9-Hole Peg Test

Indexing Metadata/Description

› **Outcome measure/test:** 9-Hole Peg Test
› **Synonyms:** Nine Hole Peg Test (NHPT), nine hole pegboard test
› **Description/use:** A measure of finger dexterity\(^1\)
  • The 9-Hole Peg Test (9-HPT) was originally designed for patients who have had a stroke, but it can be used with a wide range of populations, including patients with various neurological impairments
› **CPT codes**
  • 97001 Initial Physical Therapy Evaluation
  • 97002 Physical Therapy Reevaluation
  • 97003 Occupational Therapy Evaluation
  • 97004 Occupational Therapy Reevaluation
  • 97750 Physical Performance Test or Measurement, with written report
› **Indications**
  • Impaired fine motor control
  • Impaired eye-hand coordination
  • Limitations in hand function
  • Screening for fine motor problems in children\(^2\)
› **Population**
  • Acquired brain injury
  • Stroke\(^3\)
  • Multiple sclerosis (MS)\(^4\)
  • Spinal cord injury
  • Children\(^5\)
  • Parkinson’s disease (PD)\(^6\)
  • International
    - The test has been standardized in Bangladesh\(^17\)
› **ICD-9 codes**
  • 320-359: Diseases of the nervous system
    – 342 Hemiplegia and hemiparesis
    – 340 Multiple sclerosis
    – 332 Parkinson’s disease
  • 430-438 Cerebrovascular disease
    – 438 Late effects of cerebrovascular disease
    – 438.2 Hemiplegia, hemiparesis
    – 438.8 Other late effects of cerebrovascular disease
      - 438.81 Apraxia
      - 438.84 Ataxia
› **ICD-10 codes**
  • C69-C72 Neoplasms of brain and other parts of central nervous system
  • G00-G99 Diseases of the nervous system
  • G35 Multiple sclerosis
• G20 Parkinson’s disease
• H80-H83 Diseases of inner ear
• H81 Disorders of vestibular function
• I60-I69 Cerebrovascular diseases
• I63 Cerebral infarction
• I69 Sequelae of cerebrovascular disease
• M00-M99 Diseases of the musculoskeletal system

(ICD codes are provided for the readers’ reference, not for billing purposes)

› G-Codes

• Mobility G-code set
  – G8978, Mobility: walking & moving around functional limitation, current status, at therapy episode outset and at reporting intervals
  – G8979, Mobility: walking & moving around functional limitation; projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
  – G8980, Mobility: walking & moving around functional limitation, discharge status, at discharge from therapy or to end reporting

• Changing & Maintaining Body Position G-code set
  – G8981, Changing & maintaining body position functional limitation, current status, at therapy episode outset and at reporting intervals
  – G8982, Changing & maintaining body position functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
  – G8983, Changing & maintaining body position functional limitation, discharge status, at discharge from therapy or to end reporting

• Carrying, Moving & Handling Objects G-code set
  – G8984, Carrying, moving & handling objects functional limitation, current status, at therapy episode outset and at reporting intervals
  – G8985, Carrying, moving & handling objects functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
  – G8986, Carrying, moving & handling objects functional limitation, discharge status, at discharge from therapy onto end reporting

• Self Care G-code set
  – G8987, Self care functional limitation, current status, at therapy episode outset and at reporting intervals
  – G8988, Self care functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
  – G8989, Self care functional limitation, discharge status, at discharge from therapy or to end reporting

• Other PT/OT Primary G-code set
  – G8990, Other physical or occupational primary functional limitation, current status, at therapy episode outset and at reporting intervals
  – G8991, Other physical or occupational primary functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
  – G8992, Other physical or occupational primary functional limitation, discharge status, at discharge from therapy onto end reporting

• Other PT/OT Subsequent G-code set
  – G8993, Other physical or occupational subsequent functional limitation, current status, at therapy episode outset and at reporting intervals
  – G8994, Other physical or occupational subsequent functional limitation, projected goal status, at therapy episode outset, at reporting intervals, and at discharge or to end reporting
  – G8995, Other physical or occupational subsequent functional limitation, discharge status, at discharge from therapy onto end reporting

