INTRODUCTION:

Vibratory Perception Threshold (VPT) is a sensory measure that is commonly used to evaluate diabetic neuropathy and has been associated with neuropathic arthropathy. Studies at our institution have shown that subjects with knee OA and hip OA have generalized vibratory sense deficits with impaired VPT at the upper and lower extremities compared to age matched controls. Current hypotheses for the role of sensory deficits in OA suggest that they may be mechanistically important in lower extremity OA pathogenesis. It is important for future studies to further evaluate the role of these deficits and correlate them with other pathophysiologic factors in OA. In recent OA studies, VPT has been measured using a biothesiometer. Here we sought to investigate a more clinically feasible method of assessing VPT by the use of a tuning fork so that the testing method may be incorporated more easily into large clinical studies. We also sought to characterize the sensory deficits with other demographic and OA disease parameters. Our main hypothesis is that tuning fork measurements will correlate with biothesiometer measurements and therefore, the tuning fork may be used as an alternative method to assess VPT.

METHODS:

Data from subjects with radiographic and symptomatic knee OA were evaluated. All subjects had AP standing knee radiographs that were evaluated for severity using the Kellgren Lawrence (KL) grading scale. All subjects completed WOMAC® visual analog scale pain evaluations. For tuning fork measurement, the tuning fork (128Hz) was struck by the examiner until the two ends of the tuning fork hit one another. The tuning fork was then placed on the first MTP and the subject was asked to comment when they no longer felt the vibration from the tuning fork. The time, in seconds, from striking of the tuning fork until vibration was no longer felt was recorded as the vibratory acuity. Biothesiometer measurements were performed using a biothesiometer (Bio-Medical Instrument Co.) operating at a frequency of 120Hz. The applicator tip was placed at the first MTP. The voltage was initially set at “0” volts and the voltage output increased by 1 volt/second. Subjects commented upon their first sensation of vibration and the number in volts was recorded as the vibratory acuity. Pearson correlation was used to evaluate the relationship between tuning fork and biothesiometer measurements. A Bland and Altman analysis was performed to further assess for agreement between the two methods. Pearson correlations were used to evaluate associations between tuning fork vibratory sense and age, body mass index (BMI), height, and knee pain. Independent samples t-tests were used to evaluate differences between gender and radiographic knee OA severity (KL grade).

RESULTS:

63 subjects were enrolled and evaluated (18 males and 45 females; mean age 57 ± 11 years) of which 44 subjects had radiographic severity KL grade 2 and 19 subjects had KL grade 3. 41 of the subjects, tuning fork and biothesiometer evaluations were performed at the same study visit and were used to evaluate relationship between these measurements. Tuning fork and biothesiometer measurements were inversely correlated, r=−0.629, p<0.001 (Figure 1). Bland and Altman analyses revealed measurements were within the limits of agreement and therefore there was no significant bias between the two methods (Figure 2). Vibration threshold correlated inversely with age (r=−0.418, p=0.001) and height (r=−0.375, p=0.002). There were no significant correlations between BMI (r=0.102, p=0.426) or knee pain (r=−0.179, p=0.174). Females had significantly better vibratory sense than males (14±4 vs 9±4 seconds, p<0.001). KL grade 2 subjects had significantly better vibratory sense than subjects with KL grade 3 knee OA (13±4 vs 10±4 seconds, p=0.008).

DISCUSSION:

These results demonstrate that tuning fork measures correlate with biothesiometer measures of vibratory perception. The tuning fork is a simple and readily available instrument that may be a more convenient and practical alternative to the biothesiometer to assess vibratory sense in large clinical studies. Furthermore, tuning fork measures of vibration correlate with age, gender, height, and radiographic OA severity, suggesting that adjustments for these variables should be incorporated into studies evaluating the role of sensory deficits in lower extremity OA.

REFERENCES:


