DEVELOPMENT OF BEDSIDE SCREENING TEST FOR PERSONS WITH APHASIA IN TELUGU

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May, 2013

FOR MY MOTHER

Certificate

This is to certify that this dissertation entitled "**Development of Bedside Screening Test for Persons with Aphasia in Telugu**" is a bonafide work in part fulfillment for the degree of Master of Science (Speech-Language Pathology) of the student (Registration No. 11SLP008). This has been carried out under the guidance of a faculty of this institute and has not been submitted earlier to any other University for the award of any other Diploma or Degree.

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Declaration

This dissertation entitled "**Development of Bedside Screening Test for Persons with Aphasia in Telugu**" is the result of my own study under the guidance of Dr. S. P. Goswami, Professor of Speech Language Pathology and Head, Department of Speech Language Pathology, All India Institute of Speech and Hearing, Mysore, and has not been submitted earlier in any other University for the award of any Diploma or Degree.

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"It is our choices...that show what we truly are, far more than our abilities."

- *Albus Dumbledore*

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CHAPTER - I

INTRODUCTION

Language is a complex system of symbols manifested in speech, writing and gesture (Solot, 1998). It can be receptive or expressive, verbal or non-verbal. Receptive language refers to the skills involved in understanding the spoken language. Expressive language refers to the skills used to express one's thoughts, ideas, knowledge and experience. Human interactions and experiences are tightly bound by language. Across life span, the mental development and behaviors are constantly being transformed through social action and social interaction. An effective usage of language also determines maturity of an individual (cited from Language intervention strategies in adult aphasia, Chapey, 1994).

Based on the many definitions quoted in literature, Aphasia is a complex heterogeneous neurogenic condition which alters areas responsible for language in the brain due to brain damage manifested through partial or complete loss of symbolic communication due to disturbance in one or more modalities; the impairment is not due psychosis, perception, sensation, cognition or intelligence.

1.1 Incidence and Prevalence:

The prevalence of stroke is in higher proportion in younger individuals i.e., 18-32% out of overall persons with stroke (Dalal, Bhattacharjee, Vairale, & Bhat, 2008). Pandian (2005) investigated that out of one-fifth of persons with stroke admitted to hospital for the first time were aged below 40 years. The prevalence of stroke is 90 - 222

per 100,000 (Dalal, 2007). It is estimated that prevalence rate in India for stroke varies with region.

1.2 Signs and symptoms:

Symptomatology of the aphasia varies across individuals, depends partially or entirely on speaking situation in which the production occurs. Signs and symptoms may vary in terms of severity and level of disruption to communication. However, the most common symptoms are reduction in oral expression, spoken language comprehension, disturbances of written expression and written language comprehension. Clinical signs of aphasia are numerous and varied (Lecours, Lhermitte & Bryans, as cited in Aphasiology, pp 77, 1983).

1.3 Assessment:

Assessment is an important aspect to describe language behaviours, identify level of existing problems in various domains and also in planning appropriate management strategies and define factors to facilitate retrieval of language to improve the quality of life of persons with aphasia. It can be carried out using comprehensive test batteries and screening tools. Comprehensive test batteries are time consuming and needs the persons with stroke to be present throughout the examination. E.g. Western Aphasia Battery-Revised (Kertesz, 1979, 1982, 2006), Boston Diagnostic Aphasia Examination (Goodglass and Kaplan, 1983), Porch Index of Communicative Ability (Porch, 1967)

There have been tools available in India such as Western Aphasia Battery, Linguistic profile test and Bilingual aphasia test to assess the various skills in persons with aphasia. The assessment tools can be broadly classified as screening, diagnostic and performance tests. When the examination is brief and cursory to detect the presence of disorder is termed as screening. Three types of screening procedures relevant to aphasia, these are: 1) bedside clinical examination. 2) Screening tests per se. 3) Tests of specific aspects of language functioning

Bedside examination has been widely used traditionally for assessment of aphasia (Kirshner, 1995; Strub & Black 1993). The purpose of bedside screening is to determine whether language function is affected. It is a standard tool used by professionals such as Speech Language Pathologists and other allied professionals. The depth of the screening tool may range from unstructured conversation with the person with aphasia to a structured set of items. Bedside screening test provides the clinician with lots of flexibility, conciseness and suitability, since the professional conducts the examination at the bedside by quickly skipping across the areas of strength where there is no obvious impairment. In the literature, professionals had used different screening tools to evaluate the performance of persons with stroke using such tools.

Need for the study

There are limited reports in the literature to develop such tools in Indian context, especially in Telugu population. Based on the Census of India, 2001 Telugu ranks third in terms of highest number of native speakers. Telugu is the official state language of Andhra Pradesh; most spoken Dravidian language. Due to large ethno cultural variation,

most of the screening tools developed in the western framework become difficult to apply them in the Indian context. Hence due to limited screening tools in Telugu, there is a need to develop a particular tool in one's native language is high in order to assess the person's strengths and weakness in a better qualitative form.

Aim of the study

To develop a bedside screening test in Telugu.

Chapter- II

REVIEW OF LITERATURE

Language is a socially shared code. It represents ideas through use of arbitrary symbols and rules that govern combinations of these symbols. The linguistic code allows language users to represent an object, event, or a relationship with a symbol or combination of symbols. Language encircles complex rules that govern sounds, words, sentences, meaning, and use. These rules determine an individual's ability to understand language and formulate language. Implicit knowledge about rules of a language determines that a person can understand and create infinite number of sentences and can use language in variety of social settings (Bernstein & Farber, as cited in Language and communication disorders in children, 2009).

Stroke can affect motor, sensory, cognitive, language and other functions depending on the areas of the brain involved (Kelly-Hayes, Robertson, Broderick, Duncan, Hershey, Roth, Thies, Trombly, 1998). Stroke can affect communication in many and different ways. Communication impairments are quite widespread in the acute phase of stroke. Impairment of language is most challenging problems in the rehabilitation of persons with stroke and a significant barrier to their independent living (Pedersen, Jorgensen, Nakayama, Raaschou, & Olsen, 1996; Pedersen, Jorgensen, Nakayama, Raaschou, & Olsen, 1995). It is estimated that one third of persons with stroke have communication problems during the acute phase (Townend, Brady, & Maclaughlan, 2007a/2007; Engelter, Gostynski, Papa, Frei, Born, Ajdacic-Gross,

Gutzwiller & Lyrer, 2006; Parr, Duchan, & Pound, 2003; Kauhanen, Korpelainen, Hiltunen, Sotaniemi, & Myllyla, 2000a/2000b).

The effects of stroke depend on which part of the brain is injured and how severely it is affected. A very severe stroke can even cause sudden death. Globally, stroke is the third most common cause of mortality (Warlow, Sudlow, Dennis, Wardlaw, and Sandercock, 2003). Age has shown to have a strong association with the incidence of stroke (Dalal, 2004). The consequences of stroke can be diverse depending on the site and extent of brain damage and its effects can be transient or permanent and mild or severe. The World Health Organization (WHO, 2000) considers impact of impairments on everyday life of persons with stroke. Impairment refers to physical or cognitive effect (for example, hemiparesis or hemianopia), activity limitation refers to the functional consequence of the impairment (e.g. inability to concentrate) and participation restriction is caused by the impairment (e.g. not been able to go socially). The effects of stroke can be divided into following four broad categories:

i. Physical motor and sensory deficits
ii. Cognitive (difficulties with attention, concentration, memory and perception)
iii. Communication (aphasia and dysarthria),
iv. Psychosocial problems (depression, anxiety, anger, emotional liability, reduced activity levels and social participation).

The above mentioned effects of stroke interfere in daily life of persons with stroke in terms of activity limitation, participation restriction, and functional consequence are

caused due to thrombosis, hemorrhage, and embolism. The other common factors which also lead to stroke are traumatic brain injury, infections, tumors, metabolic disorders and neurotoxic agents. A stroke is caused by the interruption of the blood supply to the brain, usually because of blood vessel bursts or in blocked by a clot. WHO clinically defines stroke as the rapid development of clinical signs and symptoms of a focal neurological disturbance which lasts more than 24 hours or leading to death with no apparent cause other than vascular origin (WHO, 2005).Acquired aphasia can be due to brain damage to the left hemisphere of the brain particulary stroke (Carlson, 2001; Bradshaw & Mattingley, 1995).

Stroke in India contributes 41% of deaths and 72% of disability adjusted life years amongst the non-communicable diseases (ICMR, 2004). Studies carried out in India have shown that about 10% - 15% of persons with stroke were below the age of 40 years (Feigin, 2007). Aphasia is a clinically diverse condition which affects the ability to communicate by oral or written language or both following brain damage. Specifically, Aphasia is a disorder of language disturbance where the person with aphasia had an intact language prior to brain damage. Aphasia refers to a multimodality disturbance of speech, language, and memory caused by neurological injury, particularly stroke (Small, 2010). Aphasia is a major symptom of stroke which shares a common neurophysiological and neurochemical features with other stroke consequences. Aphasia may be temporary or permanent, and the exact nature of spontaneous or gradual recovery patterns among different individuals is often unknown (Basso, 1992; Kertesz & McCabe, 1977). Recovery rates in persons with aphasia vary and depend upon physiological, cognitive,

and psychological factors (Code, 2001). Hillis (2007) suggested that early recovery in persons with aphasia depends on mechanisms of tissue restoration and later recovery on the reorganization of neural networks underlying language or other compensatory mechanisms.

Lezak (1983) suggested that profiling speech and language functions in persons with aphasia will indicate communication problems by assessing aspects of verbal behavior such as "Spontaneous speech, repetition, comprehension, naming, reading and writing".

In persons with aphasia language impairment is manifested heterogeneously, there is no uniform pattern exhibited. Thus, different modalities are impaired in different degrees such as comprehension is more impaired than production or vice versa and in some reading and writing is more impaired than comprehension and production (Davis, 2007; Duffy & Ulrich, 1976). Linguistic analysis of the speech samples of persons with aphasia reveals deficits in the following domains.

1. **Expressive language**

Wernicke (1908) referred to two forms of speech production and he made a clear distinction in persons with aphasia i.e., "fluent" and "nonfluent". Persons with aphasia due to anterior lesions are typically characterized by increased effort, slow rate, reduced phrase length, and decreased verbal output. Speech output is of decreased phrase length and melody is the best predictor between fluent and non fluent speakers (Goodglass, Quadfasel, & Timberlake, 1964). Prosodic features are normal in fluent aphasia whereas

in nonfluent the output is halting, uneven rhythm, inflections are absent and melody is disrupted (Monrad – Krohn, 1947). Syntactically specific language structures are omitted (prepositions, articles, adverbs) and have difficulty in using relational words (Goodglass & Berko, 1960). In contrast speech output with posterior lesions is characterized by normal or excessive rate, normal phrase length, rhythm, melody, and articulatory agility, paragrammatic form, frequent pauses, circumlocutions and errors in use of grammatical structures of language (Paragrammatism) and substitution of words within language (paraphasia) for persons with aphasia (Pick, 1913; Lecours, Lhermitte, & Bryans, 1983; Ryalls, Valdois & Lecours, 1988). Kerschensteiner, Poeck, & Brunner (1972) described speaking rate as a powerful discriminator between nonfluency and fluency.

2. Comprehension of spoken language

Comprehension difficulties in persons with aphasia may be due to semantic processing difficulties. Deficits in verbal short term memory also contribute to comprehension difficulties (Albert, 1996; Burgio & Basso, 1997). Comprehension deficits may be limited to certain semantic categories whereas their comprehension of other semantic categories may be relatively intact (Kertesz, Davidson, & McCabe, 1998; Semenza, 2006). Davis (2007) states that comprehension difficulties are impaired when they are beyond word level, difficulties may vary from understanding narrative speech to simple words (Helms – Estabrooks & Albert, 2004). Location of the damage has an effect on auditory processing abilities of person. Pietrini, Nertempi, Vaglia, Revello, Pinna, and Ferro-Milone (1988) suggested that representation of the living things are localized in the temporal lobes of the brain.

Comprehension involves both cognitive (Attention, visual search, selection and verbal memory) and linguistic skills (Helm- Estabrooks & Albert, 2004). Damage to the temporal lobe areas affects auditory comprehension abilities (Auther, Wertz, Miller, & Kirshner, 2000). Allocation in working memory is necessary for linguistic processing which is impaired in persons with stroke, in turn affecting both sustained and selective attention in these individuals (Rothenberger, Szirtes, & Jurgens, 1982; Caplan & Waters, 1999; Csepe, Osman-Sagi, Molnar, & Gosy, 2001). Comprehension is compromised due to semantic and morphological alterations of the spoken words (Radanovic, Senaha, & Mansur, 2001). The semantic system is central aspect of language and is involved in comprehension and production (Patterson & Shewell, 1987). Rapp and Caramazza, (1998) suggest that difficulty in performance of word picture matching could be due to semantic deficits or phonetic or and visual problems.

