Quantitative Sensory Testing Methods

Number: 0357

(Replaces CPB 385)

Policy

*Please see amendment for Pennsylvania Medicaid at the end of this CPB.*

Aetna considers quantitative sensory testing (QST), also known as pressure-specified sensory device testing, experimental and investigational for the following because its diagnostic value has not been established (not an all-inclusive list):

- Detection of hyperalgesia in chronic pain individuals on long-term opioids
- Diagnosis of restless legs syndrome/Willis-Ekbom disease
- Evaluation of carpal tunnel syndrome/musculoskeletal pain/trigeminal neuralgia
- Evaluation of chronic itch
- Evaluation of pain intensity or disability in chronic pain
- Evaluation of tumor-related cancer pain
- Management of individuals with neuropathy
- Prediction of outcome in low back pain
- Prediction of the response to opioid treatment

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Policy History

Last Review: 06/11/2020
Effective: 11/19/1999
Next Review: 04/08/2021

Review History

Definitions

Additional Information

Clinical Policy Bulletin
Notes
Aetna considers current perception threshold (CPT) testing experimental and investigational because the effectiveness and clinical applicability of this testing in diagnosing and/or managing diabetic peripheral neuropathy, restless legs syndrome/Willis-Ekbom disease, or other diseases has not been established.

Aetna considers voltage-actuated sensory nerve conduction threshold (VsNCT) testing (e.g., by means of the Medi-Dx 7000 or the Neural-Scan) experimental and investigational because its clinical value has not been established in the peer-reviewed published medical literature.

**Background**

Quantitative sensory testings (QSTs) are techniques employed to measure the intensity of stimuli needed to produce specific sensory perceptions. They are used to evaluate a sensory detection threshold or other sensory responses from supra-threshold stimulation. The common physical stimuli are (i) touch-pressure, (ii) vibration, and (iii) coolness, warmth, cold pain, and heat pain. In QST, the subject must be able to comprehend what is being asked by the test, alert and not taking mind-altering medications, and not biased to a certain test outcome.

Abnormal or elevated QST measurements are not specific in the diagnosis of any particular type of neuropathy, and in fact do not necessarily indicate any form of peripheral neuropathy. There are no prospective clinical studies demonstrating that quantitative tests of sensation improve the management and clinical outcomes of patients over standard qualitative methods of sensory testing.
The vibrometer is a device used for measuring sensation/sensitivity to vibration. Testing of vibration sense can be adequately performed with a tuning fork of 128 Hz.

The American Academy of Neurology evaluated the clinical utility, efficacy, and safety of QST (Shy et al, 2003). The authors concluded that QST is a potentially useful tool for measuring sensory impairment for clinical and research studies. However, QST results should not be the sole criteria used to diagnose pathology. Because malingering and other non-organic factors can influence the test results, QST is not currently useful for the purpose of resolving medicolegal matters. The authors stated that well-designed studies comparing different QST devices and methodologies are needed and should include patients with abnormalities detected solely by QST.

The American Association of Electrodiagnostic Medicine (Chong and Cros, 2004) stated that available literature data do not allow conclusions regarding the relative merits of individual QST instruments.

Eisenberg and colleagues (2010) used both static and dynamic QST on 40 healthy volunteers in order to examine if this methodology can predict the analgesic effects of oral oxycodone, as compared to a placebo, on latency to onset, pain intensity, and tolerance to the cold pressor test. Static QST consisted of measuring heat and cold pain thresholds. Dynamic QST included measurements of the magnitude of the diffuse noxious inhibitory control (DNIC)-like effect and of temporal summation (TS). Results showed that oxycodone, but not the placebo, significantly elevated the latency and tolerance to cold pain and significantly reduced pain intensity. The static QST results showed that heat pain thresholds predicted the magnitude of reduction in pain intensity in response to oxycodone treatment (F(1,22) = 5.63, p = 0.027, R(2) = 0.17). The dynamic QST results showed that TS predicted the effect of oxycodone on the tolerance to cold
pressor test ($F(1,38) = 9.11, p = 0.005, R(2) = 0.17$). These results suggested that both static and dynamic QST have the potential to be useful in the prediction of the response to opioid treatment. The findings of this study need to be validated especially in patients with addiction.

Pavlakovic and Petzke (2010) noted that QST is a non-invasive method of assessing sensory and pain perception that has been used in the past 30 years primarily for analysis of cutaneous and mucosal perception. In recent years, several published studies have demonstrated that QST may be useful in the analysis of painful musculo-skeletal disorders as well. Based on the results of these studies, it can be postulated that QST may be useful in the analysis of the pathogenesis, classification, and differential diagnosis of musculo-skeletal disorders. However, due to the diverse ethiopathogenetic basis of these disorders, a broad range of QST test batteries may be necessary to analyze the various musculo-skeletal disease entities. These researchers analyzed published studies on this subject and summarized current information on altered sensory and pain perception available for some of the most common musculo-skeletal disorders. The authors concluded that at present, QST remains primarily a research tool but may be useful in differential diagnosis in indicating the presence of central sensitization and for clinical monitoring of disease progression or treatment response.

In a review on the usefulness and limitations of QST in neuropathic pain states, Hansson et al (2007) stated that there is a lack of specificity of current QST databases; thus QST cannot be used alone for diagnosis of a neurological lesion. The authors also noted that QST is not useful in predicting which patients with post-herpetic neuralgia (PHN) or peripheral neuropathy would benefit from lidocaine patches. Also, serial QST evaluations in patients with acute herpes zoster failed to predict who would develop PHN. Furthermore, the authors
stated that the expected role of QST in the definition of a mechanisms-based approach to neuropathic pain has not yet been met.

