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THE PIN TEST

Paul Satz and Lou D'Elia. Odessa, Florida: Psychological Assessment Resources, Inc.

Introduction

The Pin Test is a measure of manual dexterity with secondary assessment of fine motor coordination and visual-motor skills. The instrument was developed by Drs. Paul Satz and Lou D'Elia from the University of California at Los Angeles and represents an international collaborative effort with assistance from Dr. Harry van der Vlugt of the Netherlands. The Pin Test evolved from an interest in developing a measure of manual dexterity that was more sensitive and reliable than others available. The first published study using this test (Orsini, Satz, Soper, & Light, 1985) used multiple measures of handedness and laterality. Orsini et al. reported a disconcordance between self-reported handedness and several of the measures. Such findings indicated that existing measures of handedness perhaps were not that accurate, hence the need for a more sensitive measure.

The Pin Test consists of six separate parts: a 16-gauge aluminum holder; a 16-gauge aluminum plate (about 5" × 4") with 101 holes drilled in a sinusoidal pattern across it; a noncoated piece of corrugated (C flute) cardboard with a burst weight of 150 psi (each piece has a log to keep track of the 10 uses printed on it); a numbered trial sheet; a satin straight pin, 1 1/16 inches long; and a record form.

Prior to administration of the test, the examiner must prepare the resistance cardboard by inserting it into the aluminum holder, placing the metal plate on top, and then, using the straight pin, piercing each of the 101 holes for both the left- and right-handed administration. Once this is completed, the test is ready for administration. This process must take place for each new piece of resistance cardboard. The authors suggest that the cardboard and the straight pin be replaced after every 10 subjects. The Pin Test kit includes materials for 50 administrations and a test manual (Satz & D'Elia, 1989).

Test administration is quite simple and appropriate for ages 16 through 69. The test may be administered by anyone who has a good grasp of neuropsychological tests, but interpretation requires a thorough understanding of neuropsychological

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principles. To administer the Pin Test, the examiner sets the testing apparatus in front of the subject, consisting of the resistance cardboard, the trial sheet, and the metal plate inserted into the aluminum holder. A square cutout in the metal plate indicates whether a right- or left-handed administration is being conducted. The examiner administers the test to the subject's dominant hand on the first trial, then alternates between the nondominant and dominant hand until two 30-second trials have been completed for each hand. The manual includes specific administration instructions. It is important first, of course, to determine handedness and whether peripheral damage may affect testing. Once this is ascertained, the subject is given a straight pin and asked to "push the pin into" the cardboard through as many of the holes as he or she can in a 30-second period. The record form allows the administrator to record a) the number of "hits" (i.e., complete holes punched by the pin) for each trial, b) total hits for each hand, c) percentile for each hand, d) standard score for each hand, e) Advantage Index, f) Advantage Index percentile, and g) Advantage Index standard score. The Advantage Index is calculated by dividing the number of hits for the dominant hand by those of the nondominant hand. The manual includes norms based on handedness and age, grouped as follows: 16–19, 20–29, 30–39, 40–49, 50–59, and 60–69.

The results of the Pin Test allow the examiner to determine how a particular subject performs relative to age-clustered peers for each hand, as well as dominant/nondominant performance. The authors' interpretive guide gives suggested causes for three patterns of performance. Pattern 1 occurs when total hits for both hands are below a standard score of 70. Pattern 2 is found with either a high (standard score above 130) or low (standard score below 70) Advantage Index. Pattern 3 is a combination of Patterns 1 and 2.

Practical Applications/Uses

The Pin Test is designed as a multisetting instrument to measure manual dexterity and handedness. To successfully complete the task, a subject must also utilize visual-motor and fine motor coordination. In research settings this would be an excellent task for determining concordance between report of handedness and actual hand preference. Further, the ease of administration and specific instructions make the test ideal for administration by research assistants and/or students. In clinical settings, the Pin Test would provide another measure of handedness as well as a very sophisticated measure of fine motor skills for return to work. This test may also be useful when inconsistent results are found with other tests of manual dexterity. For instance, if the Finger Tapping Test (Reitan & Wolfson, 1984) provides conflicting data, perhaps the Pin Test could serve as an additional measure. If continued discrepancies exist, then motivational or other areas could be explored. The authors suggest that the test be used in rehabilitation settings to assess improvement in fine motor skills. However, they warn that the Pin Test is not designed to be a screening test for brain damage; rather, it is a brief, nonthreatening adjunct to a comprehensive evaluation.

