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Case Report

Exploring assessment of spoken language processing in spoken language processing disorder

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ABSTRACT

Spoken language processing model by Medwetsky in the year 2011, provides an overview of auditory, cognitive and language mechanisms engaged in the processing of spoken language. It shows how deficits in the various stages of processing can be manifested and provides a framework of developing an effective interdisciplinary test battery. Present case study was designed to provide a novel way of assessment for children with spoken language processing disorders. An 8 years old Marathi speaking child who showed difficulty in following the instructions and poor attention was evaluated with spoken language processing test battery. The child was found to have deficits in various levels of spoken language processing. This holistic assessment will help to know a case in a better way and domain specific intervention of spoken language processing disorder. Spoken language processing disorder occur when a breakdown in any of these mechanisms impacts an individual's ability to effectively process and use information that is heard. We recommend that domain specific holistic assessment is essential in spoken language processing disorder. Spoken language test battery can be used for comprehensive assessment of all processes involved in the spoken language processing model.

Keywords: Spoken language processing disorder, Auditory processing, Phonological processing, Language processing

INTRODUCTION

Central auditory processing disorder (CAPD) has remained a controversy. In 1950, Ettore bocca and Helmer were the first researchers who explored auditory processing among children.[1] Kamhi in the year 2011 found great diversity in the field of audiology concerning Central auditory processing disorder (CAPD). No one really knows what causes CAPD and there were no consensus concerning test battery of tests that lead to diagnose CAPD. Different models were suggested for auditory processing where Bellis model explained only auditory processing, Buffalo model explained cognitive aspects.[2,3] Spoken language processing model by Medwetsky in the year 2011, provides an overview of auditory, cognitive and language mechanisms engaged in the processing of spoken language. It shows how deficits in the various stages of processing can be manifested and provides a framework of developing an effective interdisciplinary test battery. Spoken language processing disorders occur when a breakdown in any of these mechanisms (temporal processing, selective auditory attention, divided auditory attention, auditory memory and sequencing, auditory linguistic integration, lexical decoding, phonological processing) impacts an individual's ability to effectively process and use the information that is heard. The symptoms vary depending on the underlying deficits.[4]

Deficits in spoken language processing can lead to specific language impairment with prevalence of 7-8%, central auditory processing disorder with prevalence of 2%–3%, dyslexia with prevalence of 5-10% and 3% and speech sound disorder with prevalence of 24.4% to 48% in children.[5-8] High prevalence of spoken language processing disorders alarming us to explore novel assessment and intervention strategies. Currently when we do assessment, we focus only on one or two domains. We lack in assessment of holistically the spoken language processing. Medwetsky's model of spoken language processing suggested to use test battery for holistic assessment of spoken language processing. In Indian context Sone, explored the spoken language processing in typical developing Marathi speaking children.[9] He developed normative for the spoken language processing test battery. This gives us the availability of normative data and cut off scores for Marathi speaking children in the age range of 5 to 8 years helps in early identification of the spoken language processing disorder. Further holistic picture of the spoken language processing will help in the deficit specific intervention. In present study, we are exploring novel holistic assessment of spoken language processing in a child with Spoken language processing disorder.

CASE REPORT

An eight years old male Marathi speaking child was reported to have difficulty in following the instructions, poor attention span in the school. He was studying in second grade English medium school in Pune, Maharashtra, India. The class teacher of the child reported he was average in academic performance. The screening checklist for auditory processing (SCAP-C) was administered to screen for the CAPD. Child got score of 8 on SCAP.

It indicated that child needs to be referred for the detailed CAPD evaluation. Further child was referred for the detailed evaluation for speech language and hearing at Bharati Vidypeeth (Deemed to be University)'s School of Audiology and speech language pathology, Pune. Initially a hearing evaluation was done which revealed 'bilateral hearing sensitivity within normal limits'.

CAPD test screening test was carried which includes AMST, DDT, PPT, SPIN. Child scored 2 out of 3 for memory and sequencing domain; 0 out of 6 for Dichotic digit test (DDT) score; 1 out of 6 for Pitch pattern test (PPT) score; 5 out of 6 for Speech in noise test (SPIN) score. It shows that child was at risk of CAPD. Hence detailed CAPD evaluation was done using spoken language test battery. Spoken language test battery consists of Gap detection test (GDT); Perception of speech. In Noise Test in Marathi (PSIN-M); Dichotic Digit Test in Marathi (DDT-M); Auditory memory sequencing test in Marathi (AMST-M); Auditory-Linguistic Integration Test in Marathi (ALIT-M); and Lexical Processing Test in Marathi (LxPT-M).[10-15]

Table 1: Performance of a child on spoken language processing battery and interpretation.