Hubscher et al (2013) stated that sensitization of the nervous system can present as pain hypersensitivity that may contribute to clinical pain. In spinal pain, however, the relationship between sensory hypersensitivity and clinical pain remains unclear. This systematic review examined the relationship between pain sensitivity measured via QST and self-reported pain or pain-related disability in people with spinal pain. Electronic databases and reference lists were searched. Correlation coefficients for the relationship between QST and pain intensity or disability were pooled using random effects models. Subgroup analyses and mixed effects meta-regression were used to examine if the strength of the relationship was moderated by variables related to the QST method or pain condition. A total of 145 effect sizes from 40 studies were included in the meta-analysis. Pooled estimates for the correlation between pain threshold and pain intensity were -0.15 (95% confidence interval [CI]: -0.18 to -0.11) and for disability -0.16 (95% CI: -0.22 to -0.10). Subgroup analyses and meta-regression did not provide evidence that these relationships were moderated by the QST testing site (primary pain/remote), pain condition (back/neck pain), pain type (acute/chronic), or type of pain induction stimulus (e.g., mechanical/thermal). Fair correlations were found for the relationship between pain intensity and thermal temporal summation (0.26, 95% CI: 0.09 to 0.42) or pain tolerance (-0.30, 95% CI: -0.45 to -0.13), but only a few studies were available. The authors concluded that the findings of this study indicated either that pain threshold is a poor marker of central sensitization or that sensitization does not play a major role in patients' reporting of pain and disability.

Grosen et al (2013) noted that the role of QST in prediction of analgesic effect in humans is scarcely investigated. This updated review evaluated the effectiveness in predicting
analgesic effects in healthy volunteers, surgical patients and patients with chronic pain. A systematic review of English written, peer-reviewed articles was conducted using PubMed and Embase (1980 to 2013). Additional studies were identified by chain searching. Search terms included “quantitative sensory testing”, “sensory testing” and “analgesics”. Studies on the relationship between QST and response to analgesic treatment in human adults were included. Appraisal of the methodological quality of the included studies was based on evaluative criteria for prognostic studies. A total of 14 studies (including 720 individuals) met the inclusion criteria. Significant correlations were observed between responses to analgesics and several QST parameters including (i) heat pain threshold in experimental human pain, (ii) electrical and heat pain thresholds, pressure pain tolerance and supra-threshold heat pain in surgical patients, and (iii) electrical and heat pain threshold and conditioned pain modulation in patients with chronic pain. Heterogeneity among studies was observed especially with regard to application of QST and type and use of analgesics. The authors concluded that although promising, the current evidence is not sufficiently robust to recommend the use of any specific QST parameter in predicting analgesic response. Moreover, they stated that future studies should focus on a range of different experimental pain modalities rather than a single static pain stimulation paradigm.

Werner et al (2013) stated that QST investigates the graded psychophysical response to controlled thermal, mechanical, electrical or chemical stimuli, allowing quantification of clinically relevant perception and pain thresholds. The methods are ubiquitously used in experimental and clinical pain research, and therefore, the need for uniform assessment procedures has been emphasized. However, varying consistency and transparency in the statistical methodology seem to occur in the QST literature. A total of 16 publications, evaluating aspects of QST variability, from 2010 to 2012, were
critically reviewed in detail. A considerable heterogeneity in the statistical evaluations of test-retest data was demonstrated. The authors, using a secondary analysis of published data for didactic purposes, proposed and presented minimal requirements for reporting of test-retest QST data.

Cruz-Almeida and Fillingim (2014) summarized the scientific literature relating to the use of QST for mechanism-based pain management. A literature search was undertaken using PubMed and search terms including quantitative sensory testing, pain, chronic pain, response to treatment, outcome measure. Studies including QST in healthy individuals and those with painful disorders were reviewed. Publications reported on QST methodological issues including associations among measures and reliability. These investigators also included publications on the use of QST measures in case-control studies, their associations with bio-psychosocial mechanisms, QST measures predicting clinical pain, as well as predicting and reflecting treatment responses. Although evidence suggests that QST may be useful in a mechanism-based classification of pain, there are gaps in the current understanding that need to be addressed including making QST more applicable in clinical settings. There is a need for developing shorter QST protocols that are clinically predictive of various pain subtypes and treatment responses without requiring expensive equipment. The authors concluded that future studies are needed, examining the clinical predictive value of QST including sensitivity and specificity for pain classification or outcome prediction. These findings could enable third-party payers' reimbursement, which would facilitate clinical implementation of QST. Moreover, they stated that with some developments, QST could become a cost-effective and clinically useful component of pain assessment and diagnosis, which can further the progress toward the goal of mechanism-based personalized pain management.
The Washington State Department of Labor and Industries’ guideline on “Work-related carpal tunnel syndrome diagnosis and treatment guideline” (2014) stated that “The department does not cover quantitative sensory tests”.

