International Journal of Research in Engineering and Science (IJRES)
ISSN (Online): 2320-9364, ISSN (Print): 2320-9356
www.ijres.org Volume 11 Issue 7 ǁ July 2023 ǁ PP. 238-242

Speech Intelligibility in Hindi Speaking Children with Spastic Cerebral Palsy in Kanpur, Uttar Pradesh

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Abstract:
The current study assessed the speech intelligibility in children with spastic cerebral palsy (CP) who are native Hindi speakers in Kanpur district, Uttar Pradesh. The aim was to gain more detailed insights into how the neurodevelopmental disorder affects speech intelligibility; ultimately opening up avenues for improved rehabilitation. Total 10 children in the age group of 6-8 years were taken for the study which was divided into two groupsbased on their age with equal number of participants in each age group.The perceptual rating of speech intelligibility was provided by five qualified SLPs and their ratings were tabulated for detailed statistical analysis. The results found highly significant difference in mean speech intelligibility rating across age groups suggesting thatthere is an improvement of speech intelligibility as the age advances in children with spastic CP. The current study will aid in designing assessment protocol andeffective intervention techniques that enhance their speech comprehensibility and communication skills.
Keywords:*speech intelligibility, cerebral palsy, rating scale, Hindi language*

Date of Submission: 09-07-2023 Date of acceptance: 21-07-2023

I. INTRODUCTION:

Cerebral palsy (CP) is a neurodevelopmental disorder in which individuals experience conditions such as impaired muscle tone, mobility challenges and motor skill difficulties due to developmental brain injuries. Recognizable signs may appear earlier in life but the manifestation of this condition can evolve over time - it is usually diagnosed between ages 3-5 years old or later. Neurological rehabilitation is essential when addressing conditions caused by muscle tone abnormalities while developing physical rehabilitation therapies along with occupational therapy for individuals affected by CP are also crucial areas to consider during treatment. To improve patient autonomy multidisciplinary teams should be selected while keeping individual patient needs in mind. The aim should be to develop regularly updated global treatment care plans. Cerebral palsy impacts several vital areas such as sensory capabilities, movement abilities and cognitive function contributing majorly to verbal expression challenges such as speech, language and communication. Successful intervention from professional speech-language therapists can mitigate the impact of these challenges.

The current study focuses on exploring speech intelligibility in Hindi speaking children with spastic CP. Focusing on studying the speech intelligibility in CP children speaking Hindi sheds light on previously unrecognized aspects of the developmental process that can bring out unique challenges faced by the children. In turn, such insight contributed towards enriching current knowledge on how speech intelligibility is one of the most important aspects of communication among this demographic group.

The results obtained from this research initiative offer significant benefits to speech-language pathologists(SLPs), special educators and parent/caregivers. Providing nuanced insight into the effect of neurodevelopmental disorder on speech intelligibility in CP children speaking Hindi will help in devising culturally sensitive assessment methods. Moreover, these outcomes are instrumental in crafting strategies that cater to effective communication for the Hindi-speaking population with CPwhile developing appropriate educational resources.

A comprehensive overview of research expands our knowledge concerning the perception of speech intelligibility in children with CP. This inclusive approach offers insights into cross-cultural variations and promotes evidence-based practices among professionals working with this population.

Western Studies

Liu, Tsao and Kuhl (2005) studied the effect of reduced vowel working space on speech intelligibility in Mandarin-speaking young adults with CP. Results revealed that young adults with CP exhibited smaller vowel working space areas compared to ten age-matched controls. The vowel working space area was significantly correlated with vowel intelligibility and with word intelligibility.

Terzic, Jovanovic, Vukovic and Nedovic (2012) studied speech and language abilities in children with CP in elementary school and found that the most common impairments seen in CP children are dysarthria and reduced speech intelligibility (30-90%), but anarthria also occurs.

