Research on Humanities and Social Sciences
ISSN (Paper)2224-5766 ISSN (Online)2225-0484 (Online)
Vol.6, No.24, 2016

Effect of Auditory Training and Aided Language Stimulation on Speech Perception of Children with Hearing loss in Ibadan, Oyo State, Nigeria

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Abstract

Children fitted with hearing aid, without appropriate placement on aural rehabilitation always find it difficult to benefit maximally from the use of such assistive listening device as well as experiencing difficulty in producing intelligible speech sounds. Therefore, most of them become discouraged and not interested to undergo aural rehabilitation. Thus, this study examined the effect of auditory training (AT) and aided language stimulation (ALS), moderated on onset and degrees of hearing loss on the speech perception (detection, recognition and discrimination,) of children fitted with hearing aid in Ibadan, Oyo state, Nigeria. A pretest-posttest control group quasi-experimental research design, using a 3x2x2 factorial matrix, was adopted for the study. A purposive sampling technique was used to select 24 children (age ranged between 4 and 7 years) with hearing loss. The participants were randomly assigned to two treatment groups (AT and ALS) with a twelve-week intervention plan and a non-treatment control group. A standardised auditory trainer, and the Peabody Picture Vocabulary Test - 4th Edition (PPVT-4, r=.80 - .84), were the instruments used for the training. The five hypotheses formulated were tested at 0.05 level of significance, and data collected were analysed using Descriptive Analysis, Multivariate Analysis of Co-Variance (MANCOVA) and Scheffe Post Hoc Analysis. The findings revealed a significant main effect of treatments on the speech perception of the participants; Recognition (F 71.45, η = 94) Discrimination, (F = 88.11, η = .95) and Detection, (F = 32.06, η = 87), with ALS being a more significant treatment (Recognition (F = 3.37, p<.05); Discrimination (F= 5.25, p<.05) and Detection (F = 3.38, p<.05). The onset of hearing loss on the speech perception of the participants was significant in Recognition, (F = 9.37η=51), Discrimination, (F = 12.40η=57), and Detection, (F = 4.72η=39). The degrees of hearing loss had a significant effect on Recognition, (F = .020η=.002), Discrimination, (F = .032η=004), and Detection, (F = 4.31η=33), Treatments and onset of hearing loss interacted on Recognition (F = 4.24, η = .34); Discrimination, (F = 4.86, η = .39) and Detection, (F = 8.51, η = 65.);but no interaction between treatment and degree of hearing loss on Discrimination,(F= .73, p>.05); Recognition, (F = .83, p>.05), and Detection, (F = .96, p>.05) Onset of hearing loss interacted with the degrees of hearing loss on Detection, (F = 4.69, η = .39) but not on Recognition (F =.67, p>.05); and Discrimination, (F = .53, p>.05).Treatments, onset of hearing loss and degree of hearing loss interacted on Recognition (F =4.31, df = (1, 23), p<.05, η = .47; and Detection, F = 4.95, df = (1, 23), p<.05, η = .52. but not on Discrimination, F = .14, df = (1,23), p>.05). Based on the above findings, it is recommended that children with hearing loss should be rehabilitated using auditory training and aided language stimulation as part of the aural rehabilitative strategies meant to maximize the use of the assistive listening device.

Keywords: Auditory training, aided language stimulation, speech perception, children with hearing impairment

1.1 Introduction

Hearing is a prerequisite for the development of normal speech perception and production of any child. A child only learns to produce speech by hearing the speech of other members in the family and his or her surroundings. However, a major challenge in speech perception of a child is hearing loss. Hearing loss directly impacts a child's ability to communicate negatively. Children with hearing loss are at an increased risk of language delays compared to hearing peers throughout early childhood and into the school years (Vohr, Topol, Girard, St. Pierre, Watson, & Tucker, 2012). Children develop language and speech by hearing and imitating sounds in their environment .Therefore, a child that cannot hear all the sounds in his or her environment has difficulty understanding, communicating, and learning about the world.