Katz et al (2015) noted that opioid-induced hyperalgesia is a clinical syndrome whereby patients on long-term opioids become more sensitive to pain while taking opioids. Opioid-induced hyperalgesia is characterized by increased pain intensity over time, spreading of pain to other locations, and increased pain sensation to external stimuli. To characterize opioid-induced hyperalgesia, laboratory methods to measure hyperalgesia have been developed. To determine the performance of these methods, these researchers conducted a systematic review of clinical studies that incorporate measures of hyperalgesia in chronic pain patients on long-term opioids. PubMed and Cochrane databases were searched (terms: opioid induced hyperalgesia, study or trial, and long-term or chronic). Studies published in English were selected if they were conducted in chronic pain patients on long-term opioids and incorporated measures of hyperalgesia; acute/single-dose studies and/or conducted in healthy volunteers were excluded. A total of 14 articles made the final selection (11 were selected from the search and 3 others were found from additional sources); there was 1 randomized controlled trial (RCT), 1 prospective controlled study, 3 prospective uncontrolled studies, and 9 cross-sectional observation studies. Hyperalgesia measurement paradigms used included cold pain, heat pain, pressure pain, electrical pain, ischemic pain, and injection pain. Although none of the stimuli was capable of detecting patients’ hyperalgesia, heat pain sensitivity showed some promising results. The authors concluded that none of the measures reviewed met the criteria of a definitive standard for the measurement of hyperalgesia. They stated that additional studies that use improved study design should be conducted.
Current perception threshold (CPT) testing (also known as sensory nerve conduction threshold testing) entails the quantification of the sensory threshold to transcutaneous electrical stimulation. It has been used to examine sensory nerves. In general, CPT testing falls into the general category of QST. CPT testing has been studied for a wide range of clinical applications such as 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 neurological disorders. The AXON-II NCSs System (PainDx, Inc., Laguna Beach, CA), Neurometer® Current Perception Threshold (Neurotron, Inc., Baltimore, MD) and the Medi-Dx 7000™ (Neuro Diagnostic Associates, Inc., Laguna Beach, CA) are devices cleared by the Food and Drug Administration (FDA) through the 510k process for the use of measuring the threshold for sensory nerve conduction. Thus, the manufacturers were not required to present evidence of efficacy to support a premarket approval application (PMA). These devices have been used to detect metabolic, toxic, acquired, hereditary, compression, traumatic, and other peripheral neuropathies as well as sensory impairments resulting from central nervous system pathology. However, the effectiveness and clinical applicability of CPT testing in diagnosing and/or managing a disease has not been established.

A study by Tack et al (1994) compared CPT testing at different frequencies with standardized clinical examination scores. The authors concluded that CPT testing "seemed rather insensitive at detecting neuropathy". Compared with standard clinical examination, CPT testing "is only of limited value, mainly because of high variability and poor reproducibility".

Yilmaz et al (2010) compared sensory thresholds in different nerve-fiber types in men with chronic pelvic pain syndrome (CPPS) and healthy controls, using thermal sensory testing
and measuring CPT. These researchers enrolled 22 men with CPPS and 20 healthy control participants. They determined the thermal sensory perception thresholds of C and Adelta nerve fibers on the perineum and left posterior thigh. To test CPT, they used sine wave electrical stimulation at 5-Hz, 250-Hz, and 2,000-Hz, resulting in the selective depolarization of small unmyelinated C fibers, small myelinated Adelta, and large myelinated Abeta fibers, respectively. These researchers bilaterally tested the hypothenar surface of the palms, medial parts of soles, mid-shaft of penis, and 1 site in the mid-perineum, for a total of 7 sites. The mean age of men with CPPS was similar to that of controls [42.8 (standard deviation, 9.4) and 40.4 (standard deviation, 13.2) years, respectively, p = 0.548]. There was no significant difference between the 2 groups for thermal perception thresholds in both the perineum and left thigh (p > 0.05). There was also no difference between the 2 groups for CPT values of all 3 frequencies of stimuli in each area tested (p > 0.05 for all comparisons). The authors concluded that the absence of sensory threshold differences between men with CPPS and controls, with either thermal stimulation of C and Adelta fiber afferents or electrical stimulation of C, Adelta, and Abeta fiber afferents, discounts the existence of a peripheral neuropathy as a cause for pain in men with CPPS.

Liao et al (2010) recruited 49 patients with classical trigeminal neuralgia (TN) according to the latest guidelines of the International Classification of Headache Disorders, and divided them into an acute (less than or equal to 30 days onset; n = 13) and a chronic (greater than 30 days onset; n = 36) group. These investigators used blink reflex study and CPT testing to evaluate the painful facial areas and contralateral non-painful areas of patients with classical TN. Current perception threshold 5-Hz examinations, which correlate with unmyelinated fiber function, showed significantly decreased CPTs in the acute stage (11.62 +/- 6.99 versus 18.69 +/- 9.66, p = 0.025), but significantly increased CPTs in the chronic stage (26.67 +/- 18.65 versus 19.69 +/- 13.70, p =
0.010) on the painful side when compared with the contralateral non-painful side. However, CPTs at 250-Hz (Adelta) and 2,000-Hz (Abeta) examinations did not show significant differences between the painful and non-painful sides. In contrast, only 3 (3/49) patients showed an abnormal trigeminal nerve stimulation on the ipsilateral painful side by blink reflex study.

An assessment on the use of electroneurometer in the diagnosis of carpal tunnel syndrome (CTS) conducted by the American Association of Electrodiagnostic Medicine (David et al, 2003) reached the following conclusions: "It is the opinion of the American Association of Electrodiagnostic Medicine (AAEM) that all of the literature reviewed and describing the nervepace digital electroneurometer (NDE) and neurosentinel (NS) are flawed. Limb temperature, which affects the speed of nerve conduction, was controlled in only one study. In most reports, reference populations were not studied to provide a scientifically based source for control values. Standard statistical measures of latency values (mean, standard deviation, and range) were not specified in most reports. Moreover, most studies comparing NDE and NS to standard nerve conduction studies (NCSs) make an incorrect assumption: that distal motor latency or an isolated digital sensory latency values are sensitive measures for diagnosing median nerve entrapment at the wrist. In fact, detailed sensory NCSs, including segmental stimulation across the palm-to-wrist segment or in comparison to adjacent sensory nerves, is by far the more sensitive technique in this regard and is probably the earliest finding in median nerve entrapment at the wrist. It is the opinion of the AAEM that the NDE, as well as the newer NS, are experimental and are not effective substitutes for standard electrodiagnostic studies in clinical evaluation of patients with suspected CTS."

