2019 ISCD Official Positions Pediatric

Skeletal Health Assessment in Children from Infancy to Adolescence

These are the Official Pediatric Positions of the ISCD as updated in 2019. The Official Pediatric Positions that are new or revised since 2013 are in bold type

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Fracture Prediction and Definition of Osteoporosis

- Evaluation of bone health should identify children and adolescents who may benefit from interventions to decrease their elevated risk of a clinically significant fracture.
- The finding of one or more vertebral compression (crush) fractures is indicative of osteoporosis, in the absence of local disease or high-energy trauma. In such children and adolescents, measuring BMD adds to the overall assessment of bone health.
- The diagnosis of osteoporosis in children and adolescents should not be made on the basis of densitometric criteria alone.
- In the absence of vertebral compression (crush) fractures, the diagnosis of osteoporosis is indicated by the presence of both a clinically significant fracture history and BMD Z-score ≤ -2.0. A clinically significant fracture history is one or more of the following: 1) two or more long bone fractures by age 10 years; 2) three or more long bone fractures at any age up to age 19 years. A BMC/BMD Z-score > -2.0 does not preclude the possibility of skeletal fragility and increased fracture risk.

DXA Assessment in Children and Adolescents With Disease That May Affect the Skeleton

- DXA measurement is part of a comprehensive skeletal health assessment in patients with increased risk of fracture.
- In patients with primary bone disease, or at risk for a secondary bone disease, a DXA should be performed when the patient may benefit from interventions to decrease their elevated risk of a clinically significant fracture, and the DXA results will influence that management.
- DXA should not be performed if safe and appropriate positioning of the child cannot be assured.

DXA Interpretation and Reporting in Children and Adolescents

- DXA is the preferred method for assessing BMC and areal BMD.
- The posterior-anterior (PA) spine and total body less head (TBLH), are the preferred skeletal sites for performing BMC and areal BMD measurements in most pediatric subjects. Other sites may be useful depending on the clinical need.
- Soft tissue measures in conjunction with whole body scans may be helpful in evaluating patients with chronic conditions associated with malnutrition or with muscle and skeletal deficits.

- **Proximal femur DXA measurements can be used, if reference data are available, for assessing children with reduced weight bearing and mechanical loading of the lower extremities or in children at-risk for bone fragility who would benefit from continuity of DXA measurements through the transition into adulthood.**
- **DXA measurements at the 33% radius (also called 1/3 radius) may be used clinically in ambulatory children who cannot be scanned at other skeletal sites, provided adequate reference data are available.**
- **Lateral distal femur (LDF) DXA measurements, if reference data are available, correlate well with increased lower extremity fragility fracture risk in non-ambulatory children.**

LDF DXA can:

  - **Assess BMD in children when the presence of non-removable artifacts (orthopedic hardware, tubes), positioning difficulties, abnormal skeletal morphometry, or severe scoliosis with torsion interfere with DXA acquisition at other anatomical sites.**
  - **Monitor the effects of changes of weight-bearing in non-ambulatory children.**
- **Precision assessment at each skeletal measurement site should be calculated in a sample representative of the patient population being evaluated.**
- If a follow-up DXA scan is indicated, the minimum interval between scans is 6-12 months.
- In children with short stature or growth delay, spine and TBLH BMC and areal BMD results should be adjusted. For the spine, adjust using either BMAD or the height Z-score. For TBLH, adjust using the height Z-score.

- An appropriate reference data set must include a sample of healthy representatives of the general population sufficiently large to capture variability in bone measures that takes into consideration gender, age, and race/ethnicity.
- When upgrading densitometer instrumentation or software, it is essential to use reference data valid for the hardware and software technological updates.
- Baseline DXA reports should contain the following information:
  - DXA manufacturer, model, and software version
  - Referring physician
  - Patient age, gender, race-ethnicity, weight, and height
  - Relevant medical history including previous fractures
  - Indication for study
  - Tanner Stage or Bone age results, if available
  - Technical quality
  - BMC and areal BMD
  - BMC and/or areal BMD Z-score
  - Source of reference data for Z-score calculation
  - Adjustments made for growth and interpretation
  - Recommendations for the necessity and timing of the next DXA study are optional
- Serial DXA reports should include the same information as for baseline testing. Additionally, indications for follow-up scan; technical comparability of studies; changes in height and weight; and change in BMC and areal BMD Z-scores should be reported.