According to Davis, Davis and Mencher (2009), the most significant effect of hearing loss in children is its impact on the development of language and communication. It deprives anyone affected from getting adequate

benefit from enjoyment and communication. Children present with hearing loss of different types and degrees often find it extremely difficult to produce intelligible speech sounds. Children who could not communicate as a result of hearing loss also find it difficult to participate in social activities, even within their own family. Some common social problems of children with hearing loss includes: isolation, inattentiveness, withdrawal, bluffing and lack of concentration. Primary of all these problems is the inability to produce intelligible speech sounds that serve as a form of communication.

Speech perception, vis-a-vis detection, recognition, identification, discrimination and comprehension skills is the developmental area most severely affected by those experiencing hearing loss, and particularly important are those with congenital hearing loss and more profound hearing loss. Language has been hailed as the hallmark of humanity; the ability that separates humans from animals. As humans in society, we use our language ability continuously to embrace ideas, share our feelings, comment on the world, and understand each other's minds. According to the America Speech-Language and Hearing Association (ASHA, 2011), vocabulary develops more slowly in children who have hearing loss. The gap in vocabulary between children with normal hearing and those with a hearing loss widens with age except they catch up with intervention children with a hearing loss to understand and create shorter and simpler sentences than children with normal hearing. Children with a hearing loss often cannot hear word endings such as *-s* or *-ed.* This leads to misunderstanding and misuse of verb tense, pluralisation, and possessives, as well as non-agreement of subjects and verbs. Children with a hearing loss often cannot hear quiet speech sounds such as "s," "sh," "f," "t," and "k" and therefore do not include them in their speech. Thus, their speech may be difficult to understand.

However, early detection, diagnosis and intervention are critical for minimising the potentially serious consequences of hearing loss in children .Some major factors having an impact on interventions on rehabilitation of children with hearing loss are; age of onset of hearing loss and degrees of hearing loss; mild, moderate, severe and profound hearing loss. Age of onset hearing loss contributes largely to the development of speech perception in the realm of detection, discrimination, identification, recognition and comprehension. When hearing loss precedes the onset of speech or learning spoken language (Pre-lingual hearing loss), acquisition of speech will be difficulty without any form of intervention or rehabilitation. Individuals with pre-lingual hearing loss could either be congenitally deaf i.e. born without hearing or adventitiously deaf i.e. those who lost their hearing at about 3 to 5 years, before the development of speech and language. On the other hand, post-lingual hearing loss develops after the acquisition of speech and language. Individuals with post-lingual hearing loss became profoundly deaf after the age of 5 to 10 years. Although they have no useful hearing, these individuals had normal hearing long enough for the development of normal speech and language patterns. Although, speech may be affected, they may communicate through writing, finger spelling, signs and speech (Bakare, 2013).

Audiological intervention for a child with a hearing loss consists of diagnostic assessment to determine the nature and degree of hearing loss, followed by fitting of one or two hearing devices to allow the child's brain access to auditory stimulation. Appropriate audiological management and amplification using modern technology are essential for positive outcomes for children with a hearing loss. The two most common types of hearing technology used currently are digital hearing aids and cochlear implants. Nevertheless, children who use hearing aids are faced with the challenge of developing speech all by their own after being fitted with the assistive device, thus the need for aural (auditory) rehabilitation. Aural rehabilitation involves providing different types of treatment and therapies to those who have hearing impairment and implementing different amplification devices to aid hearing abilities. It includes specific procedures in which each therapy and amplification device has as its goal towards the habilitation or rehabilitation of persons with hearing loss to overcome the handicap (disability). Auditory training and aided language stimulation are two out of the types of aural rehabilitation strategies that can be employed in the habilitation or rehabilitation of children with hearing loss.

According to Blamey and Alcantara (1994), auditory training is the use of instruction drills, or practice designed to increase the amount of information that hearing contributes to a person's total perception. The objective of the analytic training approach is to have an individual identify acoustic speech cues in nonsense syllables and then progress to identification of isolated words. In synthetic training, the individual is trained in the identification of related words, sentences, and phrases so that they can use them meaningful and contextual information (Tye-Murray, 2004). Depending on the overall goal of auditory training, these two methods can either be used in conjunction with one another or separately. When considering the use of auditory training, it is imperative to consider all characteristics of the individual such as; degree of hearing loss, cognitive abilities, general health status, motivation and self-reported hearing handicap/disability, as well as characteristics of the training including; type, modality (i.e., whether visual cues are included), method, procedure, stimuli, duration, frequency of sessions, and feedback offered.

