The place of absolute temperatures in breast thermography

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SUMMARY. The absolute temperature map of breast thermograms remains static in 85.7% of normal women, when rescreened in the same hormonal phase. Absolute temperatures failed to be valuable in the differential diagnosis of breast lesions.

Key words: thermography; breast absolute temperature; breast temperature in menstrual status.

It has been recognised for a number of years that each woman has a characteristic breast thermogram, the pattern of which remains constant unless her hormonal status changes and which reverts to normal after any temporary change in that state ([1,2]). With the possibility of computerised thermographic screening, it would be useful to know if breasts have a static temperature map as well as vascular pattern. The equipment used in the project was an Aga 665 with a standard temperature reference source. There is an 11" lens used at a focal distance of 6 feet. The equipment is allowed to stabilise for fifteen minutes after switching on. The women cool for fifteen minutes and the screening is done in the same ambient temperature of 18" C plus or minus 1" C. Considerable care is taken to maintain these standards so that conditions for examination are completely reproducible.

The temperatures recorded are that of the areola, and the maximum and minimum temperatures, i.e. the range of temperature over the breast. The temperature of the supra-sternal notch is also noted. With the available equipment, it was not possible to assess the mean temperature or the total heat output, both of which I consider should be investigated.

Women were chosen for this project when they had normal thermograms by accepted criteria ([3]), and when their breasts were clinically and radiologically normal on two examinations at an interval of one year. Women with a past history of breast pathology were excluded. To avoid any effect of circadian rhythm, repeat examinations were done within the same hour of the day as the first examination. 758 women who fulfilled these conditions have been examined. The group consists mainly of childless women, those of low parity and those with a family history of breast cancer.

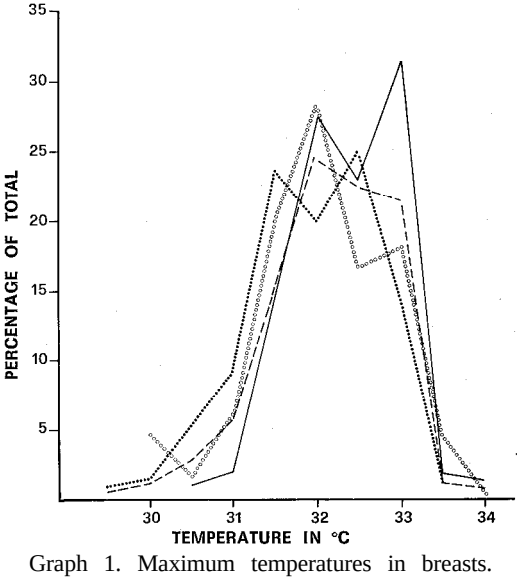
When re-screened after twelve months: 84.9% (642) had temperatures within 1" C of the previous recordings. Graph 1 shows the maximum temperatures of the breasts in those women, divided into three groups - those in the reproductive phase of life, the menopausal, and the post-menopausal. It will be noted that, on the whole, there is a general tendency for the temperatures to be lower in the post-menopausal group compared to the reproductive group. This is also the case with the areolar temperatures (Graph 2).

One hundred and sixteen women had changes over 1" C in two or three of the recorded temperatures (Table I). 28.2% of

Table I. **Constancy of temperature on rescreening.**

Temperatures assessed: maximum, minimum and areolar

Total number of women		758
Temperatures within 1°C of previous readings when rescreened after twelve months		642 (84.7%)
Change of more than 1°C in two or three readings after twelve months		116 (15.3%)
Of these 116 women		
Reproductive phase (35% down, 65% up)	33 (28.2%)	
Menopausal phase (49% down, 51% up)	31 (27.4%)	
Postmenopausal phase (88.5% down, 11.5% up)	52 (44.4%)	



Graph 1. Maximum temperatures in breasts.

— — — — 753 Normal controls:
——— 352 Reproductive phase of life;
o o o o 134 Menopausal;
• • • • 272 Post-menopausal.

these women had a regular menstrual cycle, 27.4% were menopausal and 44.4% post-menopausal. Of those in the first group, 35% had a fall in temperature and 65% a rise in temperature. The change in temperature in 80% of this group was considered to be due to hormonal influences. The alteration in temperature was recorded at a different stage of the cycle from the previous estimation and when repeated at the same stage of the cycle, was comparable with the original recording.

In the menopausal group of 31, 49% showed a fall, **51%** a rise in temperature and this varied from time to time - probably due to an unstable hormonal effect.

Of the 52 in the post-menopausal group, all but 6 had a fall in temperature. This could be important, in that a rise in temperature in a post-menopausal woman might herald pathological change.

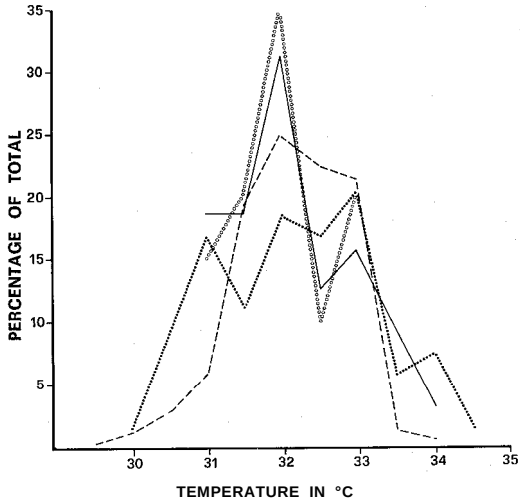
Table II. **Temperature ranges (in degrees centigrade) according to menstrual status.**