One drawback for its use as a pre/post measure is the test's documented robust practice effect, which may interfere with correct interpretation of results unless the clinician is very familiar with the test and its serial administration. Very fine

motor skills are required to hold and manipulate a straight pin. Application of this instrument to lower functioning populations such as moderate to severe traumatic brain injury patients, lower functioning developmentally disabled individuals, or others having difficulty with very fine motor skills would be inappropriate. Although a straight pin is relatively safe for most populations, safety and liability issues may need to be addressed when using this test in some settings.

Administration is straightforward and the manual provides adequate instructions. However, preparing the resistance cardboard requires approximately 5 minutes and is, at the very least, unpleasant. Pushing a pin through 202 holes (for both right- and left-handed administrations) with corrugated cardboard underneath is no easy task. The authors of this review could find no painless solution to this task if the instructions are to be followed carefully. Also, certain holes are more difficult to prepare due to the "spines" or corrugated ridges running throughout the cardboard, and these may affect subjects' performance. Pilot subjects taking the test for these reviewers also complained that it was slightly painful, particularly on the second trial of each hand.

Scoring the Pin Test requires approximately 3 minutes, and the process is easy as long as the scorer remembers two very important details: first, that the norms tables are based on hand dominance, and second, that one must look under the correct age.

Interpretation of the test requires both an objective scoring process as well as clinical judgment. Although norms are provided with which to compare the subject's performance, clinical judgment determines whether motivation can be considered as a contributor to a certain pattern of performance. Analysis of performance can be done at two levels. The first is relatively unsophisticated—a quantitative determination of handedness. This superficial approach still requires an analysis of subject's motivation and ruling out alternative hypotheses if the result is unexpected. At the most sophisticated level, an analysis of the Advantage Index and determining the pattern of performance will require special training in neuropsychological assessment. An understanding of laterality, handedness, plus their relationship (see Henninger, 1992) and its effect on neuropsychological functioning also will be necessary.

Of note, one study found the Pin Test correlated significantly with the Wisconsin Card Sorting Test (Green, Satz, Ganzell, & Vaclav, 1992). Green et al. postulated that neuromotor sequencing, as evidenced by the Pin Test, might be a very basic measure of higher order cerebral activation. Such a hypothesis bears further scrutiny of the precursors of executive functions and the use of such measures as the Pin Test in this issue.

Technical Aspects

Several studies were conducted as part of the standardization project. The first focused on the relationship between reported handedness on the Edinburgh Inventory (a finger-tapping apparatus) and the Pin Test. The results suggested very high concordance between self-reported handedness and the Pin Test for both right- (98%) and left-handed (96%) subjects. In comparison, there was less concor-

dance between self-reported handedness and the finger-tapping apparatus—90% for right-handers and 80% for left-handers.

In the second investigation, practice effects were studied using a repeated-trials protocol. Significant increase in performance was noted across trials (total trials = 3).

Test-retest stability over 5 to 20 days also was explored. Whereas practice effects were again noted, no change was observed with the Advantage Index.

Finally, using a very small sample of right-handed "brain-damaged" subjects, the authors reported defective performance on several of the measures.

Critique

The Pin Test provides a quick and useful assessment of manual dexterity and handedness. The test can be administered in most settings, provided there is sufficient light and a table, and administration does not require a thorough knowledge of assessment principles—it can be accomplished by a competent student or research assistant. The test authors do include interpretive strategies that require a more sophisticated understanding of neuropsychological assessment.

Problems exist, however, that detract from the utility of this test. For instance, the norming process is not well explained in the manual and overrepresents the younger ages while underrepresenting older age groups. Also, although the test was standardized with a large sample of normal subjects, there are actually more left-handed subjects than right-handed ones, which is somewhat unusual. Norms for brain-damaged subjects, both right- and left-handers, with varying neurological conditions would be very useful. Although the test is fairly simple to administer, the preparation of materials is somewhat burdensome for the examiner. The use of straight pins also presents a safety consideration with patients who are either lower functioning or prone to acting out. Both subjects and administrators have remarked that the test is painful, which may result in a motivational problem for a few patients. Finally, the fact that this test is highly sensitive to practice effects makes it less useful for serial testings as a measure of improvement.

However, it is important to recognize that while these limitations exist, the Pin Test still could serve numerous purposes. Overall, the test undoubtedly will provide neuropsychologists with an appreciation for the comprehensive assessment of fine motor activity and visual-motor function. Further, the criticisms outlined in this review would also be applicable to widely accepted measures such as The Finger Tapping Test. Hence, the Pin Test's presumed limitations are based on an absolute reference point rather than a relative one vis-à-vis other neuropsychological instruments and may reflect the status of the field much more than the adequacy of this test.

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