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Comparison of a screening test and screening checklist for auditory processing disorders

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ABSTRACT

Objective: This study was carried out to determine the relationship between two screening tools to detect auditory processing disorders (APDs). The two screening tools were the screening checklist for auditory processing (SCAP) and screening test for auditory processing (STAP).

Method: Four hundred school-going children (218 males, 182 females) studying in grades III–VIII in three schools were randomly selected for the study. These children, aged 8–13 years, were screened using the SCAP and the STAP. The SCAP was administered by teachers while the STAP was administered by an audiologist.

The children were categorised as at-risk for APD by comparing their scores with the cut-off criteria recommended for SCAP and STAP. The relationship between the two screening tools was determined.

Results: Among the 400 children, 49 (12.3%) children were found to be at-risk for APD on the SCAP and 64 (16%) were found to be at-risk on the STAP. A Chi square test of association was carried out using the data of children who were passed or referred on each of the screening tools (SCAP and STAP). A significant association ($\chi^2 = 2.93$, df = 1, $p < 0.001$) was found between the two screening tools. This was confirmed using Spearman's rank correlation coefficient, which revealed a significant correlation ($r = 0.86$, $p < 0.001$) between SCAP and STAP.

Using the scores of 31 children referred on both the screening tools, a relationship was derived between the SCAP and subsections of the STAP (speech-in-noise, dichotic consonant vowel (CV) combinations, gap detection and auditory memory). Pearson's product moment correlation coefficient indicated the presence of a significant correlation ($r = -0.46$, $p < 0.01$) between the SCAP and the auditory memory subsection of the STAP. However, no significant correlation was seen for other three subsections.

Conclusion: The study indicates an overall high correlation between the SCAP and the STAP. However, both the screening tools examine different aspects of auditory processing and thus, should be administered together to identify more children at-risk for APD.

1. Introduction

Auditory processing disorder (APD) is considered as a problem that impairs neural function thereby leading to poor recognition, discrimination, separation, grouping localisation, or ordering of non-speech sounds. It has been noted to not occur exclusively as a consequence of a deficiency in general attention, language or other cognitive processes [1]. APD has been found to occur as a comorbid condition with learning disability. The prevalence of APD in learning disability has been found to be 30–50% [2,3].

The diagnosis and management of APD has been a challenge for clinicians [4]. According to Chermak and Musiek [5], 2–3% of school-going children have APD. Similar findings have been reported in India by Muthuselvi and Yathiraj [6] who found APD to have a prevalence of 3.2% in school-aged children. In order to identify these children, screening for APD has been considered necessary by Musiek et al. [7], Bellis [8], and Chermak [9]. Screening was reported by them to spread awareness among parents and educators; enable planning effective management strategies; and make appropriate educational recommendations.

Screening for APD has been carried out using questionnaires or checklists [6,10–15] and screening tests [5,8,16–20]. Some of the checklists reported in literature include the 'children's home inventory for listening difficulty' [12], 'Children's Auditory Processing Performance Scale' (CHAPS) [13], 'Screening Instrument for Targeting Educational Risk' (SIFTER) [14], 'Screening Checklist

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for Auditory Processing' (SCAP) [10,11] and 'Scales of Auditory Behaviours' [15]. Although a number of checklists have been described in literature, limited information is available regarding their usefulness.

The CHAPS [13] was designed to be administered on parents and teachers to assess the listening ability of a child. Parents/teachers were required to compare a child with other children of same age group. The questions in CHAPS were based on the perception of auditory stimuli in the presence of noise, quiet, multiple inputs, auditory memory/sequencing and auditory attention span. Purdy and Johnstone [21] reported a significant correlation between the dichotic digit test and memory rating of CHAPS. On the other hand, Drake et al. [22] reported that there was no relation between CHAPS and diagnostic APD tests. Their findings were based on their study of 40 children in the age range of 8–15 years, who were administered CHAPS along with diagnostic tests. Like Drake et al., the lack of correlation between the CHAPS and diagnostic APD tests was demonstrated in three children by Cameron et al. [23]. They compared CHAPS with a battery of diagnostic APD tests consisting of the pitch pattern sequencing test, the duration pattern test, masking level differences, Bamford–Knowal–Bench sentences and the random gap detection test. They found no significant correlation between CHAPS and the diagnostic APD tests.