›
G-code Modifier | Impairment Limitation Restriction
---|---
CH | 0 percent impaired, limited or restricted
CI | At least 1 percent but less than 20 percent impaired, limited or restricted
CJ | At least 20 percent but less than 40 percent impaired, limited or restricted
CK | At least 40 percent but less than 60 percent impaired, limited or restricted
CL | At least 60 percent but less than 80 percent impaired, limited or restricted
CM | At least 80 percent but less than 100 percent impaired, limited or restricted
CN | 100 percent impaired, limited or restricted


- **Similar tests**
  - Box and Block Test (BBT)
  - Action Research Arm Test (ARAT)
  - Purdue Pegboard Test – designed to assist in selection of employees in industrial jobs requiring manual dexterity
  - Jebsen-Taylor Hand Function Test

- **Reimbursement**: Reimbursement will depend on insurance contract coverage. No specific special agencies are applicable for this assessment, and no specific issues or information regarding reimbursement have been identified

- **Test author(s)**: The 9-HPT was introduced by Kellor, Frost, Silberberg, Iversen, and Cummings in 1971. In 1985, Mathiowetz, Weber, Kashman, and Volland established standardized procedures

- **Contraindications/precautions to test**
  - Discontinue if unusual discomfort occurs

- **Psychometric properties**
  - **Reliability**
    - Excellent intrarater reliability in healthy young adults
    - Excellent interrater reliability in healthy young adults
    - Excellent interrater reliability in patients with chronic stroke in a study in the United Kingdom
    - High test-retest reliability of 2 trials performed with the same hand in patients with PD in a study in the United States
      - Dominant hand intraclass coefficient (ICC) = 0.88, nondominant hand ICC = 0.91
      - Score variance was predicted by age, bradykinesia, and freezing of gait but not by tremor or rigidity
  - **Validity**
    - Construct validity in healthy volunteers
      - Correlates with hand function as measured by the Applied Dexterity section of the Arthritis Hand Function Test
        - Correlation coefficients = .551 right hand and .668 left hand
    - Concurrent validity in stroke
      - Concurrent validity of the 9-HPT, ARAT, and BBT was found to be excellent based on Spearman rank correlations in stroke patients in Taiwan
      - Correlations of the 9-HPT with the Fugl-Meyer Assessment of Sensorimotor Recovery after Stroke (FMA) and the Motor Activity Log (MAL) were poor to adequate in a study conducted in Taiwan
        - In the same study, the ARAT and the BBT were shown to have fair to moderate correlations with the FMA and the MAL and so should be considered more appropriate than the 9-HPT for evaluating dexterity post stroke
    - Construct validity in children
      - A significant difference in 9HPT test scores between regular and special education students, in a study conducted in the United States, provides evidence of construct validity in children
Concurrent validity in children
- A moderate correlation was found with the Purdue Pegboard Test\(^5\)
- A negative correlation found between time to complete the 9HPT and age, when tested in 5-10 year olds, indicates that there is adequate concurrent validity. There is a negative correlation between age and fine motor dexterity in children\(^5\)
- Older children were faster than younger ones, as would be expected based on developmental research

Internal consistency
- Although subjects perform more efficiently using their dominant hands, the difference between hands was observed only during the peg-placement phase in an assessment of psychometrics during the 9-HPT in a study conducted in Japan. Differences were negligible during the peg removal phase\(^13\)
- The discrepancy between peg placement and peg removal efficiency suggests that the phases should be discriminated\(^13\)

Ceiling/floor effects
- An adequate floor effect was reported in a study in the United Kingdom using the 9-HPT with persons with stroke\(^14\)
- Participants were scored based on the cutoff of 100 seconds. Those who took more than 100 seconds to complete the test were received a score of 0. Less than 20% of participants scored the minimal value on initial assessment, and the number of participants scoring the minimal value decreased at 6 months
- There are no ceiling effects, as it is a timed test

- **Time to complete test:** 5 minutes or less\(^1\)

Potential complications/adverse effects
- Cannot be used with patients with severely impaired hand function
- Cannot be used with patients with severe cognitive impairment
- Patients may show learning effect
- Motivation, temperature, and time of day may be influencing factors

Test preparation/materials required
- No training is required
- Equipment required
  - Board (wood or plastic): with 9 holes (10 mm diameter, 15 mm depth) placed 32 mm\(^8\) or 50 mm apart\(^10\)
  - A container for the pegs: a square box (100 x 100 x 10 mm) apart from the board or a shallow round dish at the end of the board\(^9\)
  - 9 pegs (7 mm diameter, 32 mm length)\(^8\)
  - A stopwatch
- Patient is seated at a table