Auditory training is a process that involves teaching the brain to listen with the provision of auditory stimuli and coaching that helps to identify and distinguish sounds. People who experience hearing loss may choose to wear hearing aids or cochlear implants to improve their hearing. Over time, auditory training allows the child with hearing loss to discriminate between different sounds and to match meaning to sounds. Without training in the realm of communication, devices like hearing aids and other assistive listening devices would not be very useful for the child with hearing loss.

Aided language stimulation (ALS) is a communication strategy, where a communication partner teaches symbol meaning and model language by combining his or her own verbal input with selection of vocabulary on the Augmentative and Alternative Communication (AAC) system. This is done by simultaneously selecting vocabulary on the AAC system and speaking. Comprehension and communication on the AAC system are promoted through modeled use of visual icons/graphic symbols and providing the corresponding verbal label. Learners are prompted to use symbols to communicate within context of motivating, frequently occurring routines, and/or use of verbal cues. Promptings are faded as the AAC user gains proficiency. Goossens, Crian, and Elder (1992) considered aided language stimulation as an approach in which the facilitator points out picture symbols on the individual's communication display in conjunction with all ongoing language stimulation. Through the modeling process, the concept of using pictorial symbols interactively is demonstrated for the individual.

In ALS, communication partners use visual language themselves by communicating to the child and others using the child's communication chart, book, or device. ALS is an effective technique for teaching language (vocabulary and grammar) and increasing responsiveness and use of AAC. Although traditionally, speech and language therapy with children with hearing impairments has focused on improving auditory perception, speech reading, speech fluency, vocal characteristics and understanding and use of language (Bench 1992, Carney & Moeller,1998). The many changes in the treatment of children with hearing loss have necessitated the need for objective, quantifiable evidence, as clinical practice needs to be efficacious, effective, accountable, viable, equitable and acceptable. Therefore, the study wants to apply two different aural rehabilitation techniques (auditory training and aided language stimulation) to examine the effects they both have on the speech perception of children with hearing loss.

1.2Purpose of Study

The main purpose of this study is to examine the effect of auditory training and aided language stimulation on speech perception of children with hearing loss.

1.3 Significance of the Study

This study would be significant because its findings would assist children with hearing loss and even the deaf children to communicate better in the language world. As the children acquire better verbal communication skills, they would be able to express themselves better and also progress socially and educationally. This study would provide information that will help parents when looking out for rehabilitative options for their children or wards with hearing loss so as to acquire speech and language in the best approach and know what to expect during the treatment plan of their children as well as foster the relationship among the family members through communication. This study would also be significant in that its findings would also help other stakeholders working with children with hearing loss such as the audiologists in rehabilitating those with hearing loss in the society. It would equip them better with approaches to employ when working with those with hearing loss. Speech therapists would also benefit from this study in such a way that it would provide ample methods in their speech habilitation of the hearing impaired with assistive listening devices. In addition, this study would provide information that would help teachers of students with hearing impairments to cater for the speech and language needs of children with hearing loss.

1.4 Hypotheses

The following hypotheses were tested in this study at 0.05 level of significance:

1. There is no significant main effect of treatments (auditory training and aided language stimulation) on the speech perception (detection, recognition and discrimination) of children with hearing loss (participants);

2. There is no significant interaction effect of treatments and the onset of hearing loss on the speech perception of the participants;

3. There is no significant interaction effect of treatments and degrees of hearing loss on the speech

perception of the participants;

4. There is no significant interaction effect of the onset of hearing loss and degrees of hearing loss on the speech perception of the participants;

5. There is no significant interaction effect of treatments, onset of hearing loss and degrees of hearing loss on the speech perception of the participants.

2. Methodology

This study adopted a pretest-posttest control group quasi-experimental design using a 3x2x2 factorial matrix to achieve the purpose of the study. This type of research design was used to estimate cause and effect of an intervention on the participants. The target population for the study consisted of children with hearing loss, fitted with bilateral hearing aid in Ibadan.

Purposive sampling technique was used to select the participants for the study. 24 children with bilateral hearing loss with the Hearing and Speech Clinic, University of Ibadan were purposively selected for the study. Sixteen children with bilateral hearing loss with hearing aids were equally distributed into each of the two experimental groups while the last eight children were assigned into the control group.