Various Spoken language Processes	Tests	Performance/Score	Interpretation
Temporal Resolution	Gap Detection Test(10)	Gap detection thresholds for left ear- 10ms Gap detection threshold for right ear – 10 ms	Temporal Processing Deficits
Auditory Attention	Perception of speech In Noise Test (PSIN-M)(11)	PSIN-M score for right ear - 15/25 PSIN-M score for left ear -16/25	No deficits in selective auditory attention
	Dichotic Digit Test in Marathi (DDT-M)(12)	Single correct score for right ear- 12/25 Single correct score for left ear- 12/25 Double correct score - 3/25	Deficits in divided auditory attention
Auditory Memory and Sequencing	Auditory Memory and Sequencing Test in Marathi (AMST-M)(13)	Auditory memory score - 61 Auditory sequence score -25	Adequate auditory memory and sequencing skills
Auditory Linguistic Integration	Auditory-Linguistic Association Test in Marathi (ALIT-M)(14)	ALIT-M score- 4/15	Auditory linguistic integration deficits

Table 1 shows the results of spoken language processing test battery. Further using normative data available in the study done by Sone, it was compared.[9] It shows that child exhibits temporal processing deficits (GDT), divided auditory attention deficits (DDT-M), auditory-linguistic integration deficits (ALIT-M), and lexical decoding deficits for words and non-words (LxPT-M). Child showed no deficits for selective attention, auditory memory and sequencing. Further Phonological awareness test in Marathi was administered to evaluate phonological processing skills. Child scored 5 out of 8 at sentence level, 28 out of 38 at syllable level, 7 out of 18 at rhyme

level, 52 out of 90 at phoneme level. This indicates deficits in phonological awareness at sentence, syllable, rhyme and phoneme level. Language abilities of a child were evaluated by Development of language test for 7-12 years of children.[16] It showed age appropriate linguistic abilities. Literacy skills were assessed by using Dyslexia assessment of language in India.[17] The test include domains such as phonological awareness, fluency, Literacy and Random automatized naming. Phonological awareness included rhyme and phonetic replacement. Child scored 8/12 with a cut off score of 9 and 3/10 with a cut off score of 4 for rhyme and phonetic replacement respectively. Fluency domain included semantic fluency and verbal fluency and Child scored 8 and 10 with a cut off of 9 and 7 respectively. Literacy domain included letter reading, word reading, listening comprehension, letter spelling and word spelling and scores were 10/10 for letter reading with the cut off of 10, 18/25 for word reading with the cut off of 23, 4/5 for listening comprehension with the cut off of 1, 10 for letter writing with the cut off of 12, 8/20 for word spelling with the cut off score of 16. The child could complete Rapid automatized naming (RAN) in 54 seconds where he crossed cut off of 50 seconds. The DALI result indicated that child has deficits at phonological awareness (Rhyme, Phonemic replacement), fluency (semantic fluency) and literacy (Word reading, letter spelling and word spelling).

Holistic test battery used for assessment of child with listening difficulties allows us to overview all processes involved in the spoken language processing. It indicates that child has deficits for temporal processing, divided auditory attention, auditory linguistic integration, lexical processing, phonological processing, and literacy skills. Hence further deficit specific intervention can be given to reduce their impact on the development of phonological awareness, literacy skills.

DISCUSSION

The above case study highlights use of holistic test battery which includes auditory cognitive, and linguistic domain should be used in the assessment of spoken language processing disorder. This case study also highlights the association between auditory processes, phonological processes and literacy skills. Association of all these processes were not much explored. Literature shows association of phonological processing deficits with literacy disorders and impairments in the processing of basic acoustic parameters of the speech signal.[2,18-20] According to one of the most influential theories, Tallal's rapid temporal processing deficit hypothesis, phonological deficits in literacy disorder would be secondary to low-level auditory temporal processing impairments.[21] Poor readers are also slower than normal readers in rapid naming tests of common objects, letters, digits, and colors.[22] Auditory processing disorder (APD) was found to be present in 43.3% and coexisting with developmental dyslexia in 25% of the cases. The diagnosis of APD correlated with age in that children with APD were younger by 2 years than without diagnosis of APD.[23] The relationship between phonological awareness and reading was found by study done by Waknis and Vanaja.[24] Result showed strong positive correlation between phonological awareness and reading skills. Sone showed the association between the auditory, cognitive and linguistic domain for the spoken language processing.[9] Hence assessment of literacy/phonology/auditory/cognitive processes should always be done in holistic manner. This will lead to better profiling of child's spoken language processing abilities and this will help in deficit specific intervention of the spoken language processing disorders.

CONCLUSION

Spoken language processing model is a holistic model and it involves successful intertwining of auditory, cognitive and linguistic mechanisms. Spoken language processing disorder occur when a breakdown in any of these mechanisms impacts an individual's ability to effectively process and use information that is heard. A domain specific holistic assessment and intervention is essential in spoken language processing disorder as there is high prevalence of disorders like Specific language impairment, Central auditory processing disorder, Dyslexia, Speech sound disorder. Since deficits in spoken language processing can lead to different disorders, we recommend that domain specific holistic assessment is essential in spoken language processing disorder and it can be done by using Spoken language test battery.

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