Test procedure
- As quickly as possible, the subject must take the pegs from the container one at a time and place them into the holes on the board. He or she must then remove the pegs from the holes one by one and place them back into the container
- The board should be placed at the patient's midline, with the container holding the pegs closer to the hand being tested
- Standardized instructions should be provided while the activity is demonstrated
  - The patient should be instructed to “pick up the pegs one at a time and put them into the holes in any order until the holes are all filled. Then remove the pegs one at a time and put them into the container”
- Only the hand being evaluated should be used during the test
  - The dominant hand should be tested first. In hemiplegic patients, the unaffected side should be tested first
  - One practice trial (per hand) should be provided prior to timing the test
  - A stopwatch should be used to time the subject, and time should be recorded in seconds\(^8,9\)
    - The stopwatch is started when the patient touches the first peg
    - The stopwatch is stopped when the patient places the last peg in the container
  - Verbal encouragement should be provided (e.g., examiner should say “faster” while patient is performing the test, or “out again, fast” when the patient puts the last peg into the board)\(^8\)

Test scoring/interpretation
- Scores are based on the time taken to complete the test activity, in seconds
- Alternative scoring is sometimes used for patients who cannot complete the task in 50 or 100 seconds. The number of pegs placed in 50 or 100 seconds can be recorded, and the results expressed as the number of pegs placed per second\(^1,14\)
• Reported norms indicate that, on average, healthy male adults complete the 9-HPT in 19.0 seconds with the right hand and in 20.6 seconds with the left hand. Healthy female adults complete it in 17.9 seconds with the right hand and in 19.6 seconds with the left hand.

• The 9-HPT is a component of the National Institutes of Health (NIH) Toolbox for the Assessment of Neurological and Behavioral Function, which provides a set of assessment tools that can be used across the lifespan (3-85 years).

– Norms of the 9-HPT that can be used to determine the presence of impairments in dexterity across this age span have been established as part of the NIH Toolbox Norming Project.

– A sample of 4,319 subjects contributed data.

– Dexterity improved with age through childhood and then declined as individuals aged.

– The youngest age group (children aged 3-5 years) showed the longest completion time with the largest variation. The 16-39 year age group showed the shortest completion times.

– Females performed slightly better than males across all age groups.

– Dominant hands were more dexterous than nondominant hands, but only slightly.

– There were no differences based on handedness or race.

• Results of the NIH Toolbox Norming Project concur with norms for children aged 4 years through 19 years previously established to assist in identifying children with dexterity deficits.

• Adult norms for a commercially available 9-HPT were not statistically different from previously published adult norms.

– For each age group, t-test results indicated no significant differences in the average scores between the study of the commercially available 9-HPT and the previously reported study.

• The 9-HPT is a component of the Multiple Sclerosis Functional Composite (MSFC).

– For use in the MSFC, the 9-HPT is scored using an average of 4 trials. Scores from two trials for each hand are averaged and then converted to the reciprocals of the mean times for each hand; the two reciprocals are then averaged. This score can be used individually or as part of the MSFC score.

– A study conducted in the Netherlands examined the clinical impact of a 20% worsening on the 9-HPT score in MS patients.

- Of 527 MS patients participating, 71 experienced at least a 20% worsening on the 9-HPT.

- This worsening was associated with increased perceived disability, but to a lesser degree than was a 20% worsening of timed walking as measured by the Timed 25-foot Walk test (T25FW).

- 9-HPT changes were associated with diverse domains, suggesting that many systems are involved and that this test gives more global information than the timed walking test.

＞ Test follow-up

• The 9HPT can be used to establish baseline and measure progress.

Coding Matrix

References are rated using the following codes, listed in order of strength:

- M Published meta-analysis
- SR Published systematic or integrative literature review
- RCT Published research (randomized controlled trial)
- R Published research (not randomized controlled trial)
- C Case histories, case studies
- G Published guidelines
- RV Published review of the literature
- RU Published research utilization report
- GI Published quality improvement report
- L Legislation
- PGR Published government report
- PFR Published funded report
- PP Policies, procedures, protocols
- X Practice exemplars, stories, opinions
- GI General or background information/texts/reports
- U Unpublished research, reviews, poster presentations or other such materials
- CP Conference proceedings, abstracts, presentation

References