Auditory trainer is an electronic device that allows an individual to focus attention on a speaker and reduce the interference of background noise. Children who wear hearing aids can use them in addition to the auditory trainer. The Peabody Picture Vocabulary Test - 4th Editions (PPVT-4) is a standardized test developed by Dunn and Dunn (2007), designed to measure the receptive (hearing) and expressive vocabulary of English-speaking adults and children. According to the authors, the PPVT-4 was designed to address a wide range of vocabulary, based on vocabulary sources such as the *Merriam-Webster's Collegiate Dictionary,* and *Webster's New Collegiate Dictionary*. The content areas were developed with American English standards in mind; therefore suggesting that the PPVT-4 demonstrates reasonable content validity for American populations. The Peabody Picture Vocabulary Test **-** 4th Edition (PPVT-4) was used as an instructional strategy to teach speech detection, discrimination, identification, recognition and comprehension to the participants. Prior to the treatment packages, permission was sought from the parents of the participants that were used for the study. The research experiment spanned through a period of Twelve (12) weeks of four sessions per week, with a week for pretest and another one week for post-tests. The pretest was followed by a four (4) week's treatment phases which lasted for 30mins for each session in each of the experimental groups. The control group was instructed using a conventional method, covering the same number of weeks. All the three groups were subjected to pre- posttest treatment evaluation. The data collected were analyzed using the Descriptive Statistics, Multivariate Analysis of CO-variance (MANCOVA) and Scheffe Post Hoc Analysis.

3. Results

HO1: There is no significant main effect of treatments (auditory training and language stimulation) on the speech perception of children with hearing loss (participants).

Table 1. Summary of 3 x 2 x 2 Analysis of Covariance (MANCOVA)

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
pre recog	Recognition	7.608	1	7.608	2.291	.164	.203
	Discrimination	1.772	1	1.772	.270	.616	.029
	Detection	2.871	1	2.871	1.798	.213	.167
Pre disc	Recognition	1.933	1	1.933	.582	.465	.061
	Discrimination	.041	1	.041	.006	.939	.001
	Detection	.189	1	.189	.118	.739	.013
Pre detect	Recognition	.083	1	.083	.025	.878	.003

	Discrimination	.916	1	.916	.139	.717	.015
	Detection	.454	1	.454	.285	.607	.031
Treatment	Recognition	474.505	2	237.252	71.452	.000	.941
	Discrimination	281.342	2	140.671	88.114	.000	.951
	Detection	421.110	2	210.555	32.063	.000	.877
Onset	Recognition	31.113	1	31.113	9.370	.014	.510
	Discrimination	19.796	1	19.796	12.400	.007	.579
	Detection	24.454	1	24.454	4.724	.006	.393
Degree of hearing loss	Recognition	.066	1	.066	.020	.891	.002
	Discrimination	.051	1	.051	.032	.862	.004
	Detection	4.059	1	4.059	4.314	.048	.334
Treatment * Onset	Recognition	14.878	2	7.439	4.240	.012	.342
	Discrimination	24.544	2	12.272	4.869	.010	.393
	Detection	27.195	2	13.598	8.517	.008	.654
Treatment * degree of hearing loss	Recognition	2.167	2	1.084	.326	.730	.068
	Discrimination	.120	2	.060	.038	.963	.008
	Detection	2.497	2	1.248	.190	.830	.041
Onset * degree of hearing loss	Recognition	2.229	1	2.229	.671	.434	.069
	Discrimination	2.749	1	2.749	.419	.534	.044
	Detection	5.889	1	5.889	4.689	.017	.391
Treatment * Onset * degree of hearing loss	Recognition	8.714	2	4.357	4.312	.042	.486
	Discrimination	1.924	2	.962	.146	.866	.032
	Detection	15.833	2	7.916	4.959	.035	.524
Error	Recognition	29.884	9	3.320			
	Discrimination	14.368	9	4.596			
	Detection	59.102	9	6.567			
Corrected Total	Recognition	731.958	23				
	Discrimination	479.958	23				
	Detection	675.333	23				

The multivariate result was significant for treatment, Pillai's Trace = .02, F = 3.50, df = (1,23), p = .01, indicating a difference in the level of speech perception among children with hearing loss exposed to auditory training, language stimulation and the control group. The univariate F test shows there was a significant difference among children with hearing loss exposed to auditory training, language stimulation and the control

group in speech Recognition, F 71.45, df = (1,23), p<.001, η = 94; Speech Discrimination, F =88.11, df = (1,23), p<.001, η = .87 and Speech Detection, F = 32.06, df = (1,23), p<.001, η = 95 with respect to how they perceived speech after loss. The hypothesis is therefore rejected.