	Reproductive Phase			*Menopausal Phase*			*Post-menopausal Phase*		
	No.	*Max. temp.*	*Areolar temp.*	*No.*	*Max. temp.*	*Areolar temp.*	*No.*	*Max. temp.*	*Areolar temp.*
Controls (758)	352	30.5-34	28-33	134	30-34	2832.5	272	29.5-33.5	27.5-32.5
Cancers (54)	31	30-34.5	28-33	6	3 1.5-33	30-31	17	31-34	28-32.5
Pre-malignant (20)	12	31-33	27.5-31.5	5	31.5-33	29.531	3	32-33	30-3 1
Benign (32)	17	31-34	28-32	2	32.5-33	30.531	13	31-33	27.5-32.5

This project suggests that provided the screening is done in the same hormonal state, absolute temperatures should remain within plus or minus 1" C in 85.6% of normal women.

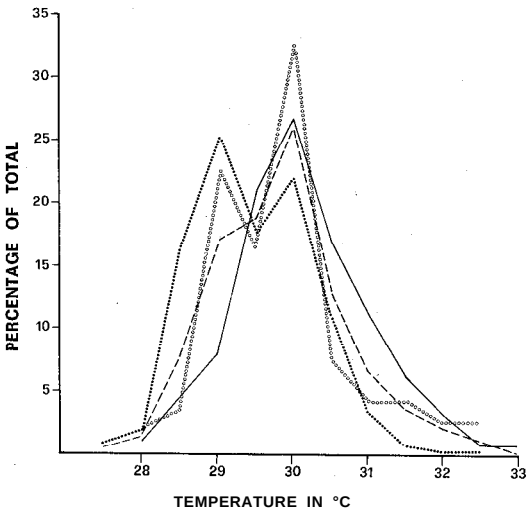
Encouraged by these findings, comparison of the temperatures in normal controls was made with those in the pathological breast of 106 women subjected to biopsy. It has been shown previously ([3, 4]) that thermography, using relative temperatures, has no part to play in the differential diagnosis of breast conditions but purely indicates the breast requiring further investigation by mammography. It was hoped that absolute temperatures would give a lead in the differential diagnosis of abnormal thermograms.

In the control women, the maximum temperatures (Graph 1) occur between 29.5°C and 34" C and the areolar temperatures (Graph 2) occur between 27.5" C and 33°C. In the cancerous breasts, the maximum temperatures (Graph 3) vary from 30°C to 34.5" C and the areolar temperatures (Graph 4) from 28°C to 33°C: Breasts with pre-malignant and benign lesions also failed to show any significant trend in maximum or areolar temperatures. The minimum temperature range was also similar



Graph 3. Maximum temperatures in breasts.

— — — — — 753 Normal controls:
106 Biopsy patients: . . . . . 54 Cancer;
0 0 0 0 20 Pre-malignant;
——— 32 Benign.



Graph 2. Areolar temperatures in breasts.

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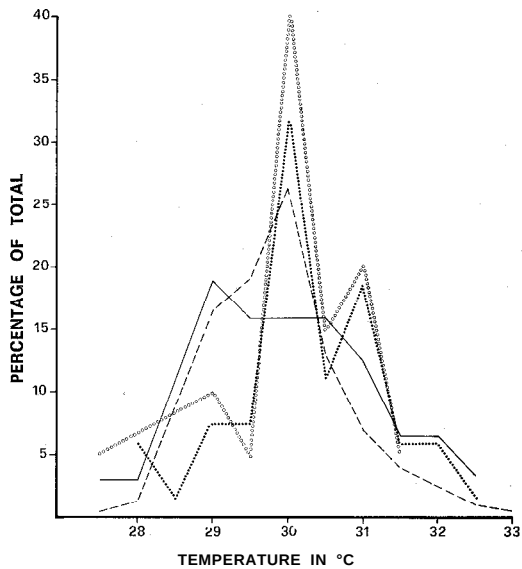

Graph 4. Areolar temperature in breasts.

- - - - - 758 Normal controls:
106 Biopsy patients: . . . . . 54 Cancer;
0 0 0 0 20 Pre-malignant;
——— 32 Benign.

in all groups. Table II shows a comparison of the temperature ranges according to the menstrual status of the women. It would appear from this project that absolute temperatures are of no value in differential diagnosis of abnormal thermograms and have little place in breast thermography - as Wallace et al said in 1969 ([5]).

This is a preliminary report. The numbers are small and more work must be done in this field which should be easier with a digital print-out of absolute temperatures and computerisation to give mean temperatures and total head output. There may not. in fact, be an increase in total heat output in an abnormal thermogram but only a change in distribution. Temperature changes along the circadian and hormonal scales may be important and further investigation of these biological rhythms and how, if at all, they are affected by a cancer is required.

REFERENCES

1. STARK A. M.: *Thesis. Screening for breast cancer.* University of Glasgow, 1972.
2. ISARD H., OSTRUM B.: Breast thermography the mammatherm. *Radiol. Clin. N. America,* 12, 167-188, 1974.
3. STARK A.M., WAY S.: The use of thermovision in the detection of early breast cancer. *Cancer,* 33, 1664-1670, 1974.
4. NATHAN B. E., BURN J. I., MAC EARLEN D. P.: Value of mammary thermography in differential diagnosis. *Brit. Med. I., 2, 316-327, 1972.*
5. DODD G. D., WALLACE J. D., FREUNDLICH I. M., MARSH L., ZERMINO A.: Thermography and cancer of the breast. *Cancer, 23, 797-803,* 1969.