Anthem

Medical Policy

Subject: Quantitative Sensory Testing
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Description/Scope

This document addresses quantitative sensory testing (QST) used for the noninvasive evaluation of sensory nerve function in individuals with symptoms of, or the potential for, neurologic damage or disease. QST systems can assess and quantify the amount of physical stimuli required for sensory perception to occur. Various testing modalities used in QST can evaluate the sensory nerves involved in touch, pressure, pain, thermal (warm and cold), and vibration.

This document highlights two QST methods: threshold testing, also known as current perception sensory nerve conduction threshold testing, and pressure-specified sensory device testing.

Position Statement

Investigational and Not Medically Necessary:

Quantitative sensory testing including, but not limited to current perception threshold testing, also known as sensory nerve conduction threshold testing, and pressure-specified sensory device testing is considered **investigational and not medically necessary.**

Rationale

Quantitative Sensory Testing

QST can be used either as an initial diagnostic test or as a monitoring test in individuals with sensory deficits. QST has been proposed as an alternative to nerve conduction, but QST is able to evaluate large, small, and unmyelinated nerve fibers, whereas nerve conduction studies are limited to large fiber nerves. When used as a monitoring technique, test/retest reliability is an important factor, as well as defining clinically significant change in sensory perception as QST is a psychophysiological test much like audiography and ophthalmological refraction, and reference standards have been difficult to establish.

In a 2022 re-affirmed report, the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology (AAN) noted QST should not be used as a sole method for diagnosis of pathology. The AAN indicated QST poses technical challenges in the methodology of testing, reproducibility, and psychophysical factors that limit the objectivity of testing results. The authors also noted QST is influenced by many extraneous factors and may be subject to misinterpretation and misuse. In addition, normal reference values vary between various methodologies, and reproducibility of QST has not been firmly established as there is significant variability between the different methodologies regarding testing techniques and interpretation of results.

In a review of technology literature concerning QST, the American Association of Electrodiagnostic Medicine (AAEM) (Chong, 2004) concluded, the “Literature data do not allow a conclusion regarding the relative merits of individual QST instruments.”

An updated literature search based on the MEDLINE database through April 2023 did not identify any new articles addressing benefits and risks of diagnostic QST used for the noninvasive evaluation of sensory nerve function in individuals with symptoms or with the potential for neurologic damage or disease.

Sensory Nerve Conduction Threshold Testing

Sensory nerve conduction threshold testing has been investigated for a broad range of clinical applications including evaluation of peripheral neuropathies, detection of carpal tunnel syndrome, spinal radiculopathy, evaluation of the effectiveness of peripheral nerve blocks, quantification of hypoesthetic and hyperesthetic conditions and differentiation of psychogenic from neurologic disorders.

Freeman and colleagues (2003) reported on a case series that examined the differentiation between QST results for small and large fiber sensory loss between individuals with peripheral neuropathy (PN), normal controls and a group of normal subjects who were asked to attempt simulating sensory loss during the testing. The subjects were tested for cold and vibration perception levels with the CASE IV sensory testing system. There were no differences between performance characteristics in the two simulation trials. Responses to null stimuli did not differentiate between groups. Freeman and colleagues concluded, “Test performance characteristics do not permit discrimination among subjects simulating sensory loss, subjects with normal responses, and subjects with peripheral neuropathy.”

In 1999, the American Association of Electrodiagnostic Medicine (AAEM) published a technology review of the Neurometer® device (Neurotron, Inc., Baltimore, MD). This device uses electrical currents of three different frequencies to activate sensory axons in the unmyelinated, small myelinated and large myelinated fiber populations. The methodology is termed Current Perception Threshold testing (CPT). This review suggested the following criteria for the evaluation of the device:

- A prospective study
- Independent ascertainment of the clinical condition evaluated
- A detailed description of the methodology
- Attention to testing conditions that could potentially affect the results
- A suitable reference population from the same laboratory
- Criteria for abnormality obtained from the reference population and defined in statistical terms

The AAEM assessment concluded there was inadequate scientific literature meeting the above criteria to validate the clinical role of current perception threshold testing.

