

d) 1)

가

가가

) 2)

a) 0°C 10

b) 10°C 1

c) 20°C 5

가

가

0°C

10

Raynaud's phenomenon

0 °C 10

.10°C 1

0°C

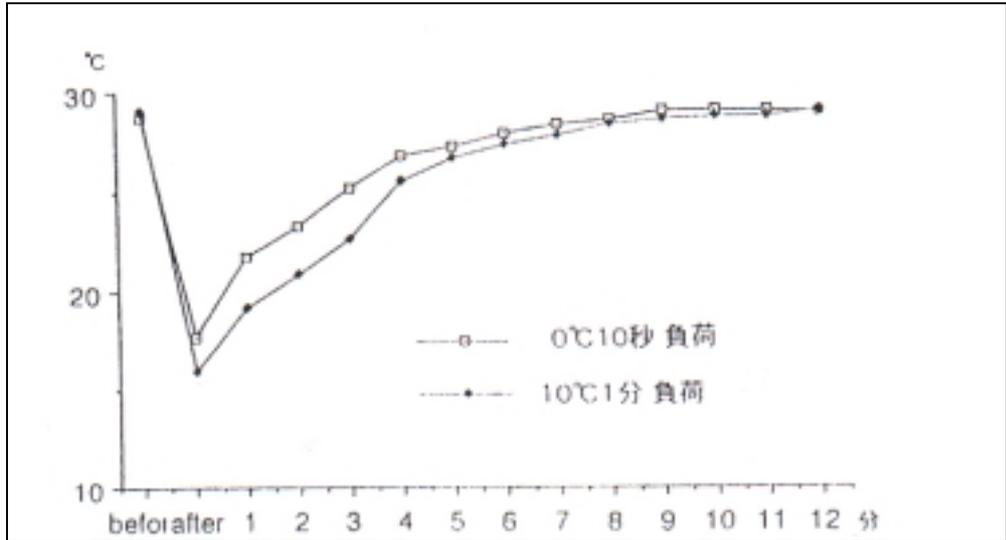
가

가

10 °C 1

0 °C 10 10 °C 1

(1)



0°C 10

5~6

100% 가

10°C 1

5~6

100% 가

가

가

가

10°C 1

0°C 10

3)4)

(再現性)

10°C 1

0°C 10

가

0°C 10

5 ~6

100% 가

10°C 1

5

6

100% 가

가

가

가

2)

가

가

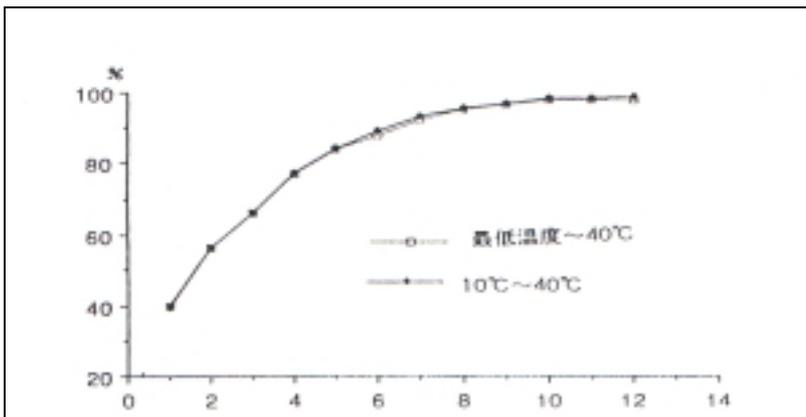
(Area)

가 가

2

2가

가



2

(Area1)

3)

가

가

(腿)

가

(가)

194 가 3) 750
 750 106 가 10
 10 (蛋白質) 106 0 °C
 가 , 6
 가 ,

28.7 ± 1.2 °C 27.5 °C
 6 82.2 ± 12.0% 70.2%
 42% 85% 6 가
 65%, 80% 5)
 가 가

4)

가)

(造影) (脂端) 42 °C (走行)

(Thermographic venography)

가

(表在)

)

(Thermal recovery)

(復溫)

)

(Reactive Thermography)

)

(Visual Thermography)

- 1) 後藤繁優 他：冷水負荷試験の日内変動, *Biomedical Thermology* 8 (1) : 61-63, 1988
- 2) 藤正 巖 他：負荷サーモグラムの時系列分析による病態生理機能画像への変換手法, *Biomedical Thermology* 8 (1) : 42-47, 1988
- 3) 谷川 誠 他：冷水負荷試験に対する糖尿病患者の反応性皮膚温変化, *Biomedical Thermology* 8 (1) : 146-148, 1988
- 4) 鹿野昌彦 他：末梢循環障害とサーモグラフィ, *Biomedical Thermology* 17 (2) : 111-113, 1998
- 5) 国本雅也：指先部冷水負荷時の皮膚温変化のうち皮膚交感神経機能を評価するにはどこに注目するのが最も適切か?, *Biomedical Thermology* 7 (2) : 154-269, 1987
- 6) 満洲邦彦：赤外線サーモグラム計測およびコンピュータシミュレーションを使用した上肢血流遮断負荷時の体表温変化に関する研究, *Biomedical Thermology* 5 (2) : 227-238, 1985
- 7) 永江 學 : , :pp45-50

II

1.

1

1,3)

1

1. , ,
- 2.
- 3.**
- 4.
- 5.
- 6.

(1)

- 1) (造影) 2) 3) 4)
- 5) 6) 7) 8)
- 9) 10) (,) 11) C T
- 12) MRI . DSA(digital subtraction angiography)

(造影劑)

가

가

가 2

1

1)

2)

가 가

3)

4)

5)

6)

7)

8)

(2) 가 2)

1) 가

2

, (重症)

2

1.

(1) (CAO)

(5)

1) (ASO)

(6) , (癩)

2) (, , 1~6)

(TAO, Burger's disease)

2.

(2)

1) -

(1)

(2) ,

(3)

3.

1)

(1)

2) (膝窩) (補足)

(2)

3) (膝窩)

(4)

1)

2) Bechterew' Disease.

3) 가

2)

2

가

.(5.)

3)

2

가

4)

가

2

가) ()) ()
 ()) ()
) (虛血肢))
) 가
 가 3).
 “ ” “ ”

(3)

가 가
 가 .
 1) / 가
 (殿部)
 , 가 가
 3).
 2) 3 가 2).
 3

1.	2.
(1) , , , ,	(1) , ,
(2) (發汗) ,	(2) , ,
(3) , , ,	(3) , , ,

(4)

1) (ASO)

가
1~2 °C

가

2) (Burger's disease , TAO)

가

가
ASO
가

3) ,

2
4

(膠原病),
(汎發

性)

(膠原病)

가
thermal defet
가
1

4

1. ()
2. ,
(紫斑病)
3. ,
4. ,
5. , ,
6. , Burger's disease

4)

2 가 . 5 “P” pulselessness(), pain()
, pailor (,), paresthesia (,), paralysis()
異常

가 가 .

subtraction

가 .

5) /

6) /

가 , .

(5)

/ 가 (1) 0.5 °C (2)
5 가 .

(1)

, (2)

()	20	25	30	35	40
	27.9	30.5	33.4	35.1	36.3
	25.8	28.9	32.7	35.4	36.4
	21.7	27.1	31.1	35.6	37.0

1) (ASO)

(Criteria)

가) 가 .) 가 .) .)
 가 .) 가 .)

- (1)
- (2)
- (3)
- (4)
- (5)

2) (TAO)

(Criteria)

가) 가) 가)
 가))
 .)

- (1) , (2) , (3) .

3) ,

(Criteria)

가) 가) 가) 가) 가)
 가))
 .)

- (1) (膠原病) (2) (3) (5)

(6)

가

1)

性)

가

(沮血
가
가

2)

/

가

가

3)

가

가

4)

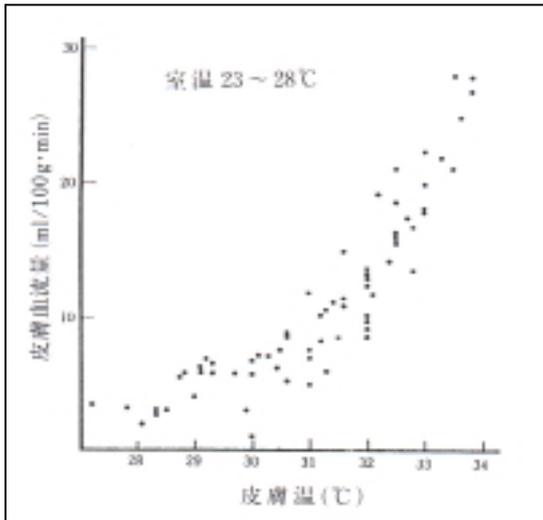
3

3

6

가

1)



1)

31°C

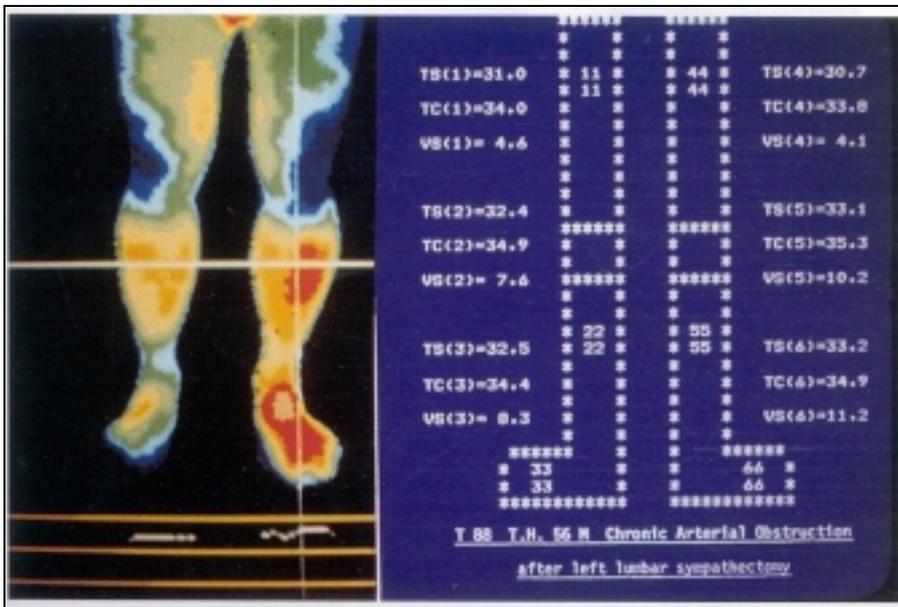
31

가

가 31

가

80%



(2) 4.6ml/100g/min.

(Routine screening

test)

- 1) 三島好雄 編：血管外科ハンドブック，南江堂，東京，1981
- 2) 中山昭雄 編：温熱生理学，理工学社，東京，1981
- 3) J. Juergens, J. Spittell, J. Fairbairn(Editor) : Peripheral Vascular Diseases, Saunders, Philadelphia, 1980

2.

(1)

1990 The American Academy of Neurology Therapeutics and Technology Assessment Subcommittee

1)

가
가

가 , 가

2)

(1) (2)
(3) (entrapment neuropathy) (4) ,

가

(理想的)

가

가 가

若宮¹⁾

(2)

가

가

()

, 若宮²⁾가

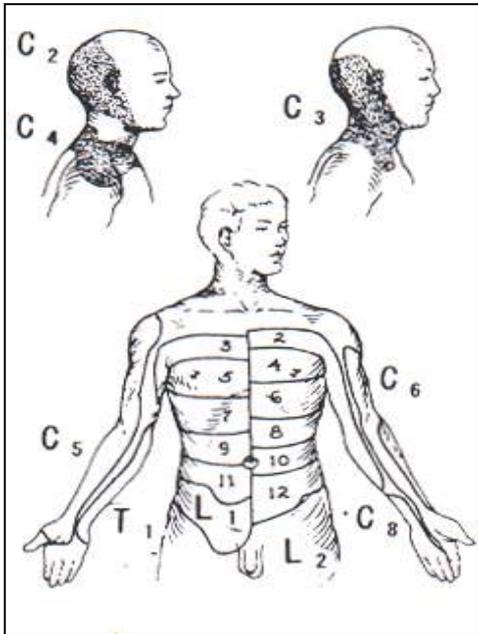
가

가
가

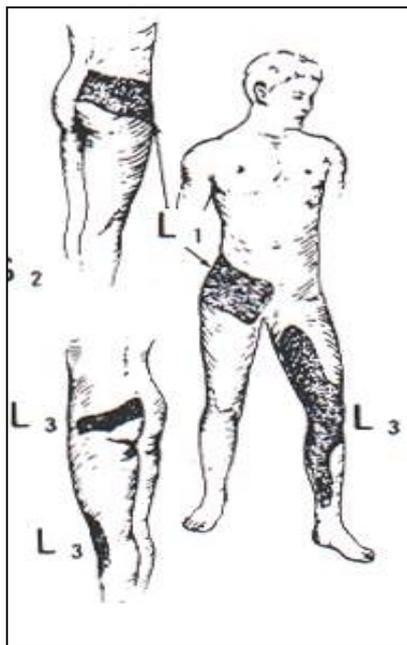
가

2

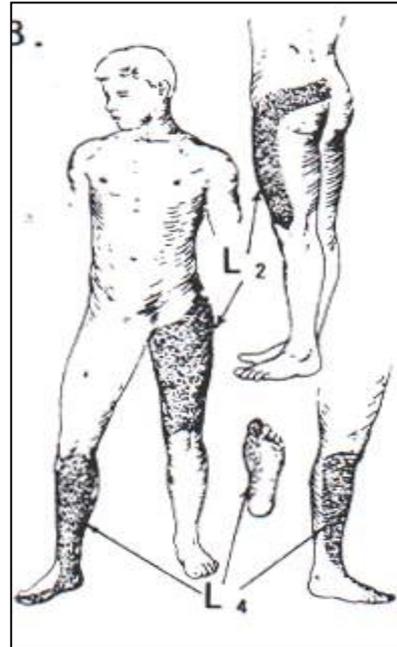
A. (根性)
(())



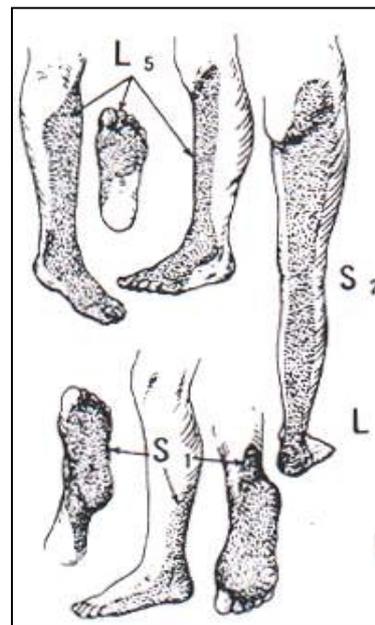
((.))



(Foerster)⁶⁾
((Lumbar))



((.))



B.

