SSW REPORT

PERFORMANCE OF NORMAL HEARING ADULTS ON THE SSW SPANISH LANGUAGE VERSION: INTENSITY EFFECTS

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Abstract

This study investigated the intensity effect on the intelligibility of the Staggered Spondaic Word Test Spanish Language Version (SSW-SLV) in normal hearing adults (N=28). Participants received the SSW-SLV at four different intensities (i.e., 25, 35, 45 & 55 dB SL) above puretone average (PTA), 40-items per each intensity. The data were collected following the standard test procedure for the American SSW test version. The responses were used to generate performance-intensity functions. ANOVA revealed no significant main effect for SL (F=1,527, df=3, 2,12; p<0,01). A post-hoc Scheffe's test revealed no differences between intensities. This study showed similar results to the American SSW test studies (Doyle, 1988). Findings revealed no differences in the intelligibility of SSW presented at different intensities. For normal hearing listeners, the test may be presented at SLs of less than 50 dB with confidence for the SSW-SLV test performance.

Introduction

The Staggered Spondaic Word Test (SSW) (Katz 1962) is a clinical tool for assessing the central auditory nervous system. The test is used as part of a comprehensive audiologic test battery when central auditory dysfunction is suspected (Doyle et al, 1988).

The original application of the SSW test was for localizing the site-of-dysfunction in cases with suspected brain or brainstem lesions. When professional attention turned to the study of auditory processing problems, as seen in learning-disabled children, the data that were obtained from brain lesion patients formed the basis for understanding difficulties (Katz, 1994).

The features that make the SSW test especially useful, include a) its resistance to the influence of peripheral hearing distortion, b) its simplicity, which makes it applicable to a wide variety of ages and disordered populations, such as individual's who are mentally challenged, autistic, or exhibit Alzheimer's, and c) coherent normative data to evaluate individuals 5 to 70 years of age, d) evidence of strong reliability and validity, and e) brevity, making the procedure cost effective (Katz, 1994).

The test requires the listener to identify two dichotically presented spondaic words that are partially overlapped in

time, this overlap occurs between the second syllable of the first spondee presented and the first syllable of the second spondee presented (Katz, 1994). Odd numbered items are presented right ear first (REF) and even numbered items left ear first (LEF). The data are combined into four conditions: 1) right non competing (RNC), 2) right competing (RC), 3) left competing (LC), and 4) left non-competing (LNC) (Bellis, 2003). The test is comprised of 40 spondaic word pairs. Two spondaic words (e.g., "upstairs" and "downtown") would comprise an entire test item, with each individual test item consisting of four elements or constituent monosyllables (e.g., "up" "stairs", "down" "town") (Doyle et al, 1988).

Standard clinical procedure requires that test be presented at 50 dB SL re the pure tone average (PTA) of 500, 1000 and 2000 Hz for the respective ear, however in case of intolerance, the presentation level may be reduced to as low as 25 dB SL, without significantly affecting test results (Doyle et al, 1988; Katz, 1994; Bellis, 2003).

The rationale for the use of SSW was based on data showing these stimuli to be relatively familiar to most listeners and intelligible over a range of intensities (Katz, 1962). In addition, intelligibility of spondaic stimuli has been shown to increase rapidly with minor increases in intensity. Katz (1962) indicated that perceptual errors resulting from peripheral hearing loss could be accounted for and corrected, thereby providing more sensitive measure of central auditory function.

The SSW test of central auditory function includes a correction factor in its scoring procedure which attempts to account for peripheral distortion and may make it useful for patients who have cochlear hearing losses. One difficulty in administering the SSW test to hearing impaired listeners is the standard 50 dB sensation level (SL) presentation level. This standard level can mean that test items may be presented to some hearing impaired listeners at intensity levels as high as 100 dB HL or greater. Katz 1979 hypothesized that the SSW test may be presented at SLs as low as 30 dB to patients with cochlear hearing loss.