Lee, Hustad and Weismer (2014) examined speech acoustic characteristics of children with CP with a multiple speech subsystems approach; speech intelligibility was evaluated using a prediction model in which acoustic measures were selected to represent three speech subsystems. They concluded that children in the speech motor impairment (SMI) group had articulatory subsystem problems as indexed by acoustic measures which makes the primary contribution to speech intelligibility variance in dysarthria, with minimal or no contribution from other systems.

Braza, Sakash, Natzke and Hustad (2019) analysed longitudinal change in speech rate and intelligibility between 5 and 7 years in children with CP. They found that the window of time between 5 and 7 years was an important period of growth for the production of connected speech where nearly all children, regardless of group, made significant changes in speech intelligibility and intelligible words per minute (IWPM). Interventions focusing specifically on enhancing intelligibility in this age range may help facilitate even further growth in children with speech motor impairment (SMI), who still had marked intelligibility reductions at 7 years of age.

Indian Studies

Singhi, Ray and Suri (2002) studied the clinical spectrum of CP in North India and analysed 1000 cases to study their clinical profile, etiological factors and associated problems. Spastic quadriplegia constituted the predominant group (61%), followed by spastic diplegia (22%). Dyskinetic CP was present in 7.8% of the cases. Acquired CP, particularly secondary to nervous system infections, constituted a significant proportion of cases.

Varghees, Dawadeeand Prabhu (2021) did a study on the effect of Hyperbaric Oxygen Therapy on speech production in children with CP and concluded that the subjective impression on vowel space following the treatment showed improvement in the distinctiveness of production, thereby indicating better speech intelligibility.

Mahobia(2022) studied theefficacy of oro–motor exercises on speech intelligibility in children with CP. The results revealed that the implementation of the oro – motor exercises on the participants led to the positive effect on the speech intelligibility of the participants, though this improvement was minimal.

Paul, Nahar, Bhagawatiand Kunwar (2022) reviewed recent advances of CP. They found that there are multiple levels of speech impairment in children with CP which includes problems such as drooling, swallowing, and feeding having a high rate of 44.0%, 50.4%, and 53.5%, respectively, and as much as half of the children are affected with speech problems. Due to the abnormal tone of CP children and impaired musculoskeletal control, speech production and swallowing are difficult in these children. Speech therapy for such conditions helps improve oro-motor skills, disarticulation problems, and communication skills (Speyer et al., 2019)

II. METHODOLOGY

The objective of this study was to analyze the speech intelligibility in children with spastic CP who are native Hindi speakers from Kanpur district in Uttar Pradesh (UP).

Participants

The present study included total 10children who were diagnosed with spastic CP. The participants were further subdivided into two groups based on their age i.e., 6.0-6.11 years and 7.0-7.11 years; 5 children in each group. All the children had undergone 15 sessions of speech therapy. Children with any type of CP other than spastic and with any associated problems like intellectual disability (ID) were excluded from the study.

Stimulus used

The study utilized various stimuli to elicit linguistic responses from the participants including materials like toys/books/pictures. For further clarity, a list of all these materials used is shown in the table below.

Table 1:

Toys and materials used for Data Collection of Speech Samples

Category	Material
Toys and Play Materials	Doll house, Building blocks, Toy cars and toy train, Kitchen set, Paper-pencil
List of Pictures	Road traffic, Village scene, Birthday party, City scene
Topics for elicited Responses	Family, School life, TV programmes, Cartoon scenes, Favourite clothes/music

Procedure

The present study centered on capturing real-life conversations during playful interactions between mother-child pairs using audio-video recording. In recluse of any interruptions that could hamper our observations,a corner room was set up within the school compound specifically for recording purposes. Throughout every session which spanned about 5 to 10 minutes every time, the focus was on bringing out every child's unique style of expression in response to stimuli like toys and pictures. The objective was to let the children express themselves as naturally as possible, with therapists and parents serving as mere facilitators while providing minimal guidance.The 7-point Speech Intelligibility Rating Scale developed by AYJNIHH, Mumbai (2003) was used for perceptual evaluation of speech intelligibility of all the participants. Five SLPs with a minimum one year of clinical experience rated the speech intelligibility of all the children using the abovementioned scale.

