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Competing Sentence Test: A Test for Central Auditory Dysfunction

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Abstract

Among the sentence tests of Central Auditory Dysfunction, the Willeford Competing Sentence Test (CST) is the only test protocol utilizing natural sentences. This closely approximates the acoustic and linguistic variables found in conversation speech, thus keeping the test materials closer to reality. The test is a useful clinical tool in evaluating the functional integrity of the central auditory system. Based on the Willeford CST, a Kannada (a Regional Language of South India) version has been recently developed, and used as one of the several measures to evaluate central auditory processing deficits in patients with posttraumatic syndrome. The background and clinical application of the CST is presented briefly.

Key words -

Competing sentence test (CST),
Central auditory disorders

Various types of sentence stimuli have been used clinically in central auditory tests for the purpose of detecting the site of lesions in patients with neurological insult. The major tests which employ sentences as stimuli are; Rapidly Alternating Speech Perception Test (RASP) [14], Synthetic Speech Identification Test (SSI) [5], [6], Competing Sentence Test (CST) [7], Ipsilateral Contralateral Competing Sentence Test (IC-CST) [8], [9], and Time Compressed Speech (TCS) [10]. These tests have been found to be useful diagnostic tools in detecting dysfunctions of the central auditory system. Of the above mentioned approaches, Competing Sentence Tests [7], [9] are the only test protocols utilizing natural sentences that are presented to subjects without physical alterations in ipsilateral and contralateral conditions. This test would seem to challenge a subject's ability to perform the dynamic processing of speech signals that occur continuously in everyday living.

This article describes the test protocol and clinical utility of CST in identifying neuroauditory disorders.

Background

Willeford's inspiration for developing the CST was partly derived from earlier test designs [5], [11]. Unlike the SSI, the CST uses simple, natural, English sentences as test stimuli. However, like the SSI,

the purpose of developing the CST was to avoid dependence on identification of highly transient single words particularly monosyllabic words. Rather, CST places emphasis on simulating language constructions one might encounter in everyday situations with the hope of gaining insight into the subject's ability to process the standard form of spoken language.

While SSI utilizes a closed set paradigm requiring the listener to identify the target sentences through keyword recognition and the citing of a given sentence by its number, the CST employs an open set paradigm in which the subject must process the entire target sentences. This brings language skill somewhat to bear on the success of decoding the message [7]. However, as can be seen from the test material, the sentences have been constructed by keeping the level of language functioning, literacy, and intellectual level of the subjects in mind.

The major consideration in the development of the CST was the nature of the stimuli used as the competing signal. Unlike other tests which employ white noise, running speech, the babble of several voices and accelerated or decelerated speech as competing stimuli, the CST uses real sentences of approximately equal length and with semantic similarity to that of the target sentences. Also, these sentences are spoken in normal speed and articulatory pattern. Thus it closely approximates the acoustic and linguistic variables found in conversation speech.

Although the test protocol uses a dichotic paradigm, precise time matching of the onsets of the competing stimuli was not considered to be a critical factor as it is with tests of more limited signals such as competing words or consonants- vowels. The reason is that the auditory processing of sentences depends on several factors such as temporal patterns, acoustic spectra, linguistic features, and syntactical characteristics of the signal. However, care has been exercised to assure that the sentence pairs do begin and end very nearly at the same time.

On the basis of a pilot study, a signal to-competition ratio of -15dB is employed. That is, the primary message is presented at 35dBSL (re PTA) and the competing message is set at 50dBSL re PTA). The instructions to subjects are based on a hemispheric-dominance model. That is, in many dichotic tests hemispheric-dominance is controlled by commanding subjects to listen to the material in one ear and ignoring the material presented to the other ear [12]. Thus, the sentence protocol has been to instruct subjects to listen to and repeat the target sentence in the test ear while ignoring the competing sentence in the competing, or non-test, ear.

Similarly, based on the same test protocol of the Willeford CST, a Kannada version (a regional language of the state of Karnataka, India) of the CST has been developed [13]. Except for a slight modification in scoring, the Kannada CST adopts same testing procedures.

Clinical application

The CST has been shown to be valuable clinical tool for detecting the presence of structural lesions in the brain. In a series of studies reported by Lynn and Gilroy [3], [14], [15], the CST has emerged as an effective test for detecting lesions in the central nervous system. The tests were carried out on patients with confirmed brain lesions such as tumours of the temporal, parietal and frontal lobes, and in vascular and degenerative diseases of the brain. In each instance, the result of the CST were highly significant. Bergman et al [16], also found performance on the CST to be drastically affected in patients with cerebro-vascular and cranio-cerebral injuries. In yet another study [13], Shivashankar used this

test as one of several measures to evaluate central auditory processing deficits in patients with post-traumatic syndrome. These patients, following minor head injury, often complain of several clearly distinguishable symptoms [17], [18] which include dizziness and intolerence to noise and speech. The result of the above study revealed that these patients are likely to have significant difficulties in processing the sentences in a highly competing environment such as everyday conversational situations where acoustical features change very rapidly. This implies that these symptoms probably have an organic genesis.

The clinical utility of the CST in evaluating central auditory processing deficits in learning disabled children has been well documented [4], [8], [19], [20], [21], [22], [23], [24]. The studies report that children with learning disabilities have auditory processing deficits resulting in reduced performance in processing the auditory signals in a competing acoustic environment.

Modified CST

Based on clinical experience, and convinced of the need for a further comprehensive test, a modified version of CST termed the Ipsilateral-Contralateral Competing Sentence Test (IC-CST) was developed by Willeford and Burleigh [8]. This test uses male and female voices in competition with each other in the same test protocol as that of the CST. However, the use of male and female voices permits three testing protocols:

1. Presenting both target and competing sentences to a single ear and requiring the target sentence to be repeated;
2. Presenting target and competing sentences dichotically (presented to opposite ears) and requiring target sentence to be repeated, and;
3. Presenting target and competing sentences dichotically and requiring both target and competing sentences to be repeated.

Based on the same principles, Shivasankar developed a modified version of Kannada IC-CST [25]. The clinical utility of the IC-CST has been established in children with learning disabilities [8]. However, the potential clinical use in detecting documented central lesions need to be explored.

Summary

Sentence stimuli have been used in a wide variety of test protocols. They probably challenge central auditory processes in ways that phonemic elements or single words do not. The use of real sentences as test stimuli closely resembles the acoustic and linguistic variables found in conversational speech. Thus, it appears that the CST can play a unique role in the clinical evaluation of central auditory deficits, particularly in a neuropsychiatric clinical practice.

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