Table 2. Descriptive Statistics of Performance in Speech Perception Based on Treatment Groups

Dependent Variables	Treatment	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Recognition	Auditory Training	**10.718**[a]	**.755**	**9.034**	**12.401**
	Aided Language Stimulation	**12.992**	**.714**	**11.401**	**14.583**
	Control group	**2.054**[a,]	**.629**	**.652**	**3.455**
Discrimination	Auditory Training	**8.825**[a]	**1.054**	**6.476**	**11.174**
	Aided Language Stimulation	**14.043**[a]	**.997**	**11.823**	**16.264**
	Control group	**3.064**[a,]	**.878**	**1.108**	**5.021**
Detection	Auditory Training	**9.230**[a]	**.490**	**8.139**	**10.322**
	Aided Language Stimulation	**11.982**[a]	**.463**	**10.950**	**13.014**
	Control group	**3.298**[a,]	**.408**	**2.388**	**4.207**

a. Covariates appearing in the model are evaluated at the following values: pre_recog = 2.2500, Pre_disc = 2.2500, Pre_detect = 2.3750.

To ascertain the rehabilitation method that was more effective, the mean table above shows that participants exposed to aided language stimulation treatment had higher averaged scores on speech recognition, discrimination and detection. The Least Significance Differences test (Fisher test) was conducted to ascertain the level of significant differences among the three groups. The result summary is presented in Table 3:

Table 3. LSD Post Hoc Analysis Showing Mean Differences Among Groups

Dependent Variable	Treatment	LSD post hoc test		
		1	2	3
Recognition	Auditory Training	**-**	**3.37***	**8.50***
	Aided Language Stimulation	**-**	**-**	**11.87***
	Control group			
Discrimination	Auditory Training		**5.25***	**6.13***
	Aided Language Stimulation	**-**		**11.38***
	Control group			
Detection	Auditory Training		**3.38***	**6.25***
	Aided Language Stimulation			**9.63***
	Control group			

*The mean difference is significant at the .05 level.

In the Table 3, the result of the Post Hoc Analysis on the level of differences between the aided language stimulation, auditory training and the control group reveals that the aided language stimulation group (Recognition (LSD = 11.87, p<.05); Discrimination (LSD = 11.38, p<.015) and Detection (LSD = 9.63, p<.05).

and Auditory training group ((Recognition (LSD = 8.50, p<.05); Discrimination (LSD = 6.13, p<.05) and Detection (LSD = 6.25, p<.05) posttest scores were significantly different from that of the control group. Also, it was observed that the difference between the posttest speech perception scores of participants in the aided language stimulation and auditory training (Recognition (LSD = 3.37, p<.05); Discrimination (LSD = 5.25, p<.05) and Detection (LSD = 3.38, p<.05) were significant.

HO 2: There is no significant interaction effect of treatments and the onset of hearing loss on the speech perception of the participants.

The results in Table 1 reveal that there was a significant interaction effect of treatment and onset on the posttest scores in Speech Recognition, $F = 4.24$, $df = (1,23)$, $p<.001$, $\eta = .34$; Speech Discrimination, $F = 8.51$, $df = (1,23)$, $p<.001$, $\eta = .39$ and Speech Detection, $F = 4.86$, $df = (1,23)$, $p<.001$, $\eta = 65$.The hypothesis is therefore rejected.

HO 3: There is no significant interaction effect of treatments and degrees of hearing loss on the speech perception of the participants.

The results in Table 1 indicate that there was no significant interaction effect of treatment and degree of hearing loss on the posttest scores in Speech Recognition, $F = .73$, $df = (1,23)$, $p>.05$; Speech Detection, $F = .83$, $df = (1,23)$, $p>.05$, and Speech Discrimination, $F = .96$, $df = (1,23)$, $p>.05$. Based on these findings, the hypothesis is accepted.