Figure 1:

Showing seven- point ratings of the Speech Intelligibility Rating Scale by AYJNIHH, Mumbai (2003)

Description of speech sample	Point scale
Normal	0
Can understand without difficulty; however feel speech is not normal	1
Can understand with little effort occasionally need to ask for repetition	2
Can understand with concentration and effort specially by sympathetic listener	3
Can understand with difficulty and concentration by family but not others	4
Can understand with effort if content is known	5
Cannot understand at all even content is known	6

Statistical analysis

The perceptual speech intelligibility ratings given by the SLPs were tabulated for descriptive analysis. Through statistical evaluation of the recorded data, mean and standard deviationwere summarized. By utilizing the T test for proportions, speech intelligibility was compared across the age groups.

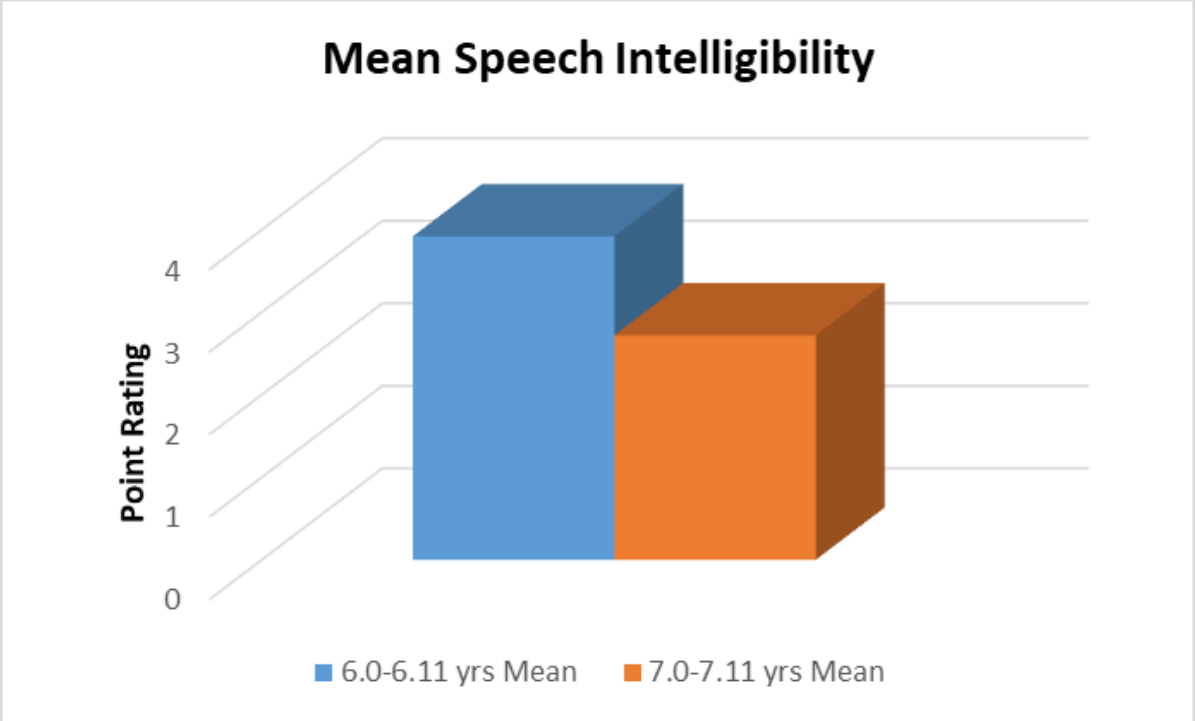
III. RESULTS:

The aim of the current study was to investigate the speech intelligibility in children with spastic CP who were native Hindi speakers by scrutinizing natural conversation speech samples. The results are discussed below.