3. Repetition of spoken language

A deficit in the ability to repeat auditory-verbal information is common among persons with aphasia. It reveals problem in verbal output or language comprehension. In persons with aphasia, repetition is more difficult when compared to other language problems (Berndt, 1988); some even exhibit difficulty even at simple level. Errors in repetition are predominantly associated with damage in perisylvian areas, but it is usually seen in all types of brain damage. Errors vary both qualitatively and quantitatively. (Wernicke, 1874; Geschwind, 1965) Damage to arcute fasiculus results in repetition difficulties. (Warrington, Lougue, and Pratt 1971, 1972) proposes that the difficulty in repetition arises due disruption of auditory short term memory. In the literature, studies

report that loss of connection between anterior and posterior areas of brain affects the conversion of auditory speech code into motor speech production resulting in repetition difficulties. Several researchers suggest that errors in repetition are as a result of a deficit in phonemic or motoric encoding (Kohn, 1984; Yamadori and Ikumura, 1975; Dubois, Haecan, Angelergues, Chatelier, & Marcie , 1973). Limitation in working memory has an effect on linguistic processing (Caspari, Parkinson, LaPointe, & Katz, 1998; Conner, Mackay, & White, 2000; Dick, Bates, Wolfec, Utman Dronkers, & Gernsbacher, 2001; Friedmann & Gvion, 2003; Martin, 2000; Murray, 2004; Wright, Newhoff, Downey, & Austermann, 2003; Yasuda & Nakamura, 2000). Persons with stroke have difficulty in automatic speech tasks like digit forward tasks. It has been reported that persons with impaired language have significant shorter verbal span on digit forward test (De Renzi & Nichelli, 1975). Digit backward is a complex task which depends on working memory processing (Black & Strub, 1978).

Literature shows that the association between the arcuate fasciculus and repetition has not been consistently upheld (Axer, Keyserlingk, Berks, & Keyserlingk, 2001; Bartha & Benke, 2003; Bernal & Ardila, 2009; Brown, 1975; Kempler, Metter, Jackson, Hanson, Riege, & Mazziotta, 1988; Mendez & Benson, 1985; Selnes, van Zijl, Baker, Hillis, & Mori, 2002; Shuren, Schefft, Yeh, Privitera, Cahill, & Houston, 1995). The superior temporal gyrus and inferior parietal cortex is sufficient to induce symptoms such as impaired repetition with intact comprehension (Anderson, Gilmore, Roper, Crosson, Bauer, & Nadeau, 1999; Quigg & Fountain, 1999; Quigg, Geldmacher & Elias, 2006).

Kempler, Metter, Jackson, Hanson, Riege, and Mazziotta (1988) suggest that repetition deficits are not necessarily linked to arcuate fasciculus damage.

4. Naming

Anomia refers to difficulty in retrieving words and it is indeed the most common symptom in persons with aphasia. Persons with aphasia have word finding difficulty (Goodglass & Geshwind, 1976). Gardner (1973) suggested that naming performance relies on operating of the element to be named. Naming difficulties are exhibited in the form of paraphasias (phonemic) or circumlocutions. The individual experiences 'tip of tongue' problems indicating the awareness of phonological characteristics of word (Benson, 1979; 1988). If there is any deficit in the processes such as decoding, storage, selection, retrieval or encoding will result in naming problems. Several authors report that site of lesion plays an important role in naming and functional neuroimaging. Picture naming involving both semantic and phonological steps of the production process (Schriefers, Meyer, & Levelt, 1990) Studies also revealed that during naming left perisylvian and extrasylvian cortex get activated (Howard, Patterson, Wise, Brown, Friston, & Weiller, 1992; Hirsch, Moreno, & Kim, 2001; Abrahams, Goldstein, Simmons, Brammer, Williams, & Giampietro, 2003; Grabowski et al., 2003; Martin , 2005; Harrington, Buonocore, & Farias, 2006; Price, Devlin, Moore, Morton, & Laird, 2005; Price, McCrory, Noppeney, Mechelli, Moore, & Biggio, 2006; Kemeny, Xu, Park, Hosey, Wettig, & Braun, 2006; Saccuman, Cappa, Bates, Arevalo, Della Rosa, & Danna, 2006). Semantic errors in naming are the result of semantic processing deficits (Hilis,

1990). Nickels and Howard (1995) found that imageability and concreteness predicted naming performance in persons with aphasia.

5. Reading

Acquired alexia is caused by an acquired disease of central nervous system such as stroke. It results from damage to mature reading system and manifests as impairment in the comprehension of written language. Acquired reading disorders can be divided into peripheral and central alexias. Peripheral subtype affects early stages of the reading process and involves difficulty perceiving the written word. Central subtype affects later stages of reading process and involves impairments in lexical or sublexical processing. In central alexias, lesion site varies greatly across subtypes and individuals. In peripheral alexias the areas of the brain lesion site is associated with visual processing. The most common residual deficits seen after partial recovery from stoke is alexia and agraphia (Beeson, Magliore, & Robey, 2005). It is also reported that, if stroke involves left posterior cerebral artery (PCA) territory or posterior watershed area between the left PCA and left middle cerebral artery (MCA) most evident clinical manifestation is reading difficulty (Binder & Mohr, 1992; Cohen & Dehaene, 2004; Hillis et al., 2005). The conversion from grapheme to phoneme is an essential process during reading. Functional imaging study by Dehaene, Le Clec, Poline, Bihan, & Cohen (2002) and Leff, Spitsyna, Plant, & Wise (2006), identified left fusiform gyrus as a critical region for processing orthographic stimuli.

6. Writing

Written language is a communication channel which acts parallel to spoken language (McNeil & Tseng, 1990). Writing skill is considered secondary to speech due to its later acquisition and later neural development. The production of written language is a complicated process. It requires integration of four main different elements i.e., linguistic content of the message, spelling of the individual word, visuospatial organization and sequencing of graphic symbols and motoric organization of orthographic output. Writing skill is easily affected following brain lesions due to its complexity. Evaluation of acquired agraphia in persons with aphasia should aim to identify the underlying mechanism of the deficit. Grossberg and Painte, (2000) in their model of writing suggested that writing is dependent on feedback from the polysensory areas (Visual and somatosensory). Most of the current models for writing share the same concepts of processing as originally described by Morton (1980). Rapcsak and Beeson (2000) suggest that during writing to dictation, central spelling processes follow one of the three central routes for processing writing. These routes are lexical-semantic, lexical-nonsemantic, and nonlexical. The proposed tasks differ in the kinds of linguistic operations they perform and types of spelling tasks. According to these models, disorders of writing are classified as central or peripheral dysgraphias. It is reported that contralateral superior parietal cortex is involved in writing (Nakamura et al., 2000; Menon & Desmond, 2001; Beeson et al., 2003; Sugihara et al. 2006). The only manifestation of stroke is writing in the territory of the superior division of the left middle cerebral artery (Hillis et al., 1999; 2004).

Thus, from the review of literature on various domain enlisted above clearly suggest that persons with aphasia can exhibit varied difficulties in language processing. Thus, a clinician should possess the skills and tools/tests to make an accurate diagnosis and design an effective treatment plan. A team based approach which includes a speech language pathologist, neurologist, physical therapist, occupational therapist and the family member as the core of team is necessary for a thorough evaluation/ assessment of persons with aphasia.

The tools used in language assessment help in quantification and delineation of aphasic behavior. The clinician should draw conclusions from the person with stroke by analyzing the quality of person's response. It is necessary to determine whether the language problems exhibited, characterizes the linguistic features seen in persons with stroke is displaying aphasia or not. Assessment should also include functional communication abilities of person with aphasia along with type and severity in order to provide strong basis for planning the treatment program.

Assessment is defined as quantitative and qualitative data gathering process about communicative function and activity limitations, understanding participation restriction, and devising appropriate rehabilitation objectives (Papathanasiou, Coppens, & Potagas, as cited in Aphasia and related neurogenic communication disorders, 2013).

- To establish a diagnosis and track relative prognosis
- To describe and understand components of language function

- Collect background information regarding person with aphasia and the family.
- Seeking information about rehabilitation goals from person with aphasia and individual.

Traditionally assessment process is divided into formal and informal procedures. A formal assessment is usually through a published quantification tool. Numerous formal tests have been developed to identify persons with aphasia. Generally these tests assess linguistic and cognitive abilities. These tests vary in terms of length, scope, and target population. The clinician must consider specific goals of assessment before administration of most appropriate test. Typically formal assessment results are quantitative and provide little guidance for development of treatment procedure. Informal assessment is a process of creating and manipulating stimuli for the purpose of making clinical decisions. It provides specific background information through record review and interviews with person with aphasia and his or her caregivers (Murray & Clark, 2006). The results of assessment process can be either quantitative or qualitative in nature. Quantitative information is expressed in raw numbers. Qualitative information is gathered by observing the person's behaviors, either spontaneous or triggered by the clinician.

International classification and Functioning, Disability, and Health Model acknowledges not only the pathophysiologic processes that directly result from disease, but also the health condition affects individuals in their daily lives and how other variables may influences how individuals deal with and recover from health conditions. Loss of body functions and structures refers to impairments in primary or secondary

outcome of health condition. Traditionally assessments are focused on this level of ICF model. Limitations in personal activities include difficulties in completion of activities of daily living or functional tasks. Restrictions in participation in society encompass problems the individual encounter while attempting to maintain life and societal activities and roles. Persons with aphasia have difficulty returning to premorbid occupation, sustaining role or status in their family, participation in leisure activities. Contextual factors include personal and environmental variables which influence how individuals experience and consequences of health condition. Age, gender, cultural and social background and motivation level come under personal factors (Papathanasiou, Coppens, & Potagas, as cited in Aphasia and related neurogenic communication disorders, 2013).

ICF model helps in taking aphasia assessment beyond traditional aphasia tests, involves procuring input from caregivers and other healthcare professionals, to identify activity and participation issues (Murray & Clark, 2006; Simmons-Mackie & Kagan, 2007).

Evidence based practice methods for assessment in persons with aphasia, encourages clinician to be updated in advances in tests and procedures for quantifying and qualifying aphasia and evaluate in terms of validity and applicability.

Assessment of language deficits in aphasic syndromes should be strictly tailored in such a way that it should tap the language deficits with emphasis on various procedures and tools that gives a qualitative and quantitative outline of the linguistic deficits (World Health organization; WHO, 2001). The purpose of assessment include (1) quantifying and qualifying communication strengths and weaknesses (2) identifying the presence and

possible influence of concomitant disorders (3) establishing treatment goals (4) providing information to predict the recovery and treatment outcome (Murray & Chapey, 2001). Spreen and Risser (2003) state that the way the clinician conceptualize the language disturbance has a direct influence on the way they design the test. Depending upon the availability of resources to the clinician, a kind of setting where they conduct the assessment and the current needs and abilities of person with stroke decides the kind of assessment the clinician can carry out.

The type of assessment varies depending on the clinical set up (Murray & Clark, 2006). For example in a hospital set up, mostly a screening procedure is important whereas, in an institutional set up a detailed assessment procedure is followed. The type of test that is constructed is influenced by the way the disorder or the language disturbances of that disorder are visualized, like in aphasia whether it is a specific disorder (unitary in nature) of selected abilities or as a pervasive disturbance (consists of subtypes) of communication. Spreen and Risser, (2003) state that while choosing any assessment method the following considerations should be made:

a) Psychometric adequacy of a test, b) Portability of the test material, c) Time requirements

Screening tests are the tools which can be used in a brief and with a quick examination of the person with aphasia to detect the presence of disorder. It is done in situations like acute health care setting or when there is a very less time to assess or when only a general overview is needed about the person with aphasia's language functioning.

Diagnostic assessment tools obtain a thorough examination of person's language performance as well as the strengths and weakness in cognitive abilities to make a diagnostic impression and to describe the strength and weakness in linguistic and cognitive abilities. Some of them are Multilingual aphasia Examination (MAE, Benton, Hamsher, Rey & Sivan, 1994),Boston diagnostic aphasia examination (3rd Ed., Goodglass and Kaplan,2000), Aphasia diagnostic Profile (ADP; Helm Estabrooks,1992), Porch index of communication Ability (PICA; Porch, De Renzi, 1990),Discourse Comprehension Test (DCT; Brookshire and Nicholas,1997), Neurosensory Center Comprehensive Examination for Aphasia (NCCEA; Spreen and Benton,1969, 1977), Psycholinguistic assessment of Language Processing for Aphasia(PALPA, Kay, Lesser & Coltheart, 1996), Minnesota test for differential diagnosis of aphasia (MTDDA, Schuell,1955,1965,1973), Western Aphasia Battery (WAB, Kertesz,1979;1982).

Descriptive evaluation is useful for the purpose of rehabilitation and counseling. In this type of assessment, information gathered is more regarding the functional strengths of the person. In rehabilitation setting it helps in making predictions of recovery, ability to process, learn, and remember new material, fine- tuning treatment tasks and tactics. Evaluation with respect to spontaneous recovery of the person is carried out in a follow up manner where the progress evaluation is conducted. The ability of person to relearn or to compensate for what they have lost is part of progress evaluation.

Functional and pragmatic assessment of the person is conducted to determine how efficient the person to communicate despite the presence of disorder. These methods may vary from bedside observation to rating scales to formal tests. (Manochiopinig, Sheard, &

Reed, 1992) These include Pragmatics protocol (Prutting and Krichner, 1987); The Profile of communicative appropriateness (Penn, 1983); The Communicative Activities in daily living, 2nd Ed (Holland & Thompson, 1998) and the ASHA – FACS (Frattali, 1995).

Aphasia may occur as co-morbid condition with other disorders such as dysarthria (articulation), aprosodia of speech (both affective and non-affective prosody), and apraxia of speech (oral apraxia & limb apraxia). The ability to engage in gestural communication also needs to be examined in person with aphasia (Beatty & Shovelton, 1999; Goldin-Meadow, 1999; Morford, 1996). Sensory skills like visual perception, stereognosis and auditory abilities should be assessed (Lecours, 1987) There are three types of screening procedures for aphasia.

