RESEARCH ARTICLE

ASSESSMENT OF INTELLIGIBILITY ACROSS SPEECH TASKS IN SPEAKERS DYSARTHRIA.

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Manuscript Info	Abstract
	Reduced speech intelligibility is one of the most common characteristic of dysarthria which can primarily impair speakers communication and hence quality of life . The present study aimed to analyze effect of speech tasks on intelligibility of speakers with dysarthria. with Parkinson's Disease (DYSPD) within the age range of 50 to 70 years of varying severities; Speech Tasks which vary in complexity was given and analyzed the intelligibiluity across various tasks The present study concludes that speech intelligibility is reduced in individuals with dysarthria and it varies across the range of speech production tasks. Therefore, stimulus type can significantly affect the speech intelligibility of speakers with dysarthria. In the current study only four tasks were used, so future research can measure speech intelligibility of speakers with dysarthria using continuous and complex stimuli such as narration and conversation. No one measurement method alone is capable analyzing different aspect of intelligibility so objective and subjective methods of intelligibility measurements can be used.

Introduction:-

The exchange and flow of information, ideas, thoughts or feelings from a speaker to a listener is termed as communication. communication is the beginning of understanding (Robert, Lawrence, Heat & Bryant, 2000) . The term dysarthria refers to a group of neuro muscular speech disorders that can be due to central or peripheral system damage and which affects the motor control over speech, the major problem faced byin dual s with dysarthria is poor coordination of speech musculature, paralysis, and weakness of the muscles responsible for speech (Darley etal., 1969S).

Speech intelligibility can be defined as how well the message conveyed by the speaker is understood by the listener (Yorkston, Beukelman, Strand, & Bell, 1999) One of the most common characteristic of dysarthria is reduced intelligibility. The intelligibility reduces as the severity increases. Speech intelligibilty can be measured in different methods.1)The subjective measurement (i) equal appearing interval scales (Darley et al., 1969a) (ii) direct magnitude estimation (iii) percentage estimate method (Carter, Yorkston, Strand & Hammen, 1996; Yorkston & Beukelman, 1978). Objective measurement includes orthographic transcription by the listeners of the words and connected speech.

In a study speech intelligibility of normals and different types dysarthria were compared a using acoustic analysis and perceptual analysis in sentence production in Amyotrophic Lateral Sclerosis (ALS), Parkinson Disease (PD)

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and normal's. Results show that the normal's were having the highest mean intelligibility in normal's which is then followed by the ALS group then by PD group for the sentence intelligibility task (Weismer, Jeng, Laures, Kent & Kent, 2001) .According to Kempler & Lancker, 2002, speech production efficacy varies with tasks. Hustad, 2007 measured speech intelligibility using transcription and rating scale in different types and severity of dysarthria across three different types of speech stimuli. Results depicts that both the measures has been affected by type and severity of dysarthria and also the speech intelligibility varies with the task.Traditionally it is thought that dysarthric features are consistent across the types and context of speech production but there is some evidence regarding the fact that the performance of individuals with dysarthria on speech intelligibility vary with different speech production task.There are few studies to assesss intelligibility of dysarthric speech across various task in Indian context. Hence the present study is planned to assess a test for intelligibility of dysarthria across various task in Marathi language.

Method:-
Participants:-
Participants of the study consisted of 15 native Marathi speaking individuals with Parkinsons Disease and with different severities within the age range of 50 to 70 years.The participants did not have any associated problems of language, cognition, psychological, visual and hearing and were be able to speak and read Marathi. The individuals with dysarthria were diagnosed and grouped according to the severity of the disorder by an experienced Speech Language Pathologi . For the individuals with PD, the samples were recorded four hours post-medication (L-dopa, Sil-dopa etc) to avoid the effect of medicine on their speech.

Stimuli:-
Stimulus for the study comprised of word and sentence list, questions for eliciting spontaneous speech and reading passage. For task I, 20 words consisting of simple and complex familiar words. For task II, 20 sentences varying in length and complexity were selected. Elicited spontaneous speech was used for task III. Twenty questions were made such that its answers are predictable and could be elicited in sentences from the participants. For the fourth task a familiar reading passagewas chosen. The stimulus was selected such that it is familiar and contains most phonemes in Marathi language.

