Evaluation of T-score Agreement Between Norland and GE Healthcare Lunar Densitometers

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ABSTRACT

Historically, T-score disagreement between DXA manufacturers has been recognized. With standardization efforts, it might be assumed that such discordance no longer occurs. However, recent clinical observations suggested that femur neck (FN) T-scores of women scanned using a Norland densitometer may be lower than obtained using GE Healthcare equipment. As such, this study evaluated T-score agreement in women scanned using Norland and GE Healthcare densitometers.

Eighteen women (age 30-74 years, mean 56) had lumbar spine and left proximal femur measurements obtained on a Norland Excel and a GE Healthcare Lunar Prodigy densitometer within 30 days. Norland software version 3.9.4 and Lunar software version 9.2, with the NHANES III proximal femur database, were utilized. BMD was compared using a paired T-test. Linear regression and Bland-Altman analyses evaluated T-score relationship and bias.

BMD differed ($p < 0.001$) at the L2-4 lumbar spine (LS), total proximal femur (TF) and FN. LS and TF T-score correlation was good; $R^2 = 0.96$ and 0.91 respectively and mean T-score bias was low at 0.10 and 0.11 respectively. However, greater disparity was observed at the FN; BMD $R^2 = 0.78$, mean T-score bias = -0.59.

In conclusion, there is good T-score agreement at the LS and TF between these two instruments, however, there is a consistent difference of approximately 0.6 T-score at the FN. As T-scores were usually lower using the Excel, some patients may be diagnosed with low bone mass that would be classified differently on the Prodigy. Efforts to improve T-score agreement between these instruments are appropriate.

INTRODUCTION

Areal bone mineral density (BMD, g/cm²) as measured by DXA instruments from various manufacturers varies substantially due to differences in hardware and software. As such, BMD values for an individual scanned on densitometers from different manufactures cannot be directly compared. Use of T-scores should enhance agreement between manufacturers, however this has historically not been entirely successful due to use of proprietary databases and differing regions of interest. Consistent with this, recent clinical observations suggested that femur neck T-scores of women scanned using a Norland densitometer may be lower than obtained using GE Healthcare instruments. To further evaluate this possibility, this study evaluated BMD and T-score agreement in women scanned with a Norland and a GE Healthcare densitometer.

METHODS

Study Design

- Patients obtaining BMD measurement using a Norland Excel densitometer at a Family Practice clinic were informed of this study
- Those agreeing to participate were asked to call the UW Osteoporosis Research Program to schedule a second BMD measurement using a GE Healthcare Lunar Prodigy
- Scans of the lumbar spine and left proximal femur were performed on all participants within 30 days on both instruments

DXA Scan Performance

- Norland scans were performed by the Family Practice clinic DXA technologist using a Norland Excel
- GE Healthcare scans were performed by ISCD-certified DXA technologists at the UW osteoporosis clinical research program using a Lunar Prodigy
- All scans were performed and analyzed according to manufacturer's recommendations
- Software versions utilized were as follows:
  - Norland; 3.9.4
  - GE Healthcare; 9.2 with the NHANES III database

Statistical Analysis

- BMD compared using paired T-test.
- BMD and T-scores were compared by linear regression and Bland-Altman analyses using Analyse-it software (Leeds, UK)

RESULTS

Patient Demographics

- Eighteen women participated in this study
- Age; mean, (SD) [range]: 56.9 (11.0) {30-74] years
- Weight; mean, (SD) [range]: 64.2 (3.4) [54.1-70.0] kg

