# TransScan Medical Inc.'s T-Scan 2000
# INFORMATION FOR PRESCRIBERS

## 1. BRIEF DEVICE DESCRIPTION

The T-Scan 2000 is a real-time, noninvasive, radiation-free, two-dimensional multi-frequency imaging device for breast examination. Based on the concept that there are large inherent differences in capacitance and resistance between neoplastic tissue and surrounding normal tissue, the T-Scan maps the local distribution of tissue electrical impedance in a range of frequencies from 50 - 20,000 Hz, by applying a minuscule, alternating current, electrical signal (approximately 1 volt) via a reference electrode on the body, and detecting the resulting impedance values at each of 256 sensors in a 16x16 array on a probe pressed against the breast. See the User's Manual for a detailed device description.

## 2. INDICATIONS FOR USE

The T-Scan 2000 is intended for use as an adjunct to mammography in patients who have equivocal mammographic findings within ACR BI-RADS™ categories 3 or 4. In particular, it is not intended for use in cases with clear mammographic or non-mammographic indications for biopsy. This device provides the radiologist with additional information to guide a biopsy recommendation.

## 3. CONTRAINDICATIONS

None.

## 4. WARNINGS/ PRECAUTIONS

Patient Management

The T-Scan has not been studied on patients with implanted electronic devices, such as pacemakers. Because pacemakers detect low level electrical signals, there may be interference from the T-Scan, causing possible malfunction of the implanted device. Therefore the T-Scan is not recommended for use on such patients.

The T-Scan 2000 does not replace conventional methods for detecting or diagnosing breast cancer, such as mammography, clinical breast examination, ultrasound, or biopsy evaluation, when appropriate.

The T-Scan is not intended for use as a screening device for breast cancer. While the T-Scan has been shown to be effective in evaluation of lesions identified by other modalities, its use in detecting and evaluating lesions *not* identified by other modalities has not been fully studied.

Cases with clear mammographic or non-mammographic indications for biopsy should not be evaluated with the T-Scan 2000. Based on the ACR BI-RADS lexicon, clear mammographic indications for biopsy would include:

Linear and/or branching calcifications;
Clustered punctate or pleomorphic calcifications;
Masses with ill-defined or spiculated border; and
Clear architectural distortion.

Utility and results obtained with the device varies among users, based in part on the users' patient management methods. Thus, in the management of an individual patient, the attending physician should determine if a T-Scan should be performed and how to interpret T-Scan results.

Any additional finding suggesting possible additional lesions (in the vicinity of a previously identified lesion) is not considered a positive finding if there is no corresponding mammographic finding.

In order to avoid its misinterpretation as a border artifact, the T-Scan probe should be placed so that any focal abnormality is located away from the edge of a detector. If a patient has had recent breast surgery at the targeted site, T-Scan examination of that site should be deferred until complete healing occurs (typically about three months after surgery), as the surgical wound may present an impedance artifact.

The T-Scan probe should not be used on subjects with breached skin or open sores on the breast area. Doing so may increase the risk of transmission of infection between patients (See Technical Warning below and User's Manual).

The influence of hormonal changes connected with the menstrual cycle on T-Scan results has not been fully studied.

The safety and effectiveness of a T-Scan examination has not been established in pregnant patients.

The T-Scan 2000 is designed to be used only in hospitals or clinical settings by medical professionals who have satisfactorily completed the start-up phase of the TransScan Clinical Training program for the T-Scan 2000. A follow-up training 30 to 60 days after completion of the initial phase is also required.

Technical

The T-Scan 2000 must be used only in accordance with the complete instructions for use provided.

In order to prevent electrical shock, do not remove covers or panels of the T-Scan 2000.

Do not attempt to repair the T-Scan 2000. Installation and servicing should be undertaken only by qualified service personnel.

After each examination always thoroughly clean the T-Scan 2000 Scan probe with mild detergent or alcohol to remove residual gel or conductive material. Failure to do so may result in the probe producing inaccurate recordings and possible disease transmission.

## 5. ADVERSE EVENTS

No adverse events were reported in the course of the clinical studies performed. No adverse events have been reported from systems installed intentionally.

As with any diagnostic device, improper interpretation of results and unknown factors or influences can result in misleading results.

## 6. CLINICAL STUDIES

The intended usage mode of the T-Scan 2000 follows identification of suspicious lesions by mammography or palpation followed by mammography. The T-Scan examination is targeted to the vicinity of the suspicious lesion, and the T-Scan image is adjunctively interpreted together with the mammogram. In order to evaluate the safety and effectiveness of the T-Scan 2000 as an adjunct to mammography, three studies were performed: a Blinded Study, a Targeted Study, and an Intended Use Study.

### 6.1. Blinded Study

In a multicenter, prospective, blinded re-reading study carried out in 7 clinical centers in the USA, Europe and Israel, between May, 1995 and March, 1997, mammograms and T-Scans were collected prospectively, blindly re-reread, and the diagnostic accuracy of mammography alone was compared to that of adjunctive use of T-Scan with mammography. A total of 504 breasts in 481 patients were biopsied.

