3-Dimensional Volumetric OCT Bone Densitometry of the Hip and Spine
Do you have a need for a bone densitometer, a CT scanner you can use for 10–30 minutes a day, a desire for the best technology and, at the same time, the most cost-effective system? If your answer is yes, then QCT PRO is for you.

QCT PRO, in conjunction with your CT scanner, is a complete system for hip and spine bone densitometry that gives you the best of both worlds. QCT PRO provides DXA equivalent hip studies for use in diagnosis of osteoporosis and low bone mass, and fracture risk assessment; and, QCT trabecular spine measurements for sensitive treatment monitoring and early detection of low bone mass.

In today’s cost conscience health care environment and ever decreasing reimbursements, cost must be considered. DXA simply cannot compare with QCT PRO. With a low purchase price, no site, personnel, or significant on-going costs, the cost to acquire and use QCT PRO is a small fraction of DXA, making QCT PRO the sensible financial investment in addition to the performance choice.

The first and only system to exploit CT’s inherent advantage for true 3-dimensional densitometry of the spine and hip
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- **DXA Equivalent Hip BMD**
  Exclusively from Mindways. Analogous measurements to DXA; reports instantly recognizable to clinicians with previous DXA experience; measurements interpreted in the same manner.

- **Trabecular Spine BMD**
  The well-established early response of trabecular bone to bone loss/gain coupled with precise 3D QCT trabecular-spine BMD measurements yields the highest sensitivity to change in bone status.

- **Fast**
  Scan time typically less than one minute, analysis 2–3 minutes.

- **Easy**
  Highly automated analysis does not require dedicated personnel.

- **Cost Effective**
  System acquisition, installation, and operational costs are a small fraction of DXA — utilizes equipment and personnel you already have.
The heart of QCT PRO is a Windows® application that runs on a PC independent of your CT scanner. The QCT PRO software includes tools that allow you to quickly and easily obtain BMD estimates within the hip and spine. Also included is a DICOM server to interface with your CT scanner, and specialized utilities, such as SlicePick, to help you efficiently integrate QCT PRO into your clinical workflow. Solid, maintenance-free CT calibration and QA phantoms complete the package.
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CTXA is a revolutionary new technology that enables you to produce DXA-equivalent hip measurements from a CT volumetric 3D dataset. The areal measurements and ROIs are the same as those used for DXA-hip. The measurements are interpreted like DXA-hip measurements, including the usage of WHO criteria for fracture-risk assessment. Any physician who is familiar with interpreting DXA reports will instantly recognize and feel comfortable with CTXA reports, and understand how to use them in the diagnosis of osteoporosis and low bone mass conditions.

CTXA studies are quick and easy and can be combined with spine in one examination, further increasing procedural efficiency. Scan times are typically less than one minute and the highly automated analysis is 2 to 3 minutes. Total study times of less than 10 minutes are easily attainable.

CTXA exploits the 3D data set to go beyond DXA. Besides the standard DXA areal BMD estimates, CTXA provides volume density in each of the standard DXA ROIs, along with separate cortical and trabecular bone compartment area and volume density estimates.

CTXA provides a simple, efficient, cost-effective BMD replacement for DXA for use in the detection and monitoring of osteoporosis and low bone mass conditions, and it provides new information not available from DXA that may hold the key to better patient care in the future.

**DXA Equivalent BMD of the Hip**

- Bone mineral analysis of the proximal femur.
- Volumetric BMD estimates provided in addition to standard DXA-like areal density measurements.
- Separate pseudo-cortical and pseudo-trabecular bone compartment density measurements (both areal and volume density estimates calculated).
- Used in diagnosis of osteoporosis, low bone mass, fracture risk assessment and long-term treatment monitoring.
- 0.7% precision; 1.1% long-term precision, total hip; 2.3% long-term precision, femoral neck.
- T- and Z-scores.
- Bilateral hips from a single scan.

**Going beyond DXA**

**DXA Equivalent Regions of Interest**
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QCT has the unique advantage among bone densitometry technologies to measure trabecular BMD exclusive of surrounding cortical bone and extraneous sources of calcium. Bone loss or gain is commonly 2–4 times more rapid in trabecular bone than cortical bone. Rapid change in trabecular bone coupled with the excellent precision of 3D Spine QCT BMD measurements means 3D Spine provides both high sensitivity to short-term gain or loss of bone for treatment monitoring as well as early detection of low bone mass.

3D Spine QCT BMD measurements are further enhanced by 3D Spine’s ability to isolate trabecular bone within the spine exclusive of osteophytes, bone tumors or other structures that can confound other BMD measurements. And 3D Spine’s unique feature among all other QCT systems of retrospective repositioning of the spine makes 3D Spine BMD studies simple for patients with spine deformities, such as severe scoliosis, that are difficult or impossible to handle with other BMD systems. 3D Spine is the best technology for short-term treatment monitoring and early detection of low bone mass.