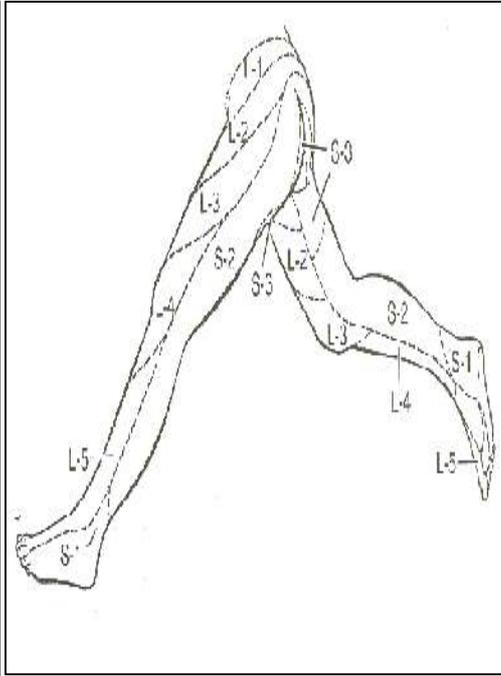
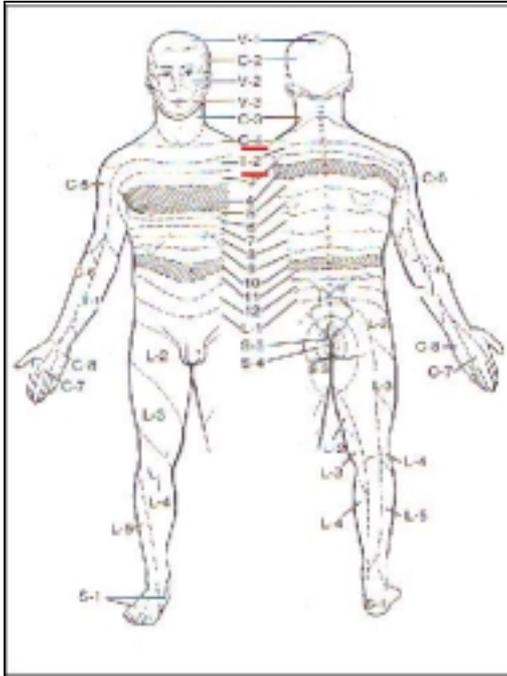
(根性)

(分節性)

10)

4

2



가 8 1 2

3 2 3 (尾骨)

20 25 (後)

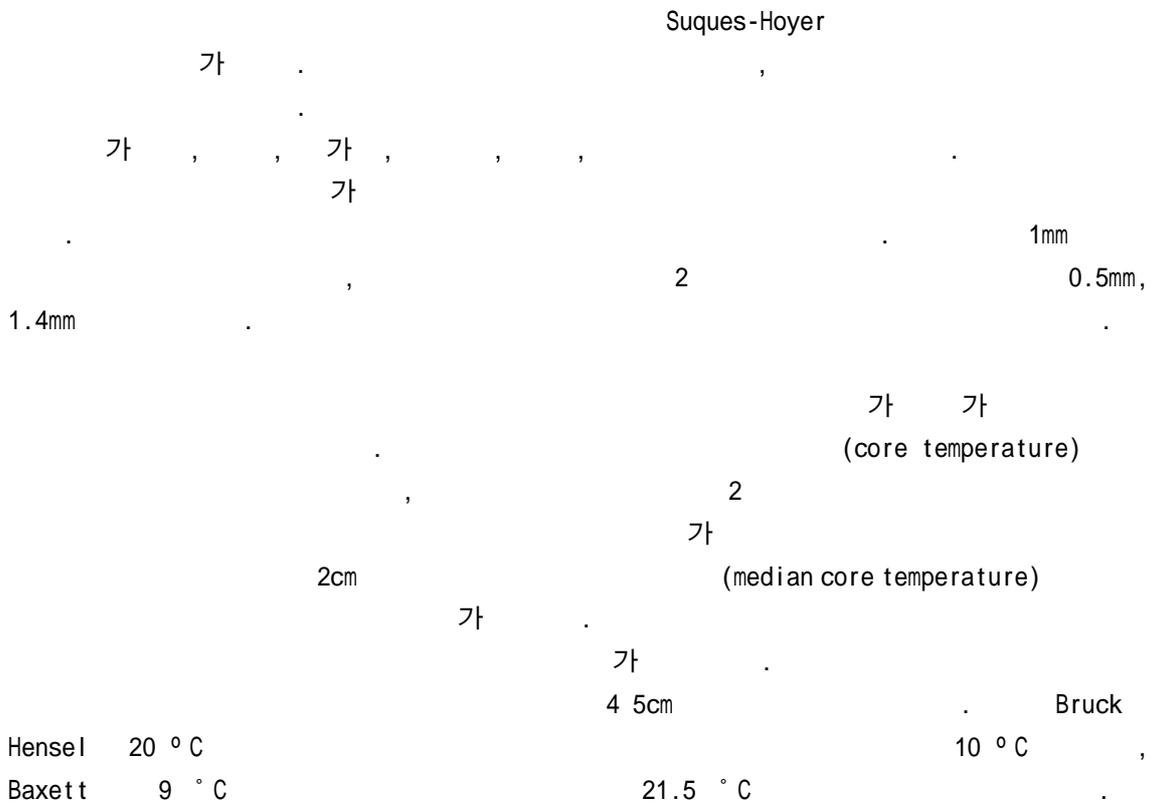
根) 5 (節前纖維)

維) (節後纖維)

(alpha -)

(sweat) (beta) (Folkow)

bradkinin



(3)

11)13)

thermatome() 12)

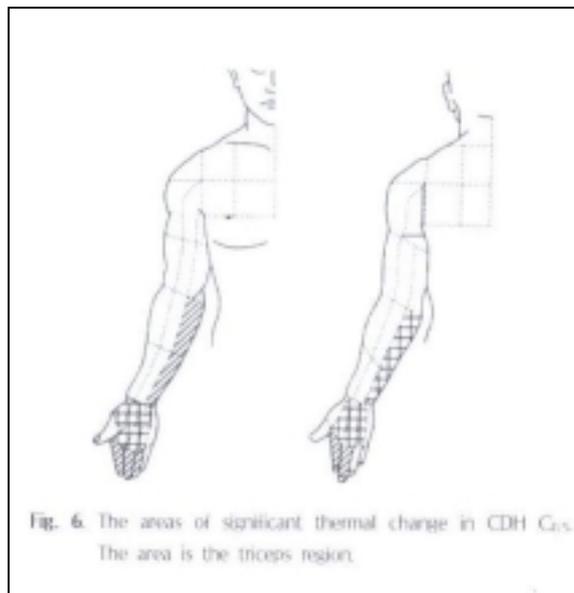
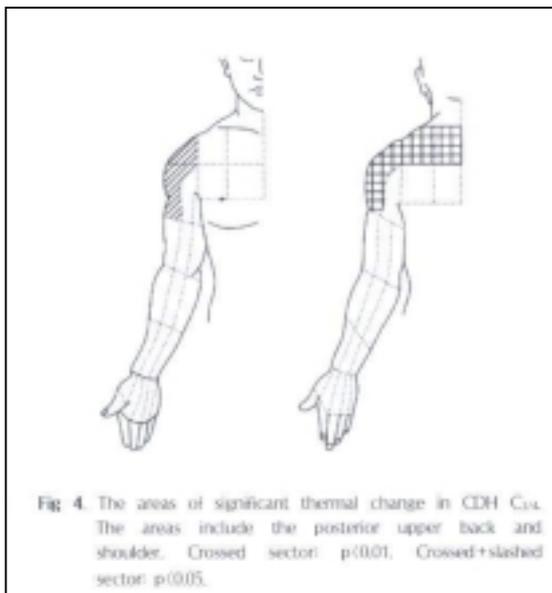
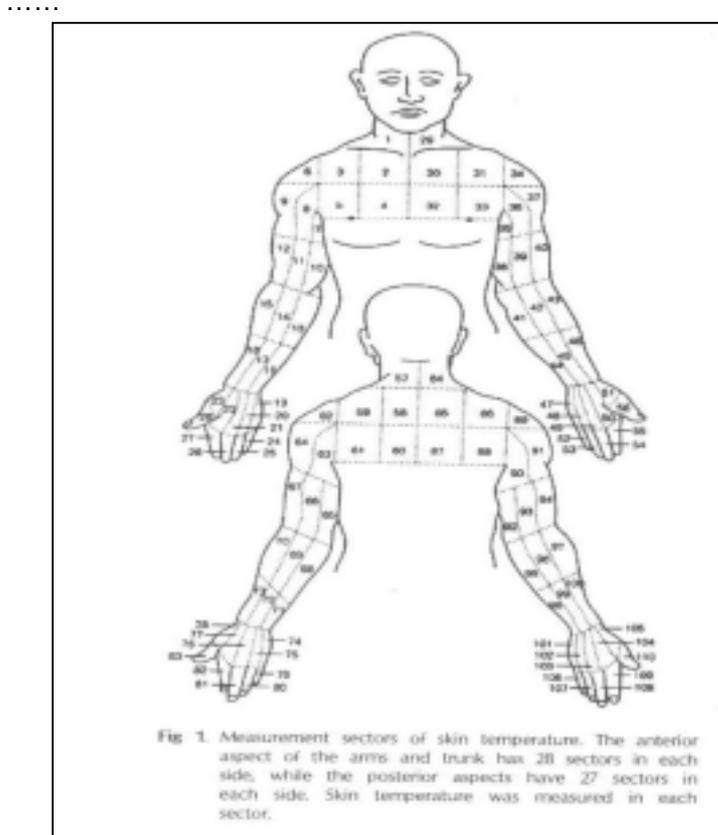
Figure 1.

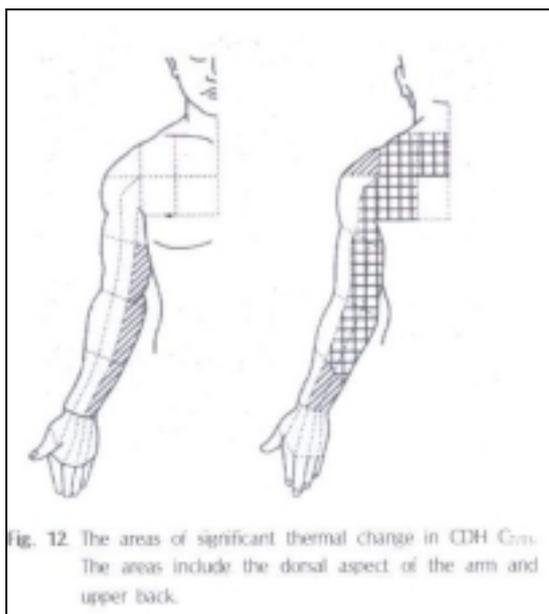
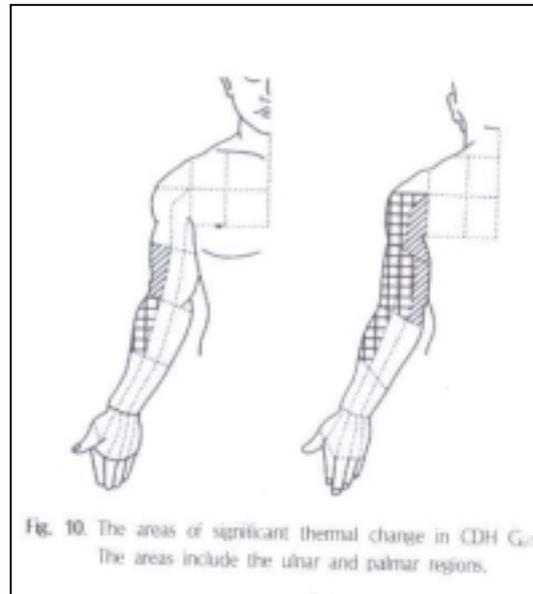
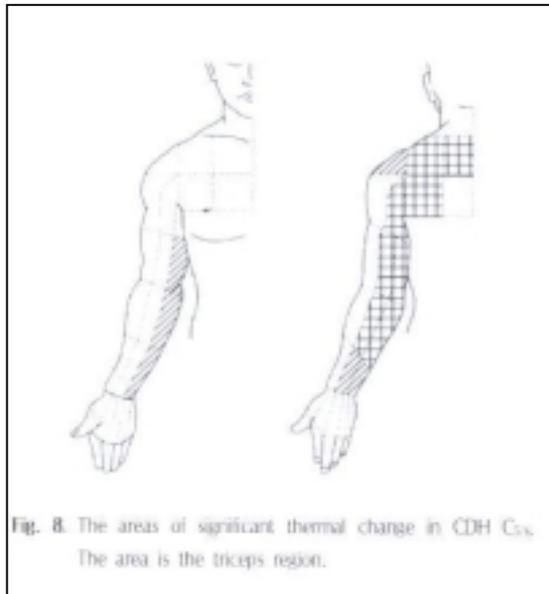
28

27

- Figure 4 . CDH 3/4 thermal change area ,
- Figure 6 . CDH 4/5 thermal change area
- Figure 8. CDH 5/6 thermal change area
- Figure 10. CDH 6/7 thermal change area

Figure 12. CDH 7/T1 thermal change area





- thermatome() 11)

Fig1. 15 , 20 4

Fig2.
--Dotted area : 0.1 °C, Slashed area : 0.2 °C , Double slashed area : 0.3 °C
Blacked area : 0.4 °C

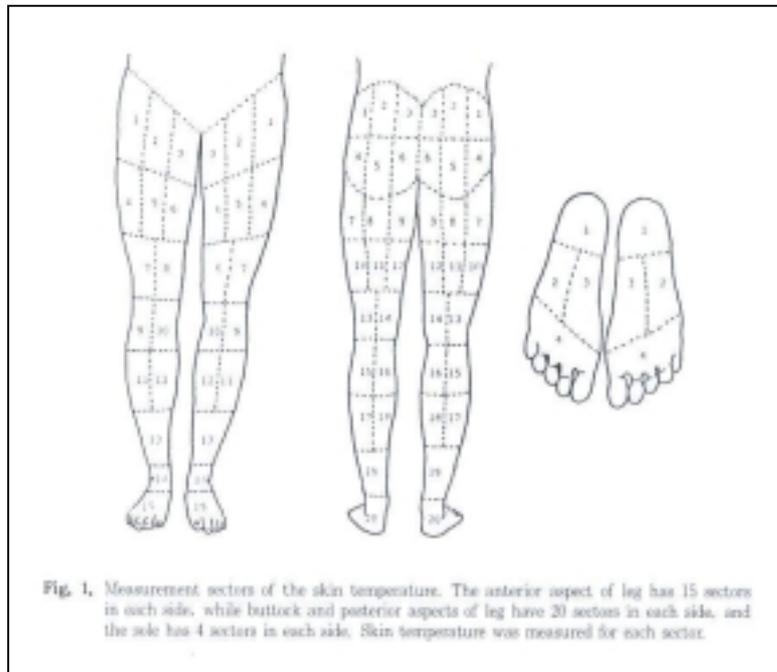


Fig. 1. Measurement sectors of the skin temperature. The anterior aspect of leg has 15 sectors in each side, while buttock and posterior aspects of leg have 20 sectors in each side, and the sole has 4 sectors in each side. Skin temperature was measured for each sector.

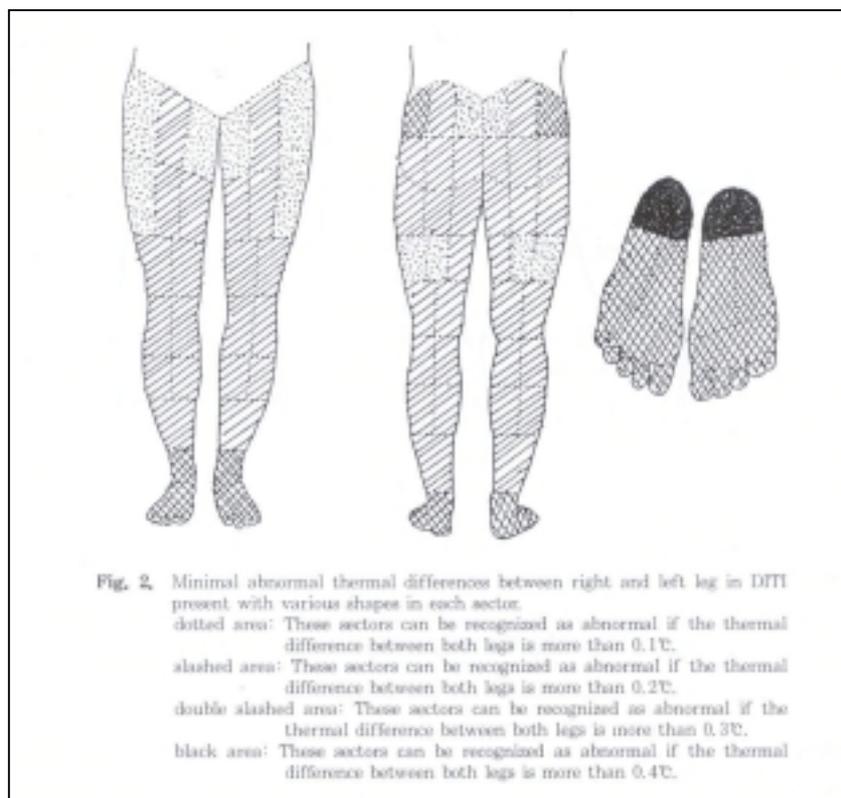
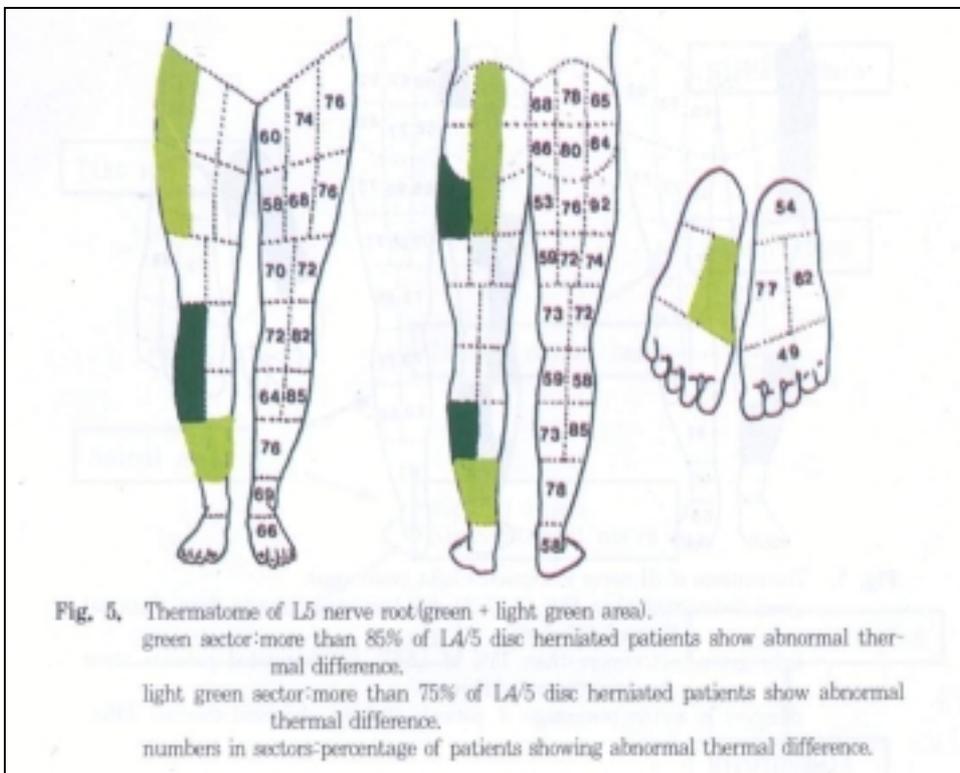
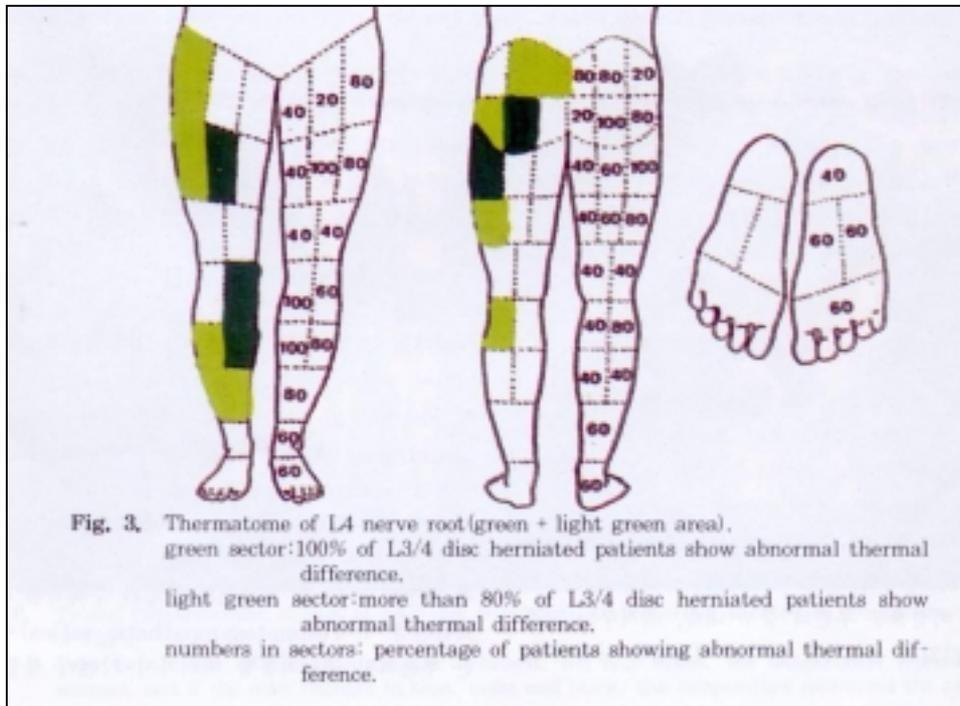