The Blinded Study results demonstrated that adjunctive use of the T-Scan 2000 significantly improved both sensitivity and specificity as compared to mammography alone. For 273 cases with equivocal mammograms (50 biopsy and 223 biopsy negative), sensitivity improved from 60% to 82% (p=0.02), while specificity improved from 41% to 57% (p=0.0003)

**Table 6-1: Results for Equivocal Mammograms (N=273)**

| | Mamm. Alone | Mamm. And T-Scan | McNemar p-value |
|---|---|---|---|
| **Sensitivity** (N=50) | 60% | 82% | 0.02 |
| **Specificity** (N=223) | 41% | 57% | 0.0003 |

In order to prevent bias, the protocol for this study required that both mammogram and T-Scan examinations and interpretation be conducted without knowledge of the results of other tests. However, the intended use of the T-Scan also includes targeted examination (placing the probe in the vicinity of previously identified lesions) which was not employed in this study.

## 6.2. Targeted Study

A "targeted" mode study, at two centers in Israel (Elisha Hospital and Hadassah Hospital) was conducted where the T-Scan examiner had knowledge of the position of the abnormal finding on mammographic or clinical examination, so that the T-Scan probe could be positioned appropriately for the area of concern.

The two study populations were similar in age and lesion size distribution and to that of the Blinded Study. The centers had a lower prevalence of cancer (23% in Elisha, 24% in Hadassah) than the Blinded Study (36%), and had a median lesion size of 15 mm versus 13mm in the Blinded Study.

The diagnostic accuracy of the targeted T-Scan examination is presented in **Table 6-2.**

**Table 6-2: Targeted T-Scan Accuracy in Targeted Study**

| | Elisha (N=583) | Hadassah (N=74) | All (N=657) |
|---|---|---|---|
| **Malignant** | 132 | 18 | 150 |
| **Benign** | 451 | 56 | 507 |
| **Sensitivity** | 77% | 83% | 78% |
| **Specificity** | 68% | 54% | 67% |

## 6.3. Pistoia Hospital Intended Use Study

At the Pistoia Breast Clinic in Italy, the T-Scan examination was targeted at lesions previously identified by mammography or physical exam and the T-Scan interpretation was done adjunctive to the mammographic results, as the device is intended to be used.

Self-referred women, scheduled for routine breast examination between June, 1997 to December 31, 1998 were potential candidates for the study. Seventy-four patients, representing all consecutive biopsy cases for that time period, had T-Scan examinations. The mean age was 57.9±13.6 years (range 17-81) and the mean lesion size was 13.5±8.2 mm (range 1.0-50.0mm).

Of 64 cases where biopsy results, mammogram, and T-Scan were available (56 malignant and 8 benign), 36 were equivocal cases (corresponding to mammographic levels of suspicion LOS 2 and 3, where LOS 2 and 3 correspond to BI-RADS 3 and the relevant portion of BI-RADS 4). The data from these equivocal cases are summarized in **Table 6-3.**

**Table 6-3 Mammogram and T-Scan Accuracy for Pistoia Study**

| | Mammogram | Adjunctive T-Scan | McNemar p-value |
|---|---|---|---|
| **Equivocal Cases (LOS = 2, 3)** | | | |
| Sensitivity | 20/30 (66.7%) | 28/30 (93.3%) | 0.04 |
| Specificity | 3/6 (50.0%) | 5/6 (83.3%) | 0.50 |

This study confirms that a T-Scan examination performed according to intended use (including targeted recording and adjunctive interpretation) improves diagnostic accuracy as compared to mammography alone.

## 6.4. Combining Clinical Study Results

Statistical modeling was employed to combine the results from the three studies (Blinded, Targeted, and Pistoia Intended Use) to verify the results from the Pistoia Study, as well as to provide a single estimate of the changes in sensitivity and specificity resulting from use of the T-Scan 2000.

The Bayesian multinomial-logistic model employed in this analysis estimates that T-Scan improves sensitivity by 0.156 (95% CI 0.024-0.288) compared to mammography alone, in patients with equivocal mammograms (LOS 2 and 3). This model also estimates that T-Scan improves specificity by 0.202 (95% CI 0.009-0.388) compared to mammography alone, in the same patients. Thus, the model predicts a substantial reduction in total negative biopsies, while increasing the net number of cancers detected (*i.e.*, the difference between the cancers detected from among the BI-RADS 3 patients and those delayed from among the indicated BI-RADS 4 patients).

## 7. PATIENT SELECTION AND TREATMENT

See Indications for Use and Warnings/Precautions.

## 8. PATIENT COUNSELING INFORMATION

Not Applicable.

## 9. CONFORMANCE TO STANDARDS

The T-Scan 2000 conforms with IEC-60601-1 standard as:
class 1 equipment,
applied part type BF, and
suitable for continuous operation.

