CHAPTER 1 ESSENTIAL PRESCRIBING INFORMATION

This chapter provides overview information about the practical and clinical applications of the QUS-2 Calcaneal Ultrasonometer. Additional information is provided regarding safety precautions, system components, and product specification.

Caution: Federal (U.S.A) Law restricts this device to sale by or on the order of a physician (or properly licensed practitioner).

1.1. Device Description

The QUS-2 Calcaneal Ultrasonometer assesses the quality of the calcaneus by sending a form of acoustic energy, known as ultrasound, from one transducer to another through the heel bone. By analyzing the ultrasound that traverses the heel, the QUS-2 determines the patient's calcaneal Broadband Ultrasound Attenuation (BUA) that can be compared to the results from a reference population. The result of this comparison, expressed in standard deviations, is called the T-Score. The T-score offers a convenient method for assessment of the calcaneus.

The Metra Biosystems QUS-2 Calcaneal Ultrasonometer was designed explicitly for its ease of use, precision, and clinical accuracy. The QUS-2 features a variety of convenient characteristics including:

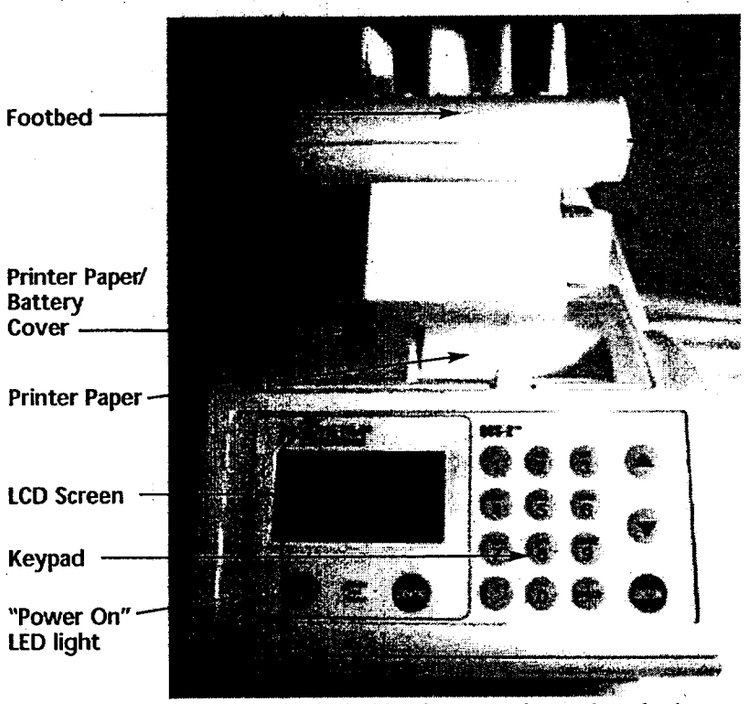
- ✓ **Portability:** The QUS-2 weighs approximately 7 pounds (3.2 kg) and is easily carried from one location to another. Scans can be conducted in the office, at the bedside, or any convenient location.
- ✓ **Scanning:** The scanning technology of the QUS-2 allows reproducible and accurate measurement of the calcaneus without a positioning device. The footbed accommodates both small and large feet.
- ✓ **Rapid Turnaround Time:** A scan can be completed in less than two minutes.
- ✓ **Battery Operation:** The QUS-2 can operate on rechargeable battery power or AC power, providing ultimate flexibility for the operator.
- ✓ **Dry Measurement:** The QUS-2 is a dry ultrasound system thereby avoiding sanitization and clean-up problems associated with wet systems.
- ✓ **Ultrasound Gel:** The QUS-2 determination is performed with readily available water-soluble ultrasound gel.

The QUS-2 Calcaneal Ultrasonometer is a self-contained unit that can function without external computer support or an AC power outlet. The controls for operating the QUS-2 are located on the front panel (Figure 1). When the QUS-2 is operational, powered by either AC or battery, the "Power On" LED located in the lower left corner of the front panel is illuminated.