In 2003, the Centers for Medicaid and Medicare Services (CMS) issued a decision memorandum in support of a national noncoverage determination for sensory nerve conduction threshold testing, which considered both the Neurometer and the Medi-Dx 7000™ device (Neuro Diagnostic Associates, Inc., Laguna Beach, CA). CMS established the following principles in assessing these devices:

- The device must have conclusive diagnostic ability as supported by strong test performance (that is, an accepted reference standard against which to compare the sensory nerve perception threshold testing devices both in terms of sensitivity and specificity), definition of normative values; and/or
- The quantitative information provided actually affected individual management and led to an improvement in individual net health outcomes.

The CMS document noted,

> Relatively simple, non-invasive tests might have a value in the initial assessment of symptomatic patients to determine if more invasive tests are warranted. Sensory nerve conduction threshold testing is considered by some to be such a device. However, the evidence still must demonstrate that the simpler test has an acceptable level of validity otherwise it cannot reliably predict who will need more invasive tests.

Based on their extensive analysis, CMS concluded, "Based on the evidence as a whole, CMS concludes that the use of any type of sensory nerve conduction testing device … to diagnose sensory neuropathies or radiculopathies in Medicare beneficiaries is not reasonable and necessary."

Pressure-Specified Sensory Device Testing

The Pressure-Specified Sensory Device (PSSD) is a form of QST which assesses large myelinated sensory nerve function by a computer-based form of two point discrimination testing. There is insufficient evidence to demonstrate PSSD testing provides any further information than standard evaluation and management of individuals with potential nerve compression, disease, or damage. Standard evaluation and management consists of physical examination techniques and may include Semmes-Weinstein monofilament testing and, in some more complex cases, nerve conduction velocity testing. While PSSD may be a useful adjunct in neurosensory testing, no clinical trials were identified demonstrating the use of the PSSD resulted in earlier or more accurate diagnosis of nerve damage and improved individual outcomes. In addition, no clinical practice guidelines were found addressing the use of PSSD.

Results of two studies (Wood, 2006; Siemionow, 2006) provide limited evidence PSSD may be more sensitive than some existing tests. However, the number of individuals evaluated was limited in size in both studies. In the former paper, only 17 individuals with diabetic ulceration or amputation and in the latter, 25 individuals with peripheral nerve dysfunction were evaluated. More robust studies are required to establish sensitivity and specificity. Additional research is needed to validate the clinical utility of PSSD in identifying individuals at risk and improving clinical outcomes as compared with standard, current care. The need for validation of reference values for normal and specific disease populations was noted.

Background/Overview

Quantitative Sensory Testing

QST systems quantify the amount of physical stimuli required for sensory perception to occur. Stimuli used in QST include touch, pressure, pain, thermal (warm and cold), vibratory, or electric current. Depending on the type of stimuli used, QST can assess small or large fiber dysfunction. QST with touch and vibration can evaluate large myelinated A alpha and A beta sensory fibers. Thermal stimuli can assess small myelinated fibers and unmyelinated sensory nerve function. Low strength alternating electrical currents of selected frequencies are also reported to selectively stimulate different axons.

QST has been used in the diagnosis and management of a variety of conditions such as diabetic neuropathy and other uremic and toxic neuropathies, as well as carpal tunnel syndrome and other nerve entrapment/compression disorders or damage.

Because QST evaluates an individual's subjective response to objective physical sensory stimuli, it is psychophysical in nature. This requires the tested individual to be alert, able to follow directions, and cooperative. Due to the subjective component of testing, psychological factors must be taken into consideration during testing and in evaluating test results, thus reducing the degree of objectivity QST can provide.