What the Experts Say

QCT’s ability to selectively assess the metabolically active and structurally important trabecular bone in the vertebral centrum results in excellent ability to predict vertebral fracture and to serially measure bone loss, generally with better sensitivity than projectional methods such as DXA or DPA. The postmenopausal trabecular bone loss measured by QCT is 2–3 times greater than the integral bone loss measured by DXA.

Solving the equations for the time to reach meaningful change revealed a mean time of 2.66 months for DXA and 1.54 months for QCT, DXA taking an average of 73% longer than QCT.

We believe that consideration should be given to the use of QCT as the ‘gold standard’ against which other measurements of spinal BMD are judged.

Sagittal: -15.47°
Coronal: 54.43°
Axial: 39.53°

The 3D QCT Trabecular Advantage

• Bone mineral analysis of the lumbar spine.
• Volumetric BMD estimates of isolated trabecular bone.
• High sensitivity to bone gain/loss for short-term treatment monitoring.
• High sensitivity for early detection of low bone mass conditions.
• Precision up to 1%.
• T- and Z-scores.
• AutoROI’s.

Scoliotic spine as seen by DXA, conventional QCT, and 3D QCT

3D QCT

Osteophytes as seen by QCT and DXA

DXA Structures are superimposed. Osteophytes and other undesirable structures are included in the measurements.
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QCT Osteophytes and other undesirable structures can be eliminated from the measurements.

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Men and women at risk for coronary artery disease, lung cancer and prostate/ovarian cancer are in the same age group as those at risk for bone loss. SlicePick makes it possible to obtain a bone density measurement from whole body screening studies with no extra scans or exposure, simply by inserting the calibration phantom under the patient during the scan. SlicePick is then used to extract the relevant skeleton for measurement.

SlicePick generates AP and lateral projection images from the whole body data set. The skeleton to be analyzed is simply encircled within a box. SlicePick extracts those images for analysis with QCT PRO.

QCT PRO integrates easily with your CT workflow delivering high volume with low impact. Analysis is on a PC instead of the scanner console, limiting scanner impact to scan acquisition—typically about 5 minutes. The separate and highly automated analysis can be done at any time and does not impact your scanner, typically taking less than 3 minutes. A total procedure time of about 8 minutes allows a BMD service to be integrated in all but the busiest CT scanner.

BMD analysis is fast, highly automated, and can be done by virtually anyone. Analysis entails 6 simple steps, most of which require little or no user interaction.
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**Integrate BMD with Whole Body Studies**

**Low Scanner Impact**

<table>
<thead>
<tr>
<th>Mins/Day</th>
<th>Studies/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>260</td>
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<tr>
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<td>30</td>
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</tr>
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<td>60</td>
<td>3120</td>
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**5 Minute Scan**

QCT PRO integrates easily with your CT workflow delivering high volume with low impact. Analysis is on a PC instead of the scanner console, limiting scanner impact to scan acquisition—typically about 5 minutes. The separate and highly automated analysis can be done at any time and does not impact your scanner, typically taking less than 3 minutes. A total procedure time of about 8 minutes allows a BMD service to be integrated in all but the busiest CT scanner.

**3 Minute Analysis**

BMD analysis is fast, highly automated, and can be done by virtually anyone. Analysis entails 6 simple steps, most of which require little or no user interaction.

**8 Minute BMD Study**

SlicePick generates AP and lateral projection images from the whole body data set. The skeleton to be analyzed is simply enclosed within a box. SlicePick extracts those images for analysis with QCT PRO.

**No Extra Scans, No Extra Exposure**

Integrate BMD with Whole Body Studies
Do the Math

The dominant cost of a bone densitometer is the scanning device. You’ve already made that investment—your CT scanner. QCT PRO is an add-on to your CT scanner. DXA is a capital equipment acquisition necessitating space, personnel, and perpetual maintenance costs. QCT PRO eliminates the redundant scanner cost while improving utilization of existing equipment. QCT PRO and your scanner add up to a better densitometer at a significantly lower cost than DXA. Do the math.

Projected 2nd Year Profit/Loss*

<table>
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<tr>
<th>Patients/Wk</th>
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<tr>
<td>10</td>
<td>31,740</td>
<td>-40,960</td>
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<td>15</td>
<td>47,860</td>
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Financial Analyzer is free software available from Mindways that you can use to estimate your annual profits based on your patient referral base, costs to acquire and maintain a bone densitometry system, and per-exam expenditures and payments. This information is input in a simple, yet flexible, manner that can support a broad range of system financing options and cost-accounting schemes.