Table 2:
Showing mean speech intelligibility in CP children and its comparative value across age groups

	Age group				
	6.0-6.11 yrs		7.0-7.11 yrs		p value
	Mean	SD	Mean	SD	
Speech Intelligibility	3.92	0.54	2.72	0.414	**0.01**

Figure 2:
Showing mean speech intelligibility rating in CP childrenacross age groups



The mean speech intelligibility rating in the age group of 6.0-6.11 years was 3.92 which indicated that listener can understand speech with concentration and effort specially by sympathetic listener. Whereas, it was found that in the age group of 7.0-7.11 years, the mean speech intelligibility rating was 2.72 indicating that speech can be understoodwith little effort, occasionally need to ask for repetition. The comparative values of mean speech intelligibility ratings across age groups showedhighly significant difference suggesting that speech intelligibility in CP children gets better with increasing age.

IV. DISCUSSION:

The speech intelligibility of Hindi speaking children with spastic CP was assessed which provided an informative guide for both parents and SLPs alike. This newfound comprehension can facilitate improved outcomes for children facing challenges in their communication skills.The results showed that mean speech intelligibility rating in the age group of 6.0-6.11 years was 3.92 which indicated that listener can understand speech with concentration and effort specially by sympathetic listener. Whereas, it was found that in the age group of 7.0-7.11 years, the mean speech intelligibility rating was 2.72 indicating that speech can be understood with little effort, occasionally need to ask for repetition. The comparative values of mean speech intelligibility ratings across age groups showed highly significant difference suggesting that speech intelligibility in CP children gets better as the age advances.

The results of the current study agree with the previous western study by Terzic et al (2012) who found thatpoor speech intelligibility is one of the most common characteristics seen in speech of children with CP.However, oro-motor exercises must be included in the intervention plan while working with these children

(Mahobia, 2022). The results of the current study align with the results of the study by Braza et al (2019) who found that improvement in speech intelligibility has a direct corelation with the increase in age in children with CP.

V. SUMMARY & CONCLUSION:

The study at hand offers valuable information on the speech intelligibility in Hindi speaking children with spastic CP between the ages of 6 and 8 years old. Furthermore, this study seeks to contrast the mean speech intelligibility ratings across the groups for children with spastic CP speaking Hindi in the age range of 6-8 yearsduring natural conversation and picture description exercises. For this purpose, total 10 childrenwere taken as subjects who were diagnosed with spastic CP. They were further subdivided into two groups based on their age i.e., 6.0-6.11 years and 7.0-7.11 years; 5 children in each group from Kanpur district, UP. All the children had undergone 15 sessions of speech therapy. The speech samples were gathered from these children employing diverse equipment such as toys and books supplemented with visual aids like pictures while capturing all events via audio/video recording using Vivo V2029 smartphone. Speech intelligibility was perceptually measured by five SLPs using the Speech Intelligibility Rating Scale developed by AYJNIHH, Mumbai (2003).The results showed that mean speech intelligibility rating in the age group of 6.0-6.11 years was 3.92 which indicated that listener can understand speech with concentration and effort specially by sympathetic listener. Whereas, it was found that in the age group of 7.0-7.11 years, the mean speech intelligibility rating was 2.72 indicating that speech can be understood with little effort, occasionally need to ask for repetition. The comparative values of mean speech intelligibility ratings across age groups showed highly significant difference suggesting that speech intelligibility in spastic CP children gets better with increasing age.

Clinical Implications

The results of the present study can be effectively applied in clinical settings by the SLPs to understand the speech intelligibility in children with spastic CP and itssignificance inassessment and therapeutic outcomes. This understanding and correlation are important for the implementation of an effective intervention program.

Limitations

This research work has a few limitations like limited sample size and age groups.This may not be entirely representative of the diverse population out there which may lead to issues with reliability in broader instances.

Future Recommendations

Expanding participant population sizes and age groups - alongside investigating alternative Indian languages- will further enhance the scope and depth of the current research.

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