Sensory Nerve Conduction Threshold Testing

Sensory nerve conduction threshold testing, which also may be referred to as current perception threshold testing, involves measuring the minimal amount of transcutaneous (across the skin) electrical stimulation required to evoke a sensation in the individual. An area of the skin that corresponds to a specific nerve is tested. It is believed that the extent of nerve damage an individual has suffered can be determined by measuring the amount of electrical stimulation needed for the individual to feel the stimuli. In theory, the greater the degree of nerve damage, the greater the quantity of electrical stimulation required to trigger a response in the nerve fibers and then be perceived. Sensory nerve conduction threshold testing differs from some other forms of quantitative sensory testing (QST) in that it employs electrical stimulation to generate a response from the axons while other forms of QST use non-electrical physical stimuli of the sensory receptors being tested.

In sensory nerve conduction threshold testing, typically three different frequencies of electrical stimuli are used:

- The A-beta fibers have the largest diameter, are myelinated and conduct nerve impulses faster than the other two types of fibers. The A-beta fibers are thought to conduct sensations related to touch, vibration and mild pressure; 2000 Hz currents are said to selectively activate this population of axons.
- The A-delta fibers are myelinated, but smaller than the A-beta fibers. They conduct impulses faster than the C fibers, but are slower than the A-beta fibers. They are thought to conduct sensations related to cold temperatures and some pain; 250 Hz currents are said to selectively activate this population of axons.
- The C fibers are not myelinated and conduct impulses the slowest of all three of the fiber types. They are believed to conduct sensations related to warmth and, in some cases, pain; 5 Hz currents are said to selectively activate this population of axons.

The U.S. Food and Drug Administration (FDA) has approved at least two devices for measuring the threshold for sensory nerve conduction including, but not limited to, the Neurometer Current Perception Threshold (Neurotron, Inc) and the Medi-Dx 7000 (Neuro Diagnostic Associates, Inc.). An updated version of the Medi-DX 7000 is the Neural-Scan™ (Neuro Diagnostic Associates, Inc.). The Neural-Scan is a current potential threshold test with a potentiometer.

Pressure-Specified Sensory Testing

Pressure-specified sensory testing is a method to assess nerve function by quantifying the thresholds of pressure detected with light, static, and moving touch. The Pressure-Specified Sensory Device™ (Sensory Management Services LLC, Baltimore, MD) consists of one or two blunt probes and sensitive transducers to measure and record the perception thresholds of pressure on the surface of the body in grams per square millimeter. The technique is an advanced modification of the two point discrimination methodology. The

device has been used to aid in the diagnosis and assessment of nerve function, including diabetic peripheral neuropathy, carpal tunnel syndrome, and other nerve entrapment or compression syndromes, and postoperative assessment of sensory outcomes after liposuction, breast reduction mammaplasty, etc. The Pressure-Specified Sensory Device received FDA 510(k) marketing clearance in August 1994.

Coding

The following codes for treatments and procedures applicable to this document are included below for informational purposes. Inclusion or exclusion of a procedure, diagnosis or device code(s) does not constitute or imply member coverage or provider reimbursement policy. Please refer to the member's contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

When Services are Investigational and Not Medically Necessary:
For the following procedure codes, or when the code describes a procedure indicated in the Position Statement section as investigational and not medically necessary.

CPT

0106T	Quantitative sensory testing (QST), testing and interpretation per extremity; using touch pressure stimuli to assess large diameter sensation
0107T	Quantitative sensory testing (QST), testing and interpretation per extremity; using vibration stimuli to assess large diameter fiber sensation
0108T	Quantitative sensory testing (QST), testing and interpretation per extremity; using cooling stimuli to assess small nerve fiber sensation and hyperalgesia
0109T	Quantitative sensory testing (QST), testing and interpretation per extremity; using heat-pain stimuli to assess small nerve fiber sensation and hyperalgesia
0110T	Quantitative sensory testing (QST), testing and interpretation per extremity; using other stimuli to assess sensation

HCPCS

G0255	Current perception threshold/sensory nerve conduction test (SNCT), per limb, any nerve