Messages are displayed on the LCD screen on the left side of the front panel. The keypad, located adjacent to the LCD screen, allows the entry of simple numerical responses, when prompted, to select the type of scan to be performed and to enter

patient data. Once a scan is completed, the results are displayed on the LCD screen and are printed by the on-board printer located above the keypad.

Figure 1 The QUS-2 Calcaneal Ultrasonometer - Front View



The patient's foot is aligned in the footbed with reference to three points: heel post, foot calipers, and colored bar centering indicators (Figure 2). The footbed has an open design and fits either foot. During the scan, mobile transducers move along the patient's heel, sending a broadband ultrasound signal into the heel. The transducers locate and scan an area of approximately 1 cm^2 called the Region of Interest (ROI). The emerging signal is analyzed and the Broadband Ultrasound Attenuation (BUA) in decibels per megahertz (dB/MHz) is calculated. An individual's BUA result is then compared to a reference population for determination of a T-Score (See Appendix 5 for further information).

The footbed accommodates a foot of women's shoe size 5 to men's shoe size 12 (USA), or sizes 35-45 (European).

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Figure 2 The QUS-2 Calcaneal Ultrasonometer - Top View

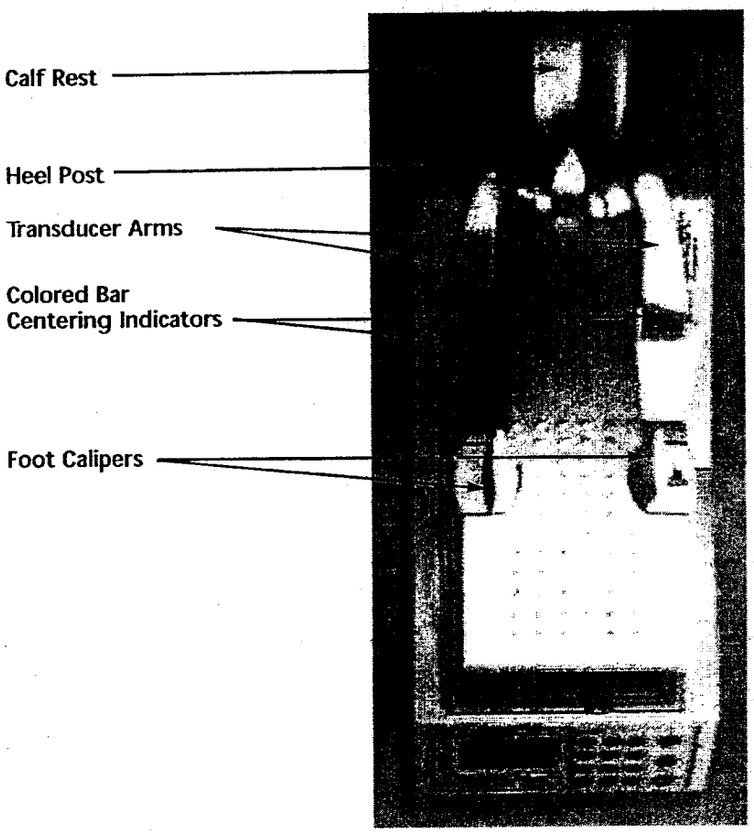
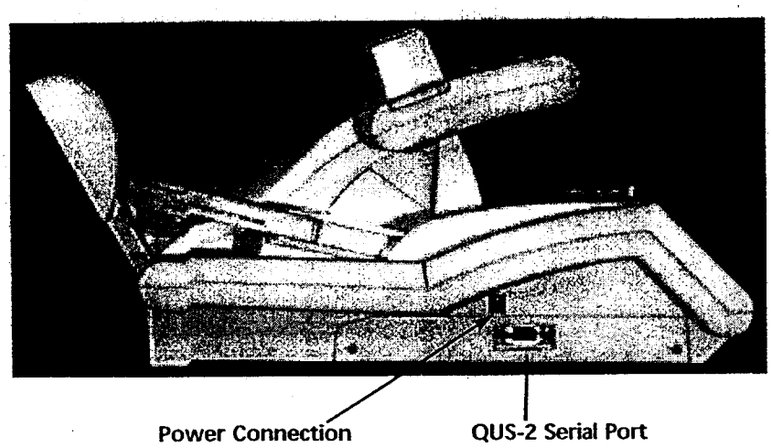


Figure 3 The QUS-2 Calcaneal Ultrasonometer - Side View



1.2 Intended Use/Indications

The QUS-2 ultrasonometer is a medical device that utilizes quantitative ultrasound for evaluation of the calcaneus. Its BUA (broadband ultrasound attenuation) value is intended to be used as an aid in the diagnosis of osteoporosis and in the determination of risk of subsequent atraumatic fracture.