Although Doyle (1988) found the SSW test can be presented to normal hearing listeners at intensity levels as low as 20 dB SL, with virtually no effect on intelligibility. A lower presentation level may be especially beneficial for patients having losses exhibiting a reduced dynamic range (Flynn, et al, 1984).

SSW-SLV

Due to its clinical utility the SSW test has been developed in different language versions. In 1990, the Spanish language version (SSW-SLV) was developed by Hernan Soto (Universidad Metropolitana de Ciencias de la Educación, Santiago of Chile), Robert A. Windham (Gallaudet University) and Jack Katz (University of Buffalo, New York state University).

The SSW-SLV is similar in its constructions and diagnostic features to the English version. To accomplish cultural and linguistic differences between North American English speakers and Hispano-American native Spanish speakers were taken into account. The American English test uses a high proportion of monosyllabic

words, so it was not too difficult to find spondaic words (hot dog, ice cream, etc.) that have the same stress in both syllables. Spondaic words are not common in the Spanish language, so two familiar bisyllabic words were employed; a procedure that had been used successfully in the development of the SSW in other languages. Words were chosen taking children language levels into consideration. For this reason, words that were familiar for children 5 to 17 years and adults from 35 to 70 years were chosen (Soto, 2004).

The 40 items of the SSW-SLV have similar structures to the English version. The first and the second combination of the first two words have a logical meaning, as well as the first and fourth words. See Table 1.

There is no known published data regarding the SSW-SLV and intensity effects. The purpose of this research was to examine effects of intensity changes on the SSW-SLV in adults with normal hearing.

METHOD

Twenty-Eight Spanish native speaking adults (14 males and 14 female) between 20 and 53 years ages (M=33 age) volunteered. All participants are without a history of auditory processing disorders (established previously to the study) or otologic disorders. All subjects presented with normal hearing levels < 20 dB HL at the frequencies 250 to 8000 Hz, normal tympanograms, normal acoustic reflexes at 500/1000/2000 Hz (ipsilateral), and negative tone decay at 500 Hz, bilaterally. The word recognition scores were over 92% for both ears for Farfàn Lists.

Participants received testing via the MADSEN audiometer, model ORBITER 922 in a double-walled sound suite and the use of the Impedanciometer MADSEN, model ZODIAC 662. The SSW Spanish language version used was developed by AUDITEC St Louis (by Soto Ramos & Windham) by RCA CD player (RP2255). This study was approval by the ethical committee of the Hospital Sotero del Rio, Servicio de Salud Sur Oriente, Santiago, Chile.

PROCEDURE

The test items were presented at the following four intensity levels for each subject: 25 dB SL, 35 dB SL, 45 dB SL 55 dB SL, re the three frequency PTA (500-1000-2000 Hz) of each individual. All intensity presentations levels were randomized (each quarter), the REF / LEF conditions were balanced among the individuals. Ten test items were presented at each sensation level.

The listener's responses to each of the bisyllabic components in each word pair were scored at each SL. Omissions, substitutions and distortion have the same value. The percent of correct scores were used to generate a PI function.

RESULTS

The scores across all intensities showed a high intelligibility percent between 97.5% at 25 dB SL and 99% at 35 dB SL. See Table 2. Figure 1 displays the intelligibility scores (means and standard deviations for each intensities) and PTA scores.

ANOVA revealed a no significant main effect for SL (F=1,527, df=3, 2,12; p<0,01). A post-hoc Scheffe's test was used to confirm results, and revealed no significant differences among intensities.

DISCUSION

Findings reveal that intelligibility is high across all the intensities (SLs). Although the intensities were not exactly the same used at Doyle et al (1982) (+20,+30,+40,+50 dB re PTA), the results observed in this study are quite similar (PI function) to the American version (EC lists).

Studies indicate that SSW test list (EC) is highly intelligible to normal-hearing listeners even at SLs as low as 10 dB (Doyle et al, 1988). The SSW-SLV used in this study is the only one available in Spanish for clinical use so we used the 40 item score method. Although the word material used for the SSW-SLV is different to the American version (i.e., spondees verses bisyllabic words), the results are similar (% intelligibility).