ICD-10 Diagnosis

	All diagnoses

References

Peer Reviewed Publications:

1. den Bandt HL, Winifred D Paulis WD, et al. Pain mechanisms in low back pain: a systematic review with meta-analysis of mechanical quantitative sensory testing outcomes in people with nonspecific Low back pain. J Orthop Sports Phys Ther. 2019; 49(10):698-715.
2. Freeman R, Chase KP, Risk MR. Quantitative sensory testing cannot differentiate simulated sensory loss from sensory neuropathy. Neurology. 2003; 60(3):465-470.
3. Hubscher M, Moloney N, Leaver A, et al. Relationship between quantitative sensory testing and pain or disability in people with spinal pain – a systemic review and meta-analysis. Pain. 2013; 154(9):1497-1501.
4. Nogueira MP, Paley D, Bhave A, et al. Nerve lesions associated with limb-lengthening. J Bone Joint Surg Am. 2003; 85-A(8):1502-1510.
5. Radoiu H, Rosson GD, Andonian E, et al. Comparison of measures of large-fiber nerve function in patients with chronic nerve compression and neuropathy. J Am Podiatr Med Assoc. 2005; 95(5):438-445.
6. Siao P, Cros DP. Quantitative sensory testing. Phys Med Rehabil Clin N Am. 2003; 14(2):261-286.
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8. Sorensen L, Molyneaux L, Yue DK. The level of small nerve fiber dysfunction does not predict pain in diabetic neuropathy: a study using quantitative sensory testing. Clin J Pain. 2006; 22(3):261-265.
9. Technology Review: the Neurometer Current Perception Threshold (CPT). AAEM Equipment and Computer Committee. American Association of Electrodiagnostic Medicine. Muscle Nerve. 1999; 22(4):523-531.
10. Vuilleumier PH, Biurrun Manresa JA, Ghamri Y, et al. Reliability of quantitative sensory tests in a low back pain population. Reg Anesth Pain Med. 2015; 40(6):665-673.
11. Wood WA, Wood MA, Werter SA, et al. Testing for loss of protective sensation in patients with foot ulceration: a cross-sectional study. J Am Podiatr Med Assoc. 2005; 95(5):469-474.

Government Agency, Medical Society, and Other Authoritative Publications:

1. Centers for Medicare and Medicaid Services. National Coverage Determination. Sensory Nerve Conduction Threshold Tests (sNCTs). NCD# 160.23. Effective 4/1/2004. Available at: http://www.cms.hhs.gov/mcd/index_list.asp?list_type=ncd. Accessed on May 5, 2023.
2. Centers for Medicare and Medicaid Services. Decision Memorandum. Reconsideration of National Coverage Determination: Sensory Nerve Conduction Threshold Testing. July 18, 2003. Available at: http://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=26&NCDId=270&ncdver=2&NcaName=Electrodiagnostic+Sensory+Nerve+Conduction+Threshold&IsPopup=y&bc=AAAAAAACAAAAA%3D%3D&. Accessed on May 5, 2023.
3. Chong PS, Cros DP. American Association Of Electrodiagnostic Medicine Review: Quantitative sensory testing equipment and reproducibility studies. 2004. Available at: http://www.aanem.org/AANEM/media/AANEM/Documents/Practice/Tech%20Lit%20Reviews/qstTechniques.pdf. Accessed on May 5, 2023.
4. Chong PS, Cros DP. AAEM Practice Topic in Electrodiagnostic Medicine. American Association of Electrodiagnostic Medicine. Technology literature review: Quantitative sensory testing. Muscle Nerve. 2004b; 29(5):734-747. Available at: http://www.aanem.org/AANEM/media/AANEM/Documents/Practice/Tech%20Lit%20Reviews/qstReview.pdf. Accessed on May 5, 2023.
5. Shy ME, Frohman EM, So YT, et al. Quantitative sensory testing: report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology. Reaffirmed January 22, 2022. Neurology. 2003; 60(6):898-904. Available at: https://www.aan.com/Guidelines/home/GuidelineDetail/87. Accessed on May 5, 2023.