1.3 Contraindications

None known.

1.4 Warnings and Precautions

The QUS-2 is a medical device and should be operated according to the instructions and specifications described in this manual. Refer to Appendix I for system specifications.

CLINICAL:
The QUS-2 should not be used on subjects with breached skin (abraded skin) or open sores on the area of the foot that comes into contact with the system, including foot bed, heel post, front calipers and transducers. Doing so may increase the risk of transmission of infection between patients.

TECHNICAL:
The QUS-2 requires proper cleaning and disinfecting procedures (reprocessing) between each patient use. Doing so can help prevent transmission of infection between patients. Refer to Chapter 8 for Cleaning and Disinfection instructions.

1.4.1 General Precautions

Read this manual before operating the QUS-2.

Never charge or discharge the battery near sparks or open flames. Always disconnect and remove the battery before transporting or shipping the QUS-2.

Avoid exposure of the QUS-2 to direct sunlight or temperature extremes during operation. Airflow from heating or cooling systems, where temperatures may exceed 35°C (95°F) or drop below 15°C (59°F), may adversely affect system performance.

Never expose the QUS-2 to abrasive or corrosive materials, such as sodium hypochlorite (bleach), as contact may damage the instrument surfaces.

Never use the QUS-2 or its accessories in a manner other than indicated.

Only technically qualified personnel should perform troubleshooting and service procedures on internal components. Unauthorized access to internal components will void the warranty.

Keep hair and clothing away from moving parts to avoid injury.

Follow local governing ordinances and recycling plans regarding disposal or recycling of device components and packaging.

1.4.2 Patient Safety

Measurements using the QUS-2 should be performed only by a trained operator.

Do not leave patient unattended during the measurement procedure.

The QUS-2 is not intended for use on children.

Do not let patient stand on the QUS-2.

Never connect QUS-2 to a peripheral device, such as a computer, while a patient is in the vicinity of the QUS-2.

1.4.3 Operator Safety

Do not attempt to repair the QUS-2. The device contains no operator-serviceable parts other than the battery and printer paper.

Never use liquids on or near the QUS-2 as contact with internal components may create a shock hazard. Do not operate the system if internal components have been exposed to fluid. Only exterior surfaces can be wiped with a damp towel ~~or cloth~~.

Do not pick up the QUS-2 by the footbed or transducer arms. Lift the device by the base only.

1.4.4 Electrical Safety

When operating using AC power, ensure that the system is connected to a grounded power receptacle that provides voltage and current within the specified rating for the system (100V - 240V). Use of an incompatible power receptacle may produce electrical shock and fire hazards.

Do not use a non-ground plug adapter to connect primary power to the system. Use of a non-ground adapter disconnects the utility ground, creating a severe shock hazard. Never alter or cut the instrument plug-in as this causes instrument damage and a shock hazard.

Only UL 2601-1/CSA C22.2 No. 601.1 Classified Medical Devices should be connected to the QUS-2.

1.5. Adverse Events

There are no known potential adverse effects of the QUS-2 Calcaneal Ultrasonometer on health.

- Safety Experience and Sample Size: No adverse events of any kind were reported during clinical evaluation of the QUS-2 in 1377 subjects undergoing calcaneal scans using the device.
- Deaths: There were no patient deaths related to the QUS-2 Calcaneal Ultrasonometer either during or after the clinical studies.
- Adverse Events: There were no adverse events related to the QUS-2 Calcaneal Ultrasonometer either during or after the clinical studies.
- Adverse Events that may be expected: There are no known potential adverse effects on health that should be expected through use of the QUS-2 Calcaneal Ultrasonometer.