Fig. 2. Minimal abnormal thermal differences between right and left leg in DTTI present with various shapes in each sector.
 dotted area: These sectors can be recognized as abnormal if the thermal difference between both legs is more than 0.1°C.
 slashed area: These sectors can be recognized as abnormal if the thermal difference between both legs is more than 0.2°C.
 double slashed area: These sectors can be recognized as abnormal if the thermal difference between both legs is more than 0.3°C.
 black area: These sectors can be recognized as abnormal if the thermal difference between both legs is more than 0.4°C.



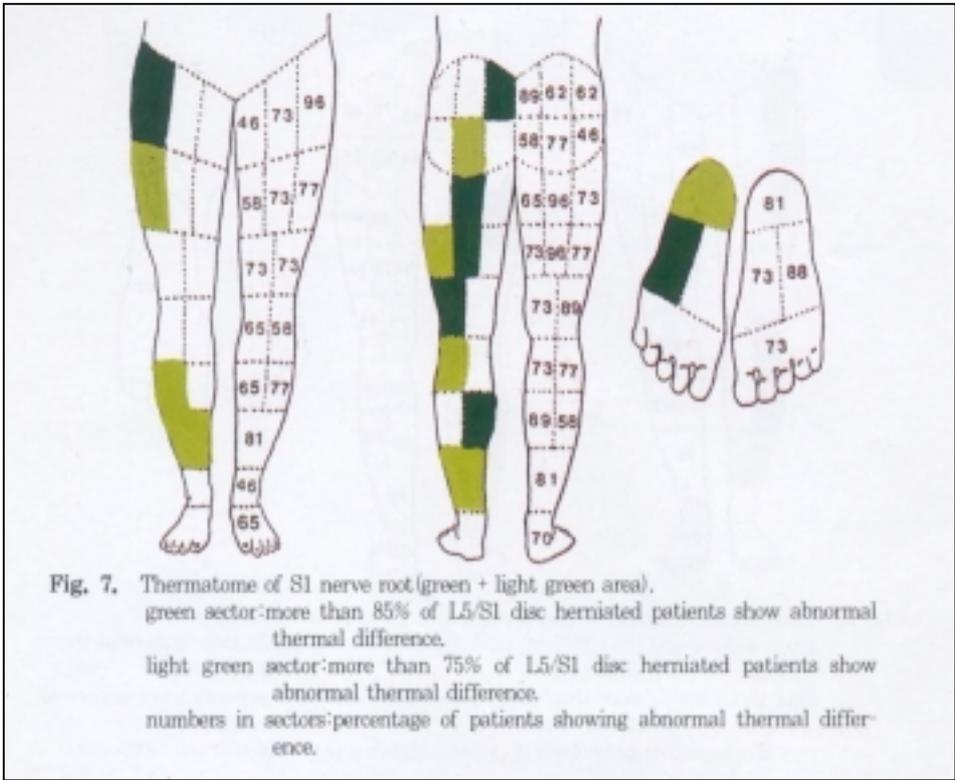


Figure 3, 5, 7 L3/4, 4/5, 5/S1 thermatome

/

75% 가 /

11)

11)

(thermatome) (sensory dermatome)⁹⁾

(sympathetic dermatome)¹⁴⁾

dermatome

13)

- 1) 若宮純司, 納光 弘, 井形昭弘 : 今日のサーモグラフィの意義と限界, 日本臨床 50 : 729-734, 1992
- 2) 若宮純司, 満洲邦彦, 藤正 巖, 中川伸一, 三宅 仁, 有村公良, 納光 弘, 井形昭弘, 滝沢行雄 : 画像定型化处理ソフトの開発, Bio. Therm. 18 : 176-184, 1998
- 3) Taylor G.I., Palmer J.H. : The vascular territories(angiosome) of the body : experimental study and clinical applications, Br. J. Plast. Surg. 1987; 40 : 113-141.
- 4) 森 於菟, 大内 弘 : 2. 脈管学, 解剖学, 金原出版 : 1-180, 1982,
- 5) 田崎義昭, 斎藤佳雄 : 第 5 章感覚の診かた・第11章感覚障害の診かた・ベッドサイドの神経の診かた, 南山堂 : 1-470, 1994
- 6) Fender F.A., Foerster's scheme of the dermatomes : Arch. Neurol. Psychiatr. 1939; 41 : 688-693.
- 7) 森 於菟, 大内 弘 : 1. 筋学, 解剖学, 金原出版 : 249-437, 1982
- 8) 平沢 興, 岡本道雄 : 2. 神経系, 解剖学, 金原出版 : 185-538, 1982
- 9) Keegan JJ, Garrett FD : The segmental distribution of the cutaneous nerves in the limbs of man. Anat Rec . 1948;102:403-412.
- 10) Park W and Bae DK : Comparisons of infrared thermogram, magnetic resonance imaging and eletro physiological test for patient to complain several types of pain . The korean society of Diagnostic thermology. In press. 2001.
- 11) Young Soo Kim,M.D., Hyung Shik Shin, M.D. : Thermatome of the Lumbosacral Nerve Roots : 最新醫學 Vol 37.1994; 29-36.
- 12) Richter C.P., Woodruff b.G. : Lumbar sympathetic dermatomes in man determined by the electrical skin resistance method, J. Neurophysiol.1945; 8 : 323-328.
- 13) Zhang HY, Kim YS, Cho YE:Thermatomal Changes in Cervical Disc Herniations.J of Korean Medical Thermology.2001;16-28.
- 14) Richter C.P., Woodruff B.G. : Lumbar sympathetic dermatomes in man determined by the electrical skin resistance method. J Neurophysiology. 1945; 8:319-326.
- 15) Richter CT, Woodruff BG : Lumbar sympathetic dermatomes in man determined by the electric skin resistance method. J Neurophysiology. 1945; 8:319-326.

3. (脊髓)

가 1)2)
3)5)

(1)

4)

/

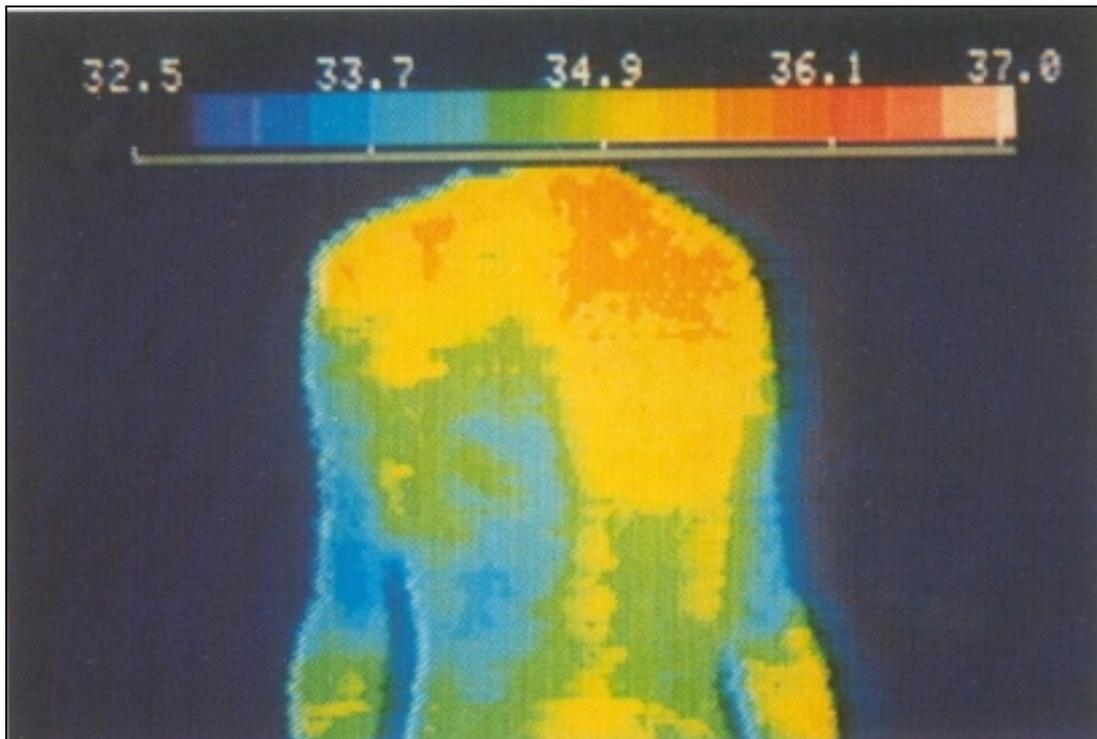
가 가

가 0.3

異常

1. (脊髓)

(背部)



(1).

가

/ 가

1)

1/3

1

3-4

(矩形)

ROI(Region of interest,)

ROI

1 3-4 ROI
가 heat stripe() (가 가
) () 가, heat flare)
(midline heat continuity on the back) 5)
/ 가 가

2) (背部温) 6)

가 7)8)
가 1/3
ROI 1 3-4
(頭髮) / (眼窩) (眉毛)
5-10mm ROI
1 , , / ()

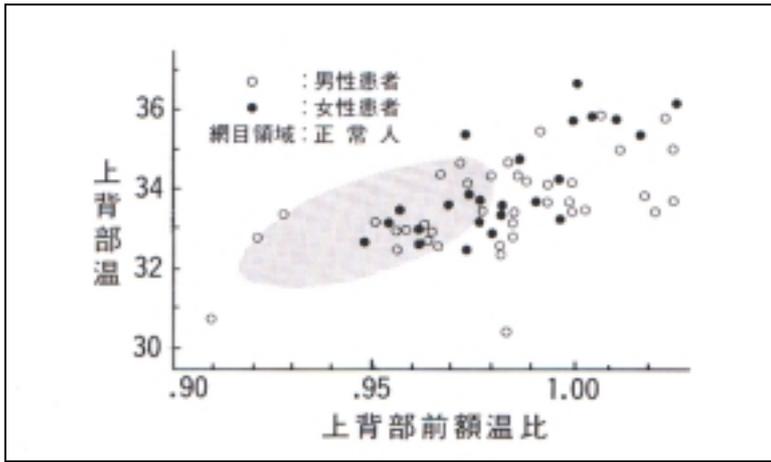
	(°C)				
				/	/
(n=67)	34.2 ± 0.5	32.8 ± 0.6	32.4 ± 0.7	0.959 ± 0.011	0.944 ± 0.013
(n=31)	34.3 ± 0.4	32.5 ± 0.7	31.9 ± 0.8	0.947 ± 0.016	0.931 ± 0.01
(n=98)	34.3 ± 0.4	32.7 ± 0.7	32.2 ± 0.7	0.955 ± 0.014	0.940 ± 0.016

가
0.955 ± 0.014, 0.940 ± 0.016 (1).
3,4
/
가 . /
(2).
sensitivity / 69.8%, /
54.0%, 44.4% 3가
가 , sensitivity 84.1%

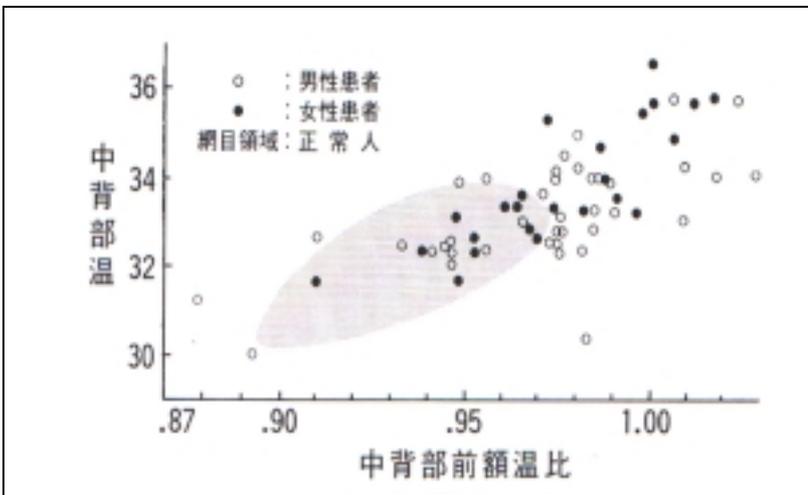
(2)

(intermediolateral nucleus) 3)

가 가 가 T1~L2-3
 가 ()
 (側柱) 가 ,
 가
 ~ 가 46).