The Medi-Dx 7000 (Neuro Diagnostic Associates) is a voltage-actuated sensory nerve conduction test (VsNCT) device. The device was cleared by the FDA based on a 510(k) application.
An updated version of the Medi-DX 7000 is the Neural-Scan (Neuro Diagnostic Associates, Inc.), which is a current potential threshold test with a potentiometer. The V-sNCT measures the voltage amplitude necessary to cause a discernable nerve impulse. VsNCT results are adjusted and compared to population means. The most severe hypoesthesia is considered the primary lesion. There is no peer-reviewed published medical literature on the use of voltage-actuated sensory nerve conduction tests and their impact on clinical outcomes.

In March 2004, the Center for Medicare and Medicaid Services (CMS) re-affirmed its non-coverage policy on the CPT and sensory nerve conduction threshold test (sNCT); CMS (2004) concluded that “there continues to be insufficient scientific or clinical evidence to consider the sNCT test and the device used in performing this test as reasonable and necessary”.

A study by Cork et al (2002) reports on the performance characteristics of vSNCT using the Medi-Dx 7000 and physical examination findings for predicting nerve root pathology on an epidurogram. The study has a number of flaws, in particular lack of blinding, and does not report on improvements in clinical outcomes with use of vSNCT. It should be noted that the study was published in a journal that not indexed by the National Library of Medicine in the PubMed database of peer-reviewed published medical literature.

In addition, it should be noted that CPT code 95904 is not the correct code to bill for V-SNCT. CPT code 0110T (“Quantitative sensory testing (QST), testing and interpretation per extremity; using other stimuli to assess sensation”) or G0255 (“Current perception threshold/sensory nerve conduction test, (SNCT) per limb, any nerve”) should be used to bill for this service.
Pressure-specified sensory testing is a technique employed to evaluate nerve function by quantifying the thresholds of pressure detected with light, static, and moving touch. The Pressure-Specified Sensory Device (PSSD) (Sensory Management Services LLC, Baltimore, MD) was cleared for marketing by the FDA in 1994. It consists of 1 or 2 probes and transducers for measuring and recording the perception thresholds of pressure on the surface of the body in g/mm². This method is a modification of the 2-point discrimination methodology. The device has been used to assist in the diagnosis and assessment of nerve function, including diabetic peripheral neuropathy, carpal tunnel syndrome (CTS), and other nerve entrapment or compression syndromes, as well as post-operative assessment of sensory outcomes following liposuction, breast reduction mammoplasty, etc.

Siemionow et al (2006) stated that diabetic patients are more susceptible to the development of entrapment neuropathy than non-diabetics. Since these patients suffer from a slowly progressing diabetic polyneuropathy, standard neurosensory and motor tests of nerve function are insufficient in the diagnosis of super-imposed nerve compression. This is most evident in the early stages of compression when quantitative diagnosis is important for making decisions on surgical decompression. These researchers evaluated the validity of computer-assisted PSSD testing in the early detection of super-imposed entrapment in diabetic neuropathy in comparison with standard clinical tests. A total of 25 diabetic patients with complaints of peripheral nerve dysfunction were evaluated by clinical tests and PSSD. Out of those, nerve entrapment was detected in 15 patients (60 %) (9 in late stage and 6 in early stage) by neurosensory PSSD testing. Standard clinical tests were confirmative in 33.3 % of these cases (44 % of late and 16.7 % of early stage). Out of 144 evaluated nerves, 50 were diagnosed with entrapment (24 in late and 26 in early stage) using PSSD. Clinically, diagnosis was confirmed in 16 % of entrapped nerves (20.8 % of late and 11.5 % of early stage). Average diabetes duration in
patients with entrapment diagnosed using PSSD was significantly shorter than for those diagnosed clinically (4.14 +/- 2.04 versus 7.2 +/- 1.3 years, respectively; p = 0.005). Among evaluated factors, mean age and diabetes duration were found to be significantly shorter in patients with entrapment than in those with advanced diffused changes (54.47 +/- 13.07 versus 67.10 +/- 14.2 years; p = 0.019 and 5.33 +/- 3.74 versus 14.22 +/- 8.17 years; p = 0.006; respectively). The authors concluded that these results revealed higher sensitivity of PSSD in comparison with standard clinical tests in the detection of early-stage entrapment in patients with diabetes. Moreover, they stated that to assess accuracy of PSSD in the proper patients’ qualification for surgery, further prospective, post-operative studies are needed.

Slutsky (2009) reported the findings of 69 patients with signs of CTS who underwent nerve conduction studies (NCS) and testing with the PSSD. A total of 102 tests were performed (28 bilateral). Twenty patients underwent a carpal tunnel release and were retested after 4 to 6 months. The Symptom Severity Score (SSS) was calculated before and after surgery. A control group of 20 hands in 10 asymptomatic volunteers underwent identical testing. The NCS sensitivity was 87 % with a specificity of 90 % whereas the PSSD sensitivity was 81 % with a specificity of 65 %. The combined sensitivity of the 2 tests was 93 %. In the operative group the SSS improved from a mean of 3.34 pre-operatively to 1.95 post-operatively. The NCS improved in 19/21 hands whereas the PSSD improved in 16/19 hands. The non-invasive SSS and PSSD can increase the diagnostic yield in CTS, especially when the NCS are normal.