Procedure:-
Recording of speech sample:-
The speech sample was recorded from each participant separately in such a way that the participants were seated comfortably in a noise free environment with the examiner seating in front of the him/her using a unidirectional microphone . The recording was done in laptop using PRAAT software (Version 4.1.21). They were asked to listen to questions and give appropriate answer in complete sentences for the IIIrd task. For the IVth task participants were instructed to read the passage provided to them. A practice trail was also given using the stimulus for each subject before the recording.

Intelligibility measurement:-
Three experienced speech language pathologist were selected as listeners for measuring speech intelligibility using percent estimation and comprehensibility method across four speech production task for dysarthria. The listeners were instructed to score the intelligibility of each participant using percent estimation method and comprehensibility separately on a scoring sheet

Intelligibility of each participant was calculated across four tasks with percentage estimation method using the following equation; $PE = \dfrac{\text{Numberof words intelligible}}{\text{Total number of word}} \times 100$

comprehensibility using the following scale;4-normal, 3-mild, 2-moderate, and 1-severe.

Results:-
Statistical analysis:-
Repeated measures of ANOVA was used to compare intelligibility using percent estimate method within groups for different speech tasks. A statistically significant main effect was noted across the task in dysarthria speakers. Bornferonni post hoc was done for pairwaise comparison. Pair-wise comparison with Bonferonni post-hoc reveals a statistically significant difference between task I and task III (p = .028). But statistically significant difference was

not obtained between other tasks; which includes task I and II (p=0.34), task I and IV (p=.182), task II and III, task II and IV (p=.662), Task III and IV (p=1.00). There was a difference between performance of dysarthria speakers on intelligibility across word repetition and ESS.An independent t-test was done to compute the intelligibility for reading passage and ESS using comprehensibility. A paired sample t test was done to find out the variability of intelligibility in dysarthria between the tasks. One way ANOVA was done to determine the intelligibility across severity There was a significant difference across severity, (F (20.6, 2) =52.77, p=.000). Bonferonni post hoc was computed for the pair-wise comparison across the severity.There was a significant difference in intelligibility for the entire speech task between mild and severe degree (p=0.009) but not between moderate and severe (p=0.014), and mild and moderate (p=.624).

Wilcoxon t test was done to compare intelligibility across the speech tasks within each category of dysarthria severity (mild, moderate, and severe) with both the measures. It was found that statistically there is no significant difference between the speech tasks within mild, moderate and severe dysarthria. To find out the correlation between the two measures of intelligibility Spearman's correlation was used. A statistically significant correlation (r=.630, p= 0.003) was obtained between two measures of intelligibility. The results showed a good correlation between intelligibility scores using percentage estimation and comprehensibility measure indysarthria speakers.The reliability between two listeners on intelligibility measurement using PE and comprehensibility across 4 speech tasks was computed using the kappa coefficient. There was a substantial agreement between the listener's scores using PE method for the 4 speech tasks i.e. words (kappa= 0.51, p=.00), sentences (kappa=0.64, p=.000), ESS (kappa=0.81,p=.000) and reading passage (kappa= 0.72, p=.000). Substantial agreement was also obtained between listeners for comprehensibility across 2 speech tasks i.e. ESS (kappa= 0.68, p=.000), and reading passage (kappa=0.73, p=.000). The results show that there is good reliability between the listeners.

Discussion:-
The overall purpose of the study was to provide a review on intelligibility of dysarthric speech using different measurement methods across various speech tasks. Results showed that as the complexity of the tasks increases intelligibility reduces. Accoring to Kempler, Lancker, 2002 speech production efficacy varies with different tasks. Researchers have measured speech intelligibility in individuals with dysarthria and compared different methods of intelligibility. Results of studies show that; a better description of dysarthric speech can be obtained with two measurement scales i.e. transcription and comprehensibility (Hustad, 2006), transcription is a better measurement of intelligibility than percent estimation in terms of clinical measurements (Hustad, 2006) . Hence, to get a comprehensive estimate of speech intelligibility individuals with dysarthria, preferably a combination of two or more intelligibility measures should be used than relying on a measure.

Conclusion:-
The present study concludes that speech intelligibility is reduced in individuals with dysarthria as compared to healthy controls. There is a variation observed on speech intelligibility of individuals with dysarthria across the range of speech production tasks. Also intelligibility varied as the complexity of task increased. . Stimulus type can significantly affect the speech intelligibility of dysarthria speakers. Speech intelligibility of dysarthria varied across severity with both the measures. Individuals with mild dysarthria were having better mean scores of intelligibility compared to moderate and severe. A good correlation was obtained between both the intelligibility measures, with better scores obtained for comprehensibility measure than percent estimation.

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