(2) /



(3) /

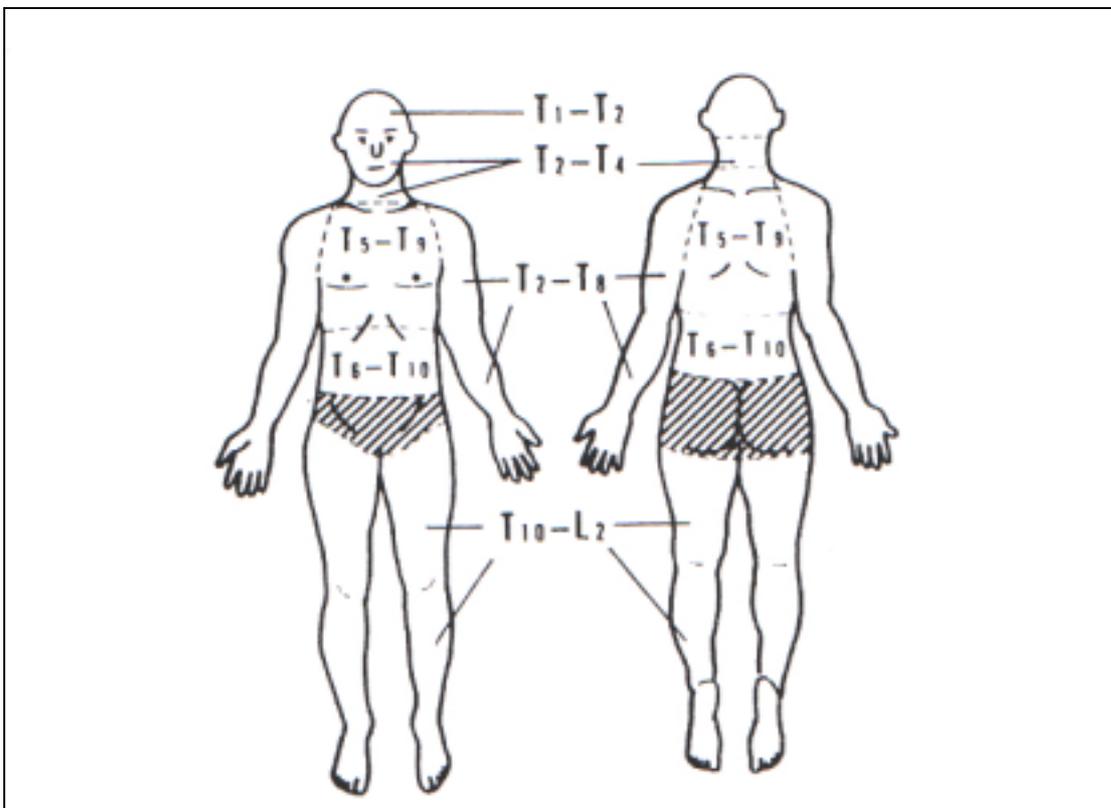
2
 1. U/F: / , M/F: /
 2.
 (U:upper back, M:middle back, F:fore head)

	U/F(-) M/F(-)	U/F(-) M/F(+)	U/F(+) M/F(-)	U/F(+) M/F(+)	
-)	10 (3)(0)(6)(1)	2 (3)(0)(6)(1)	0	8 (3)(0)(6)(1)	20
-)	0	0	0	9	9
+) (-)	5 (1)(2)(1)(1)	0	0	10 (2)(2)(5)(1)	15
+) (-)	4 (1)(1)(1)(1)	1 (0)(0)(1)(0)	0	14 (5)(3)(3)(3)	19
	19	3	0	41	63

가 (視床)
 T1~L2-3
 9)
 2 3 10
 2 , 1 T10-12
 T1~L2-3
 , 3
 3 ()

	(髓節)	
	C8/T1-T3/T4 T1-T4 T1-T3 T2-T4 T2-T5	Johanson Bonica Kure Brodal McDowall

	T1-T5 T2-T8 T3-T6 T4-T7	McDowall Bonica, White, Johnson Brodal Kure
	T6-T10 T7-T9 T5-T9 T7-L3	Johanson Kure McDowall McDowall
	T10-L2 T12-L3	Bonica, brodal, Kure McDowall, Johnson



(4) 3, MRI

MRI
5

가

가

(3)

가?

MRI

가

가 3)

/ (全額背部) (2) /

MRI

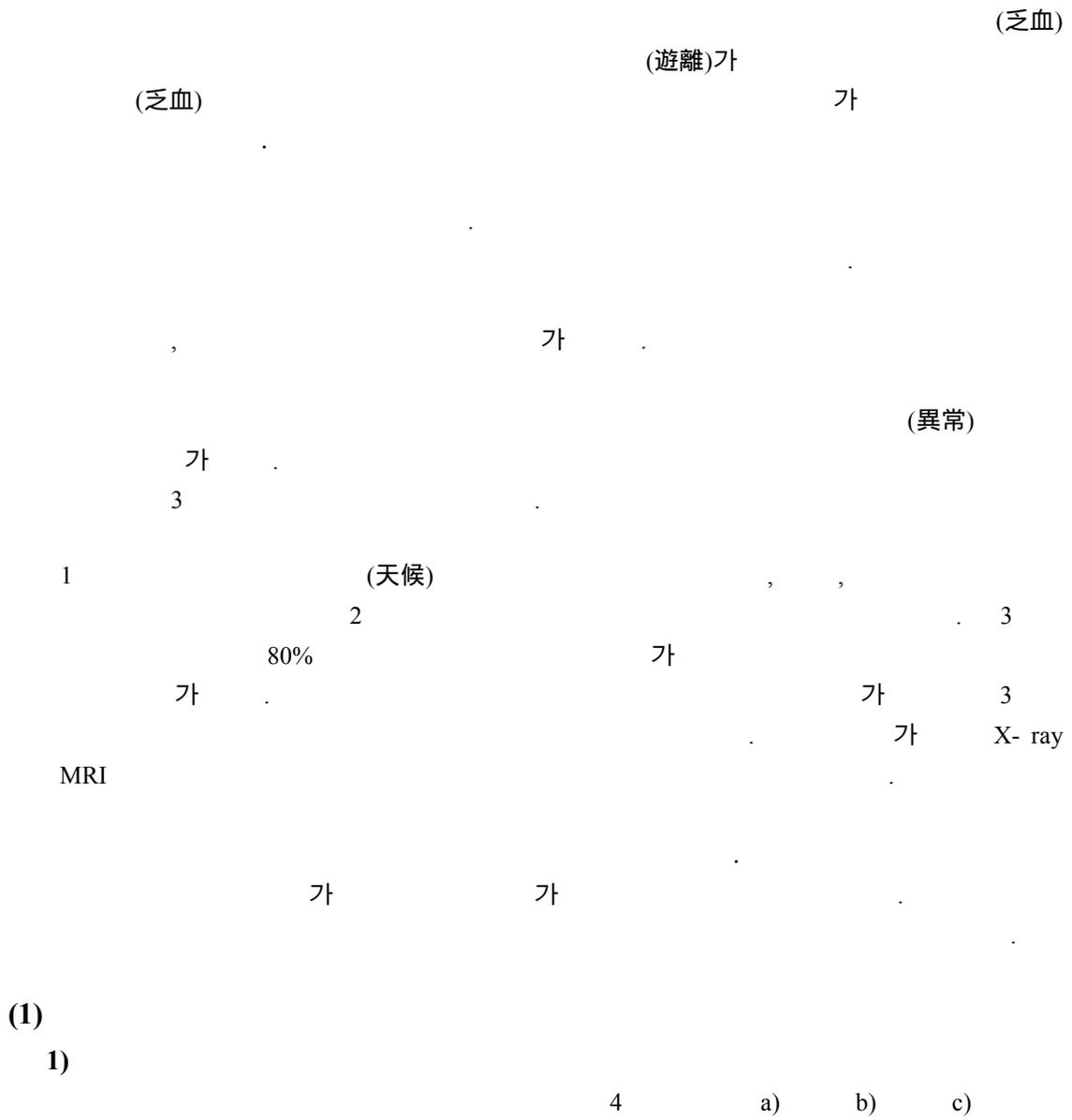
가

MRI

가

- 1) Einsiedel-Lechtape et al. : Thermographic studies of the normal back and of spinal lesions., Act Thermogy 1997; 2 :117-128
- 2) 相井平八郎 他 : 脊椎, 脊髓のサーモグラフィ, 臨放 28 : 457-461, 1986
- 3) Ishigaki T, Sakuma S, Okae S, Asai H, Shimamoto K : Infrared imaging in syringomyelia : Correlation with the laterality of the Syrinx., Thermology .1986;1 : 135-141.
- 4) Ishigaki T, Sakuma S, Sakai M, Kobayashi H, Asai H : Infrared imaging of spinal cord lesions : Relation between thermal abnormalities and extent of the lesion., Thermology.1987; 2 : 578-583.
- 5) Park W and Bae DK : Comparisons of infrared thermogram, magnetic resonance imaging and eletro physiological test for patient to complain several types of pain . The korean society of Diagnostic thermology. In press. 2001.
- 6) Ishigaki T, Ikeda Mitsuru, Asai H, Sakuma S : Forehead-back thermal ratio for the interpretation of infrared imaging of spinal cord lesions and other neurological disorders., Thermology. 1989; 3: 101-107.
- 7) 久住 武, 石崎文雄, 半間みや子, 浅賀英世 : 環境温と顔面皮膚温との関係, Biomedical Thermography 3 (1) : 1-3, 1983
- 8) 松田光司 : 健康成人男性の赤外サーモグラフィー所見, 日皮会誌 94 (3) : 245-259, 1984
- 9) Brodal A : Neurological anatomy in relation to clinical medicine. Oxford Univ Press, New York, 1969

4.



d)

(遊離) substance P가
bradykinin, histamine neuropeptides

가

substance P

1)

2)

1980 Wexler

2) 가

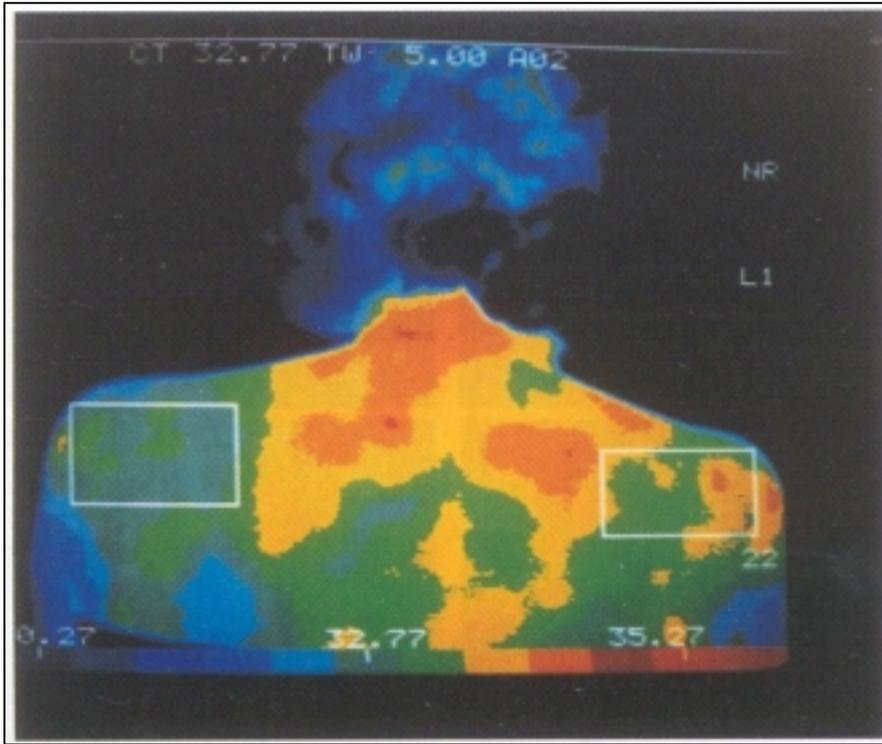
(異常)

가

1. 37 ,

(左肩甲部痛)

(頸部)



26

(心因性)

가

5

21

3)

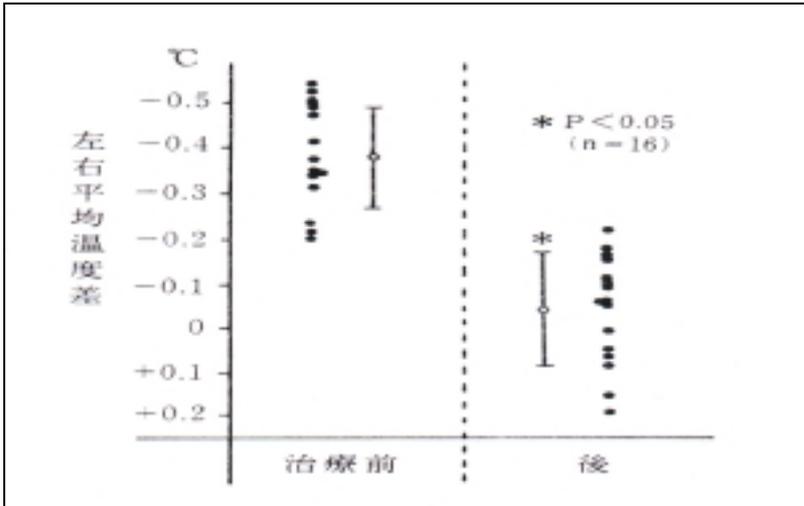
16

(2).

1.

(筋不動) (

)



2

(Pain score 2)

/

가

/

0.2

3)

가

가

가

가

L5, S1

가

4)5) 가

가

가

5)6)

()

가

7)

가

가

가

4)

(無發疹型) (皮膚) (皮膚)

(PHN)

(乏血) PHN Varicella-Zoster 가 PHN 가

(癍痕)

PHN PHN

PHN 가

(亞急性)

(iontophoresis)

8) PHN 가

(reflex sympathetic dystrophy, RSD)

가 가

5)

가
가

X-ray, CT, MRI

가

(心因性)

가)

가 / 가
가

)

가

가

가

가

가

)

(心因性)

(心因性)

(鬱病)

(鬱)

(妄想)

가

)

가

가

(가

)

(異常)

가

(異常)

6)

(肩關節 周圍炎:

50%

)

가

가

(凍結肩)

delto-pectoral portion

가

가

(2)

/

/

가

4

, 가 ,

4

/

9)

(屈側),

/ 가 0.3

thermal-pattern

0.2

9)

- 1) 寺田美恵, 真崎容子, 矢部雅哉 他: サブスタンス P に対するリドカインの拮抗作用について, *Pain Research* 5: 17-22, 1990
- 2) Wexler, C.E.: Thermographic evaluation of trauma (spine)., *Acta Thermographica* 5: 3-11, 1980
- 3) 平野勝介, 鈴樹正大, 渡部美種: 外傷性頸部症候群に対するサーモグラフィの応用, *医学・生物学サーモロジー* 3: 47-49, 1983
- 4) 本村喜代二, 満渕邦彦, 藤正 巖 他: 脊髄神経根圧迫症候群におけるサーモグラフィとミエログラフィーの対比, *医学・生物学サーモロジー* 8: 130-132, 1988
- 5) 高橋 弦, 高橋和久, 山縣正庸 他: 腰椎椎間板ヘルニアにおける患肢低温域と臨床所見 -サーモグラフィによる検討-, *臨床整形外科* 27: 33-39, 1992
- 6) 満渕邦彦, 沖永修二, 本村喜代二 他: 末梢神経障害において生じる体表温異常の病態生理に対する検討, *医学・生物学サーモロジー* 7: 104-107, 1987
- 7) 本村喜代二, 満渕邦彦, 藤正 巖: サーモグラフィによる腰部脊髄神経根障害の臨床診断応用, *医学・生物学サーモロジー* 9: 115-120, 1989
- 8) 鈴木紀行: 帯状疱疹皮疹治癒後の疼痛に対するステロイドを用いたイオントフォレーシス療法の効果. *ペインクリニック* 13: 644-648, 1992
- 9) 佐々木真理子, 平野勝介: 左右平均温度差の正常域と人体温度分布の恒常性に関する予備的研究, *医学・生物学サーモロジー* 18: 186-188, 1998

5.

가 , 2) 가 가 1) , 3) , 4) 가 가 , 5) 1)2)

(1)

1 1)2)

1 -

*

(股) ... (膝) ... (肩) ... (50) ...