Nath et al (2010) stated that brachial plexus upper trunk injury is associated with winged scapula owing to the close anatomical course of the long thoracic nerve and upper trunk. Needle electromyography (EMG) is a common diagnostic test for this injury; however, it does not detect injury in most
patients with upper trunk damage. The PSSD may be an alternative to needle EMG. In this study, a total of 30 patients with winged scapula and upper trunk injury were evaluated with needle EMG and PSSD. Needle EMG testing of the biceps muscle was compared with PSSD testing of the dorsal hand skin (C6 damage), and EMG testing of the deltoïd and spinati muscles was compared with PSSD testing of the deltoïd skin (C5 damage). Pressure values measured by PSSD were significantly higher on the affected arm. The authors concluded that PSSD tests consistently identified injuries that were not detected by needle EMG tests. They stated that these findings provided evidence that the PSSD is more effective than needle EMG in the detection of brachial plexus upper trunk injury. The findings of this small uncontrolled study need to be confirmed by further investigation.

Sever et al (2013) noted that intra-neural fibrolipoma is a benign, uncommon tumor that is characterized with infiltration of the epineurium and perineurium by fibro-fatty tissue; pre-operative diagnosis is difficult. However, the Pressure-Specified Sensory Device (PSSD) may support identifying the earliest stages of intra-neural fibrolipoma when traditional electro-diagnostic testing is unable to detect a change in peripheral nerve function. These researchers reported the use of PSSD in the evaluation of motor and sensorial functions in patients with intra-neural fibrolipoma. Five patients (3 males, aged 23 to 53; mean of 41 years) with intra-neural fibrolipoma were operated on. Grip strength, pinch strength and sensorial functions were assessed in all patients before surgery and at the end of the follow-up period by PSSD. Patients were followed-up for 7 to 24 months (mean of 12 month). All of the patients improved dramatically following the operation and they had total relief of pain and paresthesia. The authors concluded that decompression of intra-neural fibrolipoma of the nerve with limited excision and epineurectomy without sacrificing the main nerve and its branches is the ideal surgical procedure. They recommended the use of PSSD in the
investigation of patients with peripheral nerve compression, and chronic unusual volar forearm and wrist swelling. They stated that PSSD is an important tool for pre-operative evaluation and diagnosis of intra-neural fibrolipoma. The findings of this case-series study need to be validated by well-designed studies.

Quantitative Sensory Testing for Low Back Pain

Marcuzzi and colleagues (2016) stated that QST measures have recently been shown to predict outcomes in various musculoskeletal and pain conditions. These researchers summarized the emerging body of evidence examining the prognostic value of QST measures in people with low back pain (LBP). The protocol for this review was prospectively registered on the International Prospective Register of Systematic Reviews. An electronic search of 6 databases was conducted from inception to October 2015. Experts in the field were contacted to retrieve additional unpublished data. Studies were included if they were prospective longitudinal in design, assessed at least one QST measure in people with LBP, assessed LBP status at follow-up, and reported the association of QST data with LBP status at follow-up. Statistical pooling of results was not possible due to heterogeneity between studies. Of 6,408 references screened after duplicates removed, 3 studies were finally included. None of them reported a significant association between the QST measures assessed and the LBP outcome. Three areas at high risk of bias were identified which potentially compromised the validity of these results. The authors concluded that due to the paucity of available studies and the methodological shortcomings identified, it remains unknown whether QST measures are predictive of outcome in LBP.

Quantitative Sensory Testing for Trigeminal Neuralgia
In an observational study, Flor and associates (2016) used QST to detect abnormalities in sensory processing in patients with trigeminal neuralgia (TN) by comparing the affected and non-affected nerve branches with their contralateral counterparts and by comparing the results of the patients with those of controls. Quantitative sensory testing was conducted on 48 patients with idiopathic TN and 27 controls matched for age and gender using the standardized protocol of the German Neuropathic Pain Network. Stimulations were performed bilaterally in the distribution of the trigeminal branches. Patients had no prior invasive treatment, and medications at the time of examination were noted. In patients with TN, deficits in warm and cold sensory detection thresholds in the affected and also the non-affected nerve branches were found. Tactile sensation thresholds were elevated in the involved nerve branches compared to the contralateral side. The authors concluded that QST showed subtle sensory abnormalities in patients with TN despite not being detected in routine clinical examination. They stated that these findings may provide a basis for further research on the development of TN and also on improvement after treatment; and more data are needed on the correlation of such findings with the length of history of TN and with changes of the morphology of the trigeminal nerve.

Quantitative Sensory Testing / Current Perception Threshold Testing for Restless Legs Syndrome/Willis-Ekbom Disease

Cho and colleagues (2018) stated that restless legs syndrome/Willis-Ekbom disease (RLS/WED) is a sensorimotor neurological disorder, and it is especially aggravated at night. These researchers examined the diurnal sensory dysfunction in primary RLS/WED using the CPT test, compared to healthy controls. A total of 30 primary RLS/WED subjects and 30 healthy controls were enrolled. The severity of RLS/WED and sleep problems were evaluated in all subjects. Peripheral polyneuropathy was excluded through neurological...
examination and nerve conduction study. These investigators used the Neurometer system for the CPT test and applied 3 different parameters (2,000 Hz, 250 Hz, and 5 Hz) to stimulate both big toes. The CPT test was performed twice, once during the asymptomatic daytime period and again in the evening, when the patients were symptomatic. The mean ages of the RLS/WED group and controls were 50.5 ± 11.7 (22; 73.3 % women), and 46.3 ± 11.4 (24; 80.0 % women), respectively. The mean international RLS/WED study group severity scale score was 28.6 ± 4.25. There was no significant difference in the CPTs between the RLS/WED patients and controls in daytime. However, the RLS/WED patients had lower mean CPT measurements for all 3 stimulation protocols in the evening (2,000 Hz: 393.2 ± 93.7 versus 430.8 ± 79.6, 250 Hz: 172.0 ± 48.4 versus 198.5 ± 38.2, and 5 Hz: 98.0 ± 34.1 versus 124.6 ± 31.3), while the healthy controls showed no difference. The authors concluded that RLS patients showed a lower CPT in the evening. The diurnal variation of hyperalgesia in RLS/WED patients indicated a central (circadian) sensory processing disturbance rather than a peripheral disturbance. These preliminary findings need to be validated by well-designed studies.