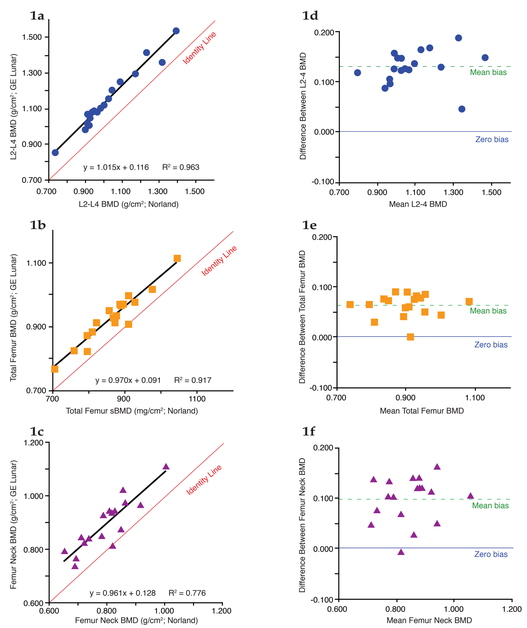
BMD Relationships (Figures 1a-f)

- BMD was highly correlated at the L2-4 spine (1a) and total femur (1b) but less well correlated at the femur neck (1c)
- As expected, measured BMD was ~11% lower ($p < 0.001$) using the Excel at the L2-4 spine and femur neck

T-score Relationships (Figures 2a-f)

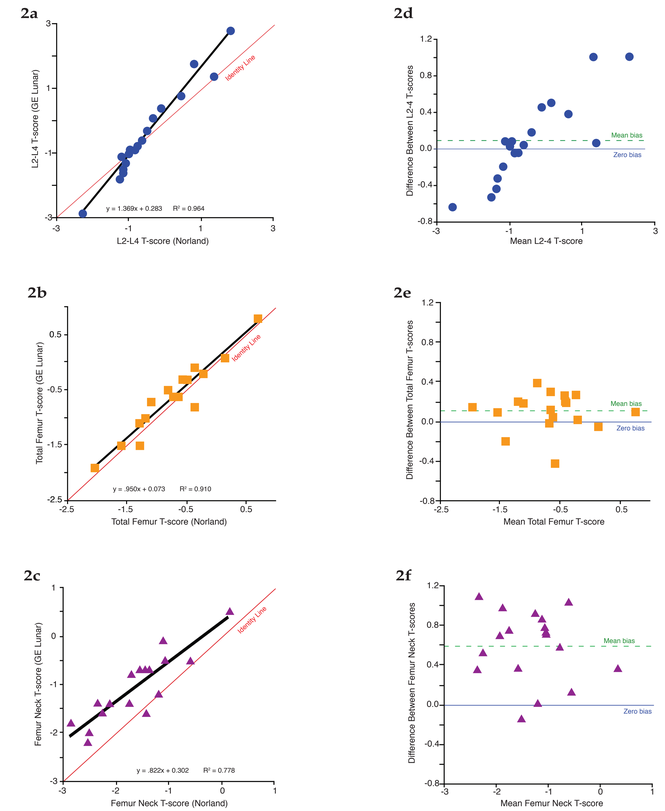
- T-score was highly correlated at the L2-4 spine (2a) and total femur (2b) but less well correlated at the femur neck (2c)
- Minimal bias was present at the L2-4 spine (Figure 2d) and total femur (Figure 2e)
- Greater bias was present at the femur neck (Figure 2f)

FIGURES



Figures 1a-f: ***BMD Relationships.*** In this population, the mean BMD was 11.4, 6.9 and 10.9% lower at the L2-4 spine, total femur and femur neck respectively using the Norland densitometer. Despite the expected bias reflecting different instruments, BMD was well correlated; $R^2 = .96$ and .92 at the lumbar spine and total femur.

FIGURES



Figures 2a-f: ***T-score Relationships.*** In this population, excellent T-score agreement was observed at the L2-4 spine and total femur where the mean bias was 0.10 and 0.11. However, a more substantial bias (0.59) was observed at the femur neck.

CONCLUSIONS

- In this population of women whose BMD was measured on Norland and GE Healthcare densitometers:
  - Good T-score agreement was observed at the L2-4 spine and total femur.
  - Bias was noted at the femur neck with lower T-scores reported using the Norland densitometer.
- Efforts to improve T-score agreement between these instruments are indicated.