*

(腰椎) ... (頸椎) ... ()

*

... ()

*

*

(2)

가 가 가

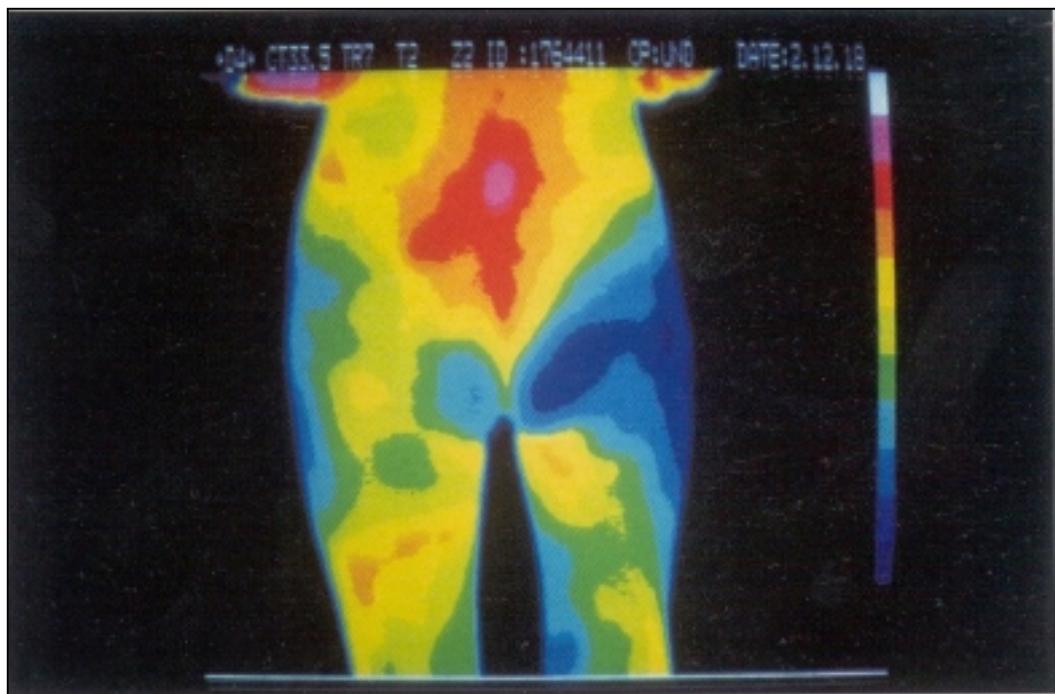
가

가 ,

가
 / 가
 (面) (点) , (矩形)

가
 (3) 가
 1)2)

1)
 가
 3~5)
 가



(1). (股關節)

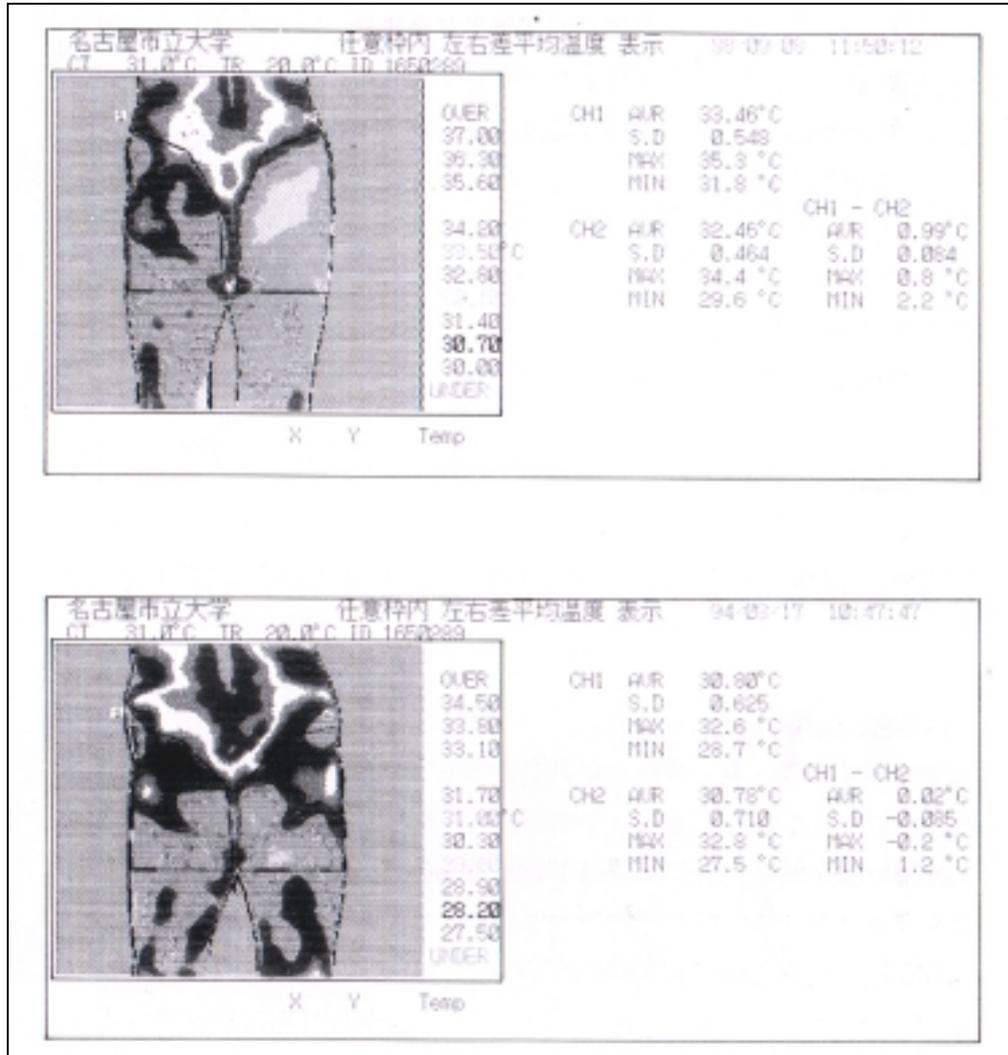
()

(1)

가
(外轉筋)

가

가



2.

: , : 5 4

/ 2(上)

() 0.99 가

가 (100) 50

가

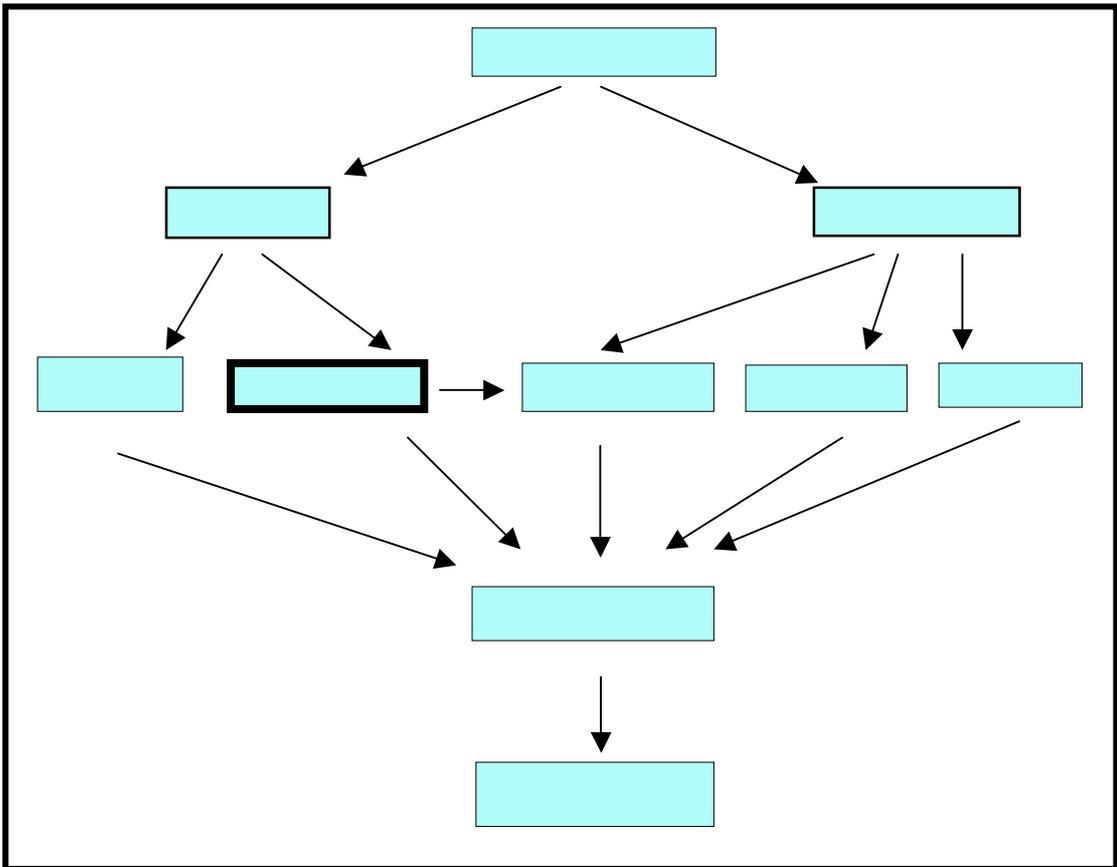
(2).

가

가

2()

가
 / 가 2() 5 4 / 가 0.02
 가 44 , 2() 100
 가 가
 (3).



(3)

가
 thermographic index (T1) Collins Ring, Engel 가 6~8)
 (穿刺排液)

가

가

()

가 /

가

2)

(腰椎) (椎間板)

가 , Keegan

(dermatome) 가

MRI

(thermatome)

(vascular thermatome)

가 / 가

가 가

(間歇性跛行) (脊柱管狹窄症) 가

가

(頸椎後從韌帶骨化症)

1, 2 가 가

1, 2 가 가 가 ,

가 가

(鬱血性)

가

(가)

가

3)

가 가

가 가

가

가 /

0.43 가 , /

19

가

(上腕神經層) ,

가

가

가

0.41 , 0.53

가

가

가 , 가 /

9)

4) -

가

가 X

- 1) 蟹江良一：整形外科疾患へのサーモグラフィの応用, *Biomedical Thermology*, 8 : 249-254, 1988
- 2) 蟹江良一：熱画像検査の手順と診断のための基準 —筋・骨格・神経系疾患—, *Biomedical Thermology*, 13 : 83-88, 1993
- 3) 蟹江良一 他：サーモグラフィによる変形性股関節症の評価とその意義, *Biomedical Thermology*, 9 : 139-141, 1989
- 4) 蟹江良一：変形性股関節症への医用サーモグラフィの応用, *関節外科* 10 : 1071-1081, 1991
- 5) Kanie, R. : Thermographic Evaluation on Osteoarthritis of the Hip. *Biomedical Thermology*. 1995;15 : 72-76,
- 6) Collins, A.J., et al. : Quantitation of Thermography in arthritis using multi-isothermal analysis. I. The Thermographic index., *Ann. Rheum. Dis.*1974; 33 :113-115,
- 7) Ring, E.F.J. : Objective measurement of arthritis by Thermography. *Acta Thermographica*. 1980; 5 :14-18,
- 8) Engel, L. M. : Thremography in locomotive diseases. *Acta Thermo-graphica*. 1980;5 : 11-13,
- 9) 蟹江良一：高齢社会とサーモグラフィ, *Biomedical Thermo-logy*, 17 : 90-96, 1998
- 10) Fischer AA. Documentation of myofascial trigger points. *Arch Phys Med Rehabil* 1988; 69: 286-291.
- 11) , , : Trigger point . 1991; 15: 527-533.
- 12) , : 가. . 1997; 21(3): 500-510.

6.

가 2 , 異常 (多糖), , ,

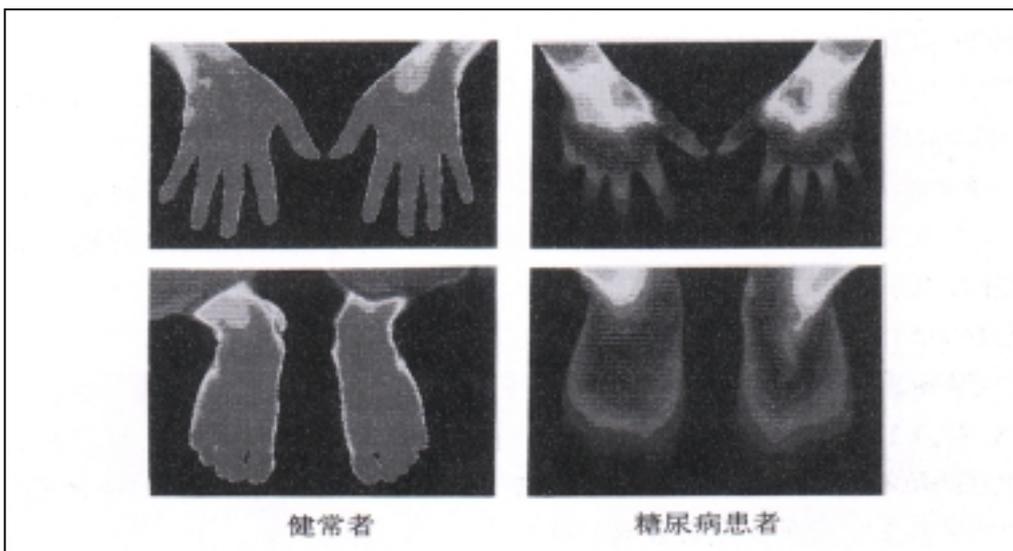
(1)

insulin , insulin 가 ,
 , 가
 가 가 (壞疽)
 가 가
 1).

(2)

1)

가 , (가)
 가 / 가 (가)
)가 / 가 3)



(1)

3)

가 가 가

II.III.IV

1

(가 , 가)

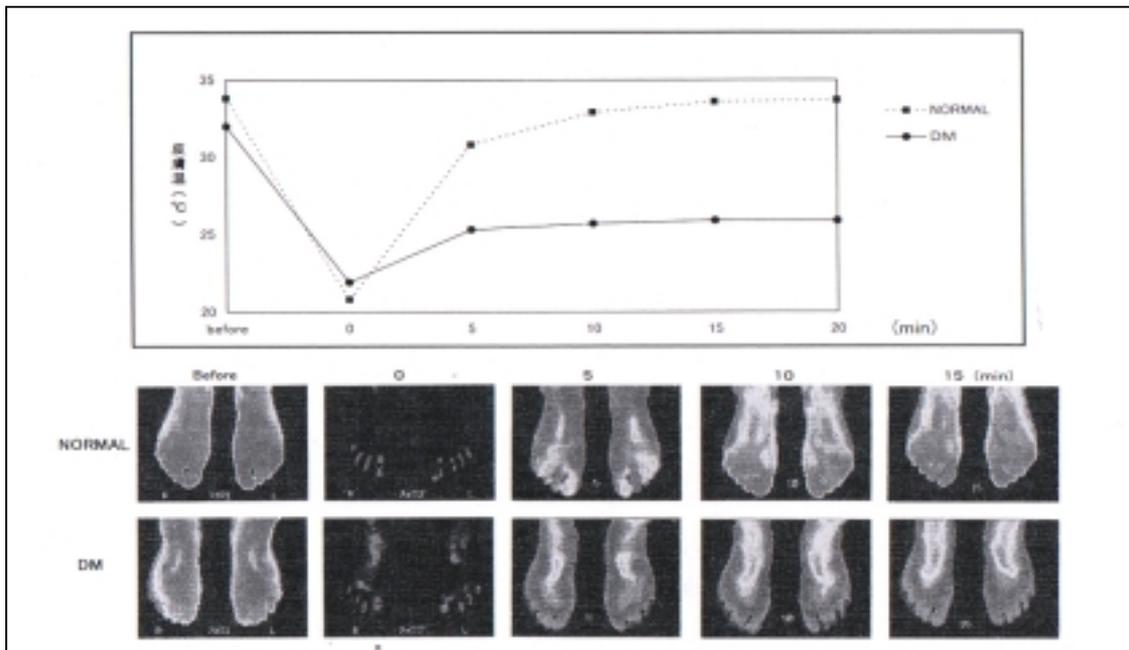
가

1

1

(mean ± SD) ()

	()		()			
	32.4 ± 1.3	33.0 ± 1.2	32.4 ± 1.3	33.0 ± 1.2	33.7 ± 1.7	33.3 ± 1.3
	3.24 ± 1.4	33.0 ± 1.3	32.4 ± 1.4	33.0 ± 1.3	33.7 ± 1.6	33.2 ± 1.2



(2)

가)

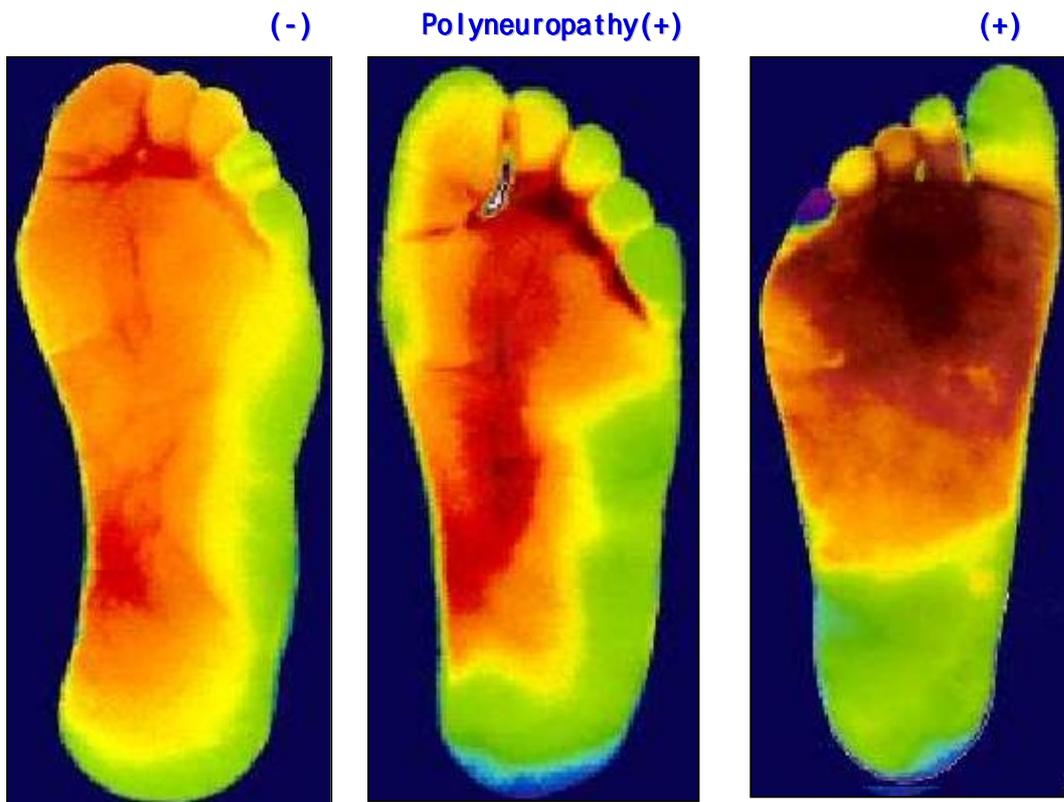
-
-
-
-

)

가

: great toe(GT), 5th toe(T5), heel(H), 3rd metatarsal head(MT3), lateral plantar arch(LP), medial plantar arch(MP)

)



2)

가

가

가

4)

2 10

1

3)

異常
(定性的)

가

$$t \quad (\%) = \frac{1}{-} \times 100$$

(2)⁵⁾.