Furthermore, an UpToDate review on “Clinical features and diagnosis of restless legs syndrome/Willis-Ekbom disease and periodic limb movement disorder in adults (Ondo, 2018) does not mention quantitative sensory testing / current perception threshold testing as a diagnostic tool.

Quantitative Sensory Testing for Management of Oxaliplatin-Induced Peripheral Neuropathy

Delmotte and co-workers (2018) carried out a 2-year prospective study to better understand how QST could help the clinician in the management of oxaliplatin-induced peripheral neuropathy (PN) in terms of earlier and more reliable detection. Thermal sensory assessment, tactile sensory assessment, neuropathic pain assessment and
adverse events (AEs) gradation (NCI-CTC) were performed during treatment and 6 months following completion of treatment. A total of 35 patients were enrolled and followed-up during 1 year. Cold and warm detection thresholds were higher 6 months after treatment completion than at enrollment. Mechanical detection thresholds didn't change significantly. Neurotoxicity was mostly grade-1, only 18% grade-2 and no grade-3. Grade-2 patients received lower oxaliplatin cumulative dose than grade-1, which revealed effective dose adaptation and grade-2 patients were more likely to develop painful PN. The authors concluded that thermal thresholds impairment emerged too late to help the clinician in the prophylaxis of PN. Management of oxaliplatin-treatment based on NCI-CTC, as currently recommended, remained the best way to detect PN and ensure treatment adaptation.

Quantitative Sensory Testing for Management of Peripheral Neuropathy in Head and Neck Cancer

Roldan and associates (2018) noted that chemotherapy-induced PN (CIPN) is a common and chronic complication associated with cancer treatment. Prior investigations have demonstrated the presence of sub-clinical PN in patients with colorectal cancer (CRC) even before the patients had received chemotherapy. In a retrospective analysis, these investigators examined sub-clinical PN of the upper limbs in patients with squamous cell carcinoma of the head and neck (HNSCC), which developed before their exposure to neurotoxic anticancer agents. With the use of the authors’ QST data bank, they retrospectively assessed the afferent fiber function of 25 patients with HNSCC before they had received chemotherapy (the patient group) and compared the findings with those from 23 healthy control patients. Skin temperature, sensorimotor function, sharpness detection, thermal detection, and touch detection (using both von Frey monofilaments and the Bumps detection test) were measured. Touch thresholds were statistically higher in the patient group than in the healthy
volunteer group at the palm (mean ± SD, 0.54 g ± 0.07 g and 0.27 g ± 0.05 g, respectively [p < 0.01]) and at the forearm (0.74 g ± 0.12 g and 0.41 g ± 0.08 g [p < 0.05]). There was also a clear deficit in touch sensation as indicated by a Bumps detection threshold in patients of 6.5 µm ± 0.8 µm and in controls of 3.7 µm ± 0.5 µm. This yielded an elevation in threshold to 165% in the patients relative to that of the control volunteers. The grooved pegboard test showed delayed completion times for patients compared with controls, with differences of 18.65 seconds in the dominant hand and of 23.36 seconds in the non-dominant hand. The sharpness detection thresholds did not differ between patients and volunteers. The authors concluded that patients with HNSCC were found to have deficits in sensory function before undergoing treatment, suggesting that cancer itself altered peripheral nerve function and may contribute to the development of CIPN. These results confirmed the sensitivity of the Bumps detection test and highlighted its potential role in early detection of PN, especially in cancer patients for whom chemotherapies associated with CIPN have been prescribed.

The authors stated that the drawbacks of this study included inadequacies in the original data acquisition and documentation of the QST and the medical records could not be addressed due to the retrospective nature of the study. In addition, based on available information, these investigators did not find an objective parameter able to correlate the QST findings with pre-pain levels.

Quantitative Sensory Testing / Current Perception Threshold Testing for Management of Chronic Pain Following Lower Extremity Fracture

Griffioen and colleagues (2018) stated that chronic pain is a significant problem for patients with lower extremity injuries. While pain hypersensitivity has been identified in many chronic pain conditions, it is not known whether patients with chronic pain following lower extremity fracture report pain
hypersensitivity in the injured leg. These researchers quantified and compared peripheral somatosensory function and sensory nerve activation thresholds in persons with chronic pain following lower extremity fractures with a cohort of persons with no history of lower extremity fractures. This was a cross-sectional study where QST and CPT testing were conducted on the injured and non-injured legs of cases and both legs of controls. A total of 14 cases and 28 controls participated in the study. Mean time since injury at the time of testing for cases was 22.3 months (standard deviation = 12.1). The warmth detection threshold (p = 0.024) and nerve activation thresholds at 2,000-Hz (p < 0.001) and 250-Hz (p = 0.002), respectively, were significantly higher in cases compared to controls. The authors concluded that the findings of this study suggested that patients with chronic pain following lower extremity fractures may experience hypoesthesia in the injured leg, which contrasted with the finding of hyperesthesia previously observed in other chronic pain conditions; but was in accordance with patients with nerve injuries and surgeries. This was the first study to examine peripheral sensory nerve function at the site of injury in patients with chronic pain following lower extremity fractures using QST and CPT testing. These researchers stated that it is important that future studies examining chronic pain following traumatic lower extremity fractures use both QST and CPT because CPT reflects the function of afferent fibers, while QST reflects the function of both skin receptors and afferent fibers. Research contributing to the understanding of the underlying mechanisms associated with chronic pain following lower extremity fractures has the potential to markedly improve patient quality of life (QOL), aid in the development of trauma-specific practice guidelines, and decrease health-care costs associated with chronic pain.