HO 4: There is no significant interaction effect of the onset of hearing loss and degrees of hearing loss on the speech perception of the participants.

The results in Table 1 reveal that there was a significant interaction effect of onset of hearing loss and degree of hearing loss on the posttest scores in speech perception, F-test analysis reveals that the interaction effect was significant on speech detection, $F = 4.69$, $df = (1,23)$, $p<.001$, $\eta = .39$.However, the interaction effect of onset of hearing loss and degree of hearing loss on speech perception was not significant (Recognition ($F = .67$, $df = (1,23)$, $p>.05$; Discrimination, $F = .41$, $df = (1,23)$, $p>.05$). Further analysis was conducted to look at the mean differences in speech detection based on the interaction effect of onset of hearing loss and degrees of hearing loss.

Table 4. Descriptive Statistics of Performance in Speech Perception Based on the Interaction Between Onset and Degree of Hearing Loss

Dependent Variable	Onset	degree_of_hearing_loss1	Mean	Std. Error
Detection	Post Lingual	Severe to Profound	**8.182**[a]	**.817**
		Moderate to Severe	**10.401**[a]	**.485**
	Pre Lingual	Severe to Profound	**9.756**[a,b]	**.551**
		Moderate to Severe	**6.494**[a]	**.538**

a. Covariates appearing in the model are evaluated at the following values: pre_recog = 2.2500, Pre_disc = 2.2500, Pre_detect = 2.3750.

The mean differences show that participants exposed to post-lingual hearing loss who had moderate to severe hearing loss had better speech perception dimension recognition, discrimination and detection than participants who were treated to post-lingual hearing loss with "severe to profound" hearing loss, participants treated to pre-lingual with either "moderate to severe" or "severe to profound" hearing loss.

Table 4.11. LSD Post Hoc Analysis Showing Mean Differences based on onset and degree of hearing loss

Dependent Variable	Degree of loss	Treatment	LSD post hoc test	
			1	2
Detection	Severe to Profound	Post Lingual	-	**1.72**
	Severe to Profound	Pre Lingual		
Detection	Moderate to Severe	Post Lingual		**3.39***
	Moderate to Severe	Pre Lingual		

*mean difference is significant at the .05 level.

The post hoc analysis shows that participants exposed to post lingual hearing loss who had moderate to severe hearing loss had better speech detection (LSD = 3.39, $p<.05$) than participants who were treated to pre-lingual hearing loss with "moderate to severe" hearing loss.

HO 5: There is no significant interaction effect of treatments, onset of hearing loss and degrees of hearing loss on the speech perception of the participants.

The results in Table 1indicate that there was a significant interaction effect of treatment, onset of hearing loss and degree of hearing loss on the posttest scores in speech perception. F-test analysis reveals that the interaction effect was significant on Speech Recognition (F =4.31, df = (2, 23), $p<.05$, η = .47; and Detection, F = 4.95, df = (2, 23), $p<.05$, η = .52.However, the interaction effect of treatments, onset and degree of hearing loss on speech perception was not significant on speech discrimination, F = .14, df = (1,23), $p>.05$).

4. Discussion of Findings

Main effect of treatments (auditory training and aided language stimulation) on the speech perception of children with hearing loss

The results in Table 1 showed that there was a significant main effect of the treatments (auditory training and aided language stimulation) on the speech perception of children with hearing loss. This means that the therapeutic interventions of Auditory Training and Aided Language Intervention were effective in enhancing speech perception of children with hearing loss that have been fitted with hearing aids. From the results in Table 2, aided language stimulation was found to be more effective. Aided language stimulation approach is particularly effective when it comes to language acquisition. This could be as a result of presenting language together with pictures to help the participants under the aided language stimulation group so as to enhance their speech perception. The use of pictures aids language acquisition of children as they are able to see what they are being introduced to. Therefore the study corroborates the earlier study of Dada and Alant (2009) which confirmed that aided language stimulation has an influence on the vocabulary acquisition of children with little or no functional speech. The findings also support earlier findings of Sweetow and Palmer, (2005) that auditory training can improve speech perception (recognition skills) to a great extent, especially if it is used in the synthetic training approach.