가

가

가 (40~59)

(60~70)

6)

2

	(n=122) 47.9	(n=100) 53.8
5	85.7 +- 9.7	64.9 +- 21.9*
15	95.8	85.9
5	79.3 +- 14.2	52.7 +- 15.9*
15	98.0	67.1

(%) (mean +- SD) *p<0.01

122

3

5

15

50

15

5

3)

3)

4)7)

가

가

가

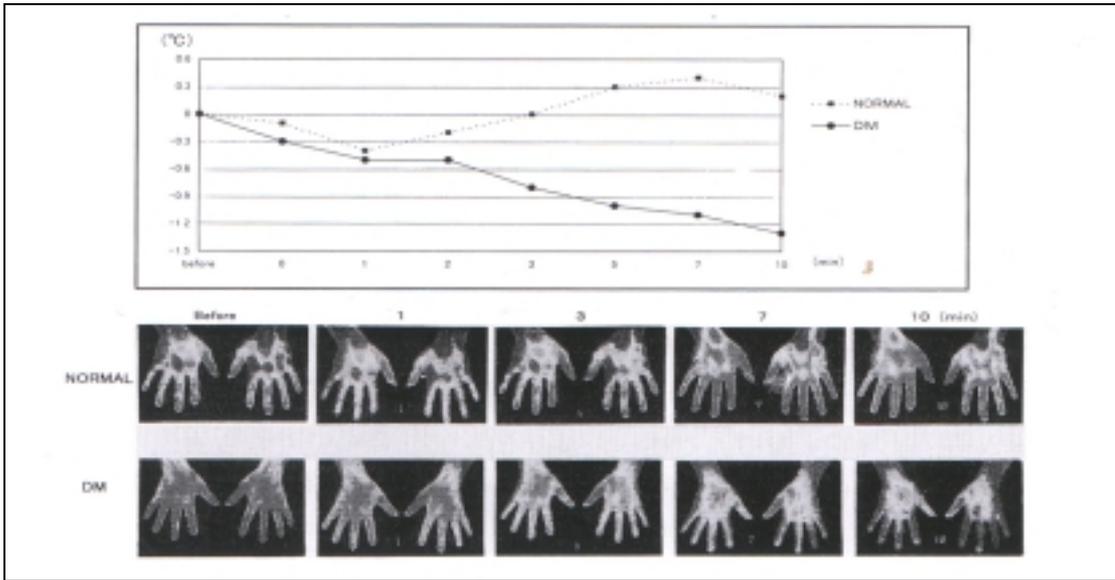
(3)

30

가

가

가



(3)

가

7).

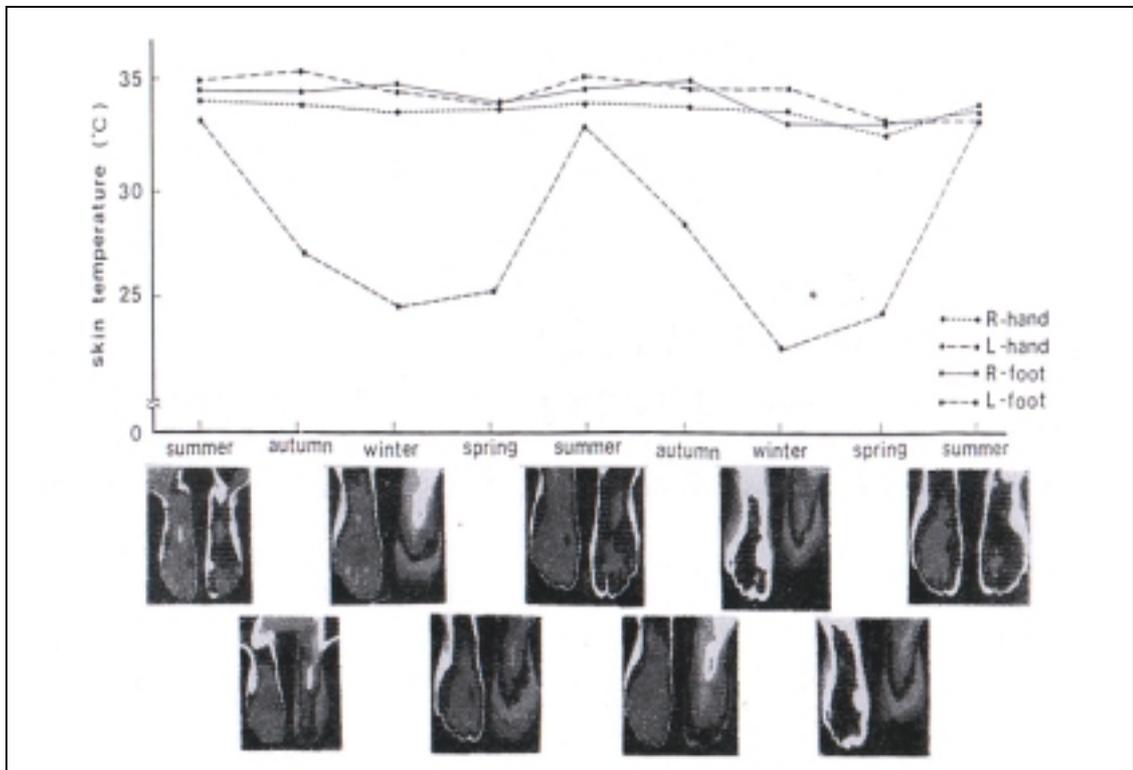
가

4)

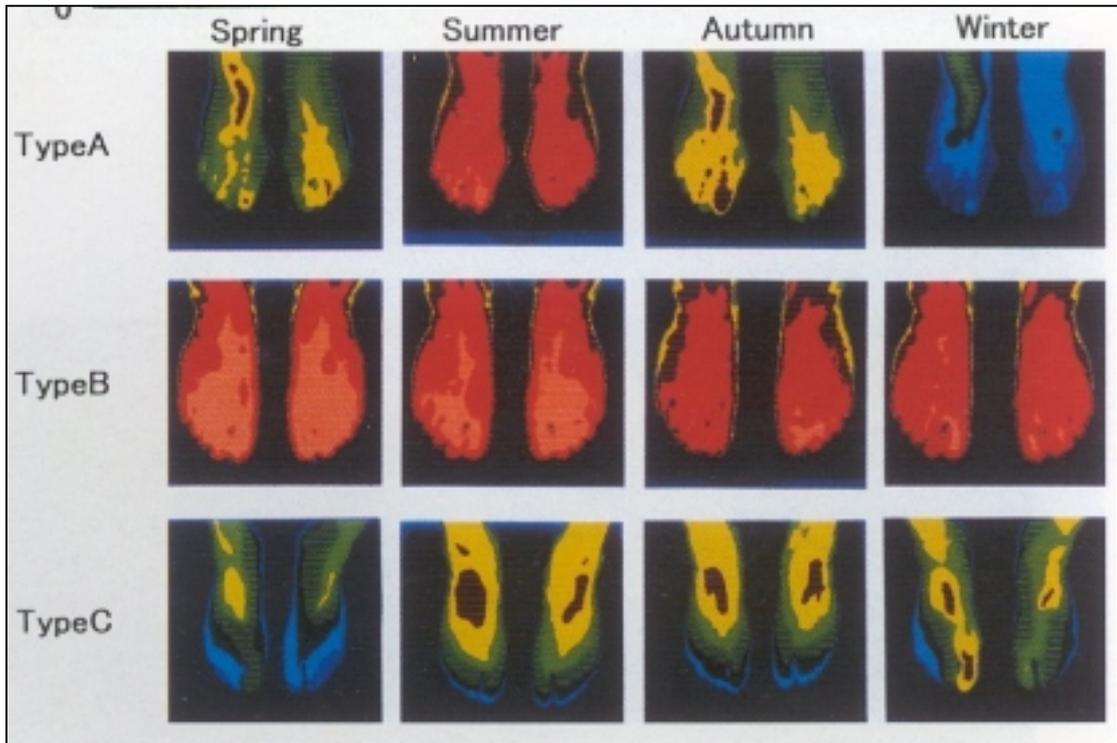
가

4

4)5)9)



(4)



(5).

3

(5).

5

Type A

5

32

Type B

5

32

Type C

가⁹⁾

2

가

가

가

가 . Type A

5) (壞疽)⁶⁾

가 (壞疽)

가

(壞疽)

a.

b.

가

c.

가

6)

6)

가

(, ,)

E₁

가

(切斷)

腑

가

(總和)

가

- 1) 松岡 瑛：サーモグラフィの臨床 —特に糖尿病を中心に—, *Biomedical Thermology* 12 : 189-194, 1992.
- 2) 芝田宏美 他：熱画像検査の環境条件の設定基準, *Biomedical Thermology* 13 : 57-59, 1993.
- 3) 松岡 瑛 他：脈管系疾患のサーモグラフィ診断基準の設定に向けて, *Biomedical Thermology* 12 : 140-144, 1992
- 4) 鹿野昌彦：負荷サーモグラフィについて, *Biomedical Thermology* 14 : 162-172, 1994
- 5) 松岡 瑛 他：臨床検査におけるサーモグラフィの現状と今後の課題 糖尿病・循環障害, *Biomedical Thermology* 14 : 154-161, 1994.
- 6) 松岡 瑛 他：糖尿病のサーモグラフィ, *サーモグラフィ* : 90-102
- 7) 平山宏美 他：糖尿病患者における末梢皮膚温反応, *Biomedical Thermology* 11 : 143-109, 1991
- 8) 村瀬成美 他：糖尿病性末梢循環障害における皮膚温の季節変動, *Biomedical Thermology* 12 : 88-91, 1992
- 9) 鹿野昌彦：各疾患における診断基準の提案, *Biomedical Thermology* 11 : 191-193, 1991.

7.

(1)

2000

1) 1956 Lawson²⁾

Lawson 가 가 가 가

가 Lawson Gaston³⁾ 가

가 가 가 가 3)

NO(nitric oxide)가 가

4)5)

8)9), 가¹⁰⁻¹²⁾ 가 6)7),

가 가 가

13)14) 가 X-

130 15)

89.6%

(2)

1)

248 (68%) Head¹⁰⁾ 68 (19%), 47 (13%) Jones¹¹⁾ 363

35 (35%), 65 (65%)¹⁵⁾

90.0%, 89.9%, 89.6%

2)

10.8% 240
130 90.8% 16)
가 110

3)

16)
16,17) Gautherie¹⁶⁾ 가
doubling time 가
가 doubling time 가가

4)

Head¹⁷⁾ 가 ferritin , DNA S-
Ki-67 (Proliferative-associated-antigen)
가 가

5)

Gautherie¹⁶⁾ Q ,
Q0-4 Q 1380 가 Jones¹¹⁾ ,
Isard¹⁸⁾ Q 가 가
가 가 가
19)
S-III 1 103 가 2cm 27
S-I 1 가 5 cm 17
S(Survival index)
가
Gautherie¹⁷⁾

6) (screening)

Hobbins20)

32 23% 68% 10% , Amarlic

89%

(3)

1)

가)

가

가

가

)

50~60%

가

가

24+- 1

18

가 20 가

가

가

가

)

10

가

2)

가)

가

가

skin to skin cross radiation
(下椽)

가

)

32

5

1

1

)

7),8).

(噴霧)

가

가

(4)

21).

가

(Th-1),

(Th-2),

(Th-3)

(1, 2,3)

1.

Th-1 ()

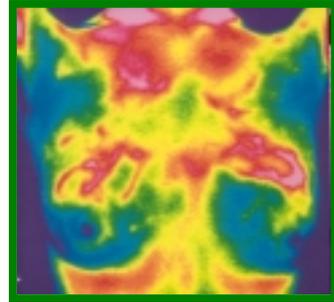
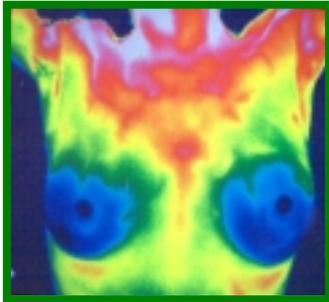
가

Th-2 ()

Th-3 ()

1 : Th-1 ()

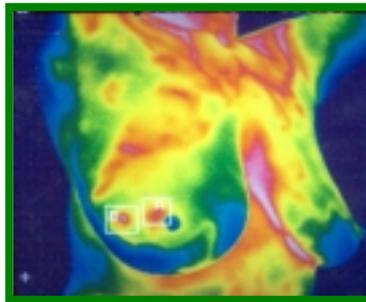
가



Th -1 (Normal) A vascular symmetry

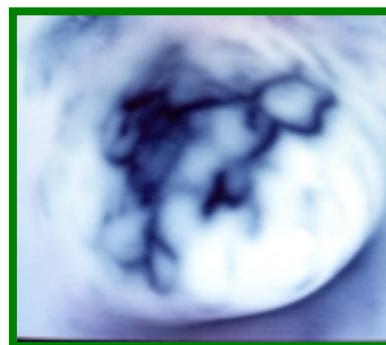
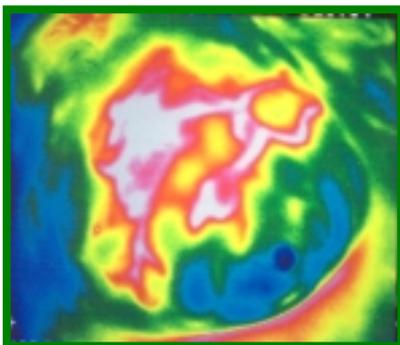
Th-1 (Normal) Vascular symmetry

2. Th-2 ()



Th-2 (Equivocal) : Localized heat abnormality only

3. Th-3 ()



Th-3 (Abnormal) : Localized heat & vascular abnormality

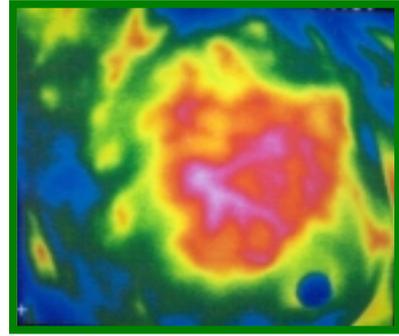
2)

45

3m

: 가)

가)



- 1). Cannon L. The validation of thermography. Amer Chiropractor 1987; 2:
- 2).Lawson RN. Implication of surface temperatures in the diagnosis of breast cancer. Can Med Assoc J 1956; 75: 309 -310.
- 3). Lawson RN, Gaston JP : Temperature measurements of localized pathological processes. Ann NY Acad Sci 121:90.1964
- 4). Anber M : Hyperthermia of the cancerous breast. Analysis of mechanism. Cancer Letters 84:23.1994
- 5). Anber M : Mechanism of hyperthermia of the cancerous breast. Biomedical Thermology 15:135.1995
- 6). Nathem BE, Burn JI, Macerlean DP : Value of mammary thermography in differential diagnosis. Br Med J 2:316.1972
- 7). Stark AM, Way S : The screening of well women for early detection of breast cancer using clinical examination and mammography. Cancer 33:1671.1974
- 8). Gautherie M, Gros CM : Breast thermography and cancer risk prediction. Cancer 45:51.1980
- 9).Hobbins WB : Thermography, highest risk marker in breast cancer. Proceedings of the Gynecological Society for the Study of Breast Disease.p267.1977
- 10). Head JF, Wang F, Elliot RL : Breast thermography is a noninvasive prognostic pcedure that predicts tumor growth rate in breast cancer patients. Ann NY Acad Sci 698 :153.1993
- 11).Jones CH, Greening WP, Davey JV, Greeves VS :Thermography of the female breast. A five -year study in relation to the detection and prognosis of cancer. Br J Radio 48:532.1975
- 12). Sterns EE, Zee B : Thermography as a predictor of prognosis in cancer of the breast. Cancer 67:1678.1991
- 13).Nyirjesy I. Breast thermography. Clin Obstet Gynecol 1982; 25: 401 -408.
- 14).Hobbins WB. Abnormal thermogram -significance in breast cancer. RIR 1987; 12: 337 -343.
- 15).Lee MH, Kwang JM. The role of thermography in the diagnosis of breast cancer. J Korean Surg Soci 1998; 54: 631 -639.
- 16).Choi HU, Lee DH, Lee HE, Park W, Lee MH. The detection of the heat production in breast cancer. J Korean Cancer Asso. 1997;29:656 -662
- 17).Gautherie M. Thermography of breast Cancer, measurement and analysis in vivo temperature and blood flow. Ann NY Acad Sci 1980; 335: 383 -415.
- 18).Head JF, Wang F, Elliot RL. Breast thermography is a noninvasive prognosticprocedure that predicts tumor growth rate in breast cancer patients.Ann NY Acad Sci 1993; 698: 153 -158.
- 19). Isard HJ, Sweitzer CJ, Edelstein GR. Breast thermogrphy: a prognostic indicator for breast cancer survival. Cancer 1988; 62: 484 -488.
- 20). Man Kyu Chae,M.D., Yong Seok Jang,M.D., Kyung Kyu Park,M.D., Kyung Yul Hur,M.D., Hye Kyung Lee,M.D., Wook Park,M.D., Min Hyuk Lee,M.D.. Infra -red Thermography as a Predictor of Prognosis in Breast Caner. J Korean Cancer Assoc 1999 : 31: 282 -288.
- 21).Hobbins WB : Thermography, highest risk marker in breast cancer. Proceedings of the Gynecological Society for the Study of Breast Disease.p267.1977
- 22). Hobbins WB : Abnormal Thermogram -Significance in Breast Cancer. RIR 12:337.1987
- 23). Min Hyuk Lee,M.D., Jun Min Kang,M.D. The role of Thermography in the Diagnosis og Breast Cancer. J Korean Surgery Soci 1998:54:631 -639

8.