1) The bedside clinical examination which is traditionally used in clinical neurology for clinical evaluation (Krishner, 1995; Strub & Black, 1993). It ranges from unstructured way to the structured test. It has been used as a standard tool by physicians, neurologists and speech clinicians.
2) Screening tests per se; where the tests are constructed in standardized ways which are relatively brief and highly sensitive. E g: Halstead – Reitan test Battery (Reitan, 1991; Wheeler & Reitan, 1962).
3) Tests of specific aspects of language functioning that are sensitive to the presence of Aphasia. E.g. The Token Test (De Renzi & Vignolo, 1962).

Compared to all the procedures of assessment, screening tools are considered as the quickest and easiest ones to make outline of person's language ability in brain damaged individuals.

During the early post-acute stages of recovery, assessment is predicted observably on the person's physical and mental status. During the initial post-acute stages the person with stroke exhibit lack of attention and mental vigilance or too weak to participate for more than few minutes of cursory examination. Hence, in these conditions it becomes difficult on the part of the examiner either to diagnose or to predict the strength and weakness of the person for further language rehabilitation. Therefore, bedside screening tests can be used competently to establish the presence or absence of language disorder, to decide whether further detailed assessment is needed and helps in adapting treatment (Al – Khawaja, Wade, & Collin, 1996). Bedside screening tools play a role as valuable indicators of cognitive status, which includes responsiveness, communicative ability and ability to be stimulated. The examiner should remember that the screening tools give only narrow range language functions and it will not give a complete language profile of the person.

Apart from detailed comprehensive examinations, historically bedside examination has been evolved as a primary method from which the formal and standardized tests are developed. It still remains as a standard tool, especially for neurologists, although speech language pathologists or neuropsychologists and other allied professionals use it in primary care or in a non-ambulatory condition. It aides the clinician with the method of examination that they can individually tailor to their own

decision – making and helps them to organize next steps in person with aphasia care (Davis 1993).

In the field of classical neurology, bedside screening is considered as a clinical evaluation method (Krishner, 1995; Strub & Black 1993). The strength of the screening tool may range from unstructured conversation with the person with aphasia to a structured set of items, such as pointing, listing the days of week etc.

There are various screening protocol used in various clinical settings. Most of the professionals use commercially available screening tools whereas some use useful developed informal tools for a quick screen together with the case history. The strength of such informal protocol is that it can reflect the specific needs of the person with aphasia and also the clinician can add or delete various domains depending on the present need of the person with aphasia. On the other hand, it fails to produce a good valid and reliable data. This is because; the clinicians have not established observation or measurement consistency within and across clinicians over time (Peach, 2001).

To overcome these problems one may use standardized aphasia screening tools so that it will be helpful to chart the recovery, both qualitatively and quantitatively. Formal screening tools aids in research studies as they have strong psychometric properties (Davis, 2000).

Ideally, the professionals can use any of the formal assessment tool and they can comment on the additional information about the person with aphasia so that it gives a

complete picture on a quick review. Accuracy of screening devices is approximately 80% (Spreen & Benton, 1965). For example, one can easily identify a motor aphasia by looking for a hemiplegia and one can get a clue for sensory aphasia by examining for hemianopsia. The presence of any sensory or motor skill deficit also can be considered while planning for the treatment strategies.

There are screening tools which are the shortened versions of comprehensive batteries. This can be procured individually or along with the comprehensive test battery. The shorter versions of aphasia batteries like Minnesota Test for Differential Diagnosis of Aphasia (Powell, Bailey, & Clark, 1980) and the Porch Index of Communicative Ability (Holtzapple, Pohlman, LaPointe, & Graham, 1989) are available. Likewise shorter version of Boston Diagnostic Aphasia Examination (BDAE-3; Goodglass & Kaplan, 2000) is also available. The short form is a condensed version of the BDAE-3 that assesses spoken and written language production and comprehension skills in 30 to 45 minutes (Spreen & Risser, 2003).

Barth, Macciocchi, Giordani, Berent and Boll, (1984) conducted a study on inter - rater reliability and prediction of verbal and spatial functioning with a modified scoring system on the Reitan-Indiana Aphasia Screening Examination (ASE). It was administered on 50 seizure persons with aphasia of mean age 16.8 years. To find out the effect of most specific scoring criteria and inte-rrater reliability, authors administered five raters on each individual. They observed a higher inte-rrater reliability with minimal training in the new

scoring method. Verbal IQ, education and verbal scores of the ASE showed a significant relationship. On the other side, the performance IQ, education and the verbal score of ASE showed a significant relationship. Even the performance score and the spatial scores showed a significant relationship. Results suggested that the interpretation of ASE scores is depended on the qualitative assessment of the type and pattern of errors obtained.

Available screening tools for persons with aphasia:

In 1975, Keenan and Brassell had designed Aphasia Language Performance Scales (ALPS) and it is composed of four 10-item scales i.e., listening, talking, reading and writing, arranged according to complexity. Scoring is 0 for profoundly impaired and 1 is insignificant impairment. This test instrument is not a standardized and comprehensive.

In 1983, Sklar has composed Sklar Aphasia scale – revised (SAS) and it is composed of four dimensions: auditory decoding, visual decoding, oral encoding, and graphic encoding. Each subtest has five items. Scoring: 5 point rating scale with 0 is correct response to 4 is no response.

In 1983, Still, Goldschmidt, and Mallin have developed a mini-object test for clinical diagnosis of aphasia/apraxia/agnosia associated with senile dementia. It is standardized and is valid, reliable, cost-effective, portable screening procedure.

In 1987, Snow conducted a study using Aphasia Screening test (AST) of the Halstead-Reitan Neuropsychological Test Battery on 36 lateralized persons with stroke

with aphasia and persons with aphasia with an etiology of tumor. Right hemisphere damaged and left hemisphere damaged differed only in one item and they showed significant difference among 33 items. The items were categorized according to the task type and the results showed that only one out of nine comparisons were significant. This study pointed the significant flaw in the AST and recommended to modify AST.

In 1987, Enderby, Wood and Wade have designed Frenchay Aphasia Screening test (FAST). It is composed of four sections: comprehension, verbal expression, reading and writing, administration time is 3 - 10 minutes. Comprehension is assessed through picture cards or objects, using pointing. Performance is compared to cut off scores at two levels: up to the age of 60 years and older than 60 years.

In 1988, Lecours, Mehler, Parente, Aguiar, Da Silva, Caetano, Camarotti, Castro, Dehaut, Dumais, Gauthier, Gurd, Leitao, Maciel, Machado, Melaragno, Oliveira, Pacirnik, Sanvito, Silifrandi, Torni had conducted a study on 100 neurologically healthy adults for tasks such as pointing, naming, and repetition abilities in both literate and illiterate population. Statistically significant differences were found to exist between the scores of the illiterate and literate subpopulations across all tasks. It is concluded that right hemisphere has more participation on language in illiterate subjects.

In 1989, Crary, Haak and Malinsky did a preliminary psychometric evaluation of ‘acute aphasic screening tool’. They compared the results of the Acute Aphasia Screening Protocol (AASP) and the Western Aphasia Battery for concurrent validity. They also compared the content and construct validity with other existing aphasia batteries and

obtained a good correlation. The results showed that AASP is a useful clinical tool for aphasic assessment for its specific purposes.

In 1990, O'Neill, Cheadle, Wyatt, McGuffog, and Fullerton have tested 51 normal elderly people aged 69 to 90 years and in person with aphasia, out of which 19% of subjects failed in the screening. Later they administered for the Frequency Aphasia Screening Test (FAST) on 82 elderly people with aphasia with stroke having a mean age of 80 years and 35% persons with aphasia failed. The results indicate that sensitivity has increased and specificity was reduced.

In 1991 Reitan has revised and designed Aphasia Screening Test (Reitan, 1991; Reitan and Wolfson, 1985; Wheeler and Reitan, 1962) to determine whether the person can perform simple tasks such as spelling a word or naming an object. Language function is briefly assessed by one or two items each. Administration time is 20 minutes.

In 1996, Al-Khawaja, Wade and Collin have carried out a comparative study of Frenchay Aphasia Screening Test (FAST) with the Sheffield Screening Test for Acquired Language Disorders (SST), on 50 suspected persons with aphasia (with mean age range 53.9 yrs). The following study helps in predicting and diagnosis of aphasia.

In 1998, West, Sands and Swain has designed Bedside Evaluation Screening Test, 2nd edition (BEST -2) to be administered and scored within 30 minutes. It comprises of seven subtests: conversational expression, object naming, object description, sentence repetition, pointing to objects, pointing to parts of a picture, and reading. A question and answer format is used to obtain responses, which may be verbal or gestural depending upon the subtest.

In 1999, Tanner and Culbertson have designed Quick Assessment for Aphasia. Administration time is 10 - 15 minutes. The following linguistic areas are being assessed namely; verbal labeling, answering questions, giving basic information, and general conversation are assessed

In 1999, Thommessen, Thoresen, Bautz-Holter and Laake developed and evaluated Ullevaal Aphasia Screening (UAS) test to be used by nurses to detect aphasia in the acute stage of stroke. It was carried out on 37 persons with stroke admitted to acute stroke unit by nurses. While the results of a comprehensive assessment by a speech therapist acted as the 'gold standard'. Only two out of 28 who screened negative on the Ullevaal Aphasia screening test (UAS) were diagnosed with mild aphasia. The Ullevaal Aphasia screening test seems to be a short and valid screening instrument for persons with aphasia in the acute stage of stroke. The screening took 5-15 minutes to complete.

In 2004, Thompson, Manning, Sherer, Yablon, Gontkovsky, and Vickery have designed Mississipi Aphasia Screening Test. (MAST). It is composed of nine subtests, each with one to 10 items. Administration time is 5 to 15 minutes. Objects are used and tasks are pointing and naming.

In 2006, Salter, Jutai, Foley, Hellings, and Teasell have evaluated measurement properties of the six screening tools for persons with aphasia and among them, the tests that most widely used and thoroughly evaluated tool is found to be Frenchay Aphasia Screening Test (FAST).

In 2008, Sabe, Courtis, Saavedra, Prodan, de Luján, and Melián have carried out the Bedside Assessment of Language (BAL) on persons with aphasia and non-aphasic persons following brain injury, assessing five linguistic areas namely: spontaneous language, comprehension, repetition, writing and reading. A total score of 25, with maximum of score of five in given in each linguistic area. The BAL showed excellent internal consistency reliability. These results indicate that the BAL has been a potentially useful tool for the diagnosis of the type of aphasia and it has been sensitive to evolutionary changes in sub-acute stages of language disorders.

Other screening instruments which are of limited use are examining for aphasia (EFA - 3; Eisenson, 1993) and Orzeck Aphasia evaluation (Orzeck, 1964). Studies have been conducted to compare the performance of persons with aphasia on different screening tools available in western context.

The current screening test for persons with aphasia in Telugu language is adapted version from bedside screening test - Second edition (West, Sands & Swain, 1998) and the Indian version of bedside screening test for persons with aphasia in Kannada (Ramya, 2011), Malayalam (Kanthima, 2011), and Odiya (Monalisa, 2012). It includes six main domains as the previous bedside screening test developed in Kannada, Malayalam and Odiya. The screening test is administered on two groups, in each of the previous three adaptations in Indian languages where group 1 consisted of neurotypical adults and group 2 consists of persons with aphasia. Each of the study concluded that it can be used to identify persons with aphasia from neurotypical adults of same age range (Ramya, 2011,

Kanthima, 2011, Monalisa, 2012). Each study showed no significant differences in scores of literates and illiterates, hence concluded it can be used for both the populations.

Thus, from the review of literature it can be stated that professionals do use screening tools and in research and in clinical setups. However, there are limited attempts to develop such tolls in Telugu language. Hence, the present study has been taken to develop a bedside screening test in Telugu language.

CHAPTER- III

METHOD

Language disturbances in aphasia can be assessed either through a detailed assessment or screening. A person needs to be physically stable and attentive during detailed assessment as it involves examination for long time. During the initial post acute stages of recovery, screening tools play a very important role to predict whether the person is deviating from the normalcy. Majority of the screening tools available are developed in western context and due to ethno cultural variation in Indian context it becomes difficult to apply them. Thus, in order to improve the quality of assessment and for the better understanding of person's strength and weakness there is a demand for developing a test material in native language. Moreover, the availability of the screening tools in Indian languages is limited; hence an attempt has been made to develop a bedside screening test in Telugu.

Aim:

To develop a bedside screening test in Telugu for persons with aphasia

Procedure:

The development of the test was carried out in two phases.

a) First phase: development of test material in Telugu.

b) Second phase: Administration of the developed test on 30 neurotypical and seven persons with Stroke.

Phase 1:

During the first phase, inputs were taken from various available western and Indian tools. The stimuli and pictures used for the test were selected from the ratings on 'feedback questionnaire' given to seven speech language pathologists (SLP). The raters were informed to consider the skills of persons with stroke during the initial post-acute stages of recovery. The rating of test stimuli was carried out in two phases. In the phase one, the stimuli were rated and in the second phase, the picture cards were rated. The syntactic and semantic aspects of Telugu language were also considered during development of the test. The "Feedback questionnaire for aphasia treatment manuals" scale developed by Goswami, Shanbal, Samasthitha, & Navitha in 2010 was used to assess the familiarity rating. The parameters considered were - "simplicity, familiarity, presentation, volume, arrangement and iconicity" etc. The ratings of the SLP using feedback questionnaire revealed that:

Parameters concerned with respect to the selection of the stimuli of the test (Simplicity, familiarity, presentation, complexity etc.): SLP's rated the test stimuli based on syntactic and semantic aspects of Telugu language. The ratings for the stimuli on these parameters were 'good' and 'very good' and 'excellent'. It indicates that the test stimuli selected for the current study was appropriate to assess the targeted linguistic skills and is also acceptable as per the cultural dimensions of the considered participants for the study.