## 10. HOW SUPPLIED

The package in which the T-Scan 2000 is shipped contains the following components: (1) a T-Scan 2000 Main Module; (2) a power cable; (3) a cart; (4) a monitor; (5) a monitor power cable; (6) a mouse; (7) a keyboard; (8) a scan probe; (9) a transmitter cable; and (10) system diskettes. All components are already assembled, therefore the user need only to remove the components from the packaging and connect them.

## 11. CLINICIAN USE INFORMATION

The usage mode of the T-Scan 2000 follows identification of suspicious lesions by mammography or palpation and involves several key elements:

- T-Scan examination is targeted to the vicinity of the suspicious lesion, with examination of other areas as necessary to confirm lesion location and to rule out artifacts and normal variants;
- Nipple examination of both breasts to check for nipple asymmetry; and
- Adjunctive interpretation of the T-Scan image jointly with the mammogram, for lesions at the same location.

The following provides a synopsis of the instructions for the T-Scan 2000. See T-Scan 2000's User's Manual for more detailed device instructions.

### A. The Spot View Screen

Targeted examinations are best performed using the Spot View screen.
The Spot View screen allows considerable flexibility for recording the selected locations on the breasts or adjacent throat and axillary areas.

To make a recording using the Spot View screen: (1) point with the mouse to the area on the drawing corresponding to the desired location on the patient, click with the left mouse button and the number 1 (or the next sequential number) appears on the drawing at the selected location; (2) press start and place the scan probe on the desired location while maintaining good skin contact to avoid air bubbles or other artifacts; (3) the probe scans the selected location to determine relative impedance; (4) to make a soft copy of the area being examined, hold the probe steady, press the RECORD button, and wait for the computer to emit a beep which signifies that the recording is complete. Occasionally carcinomas are detected by the presence of marked asymmetry between the two nipples. Therefore, it is recommended that recordings of the nipples be included in the evaluation of a lesion. See T-Scan 2000's User's Manual for detailed instructions for recording the nipples.

## B. Scanning Mode Screen

Upon completion of the targeted examination and nipple recording, a full breast examination may be conducted for one or more of the following reasons: (1) to capture the T-Scan finding in case of uncertainty in lesion location; (2) to verify of finding versus normal variant by comparison against symmetric location on contralateral breast; or (3) to document for follow-up.

The full breast examination is performed using the Scanning Mode screen. This screen allows for the recording of both breasts, using nine sectors per breast arranged in a 3x3 grid, with the central sector for the nipple. The top two 9-sector pictures are of capacitance, the bottom two are of conductance. The menubar and toolbar are identical to those on the Spot View screen.

## C. Interpreting the T-Scan 2000 Image

T-Scan images should be read with the full knowledge of previous mammography examinations. The mammograms should be available for direct visual comparison as needed. A positive T-Scan finding in the vicinity of the lesion strengthens the indication for biopsy, while a negative supports other management options.

Impedance objects are spots or regions that are notably brighter or darker than their surroundings in the sector image. Focal bright objects on the T-Scan 2000 image may be cancerous or pre-cancerous changes in the breast. The only bright object that should occur in a T-Scan 2000 examination of a normal breast is the nipple. However, other objects may also cause the appearance of bright objects in the image and need to be identified.

If an impedance object is observed, it may be due to a clinical finding, an artifact, a skin lesion, or normal anatomy. To discriminate among these possibilities:

1. Determine whether the object is due to a bubble, poor contact, or a stationary artifact. *Artifacts may appear on the T-Scan 2000 image as a result of: (1) inadequate contact on the source electrode (e.g., dark images); (2) inadequate contact on the scan probe with the breast (e.g., contact artifacts); (3) bubbles (e.g., dark spots); and (4) device malfunction (e.g., permanent artifacts in images).*

2. Evaluate whether the object is due to a skin lesion. *Lesions on the breast skin such as insect bites, pimples, scars, scratches, and fresh hematomas may cause the appearance of a bright spot on the T-Scan 2000 image. These objects and their location should be noted during the breast physical examination. If a bright spot is noted on the T-Scan image in the same location as a skin lesion, users should determine if the spot is due to the skin lesion. See T-Scan 2000's User's Manual for complete instructions on how to identify skin lesions.*

3. If the impedance object is not an artifact or skin lesion, determine whether the impedance object is due to normal anatomy. *Normal anatomical features such as a rib or bone, pectoral muscle, costal-chondral junction, and infra-mammary ridge may cause the appearance of bright objects on the T-Scan 2000 image. In general, a bright object is potentially normal anatomy when it is located in the place where the anatomical feature is found, and/or it appears bilaterally in the T-Scan 2000 image.* See T-Scan 2000's User's Manual for complete instructions on how to identify normal anatomy.

If the impedance object is none of the above, it is a clinical finding.

## 12. PATIENT'S MANUAL

Not Applicable.

## 13. REFERENCES

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