The authors stated that this study had several drawbacks. First, the sample size was small (n = 14 cases of fractures). Second, these investigators performed the testing in subjects at different time-points following injury. Readers should
interpret the CPT results with caution, as several subjects had inconsistent responses resulting in a small sample size. Third, some of the subjects took medication for their pain, which could have affected the results. Furthermore, these researchers had no information on the extent of nerve damage associated with the injuries; thus, it was possible that some of the subjects might have had sub-clinical nerve injuries. The authors tried to lessen the effects of this limitation by waiting to test patients until at least 6 months after injury, when one would expect the majority of subtle nerve injuries to have resolved. These researchers stated that a future longitudinal study in which investigators perform QST, CPT, and nerve biopsies at several time-points following injury would provide information regarding how sensory function changes as the injury heals. For all future studies, examining data from both QST and CPT testing, as the authors did in the present study, would increase the reliability of results.

Quantitative Sensory Testing for Management of Pain in Autism Spectrum Disorders

Vaughan and associates (2019) noted that sensory abnormalities in autism has been noted clinically, with pain insensitivity as a specified diagnostic criterion. However, there is limited research using psychophysically robust techniques. In this study, 13 adults with ASD and 13 matched controls completed an established QST battery, supplemented with measures of pain tolerance and central modulation. The ASD group showed higher thresholds for light touch detection and mechanical pain. Notably, the ASD group had a greater range of extreme scores (the number of z-scores outside of the 95% CI: greater than 2), dynamic mechanical allodynia and paradoxical heat sensation; phenomena not typically observed in neuro-typical individuals. The authors concluded that these data supported the need for research examining central mechanisms for pain in ASD and greater consideration of individual difference.
Quantitative Sensory Testing for Evaluation of Chronic Itch

van Laarhoven and colleagues (2019) noted that patients suffering from chronic itch exhibit signs of peripheral and central sensitization. This has been linked to parallel neuroplastic sensitization processes. However, for chronic itch, sensitization has not yet been systematically assessed, studied, and hence validated. This review (Prospero CRD42016043002) summarized and meta-analytically examined if sensory aberrations including sensitization for itch occur in chronic itch. PubMed, Embase, and Cochrane Library were searched for studies examining somatosensory sensitivity assessment by QST stimuli, including experimental cutaneous chemical pruritic provocations, in patients with chronic itch from skin/neurological conditions and compared with healthy controls. Outcomes were extracted for lesional and non-lesional skin, and risk of biases were assessed. Meta-analyses were carried out when sufficient quantitative data were available. Of 4,667 identified articles, 46 were included and 25 were eligible for meta-analyses. Patients (66% atopic dermatitis [AD]) were found more sensitive than the controls to histamine-evoked itch in lesional skin (standardized mean difference [SMD]: 0.66 CI: 0.16 to 1.15), but not non-lesionally (SMD: -0.26 [CI: -0.58 to 0.06]). Cowhage did not evoke more itch in non-lesional skin of patients as compared to the controls (SMD: 0.38 [CI: -0.04 to 0.81]). For numerous other chemical provocations as well as for mechanical, thermal, and electrical stimulation paradigms, results were ambiguous or based on few studies. The authors concluded that patients with chronic itch are only robustly sensitized to various chemical pruritic stimuli when applied lesionally. These researchers stated that more studies on somatosensory aberrations in chronic itch conditions other than AD are needed to establish whether sensitization is robustly present across chronic itch conditions.

Quantitative Sensory Testing for Evaluation of Pain
Intensity or Disability in Chronic Pain

Schoth and colleagues (2019) presented the protocol for a systematic review and meta-analysis on "Association between quantitative sensory testing and pain or disability in pediatric chronic pain". This protocol described the objective and methods of a systematic review of the association between QST measures and pain intensity or disability in pediatric chronic pain (PCP). The review will also examine if the relationship strength is moderated by variables related to the QST method and pain condition; the use of QST in PCP (modalities, outcome measures and anatomical test sites as well as differentiating between pain mechanisms (e.g., neuropathic versus nociceptive) and in selecting analgesics); the reliability of QST across the pediatric age range; the ability of QST to differentiate patients with chronic pain from healthy controls; and differences between anatomical test sites.

Medline, PsycINFO, CINHAL, Web of Science, Scopus, Cochrane Library and OpenGrey will be searched. English language studies will be eligible if they recruit a sample aged 6 to 24 (inclusive) with chronic pain, including primary and secondary pain; apply at least one of the following QST modalities: chemical, electrical, mechanical (subgroups include pressure, punctate/brush and vibratory) or thermal stimulus to measure perception of noxious or innocuous stimuli applied to skin, muscle or joint; use a testing protocol to control for stimulus properties: modality, anatomical site, intensity, duration and sequence. Following title and abstract screening, the full texts of relevant records will be independently assessed by 2 reviewers. For eligible studies, 1 reviewer will extract study characteristics and data, and another will check for accuracy. Both will undertake independent quality assessments using the Appraisal Tool for Cross-Sectional Studies. A qualitative synthesis will be presented with discussion centered around different QST modalities. Where eligible data permit, meta-analyses will be performed.
separately for different QST modalities using comprehensive meta-analysis. Review findings will be reported in a peer-reviewed journal and presented at conferences.