Parameters concerned with respect to the selection of the picture stimuli (size of the picture, color and appearance and iconicity)**:** according on the ratings of the

SLP's on these parameters, it was evident that the picture stimuli were iconic, culturally acceptable and had a clear representation of an intended object.

Parameters concerned with respect to the structure: The SLP's rated the following parameters volume, relevancy, complexity, accessibility, flexibility and stimulability as 'good', indicating that the test can serve its purpose.

Parameters concerned with respect to the output of the test: The sub-domains of the questionnaire considered were with respect to the parameters, scope of practice, generalization, and scoring pattern. For these parameters the ratings given by the SLP's was 'good' indicating that the test has implications in its suitability to assess the target population, practice, scoring pattern used. It also gives a base for predicting the type of aphasia and planning the goals for the treatment.

Description of the test:

The test includes a total of six domains. First domain consisted of two subtests and second domain has five subtests. Four subtests were present in the third domain and three subtests in the fourth domain. The last two domains had no subsections. Five test stimuli were present in each subsection, other than reading and writing. Percentage was calculated based on familiarity rating given by the professionals for each stimulus. The final test material was made with the stimuli which had a familiarity rating of 80% and above. The stimuli were given on the increasing order of complexity. For administering the tool, in each subsection and the instructions has been provided. Appropriate picture cards have been provided for various subsections.

Phase II: Administration of the test.

Neurotypical participants and persons with stroke were taken up to know the difference in their performances using the developed test. The test was administered for both groups in different seating position depending on the comfort of each person. Depending on the task, the presentation of picture cards was varied. Both the verbal and non verbal instructions were given to perform the tasks.

Table – 1: Details of persons with stroke

S.no.	Age/ sex	Time post onset of stroke	Site of lesion
1.	75y/F	6 days	Infarct in Parietal territory left occipital temporal thalamic infarct
2.	55y/M	12 days	Significant reduction in hematoma and mass affecting left parietal region
3.	30y/M	10 days	Left temporo parietal region
4.	60y/M	7 days	Left middle cerebral artery sub cortical infarct with right hemiparesis
5.	24y/M	11days	Left fronto-parietal infarct
6.	43y/M	87 days	Infarct in Left temporal, frontal, parietal lobes with degeneration of cerebral peduncle
7.	53y/M	3 days	Acute infarct in temporal perisylvian area

The developed screening test was administered on both the groups of participants according to their availability.

Ethical considerations:

During the selection of participants of the present study ethical issues were considered. The caregivers of the persons with stroke were explained about the purpose and procedure of the study. The selection of the participants was randomly based on inclusionary criteria.

Inclusionary criteria:

All the participants in the current study were divided among two groups:

Group- I: Includes neurotypical participants

Group-II: Includes persons with stroke

Group I

All participants included were native speakers of Telugu language above the age range of 18 years. The participants in the neurotypical group had no history of sensory, speech, language and cognition impairment which was ensured through informal testing. Participants had no pre morbid neurological or psychological history or any form of structural deficits. All participants had no known history of alcoholism or drugs.

Group –II

A prior diagnosis of stroke by a neurologist or physician was made to each of the participants were included. Participants considered for the current study were 18 years and above. Native speakers of Telugu language were considered. Participants with sensory deficits were excluded.

Procedure followed in test administration:

Arrangement and placement:

Presentation of objects and picture cards varied with respect to tasks for neurotypical participants and persons with stroke.

Seating:

The neurotypical participants were made to sit comfortably infront of the table where it was easy for him/her to reach or pick up the objects or the cards that were presented. Since persons with stroke were examined in a bedside condition there was no standard seating arrangement that was followed during the administration. The seating position which was comfortable for them was considered.

Test instructions and parameters:

Initially, the clinician gave a detailed explanation of the task to be performed to the participant. The instructions were given at comfortable listening level and the rate of speech, intonation, stress were maintained. Instructions were repeated only, if the participant did not perform any part of the test trial correctly. The examiner gave pretest instructions to the participant to make sure whether the person has understood the task to be performed. They were instructed in Telugu to answer the questions appropriately and or point to picture cards or objects and to perform actions with objects placed on the table. Once the participant was ready, the subsections were administered.

Domain 1: Spontaneous speech.

Each participant was involved in a general conversation and a note is made of their speech and language with respect to fluency and content which includes any effort during speech production, decreased phrase length, hesitations and paraphasias. No scoring was considered for this domain. Only qualitative description of person's speech and language was done. The modality in which the person was using was mentioned i.e. either verbal / non verbal.

Domain 2: Auditory verbal comprehension.

a) Yes / No questions.

Step 1: The questions were asked the participant and response expected was either yes / no. E.g. "Are you playing now" answer should be only "No".

b) Pointing Task.

Step 1: The picture cards were placed in front of the participant.

Step 2: Picture cards were shown by the clinician and the participant was expected to point to the one asked by the clinician.

E.g.: "point to leg" the response should be participant "pointing to the leg".

c) Auditory Word Recognition.

Clinician presented words verbally and the participants were instructed to recognize the picture card and response expected was by eye movement towards that object or any gesture or pointing to it.

For E.g.: If the clinician says “window” the expected response would be “looking towards the window” or “pointing to it” or any “gestural response” which conveys that the person has recognized the word.

d) Verification Task.

Step 1: For this subtest, single card with 3 pictures were presented. The pictures were presented one after the other in the order of test stimuli.

Step 2: instruction was to verify between the pictures and pointing to the one the clinician had asked.

For E.g. If the clinician asked to show “banana’ the response expected would be pointing to “banana” by verifying among the pictures presented.

e) Sequential commands.

Step 1: A set of objects would be arranged one after the other.

Step 2: The participants were instructed to follow the commands sequentially and perform the actions with the objects placed in front of them. Participants were reminded to perform the action sequentially according to clinician's command.

For example: if the clinician asked the participant to "close their eyes" the expected response would be "closing his / her eyes".

Domain 3: Repetition.

a) Automatic Speech.

The clinician instructed the participants to answer few questions which were in order.

E.g.: If it was "numbers" the response expected would be "Reciting numbers".

b) Word

The participants were expected to repeat the words that were told by the clinician.

E.g. If the clinician says "book" the expected response from the participant would be to repeat just the word "book".

c) Phrase

The participants were instructed to repeat the phrases that were told by the clinician.

E.g.: If the clinician says "come here" participants were expected response was to repeat the phrase "come here".

d) Sentence

Participants were instructed to repeat the sentences in the same order told by the clinician.

E.g. If the clinician says “I want this bag” participant were expected response was to repeat just the sentence “I want this bag”.

Domain 4: Naming.

a) Confrontation Naming:

Step 1: the picture cards were presented in the order of the presentation.

Step 2: The participants were instructed to name the picture card presented by the clinician.

For E.g. If the picture presented was “spoon” the expected response from the participant would be to name it as “spoon”

b) Responsive Naming:

The participants were instructed to answer the questions by naming with respect to the question. For E.g. If it was “what can you see in kitchen’ the expected response from the participant would be to name “All possible items that he/she can see in kitchen”.

c) Lexical generative Naming:

The participants were instructed to name the things which come under one specific category that were told by the clinician. For E.g. If it was “list the animals” the expected response from the participant would be to name “All possible animals”.

Domain 5: Reading.

In the reading task was given. The participants were asked to read the texts on the cards which was in the form of sentence, phrase, word, and a letter. The expected response was to read aloud the texts on the cards provided.

Domain 6: Writing.

In writing task the participants were asked to write few letters, their name, and address etc…and basic calculations (addition, subtraction).

Scoring pattern:

The responses were scored using a three point rating scale which is as shown in the Table 2

Table -2: *Scoring pattern of bedside screening test for the responses*

Rating	Response
0	No response
1	Partially correct / incomplete responses / frequent shifts from correct one to others
2	Correct response

Time constraints

The time taken to complete the test for persons with stroke was 15 minutes and for neurotypical group it was less than 10 minutes.

Statistical Analysis:

The raw scores obtained from both groups were tabulated through descriptive analysis and was subjected to statistical analysis using SPSS software (Statistical Package for the Social Sciences package, version 17. 0). The following statistical measures were used to analyze the raw data.

- Mean(X), median (M) and standard deviation (SD) in order to arrive at normative scores for each sub-domain i.e., auditory word comprehension, repetition, naming, reading and writing.

- Mann-Whitney U test, to analyze the significant difference between neurotypical and persons with stroke across domains and sub-domains.

- The upper bound and lower bound scores are obtained from the mean scores of neurotypical group across the domains to arrive at normative scores for the test.

CHAPTER - IV

RESULTS AND DISCUSSION

The primary objective of the current study was to develop a bedside screening tool for persons with aphasia in Telugu language. The study aimed at developing a screening tool which is sensitive in identifying the language deficits in persons with stroke during acute stages. All participants included in the study were native Telugu Speakers. The study included two groups of participants.

- Neurotypical adults (age range 18 and above 18 to 80; three age ranges (20-40, 40-60, 60- 80 years)
- Persons with aphasia after acute stroke (1 group; age range 18 and above)

The developed screening tool was administered on all participants. The descriptive analysis was carried out to find mean (X), median (M) and standard deviation (SD) scores for all domains and subsections of the domains and was extracted by comparing the tabulated raw scores between the two groups. Statistical analysis was done using Statistical Package for the Social Sciences software (version 17.0). The results revealed that there was a significant difference between neurotypical adults and persons with stroke across the domains and the sub-domains. The results further revealed that there was a significant difference between the two groups. To see whether there was any difference between the neurotypical adult participants of three age ranges (20-40, 40-60, 60- 80 years) were subjected to statistical analysis.

The bedside screening test included six domains with subsections. The domains were spontaneous speech, auditory verbal comprehension, repetition, naming, reading and writing skills. Each section was further divided into subsections. The results obtained are described below:

Domain 1: Spontaneous speech

In the following domain person's speech was assessed by qualitatively describing in terms of two parameters i.e., content and fluency for both neurotypical group and persons with stroke. The data was analyzed qualitatively and discussed below:

Neurotypical adults: The speech and language characteristics of participants in the group were clinically normal, they did not exhibit any form of deficits. All the participants in this group provided relevant information in terms of context of the communication.

Persons with stroke: Seven persons with stroke were examined and evaluated at hospitals in Hyderabad. The time post onset period varied from three days to eighty four days. Each of the participants had stroke in different sites of lesions in the brain. The speech and language skills were elicited by asking the following questions:

a) What is your name?
b) Where are you from?
c) Why are you here now?
d) Tell me about your native place?

The speech characteristics of each of the participants in this group are discussed in the Table - 3

S.no.	Age/ sex	Site of lesion	Mode of response	Speech and language characteristics
1.	55y/M	Significant reduction in hematoma and mass affecting left parietal region	Verbal	Expression at sentence level with comprehension relatively spared for simple tasks, telegraphic speech with paraphasias, circumlocutions, disturbed word order and inflections with frequent pause are seen.
2.	30y/M	Left temporo parietal region	Verbal	Relatively spared comprehension, word level utterances. Semantic paraphasias and circumlocutions are seen.
3.	60y/M	Left middle cerebral artery sub cortical infarct with right hemiparesis	Verbal	Increased effort with reduced output with poor articulation output. Expression is limited too.

4.	24y/M	Left fronto-parietal infarct	Verbal	Slurred speech, telegraphic speech with disturbed word order and frequent paraphasias
5.	43y/M	Infarct in Left temporal, frontal, parietal lobes with degeneration of cerebral peduncle	Verbal	Effortful speech with jargon utterances. Affected melody, inflections and rhythm, perseverations for isolated utterances.
6.	53y/M	Acute infarct with temporal perisylvian area	Verbal	Expression at word level with severe word finding difficulties. No obvious deficits in articulation skills were noticed.
7.	75y/F	Infarct in Parietal territory left occipital temporal thalamic infarct	Verbal	Slurred speech, increased effort, decreased phrase length and prosody was affected.

Thus, based on the details stated in Table-3 it can be inferred under this domain that spontaneous conversation from the participants can be elicited which in turn can be used to screen for any obvious deficits in the fluency and content aspects of the language.

Domain 2: Auditory verbal comprehension

Subtest 1: Yes – No question

Under the following sub-domain five questions were arranged in the hierarchy of complexity. The mode of response was either verbal or gestural. Each correct answer was given a score of 2; maximum score of this section that can be scored would be 10. The scores are delineated in Table 4 as mean, median and standard deviation respectively among the two groups.

Table 4 *Mean, median and standard deviation of each group in Yes – No question subsection*

Group	N	Mean	Median	SD
Neurotypical adults	30	10.00	10.00	0.00
Person with stroke	7	7.42	8.00	2.76

Descriptive analysis of persons with stroke (X = 10.00; M = 10.00; SD = 0.00) and neurotypical group (X =10.00; M = 10.00; SD = 0.00) respectively for yes-no question task. The performance was significantly better in neurotypical adults in comparison to persons with stroke based on mean, median and standard deviation scores respectively. These results suggest that it is difficult to perform this task for persons with stroke. The data was further analyzed using Mann-Whitney U test to see if, any difference among the two groups with respect to this subsection. It yielded a significant difference (/Z/= 0.00) between the groups.

Thus, the results obtained from yes-no subsection elicited responses among both group of participants and it clearly suggested a demarcation between persons with stroke and neurotypical adults, comprehension can be tapped and can be used to screen obvious deficits in comprehension of language.

Subtest 2: Pointing task

The testing of pointing task subsection involved only pointing to the picture cards. A total of five picture cards were used under this section. A score of 2 was given for the correct response whereas the maximum scoring for this sub-domain was 10. Each of group of participants was scored based on descriptive analysis tabulated scores provided in the Table - 5 below.