- Terminology
  - T-scores should not appear in pediatric DXA reports.
  - The term "osteopenia" should not appear in pediatric DXA reports.
  - The term "osteoporosis" should not appear in pediatric DXA reports without a clinically significant fracture history.
  - "Low bone mineral mass or bone mineral density " is the preferred term for pediatric DXA reports when BMC or areal BMD Z-scores are less than or equal to -2.0 SD.

VFA in Pediatric Patients

- **DXA VFA may be used as a substitute for spine radiography in the identification of symptomatic and asymptomatic VF.**
- **The Genant semi-quantitative method should be used for VFA in children.**
- **Following VFA, additional spine imaging should be considered in the following circumstances:**
  - **Vertebrae that are technically un-evaluable by VFA (i.e. not sufficiently visible), provided the detection of a VF would change clinical management**
  - **Assessment of a single, Genant Grade 1 VF, if confirmation of a Grade 1 VF alone would change clinical management**
  - **Radiographic findings that are not typical for an osteoporotic VF (e.g. suspected destructive inflammatory or malignant processes, congenital malformations, acquired misalignments or dislocations)**

pQCT in Children and Adolescents

- There is no preferred method for QCT for clinical application in children and adolescents.
- QCT, pQCT and HR-pQCT are primarily research techniques used to characterize bone deficits in children. They can be used clinically in children where appropriate reference data and expertise are available.
- It is imperative that QCT protocols in children using general CT scanners use appropriate exposure factors, calibration phantoms and software to optimize results and minimize radiation exposure.

Densitometry in Infants and Young Children

- DXA is an appropriate method for clinical densitometry of infants and young children.
- DXA lumbar spine measurements are feasible and can provide reproducible measures of BMC and aBMD for infants and young children 0-5 years of age.
- DXA whole body measurements are feasible and can provide reproducible measures of BMC and aBMD for children ≥ 3 years of age.
- DXA whole body BMC measurements for children < 3 years of age are of limited clinical utility due to feasibility and lack of normative data. Areal BMD should not be utilized routinely due to difficulty in appropriate positioning.
- Forearm and femur measurements are technically feasible in infants and young children, but there is insufficient information regarding methodology, reproducibility and reference data for these measurements sites to be clinically useful at this time.
- In infants and children below 5 years of age, the impact of growth delay on the interpretation of the DXA results should be considered, but it is not quantifiable presently.

DXA Nomenclature

- DXA – not DEXA.
- T-score – not T score, t-score, or t score
- Z-score – not Z score, z-score, or z score

DXA Decimal Digits

Preferred number of decimal digits for DXA reporting:

☐ BMD: (example, 0.927 g/cm2)	3 digits
☐ T-score: (example, -2.3)	1 digit
☐ Z-score: (example, 1.7)	1 digit
☐ BMC: (example, 31.76 g)	2 digits
☐ Area: (example, 43.25 cm2)	2 digits
☐ % reference database: (example, 82%)	Integer

Glossary

- **BMC –** bone mineral content
- **BMD –** bone mineral density
- **DXA –** dual-energy X-ray absorptiometry
- **HR -** High resolution
- **ISCD –** International Society for Clinical Densitometry
- **LDF – lateral distal femur**
- **LSC –** least significant change
- **NHANES III –** National Health and Nutrition Examination Survey III
- **PA –** posterior anterior
- **pDXA –** peripheral dual-energy x-ray absorptiometry
- **pQCT –** peripheral quantitative computed tomography
- **QC –** quality control
- **QCT –** quantitative Computed Tomography
- **QUS –** quantitative Ultrasound
- **ROI –** region(s) of interest
- **SSI –** strain strength index
- **TBLH –** total body less head
- **VF -** vertebral fracture
- **VFA – Vertebral Fracture Assessment**
- **vBMD –** volumetric BMD
- **WHO –** World Health Organization

Approved and Accepted by the ISCD Board on May 28, 2019.