Quantitative Sensory Testing for Evaluation of Tumor-Related Cancer Pain

Martland and colleagues (2019) reviewed the evidence on the use of QST in the assessment of pain in people with cancer and described which QST parameters consistently demonstrated abnormal sensory processing in patients with cancer pain. Medline, Embase, AMED, CINAHL, SCOPUS and CENTRAL were searched for observational or experimental studies using QST in patients with a cancer diagnosis and reporting pain. Search strategies were based on the terms "quantitative sensory testing", "cancer", "pain", "cancer pain" and "assessment". Data-bases were searched from inception to January 2019. Data were extracted and synthesized narratively, structured around the different QST modalities and sub-grouped by cancer pain etiology (tumor- or treatment-related pain). Searches identified 286 records of which 18 met the eligibility criteria for inclusion; 3 studies included patients with tumor-related pain, and 15 studies included patients with pain from chemotherapy-induced peripheral neuropathy (CIPN). Across all studies, 50 % (9/18) reported sensory abnormalities using thermal detection thresholds (cool and warm), 44 % (8/18) reported abnormal mechanical detection thresholds using von-Frey filaments and 39 % (7/18) found abnormal pinprick thresholds. Abnormal vibration and thermal pain (heat/cold) thresholds were each reported in 1/3 of included studies. The authors concluded that this systematic review found that pain in cancer patients is associated with abnormal sensory responses to thermal, mechanical and pinprick stimuli. However, these findings were based primarily on studies of CIPN and data on tumor-related pain are lacking, warranting further research.
**CPT Codes / HCPCS Codes / ICD-10 Codes**

Information in the [brackets] below has been added for clarification purposes. Codes requiring a 7th character are represented by "+";

<table>
<thead>
<tr>
<th>Code</th>
<th>Code Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPT codes not covered for indications listed in the CPB:</strong></td>
<td></td>
</tr>
<tr>
<td>0106T</td>
<td>Quantitative sensory testing (QST), testing and interpretation per extremity; using touch pressure stimuli to assess large diameter sensation</td>
</tr>
<tr>
<td>0107T</td>
<td>using vibration stimuli to assess large diameter fiber sensation</td>
</tr>
<tr>
<td>0108T</td>
<td>using cooling stimuli to assess small nerve fiber sensation and hyperalgesia</td>
</tr>
<tr>
<td>0109T</td>
<td>using heat-pain stimuli to assess small nerve fiber sensation and hyperalgesia</td>
</tr>
<tr>
<td>0110T</td>
<td>using other stimuli to assess sensation</td>
</tr>
<tr>
<td><strong>Other CPT codes related to the CPB:</strong></td>
<td></td>
</tr>
<tr>
<td>95907 -</td>
<td>Nerve conduction studies</td>
</tr>
<tr>
<td>95913</td>
<td></td>
</tr>
<tr>
<td>95925 -</td>
<td>Short-latency somatosensory evoked potential study, stimulation of any/all peripheral nerves or skin sites, recording from the central nervous system</td>
</tr>
<tr>
<td>95927</td>
<td></td>
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<tr>
<td><strong>HCPCS codes not covered for indications listed in the CPB:</strong></td>
<td></td>
</tr>
<tr>
<td>G0255</td>
<td>Current perception threshold/sensory nerve conduction test, (SNCT), per limb, any nerve</td>
</tr>
</tbody>
</table>

**ICD-10 codes not covered for indications listed in the CPB**
(not all-inclusive):
<table>
<thead>
<tr>
<th>Code</th>
<th>Code Description</th>
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<tbody>
<tr>
<td>E10.40 - E10.49</td>
<td>Diabetes with neurological complications</td>
</tr>
<tr>
<td>E11.40 - E11.49</td>
<td>Diabetes with neurological complications</td>
</tr>
<tr>
<td>G25.81</td>
<td>Restless legs syndrome [Willis-Ekbom disease]</td>
</tr>
<tr>
<td>G50.0 - G59</td>
<td>Nerve, nerve root and plexus disorders</td>
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<tr>
<td>G89.21 - G89.29</td>
<td>Chronic pain</td>
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<tr>
<td>G89.3</td>
<td>Neoplasm related pain (acute) (chronic)</td>
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<tr>
<td>L29.0 - L29.9</td>
<td>Pruritus [chronic itch]</td>
</tr>
<tr>
<td>M50.00 - M54.9</td>
<td>Other dorsopathies</td>
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<tr>
<td>M60.001 - M60.19</td>
<td>Myositis</td>
</tr>
<tr>
<td>M79.10 - M79.2</td>
<td>Myalgia, neuralgia and neuritis, unspecified</td>
</tr>
<tr>
<td>R20.0 - R20.9</td>
<td>Disturbances of skin sensation</td>
</tr>
<tr>
<td>Z79.899</td>
<td>Other long term (current) drug therapy</td>
</tr>
</tbody>
</table>

The above policy is based on the following references:

Quantitative Sensory Testing (QST)


Current Perception Threshold (CPT) Testing


Pressure-Specified Sensory Testing


Amendment to
Aetna Clinical Policy Bulletin Number: 0357 Quantitative Sensory Testing Methods

There are no amendments for Medicaid.