Table - 5 shows Mean, median and standard deviation of each group in pointing task subsection

Group	N	Mean	Median	SD
Neurotypical adults	30	10.00	10.00	0.00
Person with stroke	7	8.28	8.00	1.38

The tabulated scores of either group of participants are mentioned for pointing task in above Table. Neurotypical adults (X = 10.00; M = 10.00; SD = 0.00) scores reflects a good performance in pointing task, whereas in persons with stroke (X= 8.28; M= 8.00; SD= 1.38) reflects slightly lower score in parallel with neurotypical group.

While Mann Whitney U test was performed to analyze the data it showed a significant difference of (/Z/ = 0.00) between the groups.

Hence, pointing task reveals that persons with stroke performed slightly lesser in comparison to neurotypical. So, it can be suggested that present study is sensitive enough to extract obvious deficits in persons with stroke in comparison with neurotypical adults.

Subtest 3: Auditory word recognition

In the following subsection five picture cards were presented as the stimuli. Eye blink or gestures or pointing were the modes of responses used to attend the stimuli presented. Each item carried a maximum score of 2 and the total score of 10 was given. The mean, median and standard deviation scores for both the groups have been explained separately in Table-6.

Table–6 shows Mean, Median and standard deviation of each group in auditory word recognition subsection

Group	N	Mean	Median	SD
Neurotypical adults	30	10.00	10.00	0.00
Person with stroke	7	9.71	10.00	0.75

The obtained scores for both the groups indicated from the Table-6 that there lies difference among groups in terms of performance. The scores of neurotypical adults are suggestive that they performed relatively better in mean (X =10.00; M = 10.00; SD =

0.00) than persons with stroke with a value of 9.71 (X = 9.71; M = 10.00; SD = 0.75). Analysis of data was done using Mann Whitney U test showed significant difference (/Z/ = 0.038) between two groups.

Subtest 4: Verification task

Five category specific picture cards were used in the current subsection. Each picture card had three pictures which belong to same semantic category. The modality used to respond was either in form of gestures, eye movement, pointing or verbal. Each correct response was scored 2; correct response for all questions was given score of 10. All the participants are provided with scores discussed below.

Table -7 shows Mean, median and standard deviation of each group in verification subsection

Group	N	Mean	Median	SD
Neurotypical adults	30	10.00	10.00	0.00
Person with stroke	7	5.00	5.00	3.55

The scores are extracted of both groups in terms of mean, median and standard deviation for neurotypical (X =10.00; M = 10.00; SD = 0.00) and person with stroke (X = 5.00; M = 5.00; SD = 3.55) groups respectively. These scores in the Table-7 confirm that the performance of participants in the persons with stroke group is poorer compared to the participants in neurotypical group. The data was analyzed using Mann Whitney U test and it showed significant difference (/Z/ = 0.00) between two groups.

Subtest 5: Sequential commands

This subsection had five questions which involves carrying out various actions. The commands stated in these questions were in the increasing order of complexity. The response mode was non verbal, mainly through performing actions. Real objects were used in this task. Each command carried a score of 2 for a correct response and a maximum score of 10 can be obtained in this subsection.

Table-8 shows *Mean, median and standard deviation of each group in sequential commands subsection*

Group	N	Mean	Median	SD
Neurotypical adults	30	9.93	10.00	0.25
Person with stroke	7	6.29	6.00	2.13

A score of 9.93 (M= 10.00; SD=0.00) and 5.00 (M= 6.00; SD=3.55) was obtained by neurotypical and persons with stroke for the sequential command task. The mean and median scores put forth clearly show that neurotypical adults performed better than persons with stroke on sequential command task. The data was analyzed using Mann Whitney U test and it showed there was significant difference between two groups (/Z/ = 0.00) and it was based on analysis of Mann Whitney U test.

Overall performance of the participants in auditory verbal comprehension

This domain included five subsections: "yes – no questions, pointing task, auditory word recognition, verification task, sequential commands". The maximum score of this domain was 50. Descriptive statistics was done in order to arrive at the mean (M), median and standard deviation (SD) scores.

The test revealed a significant difference among the two groups. The neurotypical group (X = 49.93; M = 50.00; SD = 0.25) performed better compared to the persons with stroke (X = 36.7; M = 31.00; SD = 8.71) in all the sub-sections of this domain are depicted in Table 9. On doing a further analysis based on Mann Whitney U test the results revealed (/Z/= 0.00) that there is a significant difference between neurotypical adults and persons with stroke. This finding is evident from mean, median and standard deviation scores. In contrast, persons with stroke were able to perform auditory word recognition task much better and followed by pointing tasks, yes/no question, sequential commands and verification tasks.

Overall mean, median and standard deviation scores of auditory verbal comprehension domain in Table-9

Group	N	Mean	Median	SD
Neurotypical adults	30	49.93	50.00	0.25
Person with stroke	7	36.71	31.00	8.71

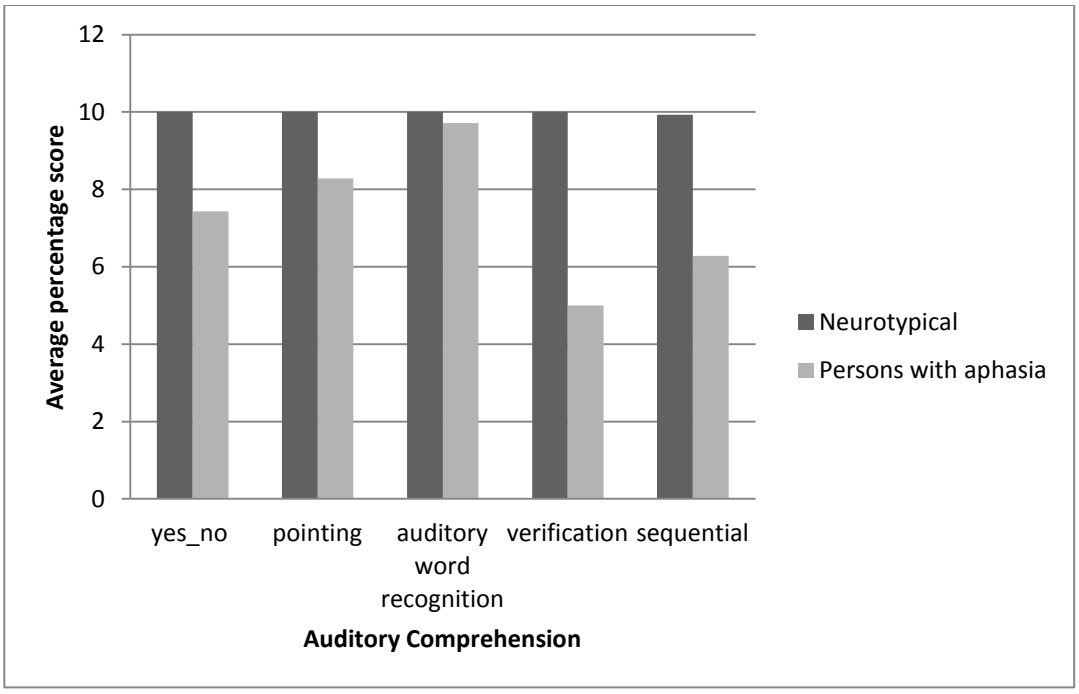

Figure 1 shows the overall means for all subsections in auditory verbal comprehension tasks for persons with aphasia and neurotypical adults

Semantic processing difficulties may be the reason for the comprehension deficits in aphasia as reported by Goodglass and Baker (1976). Literature on auditory comprehension explains that auditory perception and sense of hearing is directly necessary. In order to extract the denotative and connotative meanings from the individual words, sentences and discourse; decoding the perceived auditory information is necessary. The brain is holistically involved, simultaneously acting on linguistic process, higher level cognitive process and sensory process. The initial post-acute stages of recovery there is a lack of functioning in certain areas of brain of the persons with stroke resulting in poor vigilance and poor auditory processing. (Rothenberger, Szirtes &

Jurgens, 1982) reported that it would lead to problems in attention; both in sustained and selective attention.

Korda and Douglas (1997) reported that persons with stroke exhibit disturbances in processing both verbal and nonverbal material. The findings of the auditory verbal comprehension for persons with stroke are in accordance with their findings. Qualitative analysis of the responses revealed that participants in the persons with stroke group experience more difficulty in answering imaginative questions like “does car ride in the sky” and “does paper burn in fire”.

Csepe et al., (2001) reported that linguistic processing is impaired as a result of brain damage. Besides, Auther et al., (2000) reported that, if temporal areas of brain are damaged, the person with stroke would exhibit auditory processing difficulties which lead to poor performance in auditory comprehension. Many researchers support that the brain damage to critical areas of the brain would lead to comprehension deficits and the disturbances in cognitive functioning. Tanner,(2000); reported that difficulties in decoding- phonological, grammatical, sensory perceptual and semantic features of language can be attributed to damage to wernicke’s area. Working memory is critical for language processing has been reported by Caplan and Waters, (1999). Comprehension deficits can be caused due to limitation in working memory also.

Albert, (1976); Burgio and Basso, (1997); Caplan and Walters,(1999); DeDe, Caplan, Kemtes, and Waters, (2004); Hough, Vogel, Cannito, and Pierce, (1997); also

reported that difficulties in comprehension could also be attributed to deficits in verbal short term memory in concurrence with aging process. Verbal decoding deficits would also lead to comprehension deficits. Helm-Estabrooks and Albert, (2004); stated that auditory comprehension includes cognitive as well as linguistic skills.

Persons with stroke in this study, experience difficulty in following commands of increased length and complex syntax. Goswami (2004) in his study has reported in accordance with many investigations that sentence length and complexity has an effect on auditory comprehension. Goswami (2004) stated that the difficulty in comprehension becomes obvious when the syntactic complexity of sentence increases. Thus, the results obtained in the present study also revealed that the persons with stroke experienced difficulties in auditory verbal comprehension tasks which are an indicative of any cognitive or linguistic processing difficulties.

Domain 3: Repetition

Subtest 1: Automatic speech

There were a total of five tasks in the present sub-domain. Participants had a verbal response with a score of 2 for correct performance of each task and a maximum score of 10 for this subsection. Both participant group scores are tabulated based on descriptive analysis of mean (X), median (M) and standard deviation (SD) in the Table - 10 below.

Table 10 shows mean, median and standard deviation scores of each group in automatic speech subsection.

Group	N	Mean	Median	SD
Neurotypical adults	30	9.83	10.00	0.93
Person with stroke	7	3.00	2.00	3.21

Neurotypical adults performed close to ceiling on all the tasks with mean, median and standard deviation scores (X = 9.83; M= 10.00; S.D. = 0.93) and persons with stroke had difficulty in performance of the same task (X= 3.00; M= 2.00; SD= 3.21).Mann Whitney U test showed a significant difference /Z/= 0.00) between two groups.

Thus, based on performance of both groups of participants it can be inferred from this section that it can elicit responses from the participants. Neurotypical adults performed very well whereas persons with stroke performed poorly for the task. It suggested that automatic speech can be used to screen for any obvious deficits in the repetition of linguistic stimulus.

Subtest 2: word

The current section comprised of five words. Responses were in verbal mode in all the participants. Scoring of the current section is tabulated in terms of mean, median

and standard deviation. Correct response for a task is scored 2; maximum score for the subtest was 10.

Table 11 shows Mean, median and standard deviation scores of each group in word subsection.

Group	N	Mean	Median	SD
Neurotypical adults	30	10.00	10.00	0.00
Person with stroke	7	5.71	8.00	4.38

Significant differences were observed with respect to mean, median and standard deviation scores among two groups. On comparison it suggests that persons with stroke performed poorly compared to neurotypical adults. The mean and median of the neurotypical adults is 10.00, with no standard deviations. Persons with stroke had mean of 5.7, median of 8.00 and standard deviation of 4.38. Mann Whitney U test showed a significant difference /Z/= 0.00) between two groups.

Subtest 3: Phrase

Phrase repetition subtest included five phrases. Phrases are structured in terms of complexity and increasing phrase length. Participants had responded verbally. Correct response was scored 2; maximum score for the subtest was 10. Participants of both groups are tabulated in terms of descriptive scores in the Table- 12 below.

Table-12 show Mean, median and standard deviation scores of each group in phrase subsection.

Group	N	Mean	Median	SD
Neurotypical adults	30	10.00	10.00	0.00
Person with stroke	7	2.71	0.00	4.34

The results in the Table-12 show a mean score of 2.71, median score is 0.00; standard deviation of 4.34 for persons with stroke. Whereas for neurotypical adults mean score and median score was 10.00 with no obvious standard deviations. Mann Whitney U test showed a significant difference /Z/= 0.00) between two groups.

Subtest 4: Sentence

This subsection of sentence repetition included five tasks. All the five tasks were prepared in terms of increasing complexity. Response mode was verbal. Each correct response was scored 2 and maximum score for this subsection was 10. Results are obtained in terms of mean, median and standard deviation scores for each group of participants in Table -13 below.

Table – 13 Mean, median and standard deviation scores of each group in sentence subsection.

Group	N	Mean	Median	SD
Neurotypical adults	30	10	10.00	0.00
Person with stroke	7	2.28	0.00	3.90

The results are depicted in the Table -13 showed that mean and median was 10 through mean and standard deviation whereas for persons with stroke scores for mean, median and standard deviation are as follows (X=2.28) (M=0.00) (SD=3.90). Table -13 shows that persons with stroke have more difficulty in performing the task of repeating a sentence when compared to neurotypical group. Mann Whitney U test showed a significant difference /Z/= 0.00) between two groups.

