New Zealand
Breast Thermography Association

Breast Thermography – An Overview

What is Breast Thermography?

Breast thermography is a physiological test that provides information on temperature and infrared heat patterns of the breast.[1] Because the skin naturally emits thermal radiation (heat), it is well suited to infrared imaging.[2] Thermography differs from mammography in that it provides information on the biological activity of the breast versus the gross internal anatomy.[3] Infrared imaging is therefore a *functional test* whereas mammography is a *structural test*.[4]

As a functional test, thermography can detect breast abnormalities that other screening methods cannot identify, namely thermal and vascular changes. The increased metabolic activity seen on a breast thermogram can be an indication of injury, mastitis, fibrocystic breast disease or cancer.[5] These functional changes are thought to take place before the onset of structural changes that can occur in diseased or cancerous states. A persistent abnormal thermogram can alert the physician to the need for further investigation and identify women who need to be more closely monitored.[6-8]

Because thermograms in a healthy woman remain remarkably constant, serial thermograms can assess tissue changes over time.[9] A healthy initial thermogram can therefore serve as a baseline to compare future thermograms against.

Recognising the Limitations of Thermal Imaging

Thermography cannot and does not diagnose breast cancer. This is true also for anatomical tests such as mammograms, ultrasounds and magnetic resonance imaging. Such tests provide information on the different aspects of the disease process and identify the need for further investigations.[1] A biopsy of the breast and accompanying histological evaluation is the only definitive diagnostic test for breast cancer.[8]

As a stand-alone test, thermography has been criticised for its high rate of false negative and false positive results. Historically, infrared cameras lacked the sensitivity to detect subtle temperature changes necessary to identify and monitor disease. Since the 1990's, major advancements in infrared technology coupled with sophisticated computerised software programmes have resulted in a significant increase in the accuracy of thermal images.[10] For example, a 4-year clinical trial by Parisky and colleagues demonstrated a 97% sensitivity in the detection of breast cancer with the use of dynamic computerised thermal imaging.[11] In another recent trial, modern digital thermography was also able to detect 97% of biopsy-confirmed breast malignancies.[12]

The high incidence of 'false' positive results documented with thermography can often be a reflection of breast abnormalities that are not yet palpable through breast examination or detectable through mammograms. Early research assessing approximately 58,000 women has shown that a significant percentage (>30%) of abnormal thermograms in the absence of any other breast abnormalities eventually manifest at a later stage as cancer.[13]

Because thermography cannot provide information on the exact anatomic detail of the breast or define a specific area that needs to be biopsied, it needs to be combined with an anatomical test such as mammography.[9, 14] As a functional test, thermography cannot identify the specific cause of physiological changes to breast tissue. For this reason, it serves as a risk marker and complementary modality, rather than a stand alone assessment tool.[15, 16]

Understanding the Strengths of Breast Thermography

Thermography is a non-invasive, contact-free procedure that doesn't require compression of the breasts.[9] There is no exposure to radiation, which means repeat tests are safe and without risk.[16] Thermal imaging has been approved by the Food and Drug Association of America since 1982 as an adjunctive screening tool for breast cancer.[12]

One of the key benefits of thermography is its effectiveness in women with dense breasts, making it suitable for[4]:

- **Younger women** – approximately 18% of breast cancers are diagnosed in women during their forties. Women who develop breast cancer at a younger age tend to have more rapidly growing cancers that are more likely to metastasize (spread throughout the body).[17]
- **Women taking hormone therapy** – results from the Women's Health Initiative trial revealed a significant increase in invasive breast cancer when taking synthetic hormone replacement therapy.[18] Serial thermograms can also help monitor the effects of hormone treatment for fibrocystic breasts.[19]
- **Women with fibrocystic changes** – fibrous breasts are very dense and can mask early cancers, particularly if no microcalcifications are present. Research has shown that approximately 40% of women with fibrocystic disease and an abnormal thermogram develop breast cancer within 5 years. Conversely, women with fibrocystic disease and a normal thermogram have a less than 3% likelihood of developing breast cancer.[19]

Thermography can also provide early warnings of breast abnormalities and highlight potentially suspicious cases particularly when mammographic and clinical exams are equivocal or non-specific.[10]

Thermography as an Independent Risk Marker

An estimated 60-70% of women diagnosed with breast cancer have none of the obvious risk factors. For this reason, breast cancer has been considered an equal opportunity killer.[20] According to a number of researchers, **a persistent abnormal thermogram is thought to be "the single greatest indicator of breast cancer risk"** and is considered 10 times more important than a positive family history for the disease.[19, 20] Because physiological changes over time are known to precede morphological changes, an abnormal thermogram can often be the first warning sign of an increased risk for breast cancer.[13, 16, 21, 22]

A repeated abnormal thermogram in the absence of a palpable cancer or abnormal mammogram is associated with a greater than 30% increased risk of developing breast cancer within 10 years.[13, 15] This equates to a rate of breast cancer 6 times higher than what would ordinarily be expected from a normal population.[20] Early detection of breast cancer initiated solely by an abnormal thermogram and followed up with treatment intervention (e.g. radiotherapy or surgery) has been shown to significantly increase 5 and 10 year survival rates (36% vs. 24% in the radiotherapy group and 44% vs. 33% in the surgery group).[19]

The Value of Thermography as a Complementary Tool

An increase in the detection rate of breast cancer has been demonstrated in a number of peer-reviewed studies with the combined use of clinical breast examination, mammography and thermography.[6, 10, 13, 21, 23-25] In one study using high resolution thermography, an abnormal thermogram coupled with a positive mammogram and clinical breast exam was associated with a 98% sensitivity rate for breast cancer detection.[10] Results from a recent 2010 trial showed an 89% sensitivity rate for the detection of breast cancer in women under 50 when thermal imaging and mammography were combined.[25]

The increase in sensitivity relates to the fact that mammography and thermography do not always identify the same lesion.[6] For example, Gamagami's research revealed that thermography is able to detect changes in breast temperature and vascularity in 86% of non-palpable breast cancers. He also found that thermal imaging was able to detect 15% of cancers not visible through mammographic assessment.[10] Based on the extensive research by Gautherie and Gros, approximately 10% of breast cancers can be detected at an earlier stage with the combined use of thermal imaging.[13]

Summary

Thermography is not a competitor to, or a replacement for mammography, rather it is an adjunct tool that can identify areas of abnormal thermal symmetry which are often associated with underlying pathology.[26] When functional abnormalities are detected early, there is an opportunity for early intervention.[9, 10, 13, 27] Cure rates for breast cancer are though to be as high as 95% when detected in the earliest stages.[28]

According to Ng and Kee, when combined with other anatomical procedures, thermography "may contribute to the best possible evaluation of breast health."[29]

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