1.6. Clinical Summary

Study Objectives: Clinical studies were conducted to assess the safety and effectiveness of the QUS-2 Calcaneal Ultrasonometer as an aid in establishing the diagnosis of osteoporosis and assessing risk of osteoporotic fracture. The primary objectives of this trial were: 1) to directly compare broadband ultrasound attenuation (BUA) measured using the QUS-2 to BMD obtained using established dual x-ray absorptiometry for identification of osteoporosis and association to atraumatic fracture 2) to determine the distribution of BUA values across a wide age range in an apparently healthy female Caucasian population, and 3) to evaluate the in vivo short and long term precision of the QUS-2. To establish this goal, three separate clinical trials were conducted at 10 clinical sites in the United States and Europe.

Patients studied: QUS-2 and DXA (lumbar spine, femoral hip neck, and total hip) results were obtained for 686 female Caucasian subjects spanning the entire range of skeletal health. The population included apparently healthy women between the ages of 25 and 34 years as well as osteoporotic and non-osteoporotic women between the ages of 50 and 84 years. Total hip BMD was used to classify patient as osteoporotic using the standards established by the World Health Organization (WHO). QUS-2 results were also obtained for 623 apparently healthy women between the ages of 35 and 84 years to establish an age profile for BUA values. An additional 68 subjects underwent a series of QUS-2 measurements to establish the short term and long-term (over 16 weeks) in vivo precision of the QUS-2.

Principal Safety and Effectiveness Results:

- Clinical Accuracy: The QUS-2 and DXA results were similarly sensitive in identifying subjects with osteoporosis and for discriminating between patients with and without atraumatic fracture as shown in the following table.

Reference Range: A normal range was established for 158 apparently healthy young women between 25 and 34 years of age and for 623 apparently healthy women between 35 and 84 years of age.

Reproducibility: The in vivo short-term and long-term precision for the QUS-2 was 2.6% and 2.9%, respectively.

Table: ROC area* under the curve, its standard deviation, and 95% confidence interval by method

Groups Compared		Method	AUC	SE	95% CI
Groups 2, 3, 4 (n=387)	Groups 4, 5 (n=147)	LS T-score	0.5967	0.0269	0.5432, 0.6484
		FN T-score	0.6307	0.0269	0.5769, 0.6821
Median age = 67	Median age = 74	TH T-score	0.6154	0.0269	0.5618, 0.6669
(Non Fracture)	(Fracture)	BUA T-score	0.6422	0.2666	0.5888, 0.6929

* Not adjusted for the effect of age or any other relevant covariates.

LS T-score = lumbar spine bone mineral density T-score, FN T-score = femoral neck bone mineral density T-score, TH T-score = total hip bone mineral density T-score, BUA = calcaneal broadband ultrasound attenuation T-score, AUC = area under curve from receiver operating characteristic curve, SE = standard error of AUC estimate; 95% CI = 95% confidence interval of the AUC estimate

1.7. Individualization of Treatment

By passing an inaudible broadband ultrasonic wave through the heel, the QUS-2 determines the patient's calcaneal BUA expressed in dB/MHz. BUA results are used by the physician in the differential diagnosis of primary or secondary osteoporosis and subsequent risk of atraumatic fracture. BUA results should be used along with other factors such as laboratory test results, radiographs, lifestyle factors, and medical and family history, in the diagnosis of osteoporosis and other conditions leading to reduced bone density, and subsequent fracture.

1.8. Conformance to Standards

The QUS-2 Calcaneal Ultrasonometer uses ultrasound power levels lower than standard Imaging ultrasound devices which are widely used and accepted. No adverse events have been reported for the QUS-2 Calcaneal Ultrasonometer during clinical use, either from the clinical studies or from systems installed internationally.

Non-clinical testing demonstrated conformance to voluntary safety (UL2601-1, EN60601-1-2 1993, CSA22.2 No 601-1-M90), electromagnetic compatibility standards (EN 55011 Group I Class B, IEC 801-2 1991, IEC 801-3 1984, IEC 801-4 1988), ISO (ISO 9001), and is CE marked in accordance with EN 46001 and the Medical Device Directive (93/42/EEC).