Overall performance of the participants in repetition domain

This domain includes four subsections namely: automatic speech, word, phrase and sentence. The maximum score of this domain was 40.

Table -14 shows the overall mean, median and standard deviation scores of the participants. *Overall performance of the participants in repetition domain in Table- 14*

Group	N	Mean	Median	SD
Neurotypical adults	30	39.6	40.00	0.93
Person with stroke	7	13.71	8.00	14.38

The raw scores were subjected to descriptive statistics to arrive at mean (M) and standard deviation (SD). All the neurotypical adults (X = 39.6; M = 40.00 SD = 0.93) performed better than neurotypical (X = 13.71; M = 8.00; SD = 14.38) in all the subsections of this domain.

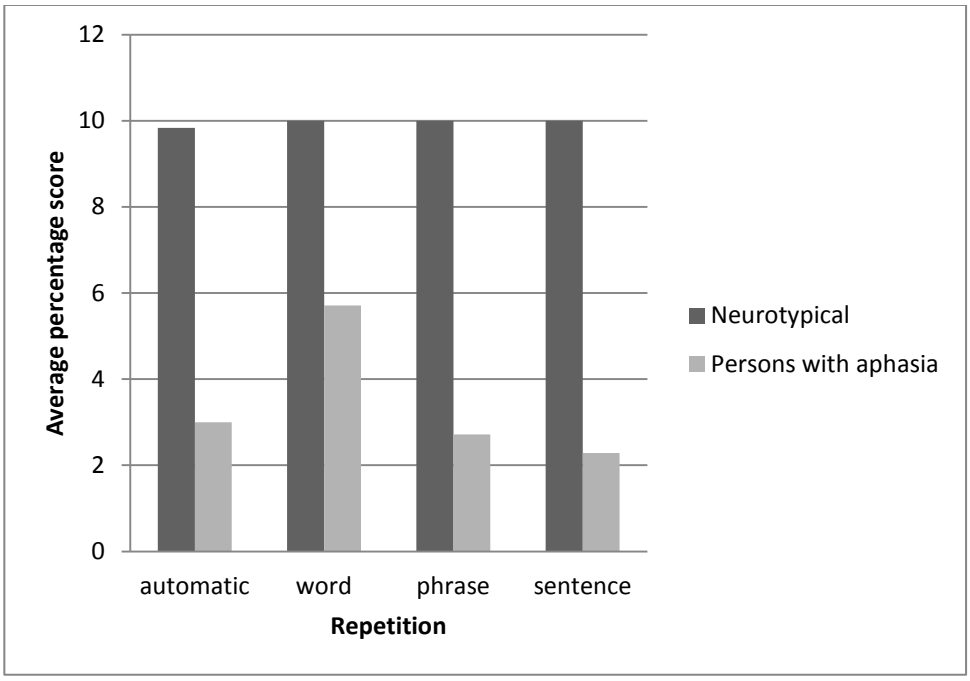

Figure 2 shows the overall means for all subsections in repetition tasks for persons with aphasia and neurotypical adults

The findings of the present study support the study done by Wernicke (1874); and Geschwind (1965). They reported that repetition difficulties exist, if there is structural damage to arcuate fasciculus in persons with aphasia. They also reported that disconnection between anterior and posterior speech areas would lead to disruption in the flow of information.

Decreased performance in persons with stroke is seen in this study. Persons with stroke showed difficulty in performing automatic speech task as it requires demand on persons working memory as reported by The Psychological Corporation, (2002) and Wilde, Strauss, and Tulsky (2004). Persons with stroke have difficulty with digit forward and digit backwards tasks. Ronnberg, Larsson, Fogelsjoo, Nilsson, Lindberg and Angquist (1996) and Ween, Verfaillie and Alexander (1996) findings reported a shorter digit span in persons with aphasia. The phonological loop and central executive gets activated based on the degree of manipulation for digit span tasks.

The performance was better for word then followed a decreased line of order as the complexity of the stimuli is shifted to phrase and sentence. Inferior parietal lobe is crucial for processing temporal order of speech syllables as reported by Moser, Fridriksson, Bonilha, Healy, Baylis, Baker and Rorden (2009). Persons with stroke examined in study had lesions in various critical sites of the cortex which facilitates in the conversion of the auditory speech code to motor speech production, due to which there is a decreased performance in all the subsections of the domain.

It is well documented in literature that many mechanisms underlie the deficits in repetition such as deficits in phoneme recognition, phonological production level, and auditory verbal memory and deficits in syntactic and semantic comprehension. Several researchers state that persons with aphasia find repetition more difficult compared to other linguistic deficits.

Researchers also attribute cognition for repetition deficits in persons with aphasia. The assumption has been supported by findings of Caspari et al., (1998); Conner, MacKay, and White, (2000); Murray, (2004); Wright et al., (2003); Yasuda & Nakamura, (2000); where limitations in working memory have a significant effect on the linguistic processing.

The study also supports findings from Baddeley, (2003) and Murray, (2004) infer that persons with aphasia has decreased working memory due to deficient phonological loop, which in turn has influence on language learning and performance. Persons with stroke in present study exhibited more difficulty in repetition of sentences with increased complexity. Bohland and Guenther, (2006) findings are in support of the present study which reported that when syllable sequence complexity is increased it increases cortical activity in anterior and posterior lobes and if there is damage to somatosensory component that would in turn result in difficulties in repetition and spontaneous speech production.

Thus, from the results it is evident that persons with stroke in the present study encountered difficulty in all the four subsections of this domains which is the result of any disassociation of circuits between components of cognition or damage to the different areas of the brain.

Domain 4: Naming

Subtest 1: Confrontation Naming

This sub-domain had included five tasks. Each of the task were presented with picture cards. The response mode was by saying the target name of the picture card. Each correct

response carried a score of 2 and the maximum score was 10. The mean (X), median (M) and standard deviation (SD) scores each group is provided in the Table – 15 below.

Table-15 shows Mean, median and standard deviation scores of each group in confrontation naming subsection.

Group	N	Mean	Median	SD
Neurotypical adults	30	9.86	10.00	0.43
Person with stroke	7	3.14	0.00	4.74

Descriptive analysis of persons with stroke (X= 3.14; M =0.00; SD= 4.74) and neurotypical group (X= 9.86; M= 10.00; SD = 0.43) respectively for confrontation naming task. The results based on scores of mean, median and standard deviation indicate that neurotypical group showed better performance for confrontation naming task over persons with stroke group. Mann Whitney U test showed a significant difference /Z/= 0.00) between two groups.

Subtest 2: Responsive Naming

This subtest of naming comprised of five questions which are arranged in terms of complexity. Participants had to respond verbally. Correct response for each task was

given a score of 2. The maximum score of this subtest was 10. The mean (X), median (M) and standard deviation (SD) scores each group is in the Table- 16

Table-16 Mean, median and standard deviation scores of each group in responsive naming subsection.

Group	N	Mean	Median	SD
Neurotypical adults	30	9.83	10.00	0.53
Person with stroke	7	1.71	2.00	2.13

The scores in the above Table- 16 are suggestive that neurotypical adults performed relatively better in mean (X = 9.83; M = 10.00; SD = 0.53) than persons with stroke with a value of (X = 1.71; M = 2.00; SD = 2.13). There is a large difference between performance for confrontation naming between neurotypical group and persons with stroke group. Performance of participants in persons with stroke group is poorer compared to the participants in neurotypical group Mann Whitney U test showed a significant difference /Z/= 0.00) between two groups..

Subtest 3: Lexical generative naming

Based on the complexity of task, five questions were arranged in this subsection. Response was through verbal mode. Correct response for each question was given a score of 2. The maximum score of this section was 10. The mean (X), median (M) and standard deviation (SD) scores each group are shown in the Table -17 as follows.

Table- 17 shows Mean, median and standard deviation scores of each group in lexical generative naming subsection.

Group	N	Mean	Median	SD
Neurotypical adults	30	9.63	10.00	0.71
Person with stroke	7	0.57	0.00	1.51

The scores are extracted of both groups in terms of mean, median and standard deviation for neurotypical X= 9.63; M= 10.00; SD=0.71) and persons with stroke (X= 0.57; M= 0.00; SD=1.51) groups respectively. These scores in Table 17 confirm that performance of participants performance of participants in the persons with stroke group was poorer compared to the participants in neurotypical group. Mann Whitney U test showed a significant difference /Z/= 0.00) between two groups.

Overall performance of the participants in naming domain

This domain includes three subsections namely: confrontation naming, responsive naming and lexical generative naming. The maximum score of this domain was 30.

Overall performance of the participants in naming domain in Table - 18

Group	N	Mean	Median	SD
Neurotypical adults	30	29.43	30.00	1.13
Person with stroke	7	5.42	2.00	7.72

The raw scores were subjected to descriptive statistics to arrive at mean (X), median (M) and standard deviation (SD). All the neurotypical adults (X = 29.43; M = 30.00 SD = 1.13) performed better than persons with stroke (X = 5.42; M = 2.00; SD = 7.72) in all the subsections of this domain.

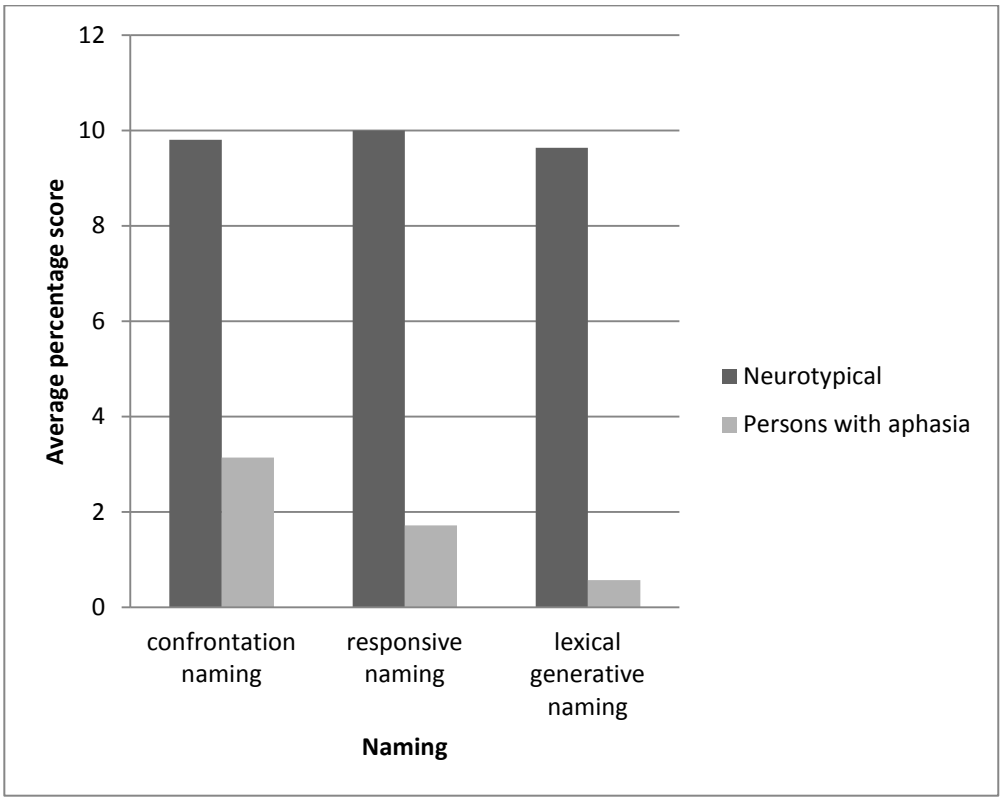

Figure 3 shows that the overall means for all subsections in naming tasks for persons with aphasia and neurotypical adults

Goodglass and Geschwind (1976) reported that persons with aphasia demonstrate difficulty in naming and word finding. Thus, inclusion of word finding ability is necessary in aphasia evaluation. Confrontation naming, responsive naming and lexical

generative naming were the three domains included in this domain. The maximum score of this domain was 30. Descriptive statistics was done to extract mean (X), median (M) and standard deviation (SD) scores from the raw data.

The performance of persons with stroke is better in confrontation naming task where the visual stimulus was present, but decreased performance is seen in both responsive and generative naming task. Contrastively neurotypical group performed better in all tasks of naming included in the domain namely, confrontation naming, responsive naming and lexical generative naming.

It was seen that the inability to retrieve phonological or orthographic word form from the intact knowledge is seen in individuals with focal brain damage. Irrespective of the type or the lesion sites, naming difficulties are common in persons with stroke (Goodglass & Blumstein, 1973). Depending on the loci of impairment naming deficits are seen in person with aphasia as reported by Luria, (1966, 1970). Persons with stroke in present study have lesion in different areas of brain where site of lesion might have an effect on naming difficulties seen in the participants. This notion is further supported by Functional imaging studies of naming by Howard *et al*.,(1992); Hirsch *et al*, (2001);Abrahams et al.,(2003); Harrington; *et al*., (2006); Price *et al*., (2005, 2006); Kemeny *et al*., (2006); Saccuman *et al*., (2006) found the activation of left perisylvian and extrasylvian cortex during naming.

The picture naming can be impaired as a result of insults to brain regions as reported by Goodglass et al and Wingfield, (1997). Paraphasias, circumlocutions and retrieval problems were the naming difficulties observed in the participants while examining person with aphasia over naming tasks. Benson, (1979, 1988) have reported findings in accordance with the present study; phonemic paraphasias and circumlocutions encompasses naming difficulties and the individual with aphasia experiences 'Tip of tongue' indicating the partial awareness of the phonological characteristics of word. These may also be due to disturbance of the internal structural representations by Kohn, Smith, and Alexander (1996) or post lexical phonemic processes by Ellis et al .,(1992). Lesser, (1989) reported that phonemic paraphasia is due to deficits in sequencing and organizing phonemic information.