Interaction effect of treatments and onset of hearing loss on the speech perception of the participants.

Table 1 showed that there was a significant interaction effect of treatment and the onset of hearing loss on the speech perception of the participants. In the Yoshinaga-Itano and Apuzzo's (1995) study, the children whose losses were identified in the first 2 months of life had significantly better language development than children identified between 3 and 12 months of life. The post hoc test confirmed showed that participants exposed to aided language stimulation who had post-lingual hearing loss had better recognition, discrimination and detection than participants treated with auditory training with pre-lingual hearing loss, participants exposed to auditory training with either post or pre-post lingual and control group with either post or pre-post lingual.

Interaction effect of treatments and degrees of hearing loss on the speech perception of the participants.

Table 4 showed that there was no significant interaction effect of treatment and degree of hearing loss on the posttest scores in speech recognition, F= .73, df = (1,23), $p>.05$; speech discrimination, F = .96, df = (1,23),

$p>.05$, and speech detection, $F = .83$, $df = (1,23)$, $p>.05$.

Interaction effect of the onset of hearing loss and degrees of hearing loss on the speech perception of the participants.

The result in Table 4 showed that there was a significant interaction effect of onset of hearing loss and degree of hearing loss on the posttest scores in speech perception. The mean differences showed that participants treated to post-lingual hearing loss who had moderate to severe hearing loss had better speech perception dimension recognition, discrimination and detection than participants who were treated to post-lingual hearing loss with "severe to profound" hearing loss, participants treated to pre-lingual with either "moderate to severe" or "severe to profound" hearing loss. Thus, it is clear that even when subjects who are deaf or hard of hearing are utilizing a rehearsal strategy, they are beginning to do so at a much later age than peers with typical hearing. Bebko (1984) noted the educational importance of this finding and suggested the necessity of providing students who are deaf or hard of hearing with direct instruction in the process of learning how to remember information.

Interaction effect of treatments, onset of hearing loss and degrees of hearing loss on the speech perception of the participants.

Tables 1 and 4 showed that there was a significant interaction effect of treatment, onset of hearing loss and degree of hearing loss on the posttest scores in speech perception. The mean differences showed that participants exposed to aided language stimulation training with post lingual and moderate to severe hearing loss had better speech recognition, discrimination and detection than participants who were treated to post-lingual hearing loss with "severe to profound" hearing loss.A few studies have tested the efficacy of training methods with visible speech for speech perception and speech production (e.g. Dagencis and Critz-Crosby, 1992; Osberger, 1989) and these studies provided speech training for individuals with hearing loss using glossometry and palatometry techniques along with the traditional aural/oral training method.

5. Conclusion

One of the major achievements of this study is that irrespective of the degrees of hearing loss, with proper amplification together with an aural rehabilitative approach, noticeable improvements will occur, positively affecting children's auditory and speech perception. This study also reveals that any individual with hearing loss that is exposed to auditory training in addition to aided language stimulation in the course of rehabilitation or habilitation will get maximum gain from the approach. This study has helped to see how effective the use of auditory training and aided language stimulation is to persons with hearing loss, how it can enable persons with hearing loss to be introduced or reintroduced back into the sound world.

6. Recommendations

Based on the findings in this study, the following useful recommendations are made:

- Parents are implored not to neglect their children or wards with hearing loss after providing them with hearing aid, thinking that the aid is enough to do the rehabilitative work. Parents should make sure their children get the needed rehabilitative therapy to help the children maximize the use of the hearing aid;
- Audiologists should make it a point of duty to create awareness among parents of children with hearing loss, youths and even adults with hearing loss not only for the affected individuals' auditory and speech gain through the hearing aids, but to make themselves available for aural rehabilitation therapies that will help them improve both auditory and speech perception;
- Speech therapists should explore all the available rehabilitative options that to assist those with hearing and speech difficulties get back their speech;
- Newborn hearing screenings should be made compulsory in all hospitals so as to detect children with congenital hearing loss and provide them with early interventions;
- Regular hearing screenings and assessment should be provided and carried out more often by the hospitals so that persons who are at risk of hearing loss will be detected early enough for the right aural rehabilitation interventions.

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