(varicocele)

(蔓狀靜脈叢, pampiniform plexus)
(90%)

(蛇行)

가
가

(逆位)가

가

subclinical varicocele

1)

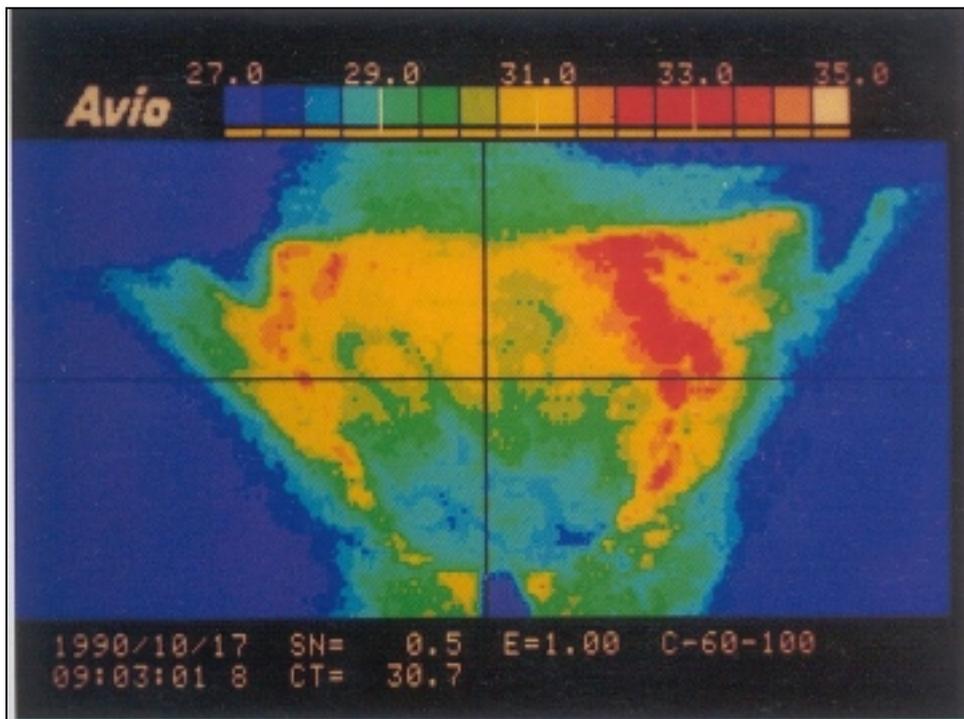
(1)

가 0.3

異常

(異常)

1. (精索) (靜脈瘤)(32),



(1). 가 2). 가 가

(2)

98.4%, 92.7% 2)
subclinical varicocele .

2) 3

- 1) Yamamoto M, Hibi H, Hirata Y, Miyake K, Ishigaki T : Effect of varicoelectomy on sperm parameters and pregnancy rate in patients with subclinical varicocele : A randomized retrospective controlled study J., Urol 1996; 155 : 1636-1638
- 2) Hamm B, Fobbe F, Sorensen R, Felsenberg D : Varicocele : combined sonography and thermography in diagnosis and posttherapeutic evaluation., Radiology..1986; 160 :419-424

9.

1)~4)

(1)

- 1) 2) , 3) 4)
- 5) 6) 7)

(())

1)

tapering off

thermal amputation

(强皮症) 가 ¹⁾
(細動脈)

4)5)

2) (網狀 皮斑)

cutis marmorata teleangiectasia congenita (皮斑)

3)

- 1) () b) () c)
- 가 (瘰)

(造影) screening test 가

가

(造影)

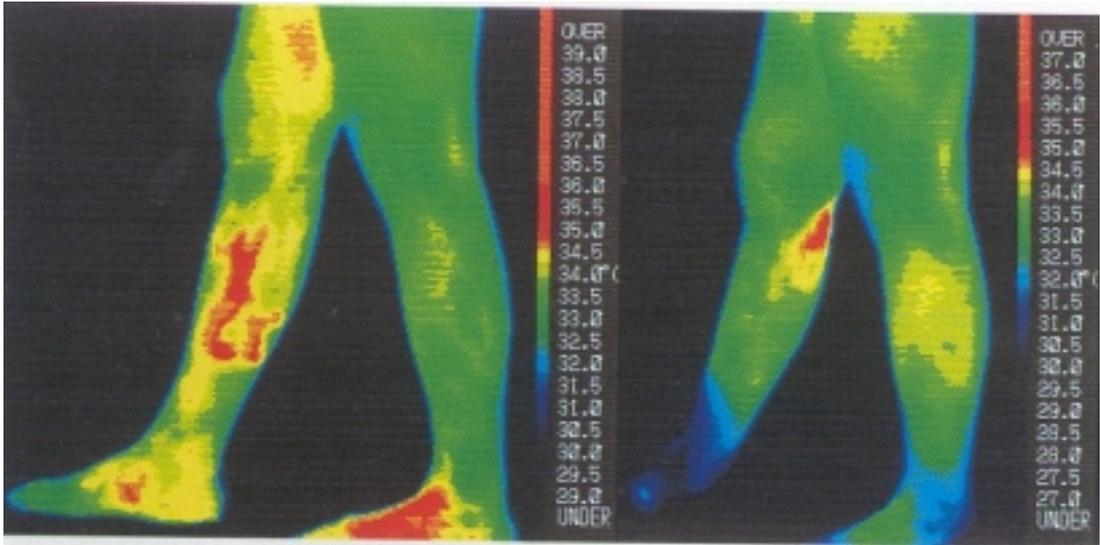
5)

4) (鬱滯)

1/3

, 가 가 가 가
가
整

가
 , 가 (鬱滯)
 1 , 가 (鬱滯)
 가



(1). 65 , (結果)

5) , 가
 가

2 3)
 6)

(病巢)가

7) 가
 / 가
 6 6) 가
 가 가 30 가 7)

- 1) 三木吉治：サーモグラフィの臨床的応用，西日本皮膚 40：696-701，1168-1175，1176-1186，1978
- 2) 三木吉治，熊切正信，村野早苗 他：皮膚疾患系（膠原病，形成外科領域を含む）サーモグラフィ診断基準，Biomedical Thermology 12：154-157，1992
- 3) 川津智是：熱画像検査診断基準の設定に向けて -皮膚科におけるサーモグラフィ検査の現状と今後の課題-，Biomedical Thermology 14：119-124，1994
- 4) 川津智是：サーモグラフィで何がわかるか -皮膚科領域における赤外線サーモグラフィ検査の現状-，皮膚病診療 18 (9)：786-792，1996
- 5) SHIRABE, H., TAKAGI, K., KAWATSU, T., Evaluating of infrared thermographic diagnosis and ultrasound color doppler ultrasonography in patients with peripheral circulatory disturbance and skin ulcer. Biomed Thermo. 1995;15：163-165
- 6) 高取明正：サーモグラフィによる冷え性の診断の確立，日産婦誌 44：559-565，1995
- 7) 川津智是，高木圭一，調 裕次：足底部の足踏み負荷サーモグラフィ，Biomedical Thermology 14：105-112，1994

10.

, 가 , / , ,

가

가

(舌口腔底癌)

가

가 가
가

가 가 가
가

1~5)7)

< >

(1)

가

1)

(瘦)

2)

1

2

가 ,

3)

(2)

(穿通枝皮弁) , (遊離皮弁) ,
가 .

2

1)

thermal recovery

1)4)5)

thermal recovery

1 a)

(廣背筋)

(

)

thermal recovery

(廣

背筋)

(胸背)

(

).

가

(胸背)

(分枝)

(1b).

thermal recovery

4).

2)

(穿通枝)

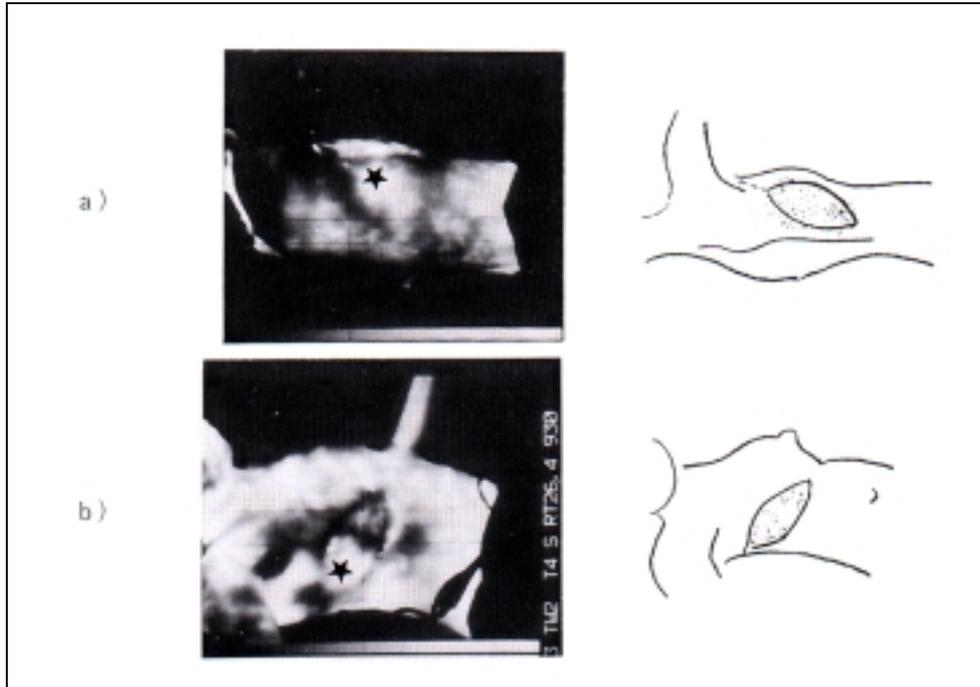
1~4)

(頭部)

(頸部)

(hot spot)

6)



(1).

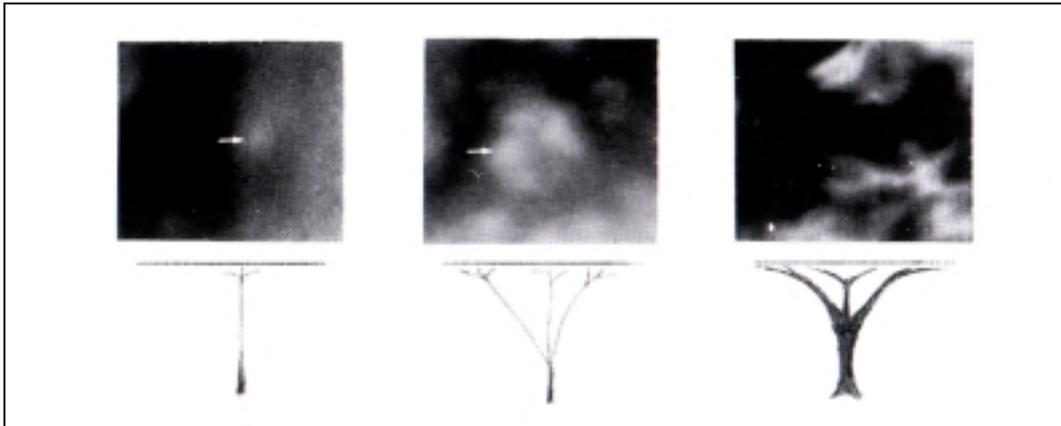
가) (廣背筋) (胸背) (),)

(島狀皮弁, 腋 가) 0.5mm 가
(遊離皮弁, 가)

(走行) 가 (2)⁷⁾. hop spot 가 가
(type I). 가 (Type II). 가

(2. , Type III).

(3). Type III 가 Type I



Type I

Type II

Type III

(2).

가

(Type I).

가

(Type II).

가

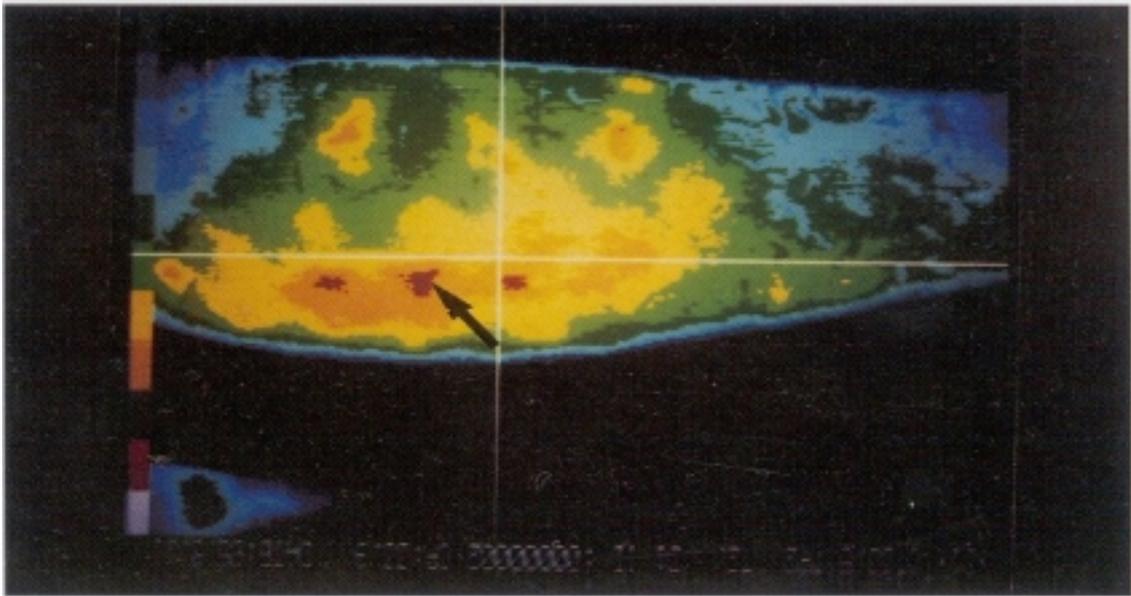
(Type III).



(3).

Type III

Type I



(4).

(穿通枝)

(,)

3

(4)

(遊離皮弁)

(3)

1)

가)

thermal recovery

가

4).

)

thermal recovery

hot spot가

hot spot

2)

(遠位端) 가
가
(遠位端) (
가
가

- 1) 佐藤俊次, 新井克志:サーモグラフィによる Axial pattern flap の作成について, Bio-Med. Thermog. 5 : 88-90, 1985
- 2) 新井克志, 木村康隆, 佐藤俊次:われわれの考案した micro-vascular flap について, 手術 39 : 1057-1059, 1985
- 3) Arai, K., Sato, T. and Ito, Y. : Use of microvascular island pedicle flaps for facial tissue defects. Ann. Plast. Suurg. : 181-186, 1987
- 4) 新井克志, 中野峰男, 伊藤嘉恭:サーモグラフィによる皮弁作成における工夫, Bio-Med. Thermog. 9 : 225-227, 1989
- 5) 新井克志, 佐藤俊次, 東 威成:形成外科領域におけるサーモグラフィの応用について; Axial pattern flap の作成に対して, Bio-Med. Thermog. 8 : 94-96, 1988
- 6) 林 祐司, 並木保憲, 島井修平:サーモグラフィによる血管穿通枝の検索, 第31回日本形成外科総会(東京), 1988
- 7) 新井克志:画像診断と手術シミュレーション, 最近の進歩:109-116, 克誠堂出版, 東京, 1995

11.