Barton, Maruszewski and Urrea, (1969); Benson (1979) reported that deficits in perception (decoding), storage, selection retrieval or actual production of the word (encoding) results in naming difficulties. Since linguistic deficits in persons with stroke are manifestations of cognitive deficits. Thus, deficit in naming can be due to cognitive deficit. The present study is in accordance with Ellsworth and Raymer (1998); according to the finding in their study both semantic and phonological stages of lexical retrieval are impaired in persons with stroke. Hilis (1990) reported that semantic processing deficits result in semantic errors in naming and comprehension, this finding is in accordance with present study. Naming deficits can also be due to the disassociation between the semantic and phonological representation of the word forms.

Many studies reported that in persons with stroke there is a disruption of mechanisms in linking semantic representation to particular word form representation may result in naming deficits.

Domain 5: Reading

Reading was evaluated using four tasks. Tasks were to be orally read aloud. A score of 2 was given for correct response. The maximum score considered for this domain is 8. The mean (X), median (M) and standard deviation (SD) scores of each group of participants are shown in the Table- 19 below.

Table 19 shows Mean, median and standard deviation scores of each group in reading section.

Group	N	Mean	Median	SD
Neurotypical adults	20	8.00	8.00	0.00
Person with stroke	4	4.5	5.00	2.51

The following Table- 19 shows that only 20 participants were literate in neurotypical group; thus this task was administered only on these 20 literate participants. Thus, participants in neurotypical group scored (X = 8.00; M =8.00 ; SD = 0.00). Out of seven persons with stroke, five of the participants were literate; only four were able to perform the task scored (X = 4.5; M = ; S.D. = 2.51). The obtained results reveal that

reading was a difficult task to perform for persons with stroke group than in neurotypical adults group.

The performance of persons with stroke was poorer than neurotypical adults. Thus, it is inferred that the areas affected would have contributed to the reduced scores. Reading is a skill which takes place by the conversion from grapheme to phoneme. There are reported studies highlighting that the activation of certain regions in the brain plays an important role in facilitating reading. The findings of Fiebach, Schlesewsky and Friederici (2002) and Binder et al. (2003) reported to have activation in bilateral mid fusiform gyrus during reading tasks. The involvement of left angular gyrus in orthography to phonology conversion in both word and subword level is also reported. Coltheart, Patterson, & Marshall, (1980); Hatfield, (1983); Ellis, (1984) in 'dual route model' explain that reading and writing mainly occurs through two routes namely lexical route (retrieval of word spelling stored in orthrographic output lexicon) and phoneme grapheme conversion route (Segmental translation from phonology to orthrography).

Based on the functional imaging and lesion studies it is reported that while reading, orthrographic stimuli processing is located more in the left fusiform gyrus by Dehaene et al. (2002); Leff et al. (2006). The results from Foundas, Eure, Luevano, and Weinberger (1998); Raymer et al., (1997) and Price and Devlin (2003) support the relevance of brain damage which disrupts the access to orthographic word forms which in turn result in difficulties in oral naming and reading.

Thus, due to the varied lesions in the areas of the brain and cognitive limitation during the post-acute stages of recovery in persons with stroke results in difficulties in accessing the stored word and orthography to phonology conversion.

Domain 6: Writing

This domain was designed to explore the performance on writing. Four tasks were used. The response mode for all the tasks was writing. Picture cards were used. Each correct response was given a score of 2. Maximum score for this domain was 8.

Table – 20 Mean, median and standard deviation scores of each group in writing section.

Group	N	Mean	Median	SD
Neurotypical adults	20	8.00	8.00	0.00
Person with stroke	2	4	7.00	1.41

Among 30 neurotypical adults; only 20 participants were literate in the neurotypical group; thus this task was administered on the literate participants. The literate participants scored (X = 8.00; M = 8.00; SD = 0.65). Out of seven persons with stroke only five were literate but only two participants were able to perform the task and scored (X = 4.00; M = 7.00; S.D. = 1.41). The obtained results show that performance for writing tasks was poorer in persons with stroke than neurotypical adults.

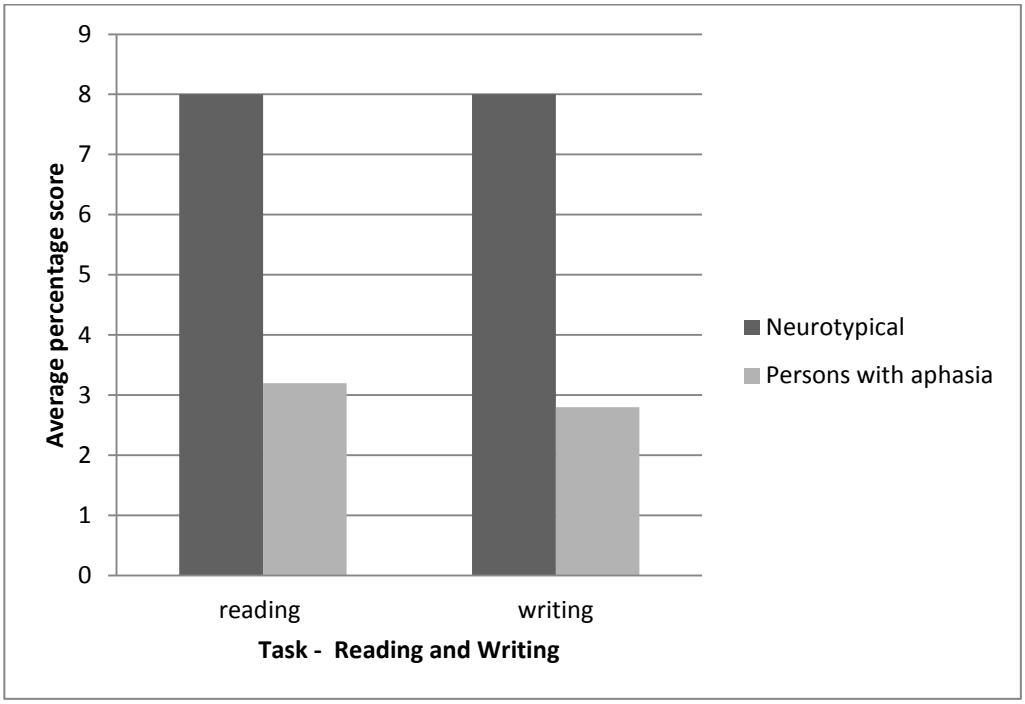

Figure 4 shows that the overall means of reading and writing tasks for persons with aphasia and neurotypical adults

The number of participants in the persons with stroke group who are able to perform the task were only 2. Corbetta and Shulman (2002); Castiello (2005) reported that writing is a skill dependent on the parietal lobe function where the controlled upper limb movements stresses on eye gaze, focused visual attention, and predictive representations of visual movement. Parietal lobe aids in grasping, pointing, reaching and analytical illustrations of visual movement. It is reported that majority of the activity of left and right parietal lobes are related to the writing execution on visual and

somatosensory control. This notion is supported from Grossberg & Paine (2000) in models of writing reporting that skill of writing is dependent on feedback from multisensory areas that is from visual and somatosensory areas. Studies report that writing process requires the flexibility of the working memory in order to perform. Since the limitations in the working memory may indirectly inhibit its flexibility which results in writing deficits. Caplan and Waters, (1999); stated allocation in the working memory is essential for language processing.

Due to the lesion present, individuals with stroke, exhibit difficulties in upper limb movements where the feedback loop is affected in facilitating writing skill and also the motoric limitations due to hemiplegia.

Therefore, according to the results obtained from the study, it signifies that persons with stroke performed poorly on the developed bedside screening test in Telugu. Persons with stroke exhibit difficulties in various modalities of speech and language due to the lesions in the brain. Across all the domains of the test, persons with stroke showed a lower mean score. In order to identify the persons with stroke having an aphasic component, it is essential to have a normative score across the domains. The normative values can be used for the screening of persons with stroke for the speech and language skills and these normative values indicate whether the persons following stroke shows any obvious language deficit.

Table 21.Bedside Screening Test for Persons with Aphasia – Telugu: Normative score sheet

Domain	Subtests	Lower bound score	Upper bound score
Spontaneous Speech	Content and Fluency	No scoring is provided, to be carried out qualitatively.	
Auditory Verbal Comprehension	Yes No Questions	10	10
	Pointing	10	10
	Auditory Word Recognition	10	10
	Verification	10	10
	Sequential Commands	9	10
	Total	49	50
Repetition	Automatic Speech	8	10
	Word	10	10
	Phrase	10	10
	Sentence	10	10
	Total	38	40
Naming	Confrontation Naming	8	10
	Responsive Naming	10	10
	Lexical Generative Naming	8	10
	Total	26	30
Sub cut off score		113	120
Reading		8	8
Writing		8	8
Total		129* Literate	136* Literate
		113 * illiterate	120* illiterate

Based on the results obtained in development of bedside screening test for persons with aphasia in Telugu. Normative scores had been put forth. The lower bound score for literate population in males and females was 129 whereas score for illiterate population it was 113. The overall score was lower for illiterate persons as the reading and writing component was not considered. Thus, if persons with brain damage are not able to carry out the reading and writing task, than irrespective of the literacy score, the cut off score will be 113. Thus, the higher bound score was 136 for literate population whereas score for illiterate population it was 120.

CHAPTER - V

SUMMARY & CONCLUSION

The current study was developed to be used by speech language pathologists for screening any obvious speech and language disturbances during the initial post acute stages of recovery following stroke. Literature reveals that screening tools are quick and simple for assessment and have good internal consistency and reliability (Sabe, Courtis, Saavedra, Prodan, De Lujan, & Melian, 2008).

The screening test was developed with an objective to provide a language specific screening tool in Indian context for Telugu population. The current study was designed to develop the screening tool to identify the presence or absence of language disturbances in persons with stroke.

The test includes six domain i.e., spontaneous speech, auditory verbal comprehension, repetition, naming, reading and writing with subsections within them. The screening kit constituted of picture cards. The study was carried out on 30 neurotypical adults of the age range 20-40, 40 – 60 and 60-80 years and seven persons with stroke.

The objective of the study was to determine the overall performance of normal participants across various domains of the test and subsections following which the performance of three age groups across domains and subsections of the test was taken up. To assess the sensitivity of the test, the study was also aimed at comparing the performance of neurotypical and persons with stroke.

The raw scores obtained were tabulated for statistical analysis using Statistical Package for the Social Sciences software (SPSS) version 17.0 software package. The scores were converted into percentage values. Descriptive analysis of the raw scores yielded the mean (X), median (M), and standard deviation (SD) scores for participants of both the groups separately across each domain and their subsections. Statistical analysis of the data using non parametric tests namely, Mann-Whitney U test to identify the significant difference between two groups across the domains and sub-domains.

Results of the present study within the neurotypical group of three age ranges revealed that there is no significant difference between three age groups across the subsections. Hence, all three age ranges were considered as single group. No obvious deficits were observed in the neurotypical group across all the domains of the test. Reading and writing were assessed only on 20 literate participants.

Results of the present study with respect to the comparison of the performance of the two groups revealed that there is a significant difference between the groups. The performance of persons with stroke was poorer when compared to neurotypical population. Persons with stroke experienced difficulties in all the domains: comprehension, repetition, naming, reading and writing. Damage to certain areas of the brain and poor cognitive skills would be contributed to the auditory processing difficulties in persons with stroke. The increased cognitive loads in naming tasks especially in generative and responsive naming which exerts pressure on the cognitive processing components in retrieving from stored memory which might have been a additional causative factor for poor performance in the stroke individuals. Thus,

indicating that the test is suitable to differentiate between neurotypical and pathological speech and disturbances.

Implication of the study

This screening tool can be used for screening to assess speech and language skills in persons with stroke.

It is less time consuming and can quickly give an idea about the presence or absence of aphasia, post stroke.

It helps in planning, appropriate management program for persons with aphasia.

Limitations:

- This screening tool can be used only for Telugu population.
- Variables like gender, education, site of lesions were not taken up for consideration.

Future Directions:

- The test can be standardized on a larger number of controls on variables like gender and education.
- The test can be carried out in other Indian languages.

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APPENDIX - I

Feedback questionnaire for aphasia treatment manuals

Sl. No	Parameters	Very poor	Poor	Fair	Good	Excellent
1	Simplicity					
2	Proverbiality					
3	Size of the picture					
4.	Colour and appearance					
5	Arrangement					
6	Presentation					
7	Volume					
8	Relevancy					
9	Complexity					
10	Iconicity					
11	Accessible					
12	Flexibility					
13	Trainability					
14	Stimulability					
15	Feasibility					
16	Generalization					
17	Scope of practice					
18	Scoring pattern					
19	Publications, outcomes and developers (Professional background)					
20	Coverage of parameters (Repetition and expression)					

Definition of parameters

1. Simplicity: Is the test stimuli comprehendible?
2. Proverbiality: is the test material familiar to the user?
3. Size of the picture: whether the picture stimuli are appropriate in size?
4. Colour and appearance: Are the picture stimuli appropriate in terms of colour and dimension?
5. Arrangement: whether the picture stimuli are within the visual field of the individual?
6. Presentation: are the number of stimuli in each section placed appropriately?
7. Volume: is the overall manual appropriate in size?
8. Relevancy: whether the test material is culturally and ethically acceptable?
9. Complexity: is the material arranged in the increasing order of difficulty?
10. Iconicity: does the picture stimuli appear to be recognizable and representational?
11. Accessibility: is the test material user-friendly?
12. Flexibility: can the stimuli be easily modified?
13. Trainability: can the stimuli be used for intervention purposes in different milieu?
14. Stimulability: does the stimulus material elicit responses from the individuals?
15. Feasibility: whether the test material is viable?
16. Generalization: can the test material be generalized to any other adult language disorders and various settings?
17. Scope of practice: is the test material within the profession's scope of practice or within the personal scope of practice?
18. Scoring pattern: whether the scoring pattern followed in the resource material applicable?
19. Publications, outcomes and developers (Professional background): is there any other resource material similar to that test material which you are aware of?
20. Coverage of parameters (Reception & Expression): does the resource material contain the essential language components to be treated?