Similarly, Muthuselvi and Yathiraj [6] checked the relation between the SCAP and five diagnostic APD tests on 42 school-aged children. The diagnostic tests included speech-in-noise, dichotic consonant vowel, masking level difference, gap detection, and auditory memory and sequencing. They found a significant correlation between the SCAP and the speech-in-noise test as well as the auditory memory test. The SCAP was also found to have a sensitivity of 71% and specificity of 68%.

Emerson et al. [24] reported that screening checklists may lead to over-referrals. In support of the use of screening tests, Schow and Seikel [25] observed that such tests had better sensitivity and specificity than screening checklists. Chermak and Musiek [5] recommended the use of a battery of tests to screen for APD. A few of the screening tests reported in the literature are the 'screening test for central auditory processing disorders' (SCAN) [18], SCAN-A for adults [19], SCAN-C for children [20], selective auditory attention test [26], test of auditory perceptual skills – revised (TAPS-R) [17], multiple auditory processing assessment (MAPA) [27], Bamford–Kowal–Bench speech-in-noise test [28] and screening test for auditory processing (STAP) [16].

Wilson et al. [29] studied the relationship between screening procedures (checklists and tests), with diagnostic APD tests. They used two checklists (CHAPS, SIFTER) and a screening test (TAPS-R). They found a weak correlation between these screening procedures with the four diagnostic tests used by them (competing sentences test, low-pass filtered speech test, frequency pattern test and dichotic digit test).

Besides the sensitivity and specificity of any screening tool, the efficiency of the same has also been determined based on the time taken for its administration. In literature, the total duration to conduct a screening task has been considered an important factor [30]. The time taken to administer the SCAN and MAPA has been reported to be 20 min [31] and 30 min [27], respectively. In contrast, the STAP has been found to require just 12 min for it to be run which included the time for scoring.

In the literature on APD screening tools, most of the studies have been restricted to evaluate the relation between screening procedures with the diagnostic APD tests. However, there is a dearth of literature pertaining to the relationship across different screening procedures i.e. screening checklists and screening tests. Such information would shed light on whether different APD screening procedures can be used independent of each other or in conjunction with each other. Hence, there is a need to compare the relationship between screening procedures.

The present study focussed on evaluating the relationship between STAP [16] and SCAP [10,11]. The results of the study would help determine whether one screening technique can be used in lieu of the other or whether both screening tools should be utilised. If the two are to be used together, the study would provide information regarding the effectiveness of a hybrid screening protocol consisting of the two procedures.

2. Method

2.1. Participants

The participants consisted of 400 school-going children (218 males, 182 females), aged 8–13 years. These children were randomly selected from among 2400 children from three different schools. The participants studied in grades III–VIII in schools where the medium of instruction was English. All the children had undergone educational instruction in English for at least three years. Prior to testing each child, it was ensured that he/she had no developmental as well as speech and hearing problems, as reported by the class-teacher and the child. The teachers' reports were based on speech and hearing screening programmes that had been conducted in the schools earlier. A letter of consent was obtained from the teachers and caregivers before testing the children. This complied with the recommendations of the Ethical Guidelines for Bio-Behavioural Research Involving Human Subjects [32] of the All India Institute of Speech and Hearing, Mysore.

2.2. Material

The study was conducted using the STAP developed by Yathiraj and Maggu [16] and the SCAP developed by Yathiraj and Macarenhas [10,11]. As described earlier by Yathiraj and Maggu [16], the STAP was developed based on the auditory processes that were reported to be predominately affected in children with APD [6,33–35]. The STAP was constructed to include four subsections (Speech in noise, Dichotic CV, Gap detection and Auditory Memory) that tapped auditory separation/closure, binaural integration, temporal resolution and auditory memory, respectively. Table 1 provides a description of the contents of the four

Table 1
Details of the subsections of STAP.

	Subsections			
	Speech-in-noise (SPIN)	Dichotic CV (DCV)	Gap detection (GD)	Auditory memory (AM)
Stimuli	Monosyllabic words	Consonants–vowels (/pa/, ta/,/ka/,/ba/,/da/,/ga/)	300 ms white noise	Monosyllabic words
No. of practice items	2 words per ear	2 CV pairs	1 token for each ear	1 token of 4 words
No. of test items	10 words per ear	6 CV pairs	6 tokens for each ear	4 tokens of 4 words
Mode of presentation	Monaural	Dichotic	Monaural	Binaural
Processes tested	Auditory separation	Binaural integration	Temporal resolution	Auditory memory