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Current Perception Threshold Testing
Medi-Dx 7000
Neural-Scan
Neurometer
Pressure-Specified Sensory Device Testing
Sensory Nerve Conduction Threshold Testing
VsNCT (Voltage-Actuated Sensory Nerve Conduction Threshold)

The use of specific product names is illustrative only. It is not intended to be a recommendation of one product over another, and is not intended to represent a complete listing of all products available.

Document History

Status	Date	Action
Reviewed	08/10/2023	Medical Policy & Technology Assessment Committee (MPTAC) review. Updated Rationale, Background/Overview, References and Websites sections.
Reviewed	08/11/2022	MPTAC review. Updated Rationale and References sections.
Reviewed	08/12/2021	MPTAC review. Updated Rationale and References sections.
Reviewed	08/13/2020	MPTAC review. Updated Rationale and References sections.
Reviewed	08/22/2019	MPTAC review. Updated Rationale and References sections.
Reviewed	09/13/2018	MPTAC review. Updated Rationale and References sections.
Reviewed	11/02/2017	MPTAC review. The document header wording updated from “Current Effective Date” to “Publish Date.” Updated References section.
Reviewed	11/03/2016	MPTAC review. Updated Rationale and References sections.
Reviewed	11/05/2015	MPTAC review. Updated Description, Rationale and References. Removed ICD-9 codes from Coding section.
Reviewed	11/13/2014	MPTAC review. Updated Description and References.
Reviewed	11/14/2013	MPTAC review. Updated Websites.
Reviewed	11/08/2012	MPTAC review. Description, Rationale, Background and Websites Updated.
Reviewed	11/17/2011	MPTAC review. Updated References and Websites.
Reviewed	11/18/2010	MPTAC review. Updated Index, References and Websites.
Reviewed	11/19/2009	MPTAC review. References updated.
Reviewed	11/20/2008	MPTAC review. References updated.
Reviewed	11/29/2007	MPTAC review. The phrase “investigational/not medically necessary” was clarified to read “investigational and not medically necessary.” References updated.
Revised	12/07/2006	MPTAC review. Title Sensory Nerve Perception Threshold Testing changed to Quantitative Sensory Testing. Pressure-specified sensory device testing added to the policy. Rationale and references updated.
	01/19/2007	Added “VsNCT (Voltage-Actuated Sensory Nerve Conduction Threshold)” to Index
Reviewed	09/14/2006	MPTAC review.
	11/22/2005	Added reference for Centers for Medicare and Medicaid Services (CMS) – National Coverage Determination (NCD).
Revised	09/22/2005	MPTAC review. Revision based on Pre-merger Anthem and Pre-merger WellPoint Harmonization.

Pre-Merger Organizations	Last Review Date	Document Number	Title
Anthem, Inc.	08/01/2002	Memo 1170	Current Perception Threshold Testing
WellPoint Health Networks, Inc.	12/02/2004	Policy 2.10.18	Sensory Nerve Perception Threshold Testing

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Applicable to Commercial HMO members in California: When a medical policy states a procedure or treatment is investigational, PMGs should not approve or deny the request. Instead, please fax the request to Anthem Blue Cross Grievance and Appeals at fax # 818-234-2767 or 818-234-3824. For questions, call G&A at 1-800-365-0609 and ask to speak with the Investigational Review Nurse.

Federal and State law, as well as contract language, including definitions and specific contract provisions/exclusions, take precedence over Medical Policy and must be considered first in determining eligibility for coverage. The member’s contract benefits in effect on the date that services are rendered must be used. Medical Policy, which addresses medical efficacy, should be considered before utilizing medical opinion in adjudication. Medical technology is constantly evolving, and we reserve the right to review and update Medical Policy periodically.