Plotting PI functions, using only 10 stimuli per level, yielded sufficient information to describe listeners. The SSW- SLV has a close agreement with Doyle's previous data with list EC. These suggest that, at least for normal hearing listeners, the test may be presented at SLs of less than 50 dB with confidence. All the intensities used show a high intelligibility, thus, the test may be presented as low as 25 dB SL PTA in the SSW-SLV, without influence on test performance. This could be useful for clients with sensorioneural hearing impairment who have a reduced dynamic range.

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Table 1. Example of the words sequence on the SSW / SSW-SLV

Sequence	1	2	3
Right Ear	Perro (dog)	Gordo (fat)	
Left Ear		Libro (book)	Viejo (old)
Conditions of Competence	(RNC)	(RC) (LC)	(LNC)

Table 2. Intelligibility % at different Intensities

	Sensation Level (SL) dB			
	+25 dB	**+35 dB**	**+45 dB**	**+55 dB**
40-item				
Mean	97,5	99,0	98,6	98,7
SD	3,2	1,6	2,0	2,6
	+20 dB	**+30 dB**	**+40 dB**	**+50 dB**
Doyle, (1982)				
40-item				
Mean	97,2	97,5	98	97,7
SD	2,4	2,3	1,9	1,8

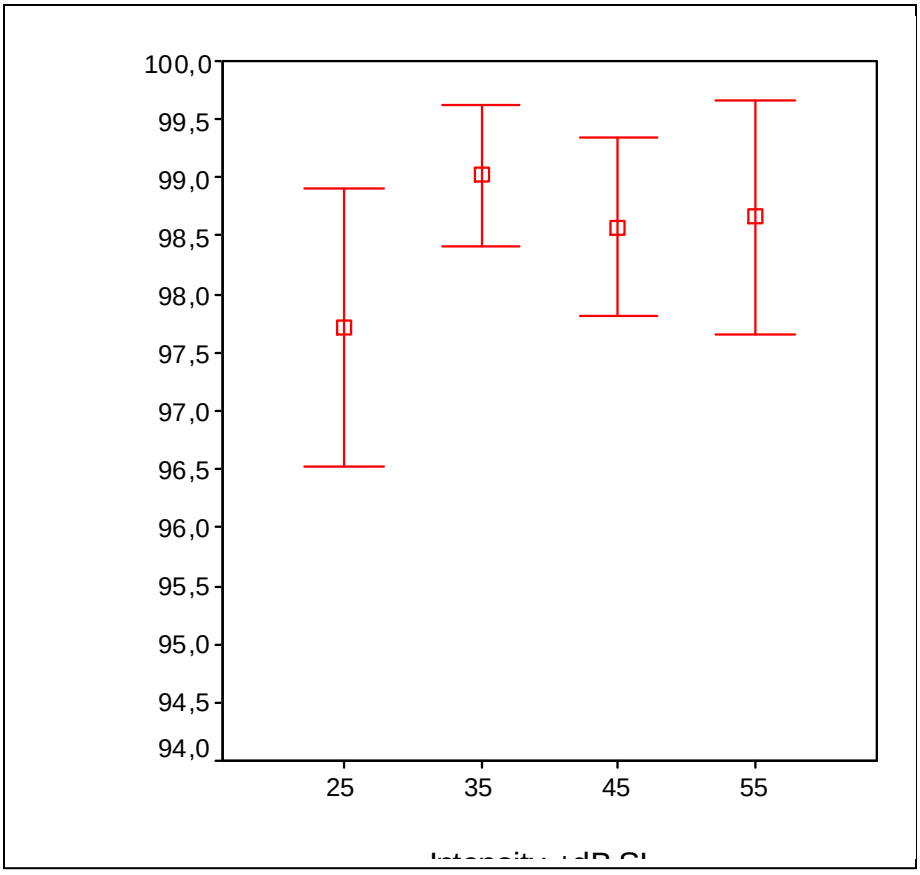

Figure 1. SSW test performance intensity (PI) functions for normal