APPENDIX - 2

Bedside Screening Test in Telugu

పేరు తేది:

వయసు/ లింగం మాతృభాష:

Spontaneous speech – Mode of communication: verbal/ nonverbal

Auditory verbal comprehension

Subdomain - Yes or no

S.No	Questions	Scoring
1	మీ పేరు కిరణ్ ?	
2	మీరు తెల్ల చొక్కా వేసుకున్నారా ?	
3	కారు ఆకాశంలో ఎగురుతుందా ?	
4	మీరు మంచం మీద కూర్చున్నారా?	
5	కాగితం మంటలో కాలుతుందా?	

Pointing task

S.No	Questions	Scoring
1	చెంచా	
2	ఆవు	
3	అగ్గిపెట్టె	
4	పెన్ను	
5	కుర్చి	

Auditory word recognition

S.No	Questions	Scoring
1	పువ్వు	
2	కన్ను	
3	ఫ్యాను	
4	చాకు	
5	మంచం	

Verification task

S.No	Questions	Scoring
1	ప్లేటు , కప్పు, చెంచా	
2	మంచం, కుర్చీ, మంచం	
3	ఆసుపత్రి, రైల్వే స్టేషన్, బస్ స్టాండ్	
4	దూకు, పరుగెతు, కూర్చో	
5	కూరగాయ, వస్తువు, పండు	

Sequential commands

S.No	Questions	Scoring
1	కళ్ళు మూసుకోండి	
2	మీ కుడి చేతిని పైకి ఎత్తండి	
3	పెన్ను పుస్తకం పైన పెట్టు	
4	పెన్ను ఇచ్చిన తరువాత పుస్తకం మూయండి	
5	పెన్ను ఇచ్చిన తరువాత కప్పు మరియు అద్దం కలిపి **నాకు** ఇవ్వండి	

Repetition

Automatic

S.No	Questions	Scoring
1	ఒకటి నుండి పది వరకు లెక్కపెట్టండి?	
2	వారాల పేర్లు చెప్పండి ?	
3	సంవత్సరం లోని నెలల పేర్లు చెప్పండి ?	
4	పది నుండి ఒకటి వరకు లెక్కపెట్టండి?	
5	అచ్చులు చెప్పండి ?	

Word

S.No	Questions	Scoring
1	ఇల్లు	
2	బడి	
3	తల	
4	సబ్బు	
5	ఇరవై ఒకటి	

Phrase

S.No	Questions	Scoring
1	ఆవు పాలు ఇస్తుంది	
2	వర్షం పడుతోంది	
3	భారతదేశం మనది	
4	ఆకాశం నీలం రంగులో ఉంది	
5	వాళ్ళు అందరికి తెలుసు	

Sentence

S.No	Questions	Scoring
1	వాళ్ళుందరు పనికి వెళ్ళారు	
2	సూర్యుడుని ఉదయాన్నే చూడవచ్చు	
3	ఈ స్థలం చాలా బాగుంది	
4	పాఠశలలో గురువులు పాఠం చెప్తారు	
5	ఈ రోజు ఓడిపోయిన వాడు రేపు గెలుస్తాడు	

Naming

Confrontation naming

S.No	Questions	Scoring
1	పిల్లి	
2	తాళంచెవి	
3	చెట్టు	
4	రేడియె	
5	బకెట్	

Responsive naming

S.No	Questions	Scoring
1	అరటి పండు ఏ రంగులో ఉంటుంది?	
2	మీరు నీళ్ళు ఎలా తాగుతారు?	
3	వంటగదిలో ఏమేమి ఉంటాయి?	
4	మీ చుట్టుపక్కల కనిపించే వస్తువుల పెర్లు చెప్పండి ?	
5	మీరు మార్కెట్ లో ఏమి చూడగలరు ?	

Lexical generative naming

S.No	Questions	Scoring
1	కూరగాయల పేర్లు చెప్పండి?	
2	ఇంటికి సంబంధించిన పదాలు చెప్పండి?	
3	ఎరుపు రంగు లో ఉన వస్తువుల పేర్లు చెప్పండి?	
4	‘‘క’’ అక్షరంతో వచ్చే పదాలు చెప్పండి?	
5	‘‘అ’’ అక్షరంతో వచ్చే రెండు పండ్లు పెర్లు మరియు ఇక్కడ చూడగలిగిన రెండు వస్తువుల పేర్లు ఒక నిమిషంలో చెప్పాలి?	

Reading

S.No	Questions	Scoring
1	అ	
2	దూరవాణి	
3	పోలీసు దొంగ ను పట్టుకున్నాడు	
4	106	

writing

S.No	Questions	Scoring
1	మీ పేరు వ్రాయండి	
2	ఒకటి నుండి పది వరకు సంఖ్యలు వ్రాయండి	
3	ఐదుకు నాలుగు కలిపితే ఎంత	
4	పదాలను చూసుకూంటు కాపి చేయండి	

Bedside Screening for Persons with Aphasia in Telugu

Domain I) Auditory comprehension

Yes/no

1. /mi:/ /pe:ru/ /kirən/
2. /mi:rU/ /ʈella/ /cokka/ /ve:sukunna:ra:/
3. /ka:ru/ /a:kaʃəmlo/ /egurutũɖa:/
4. /mi:ru/ /məncəm/ /mi:ɖa/ /ku:rcunna:ra:/
5. /ka:gitəm/ /məntələo/ /kaluʈũda:/

Pointing

1. /cəmca/
2. /a:vʊ/
3. /əggipette/
4. /pennU/
5. /kUrci:/

Auditory word recognition

1. /puvvU/
2. /kənnU/
3. /p^{h}ænU/
4. /ca:kU/
5. /məncəm/

Verification task

1. /pletU/ /kəppU/ /cəmca/
2. /kUrci:/ /bəlla/ /məncəm/
3. /aspəʈ^{h}ri/ /re:lwe steʃən/ /bəs stæd/
4. /ɖuku/ /pərgeʈu/ /ku:rco:/
5. /ku:rəgai /vəsʈuvu/ /põdu/

Sequential commands

1. /mi:/ /kəllu/ /mu:sukõ:di/
2. /mi:/ /kudi/ /ce:tini/ /paiki/ /eʈõdi/
3. /pennu/ /pusʈəkəm/ /paina/ /peʈʈu/

4. /pennu/ /iccina/ /ʈəruva:ʈa/ /pusʈəkəm/ /mujjəɖi/
5. /pennu/ /iccina/ /ʈəruva:ʈa/ /kəppu/ /məriju/ /əɖɖəm/ /kəlipi/ /na:kivvəɖi/

Domain II) Repetition:

1. /okəṭi/ /nũɖi/ /pəɖi/ /vəruku/ /lekkəpeṭṭəɖi/
2. /va:ra:la/ /pe:rlu/ /ceppəɖi/
3. /səvəcərəmlonI/ /neləlu/ /pe:rlu/ /ceppəɖi/
4. /pəɖi/ /nũɖi/ /okəṭi/ /varuku/ /lekkapeṭṭəɖi/
5. /əcculu/ /ceppəɖi/

Word

1. /bəɖi/
2. /Illu/
3. /ʈəla/
4. /səbbu/
5. /irvəi/ /okəti/

Phrase

1. /a:vu/ /pa:lU/ /isn̪ t̪ũn̪ i/
2. /vərʃəm/ /pəɖt̪ũ:ɖi:/
3. /b^{h}a:rə t̪/ /ɖe:ʃam/ /manaɖi/
4. /vallu/ /andəriki/ /ʈelusU/

Sentence:

1. /valləɖru:/ /pə:niki/ /vellaru/
2. /su:rjuḍu/ /uɖjanne/ /cu:ɾagələru/
3. /I/ /st^{h}ələm/ /ca:la:/ /ba:gũɖI/
4. /pat^{h}ʃaləlo/ /guruvu:lu/ /pa:təm/ /cəbiʈaru/
5. /i:/ /ro:dzu/ /o:ḍipo:jina/ /va:ḍu/ /re:pu/ /gelusʈa:ḍu/

Domain III) Naming

Confrontation naming

1. /pilli/
2. /ʈaləm/ /cevi/
3. /ceʈʈu/
4. /redIo/
5. /bəket/

Responsive naming

1. /ərəʈi/ /pə̃ɖu/ /je/ /rə̃gulo/ /ũʈũɖi/
2. /mi:ru/ /ni:llU/ /ela:/ /ʈa:guʈa:ru/
3. /və:nʈa:/ /gə:ɖ̪i/ /lo/ /æ:m/ /cu:ɾagələru/
4. /mi:/ /cuttupəkkəla/ /vəsʈuvula/ /pe:rlu/ /ceppə̃ɖi/
5. /mi:ru/ /ma:rkəʈlo/ /æ:m/ /cu:ɾagələru/

Lexical generative naming

1. /pe:rlu/ /ceppə̃ɖi/
2. /inʈiki/ /səbəɖincIna/ /vasʈuvula/ /pe:rlu/ /ceppə̃ɖi/
3. /nəlupu/ /vasʈuvula/ /pe:rlu/ /ceppə̃ɖi/
4. /ka/ /ʈo/ /moɖəlijje/ /pəɖa:lənu/ /ceppə̃ɖi/
5. /ippuɖu/ /mi:ru/ /na:ku/ /a/ /ʈo/ /moɖəlijje/ /rə̃ɖu/ /pə̃ɖla:/ /pe:rlu/ /ceppə̃ɖi/ /məriju/ /rə̃ɖu/ /vasʈuvula/ /pe:rlu/ /ceppə̃ɖi/

Domain IV) Reading

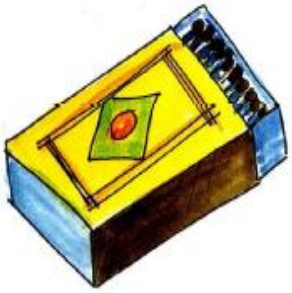
1. /a/
2. /du:rəva:ni/
3. /106/
4. /po:lisu/ /ɖ̪õga/ /ni/ /paʈʈukunna:du/

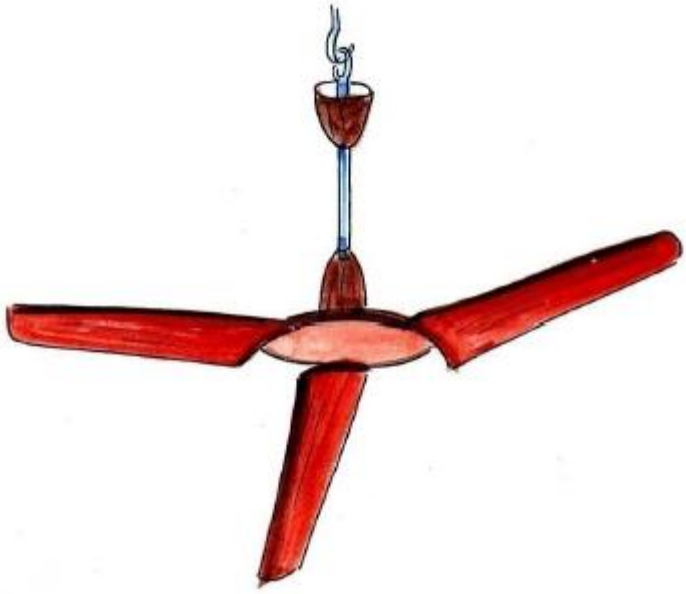
Domain V) Writing

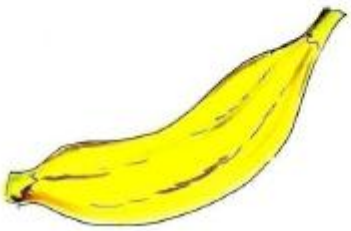
1. /mi:/ /pe:ru/ /raĩɖi/
2. /okaʈi/ /nunɖi/ /paɖi/ /varuku/ /raĩɖi/
3. /aiɖuku/ /na:lugu/ /kəlipiʈe:/ ə̃ʈ̪a/
4. /pəɖa:lənu/ /cu:sukoni/ /ka:pi/ /ce:jə̃ɖi/

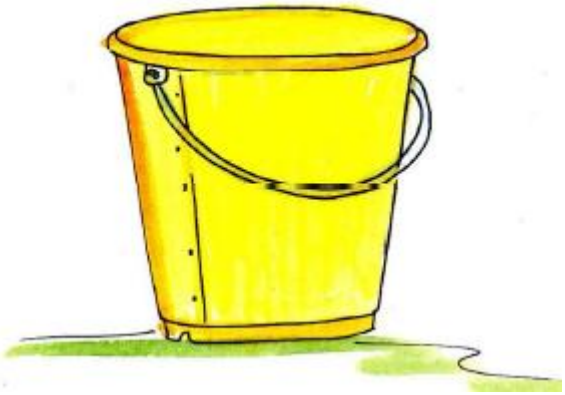
BEDSIDE SCREENING TEST IN TELUGU

(Picture cards used during administration)









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