Financial Analyzer can assist you in cost and profit comparisons of various bone densitometry systems. For example, the cost of installing a QCT bone densitometry system for use with an existing CT installation will typically be dominated by the capital expenditure for the QCT package. In contrast, a DXA system may involve significant expenses for system siting and personnel to operate the DXA scanner.

Differences in operational costs due to, for example, differences in the time to perform a bone density study using two different QCT packages can also be modeled. Financial Analyzer assists you in estimating the patient referral rate you need to achieve your financial goals. Patient referral rate is, perhaps, the least well known of the many input parameters you may define. Estimates by the National Osteoporosis Foundation indicate that only about 10% of women at risk for osteoporosis in a typical community are currently being screened for low bone density—the single most important risk factor for osteoporosis. Increasing awareness of the need for osteoporosis screening and the International Society of Clinical Densitometry recommendation that patients screened by hand, arm or heel methods and found to have low bone density be referred for a central BMD measurement (QCT or DXA) suggest that the referring population for QCT will increase substantially in coming years. Evaluating your patient referral base may be one of the best ways to estimate the long-term potential return on your investment.

Features

- Helps you estimate your patient referral base.
- Helps you estimate costs and returns.
- Helps you compare different systems, e.g., QCT vs. DXA or QCT vs. QCT.
- Estimates breakeven patient referral rates.
- Estimates annual revenue and profit.
- Prints comprehensive, site-personalized reports.
- Includes predefined values for common technologies.
- Windows® 9X/NT/2000/XP compatible.

*Example; of course your values will depend on your specific parameters.

**Do not hallucinate.**
**Do the Math**

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Radiation Dose: The Facts

Bone density measurements are considered to be a safe and effective means to help the physician diagnose osteoporosis or other low bone mass conditions, and to monitor changes in bone to assess therapy efficacy. A common misconception is that QCT x-ray doses are much larger than DXA x-ray doses, and consequently more likely to result in adverse health conditions. In reality, x-ray doses from QCT and DXA are comparable—even when considering that a DXA study is often accompanied by a lateral spine x-ray.

In all cases, the typical x-ray doses received from DXA or QCT examinations are small in comparison to other common radiation sources and are believed to present no significant health risk. The actual health risks from exposure to low x-ray doses are difficult to determine. They are estimated from known hazards from high doses, like those experienced by atomic bomb survivors. No risk of adverse health conditions have been established for lower exposures of 5000 mrem or less. Conservatively, health experts assume radiation health risks are proportional to exposure. This leads to pessimistic estimates of a 0.01% chance of developing cancer due to a 1000 mrem x-ray dose, compared to a normal lifetime risk of cancer for women in the US of 33%. All doses from bone density measurements are less than 10 mrem. By comparison, natural background radiation is about 300 mrem/year, an x-ray of the spine is 70 mrem, a mammogram is 45 mrem, and a round trip transcontinental plane flight is 6 mrem.

In accordance with current knowledge of radiation health risks, the Health Physics Society recommends against quantitative estimation of health risk below an individual dose of 5 rem in one year or a lifetime dose of 10 rem in addition to background radiation. Risk estimation in this dose range should be strictly qualitative accentuating a range of hypothetical health outcomes. The current philosophy of radiation protection is based on the assumption that any radiation dose, no matter how small, may result in human health effects, such as cancer and hereditary genetic damage. There is substantial and convincing scientific evidence for health risks at high dose. Below 10 rem (which includes occupational and environmental exposures), risks of health effects are either too small to be observed or are nonexistent... the Society has concluded that estimates of risk should be limited to individuals receiving a dose of at least 5 rem in one year or a lifetime dose of at least 10 rem in addition to natural background. Below these doses, risk estimates should not be used: expressions of risk should only be qualitative emphasizing the inability to detect any increased health detriment (i.e., zero health effects is the most likely outcome).

RADIATION RISK IN PERSPECTIVE Health Physics Society Position Statement on Risk from Ionizing Radiation

The American Cancer Society “Cancer Statistics for 1998” estimated that 1 in 3 women and 1 in 2 men in the US have a risk of getting cancer or dying from it during their lifetime. 5000 mrem or less. Conservatively, health experts assume radiation health risks are proportional to exposure. This leads to pessimistic estimates of a 0.01% chance of developing cancer due to a 1000 mrem x-ray dose, compared to a normal lifetime risk of cancer for women in the US of 33%. All doses from bone density measurements are less than 10 mrem. By comparison, natural background radiation is about 300 mrem/year, an x-ray of the spine is 70 mrem, a mammogram is 45 mrem, and a round trip transcontinental plane flight is 6 mrem.

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