가

(1)

1)

가

가

/

가

2)

(頸肩腕)

()

가

가)

가

)

가

가

가

가

1),

(中膜筋)

,

(内膜)

2)

3,4)

a)

, 가

,

가

가

5),

가

6),

가

(FSBP%)⁷⁾

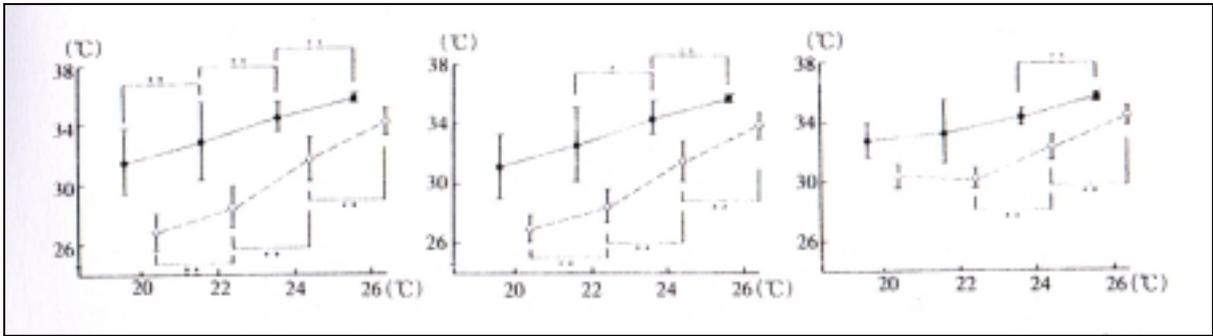
b)

(2)

가
가
26 30
5~7 24 30
22, 20 50%
0.5m INFRA-EYE 180()
0.5 5

1)

7, 6, 20, 24, 26 10 가 (DIP)
가 (1-1,
1-2, 1-3).



1-1

1-2 가

1-3

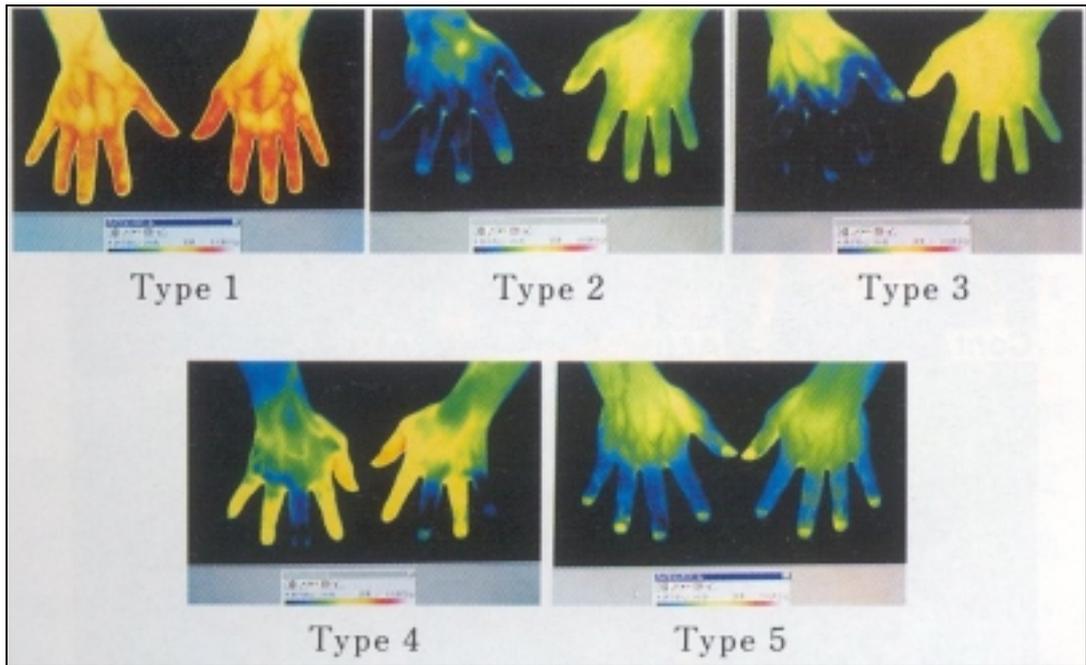
** P<0.01, *P<0.05

20, 26 DIP (1-1) 가
11.0, 8.4 가 ()
1-2) 가 가 9.8,
7.9 (1-3) 가
6.5, 5.8

가
가
가

2)

2 5 , (基節) MP ,
IP , 1, 2가 (中手骨) 15
30
24 .
(Type 1), 1 / 가
(Type 2), 가 가 (Type 3), 가
가 (Type 4), 30 (Type 5)
5 .
5 .



(2).

3)

40 (67.5 ± 6.2 , 12.9 ± 5.6)
가 1. Type 1
26 63%, 24 57%, 22 38%,

20 3% Type 1 가 .
 Type 1 Type 5 Type
 異常 가 가 20 97%가 Type 5
 가

	26	24	22	20
Type 1	25	23	15	1
Type 2	5	3	1	0
Type 3	6	2	5	0
Type 4	2	4	6	0
Type 5	0	0	1	7
Type 3, 5	1	6	9	22
Type 2, 4	1	1		
Type 2, 3		1		
Type 2, 5			2	3
Type 4, 5				5
Type 2, 4, 5			1	1
Type 3, 4, 5				1

4)

가 가 가
 (FSBP%) FSBP% strain-gauge Plethysmography DM
 2000(Medimatic) 3 가 10 5
 가
 FSBP% 24 75%
 , 75% 異常

가)

24 FSBP%가 75%
 Type 1
 (2). 26 57.1%, 24
 66.7%, 22 76.2%, 20 100.0%가
 84.2%, 84.2%, 57.9%, 5.3%
 2
 26 24 22 20
 57.1% 66.7% 76.2% 100.0%
 84.2 84.2 57.9 5.3

가 가
 가 24
 가

) 가 가 가

24 FSBP%, (5, 15~20), (5, 10), 70 8,9)

3. 4 24

46.5%

85.3%

3. 가

3 가 가

		85.3%	46.5%
FSBP%		88.2	
	(5, 10)		
5		5.9	97.7
10		50.0	69.8
	(5, 15~20)	85.3	55.8

, 가 24

- 1) 那須吉郎, 新宮彦助, 嘉本崇也 他: 振動工具使用による Raynaud 症候群 (第一報) 動脈撮影について, 中部整災誌, 15 (3) : 553-557, 1972
- 2) Takeuchi T: Pathological changes observed in the finger biopsy of patients with vibration-induced white finger. Scand J Work Environ Health . 1986; 12 : 280-283.
- 3) Ishida G, Nasu Y, Sato T et al: Sympathetic nerve activity in the skin in relation to vibration-induced white finger. Scand J Work Environ Health . 1992;18(2) : 124-127
- 4) Harada N et al: Hormonal response to cold exposure in subjects with vibration syndrome. Kurume Med J .1990;37(Supple) : 456-452.
- 5) 那須吉郎, 黒沢洋一, 田草清治 他: 振動障害の末梢循環障害に対する冷風負荷皮膚温テストについて, 日災害医誌 38 (2) : 111-119, 1990
- 6) 那須吉郎, 黒沢洋一, 田草清治 他: 振動障害の末梢循環障害におけるレーザードップラ血流波形と冷風負荷皮膚温テスト, レイノー現症との関係について Biomedical Thermology 11 (2), 135-139, 1993
- 7) Kurozawa Y, Nasu Y, Nose T: Diagnostic value of finger systolic blood pressure in the assessment of vasospastic reaction in the finger skin of vibration-exposed subjects after finger and body cooling., Scand J Work Environ Health. 1991;17 : 184-189.
- 8) Nasu Y. Kurozawa Y: Comparison of the diagnostic values among Thermography and three kinds of provocation tests for vibration induced white finger(VWF). Biomedical Thermology. 1995;13(2) :157-162.
- 9) Nasu Y. Kurozawa Y: Comparison of the diagnostic values of three kinds of provocation tests for vibration induced white finger. in ARBETTE OCH HALSA vetenskaplig skriftserie 1995;eds by G. Gemune, A. Bramar, M. Hagberg etal in Sweden.1995 ; 109-116.

12.

(1)

1)

(鍼灸) 가
黃帝內經() 傷寒論() 가
가 言正() 가
(針) 가
2,000 가
三焦 想定 (5臟 6
(가 ,)(,)(,) 가 異常 異常

2)

(機轉) 가 가
異常
3.5
.45

가

(2) (鍼灸)

1) -

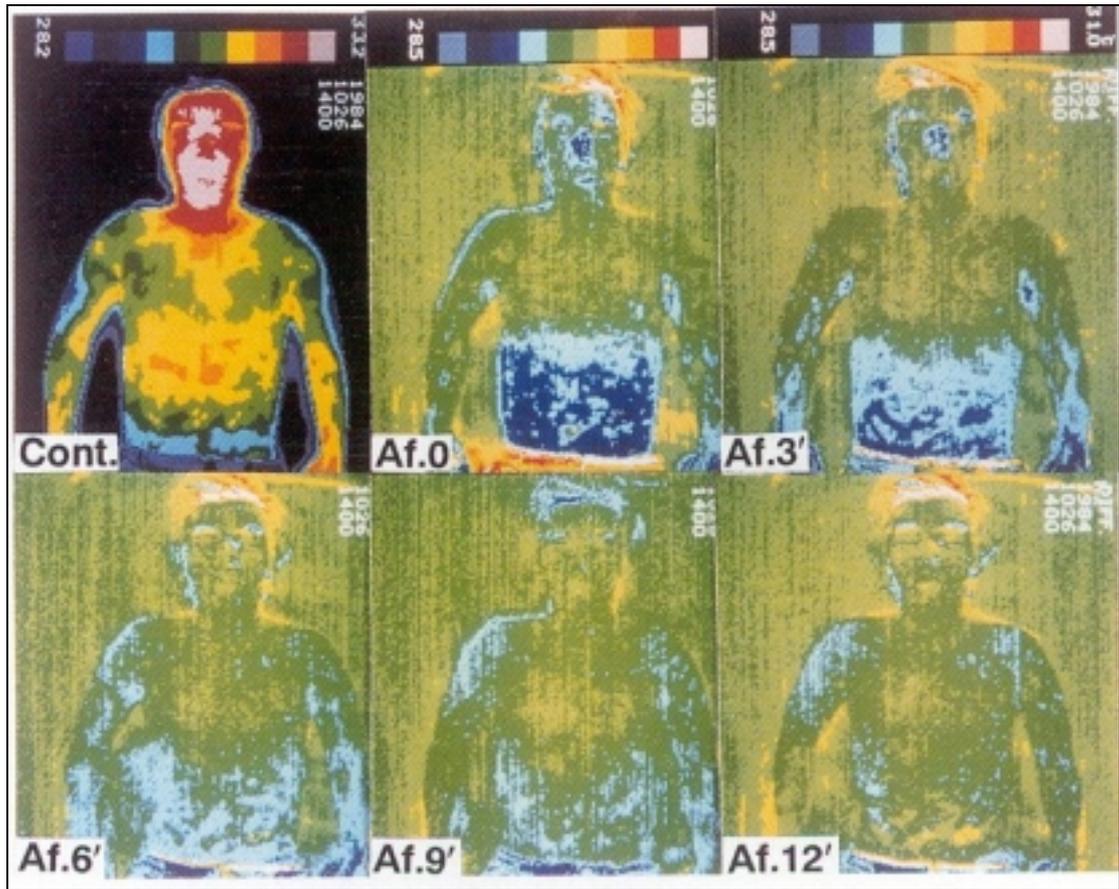
(氣 穴)

(-)

가

(,)

가 .¹⁾



(1).

(1)

가

가

()

가

2) (鍼灸)

1~3

/
가

2).

2)

3) (鍼灸)

2

(刺鍼中),
가

3)

(波高)

가

가

가,

가

가,

가

beta

4)

5)

(臥位)

(立位)

가

가

(

)

100

(臥位)

가

가

(

)

(5mm

-

가가

-

가

가

(深刺15~20mm

,

-)

10

(

가)

β

10

가

(3)

가
가
가

6)

가
가 ?

(14 / 8)

(頸腕)

가

1~3

가

(4)

1)

(10 , 21~29)

4 . 7 . 10 . 1
7)

가

가

3

(1)

(2)

4

가

7

1

가

2)

(臥位)

(立位)

가)

8)

가

가

(立位)

()

가 2.0~3.1
) 1~2
 9) 1.7~2.7 가
 4 12
 () 가
 -
 가 -

(5) (鍼灸)

1) (鍼) 10)

143
 (,)가 < > <
 >가 가 , < >< >> >
 가 (,) 119
 , 12 ,
 7 , 3 , 2 - 33 ,
 28 , 가 24
 가 143 90
 62.9% < >< > 가 70.3%
 < 가 >< 가
 > 80.0%
 가 가 44 44 30
 가

2) (鍼)

가)

5 , 1 , 4 .
 가 / ()
 (後正中線)

)

1 , 5 .
 4 .

)

2 , 5 , 가 3 . 7 .
 (, ,)
 가

3)

10)
 (30mW (照査) 1mW (照査))

40 29 (72.5%)
 - (座位) (外關穴, ,

3) 照射

- 1) 森 英俊：サーモグラフィによる経絡経穴現象の研究, *Biomedical Thermology* 7 (2) : 217-228, 1987
- 2) 西條一止：皮膚温分布と経絡、経穴現象, *日本温泉気候物理医学会雑誌* 39 (3・4) : 1-96, 1976
- 3) 森 英俊, 西條一止 他：鍼刺激による心臓・血管系の反応について, *Biomedical Thermology* 11 (2) : 50-53, 1991
- 4) 西條一止, 森 英俊 他：Decreased heart rate by acupuncture stimulation in humans via facilitation of cardiac vagal activity and suppression of cardiac sympathetic nerve, *Neuroscience Letters* 227 (3) : 165-168, 1997
- 5) 西條一止, 森 英俊 他：鍼灸刺激で誘発される生体の自律神経系・内分泌系・免疫系反応及びそのメカニズムの解析, 東京都衛生局平成3年度から平成5年度東洋医学事業研究報告書：76-98, 1994
- 6) 森 英俊, 西條一止：診断基準の設定にむけて, *Biomedical Thermology* 12 (3) : 145-153, 1992
- 7) 西條一止, 森 英俊：健康成人男子の全身皮膚温分布の季節変動, *Biomedical Thermology* 6 (1) : 43-45, 1986
- 8) 森 英俊, 西條一止：熱画像検査診断基準の設定にむけて (II), *Biomedical Thermology* 13 (2) : 77-82, 1993
- 9) 森 英俊, 西條一止：熱画像検査診断基準の設定にむけて (3), *Biomedical Thermology* 14 (2) : 131-149, 1994
- 10) 森 英俊, 西條一止：疼痛, 不定愁訴に対する鍼灸療法の効果とサーモグラフィ, *Biomedical Thermology* 17 (2) : 133-143, 1998

III.

가

가

1.

가

가

30

1970

가

가

가

가
가

가

가

가

1980

가

가가

가

<

>

< >

< >

가

/

가가
가

100

(帶域)

가

가

가

가

가

가

가

가

21

IV.

(infra-red imaging or thermography)

(核溫, core temperature)

(殼溫,

shell temperature)

(走査型)

, tele-

(contact thermography)

(走査型)

(microwave)

가

(Infrared imaging thermography)

(受光)

(受光) ,

(Infrared detector)

가

가

InSb

HgCdTe가

serial time

가

(contact thermography)

30~35

(temperature distribution)

(thermatomal dermatome)

가 dermatome
thermatome

體節的

異常 가 /

(high thermal area, hot area),
(cold spot)

(low thermal area, cold area)

(hot spot)

가

(pre-areolar heat)

(edge sign) 異常

(vascular pattern)

(temperature difference) , ΔT

가

(region of interest)

(maximum temperature)

(mean temperature) ,

(minimum temperature)

(temperature gradient ,heat stripe)

가

가

가

(thermographic index, TI)

()

(thermographic index, TI)

(thermographic score ,TH)

score, TH ,

TH1 TH2 , TH4 TH5 , TH3

TH1 TH5

thermographic

. TH3

가

(dynamic thermography)

(steady state thermography)

가

(serial real time)

(stress)

(thermal recovery)

가

가

가
2

가

(thermographic venography)

(reactive hyperthermia)

가

가

가 가

가

IV.

1999 2
80% ,
 , ECG Patient monitor
SRP ,
7 , " ISO 9001 " ,
"EN46001" "CE" "
MEDICA 가 ,
가
/

-- --