ORAL MOTOR AND ARTICULATION THERAPIES ON SPEECH INTELLIGIBILITY AMONG PERSONS WITH DOWN SYNDROME

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ABSTRACT

This study investigated the effect of oral motor and articulation therapies on speech intelligibility of persons with Down syndrome in Ibadan, Oyo State, Nigeria. A pretest-posttest control group quasi-experimental research design with a factorial matrix of three (3) experimental groups was adopted for the study. Thirty (30) persons with Down syndrome were purposively selected from outpatients to the Audiology Clinic of the Department of Special Education, University of Ibadan, Nigeria. Participants were randomly assigned to the treatment groups (oral motor therapy and articulation therapy) and a control group. The treatment was administered for eight (8) weeks. The Arizona Articulation and Phonology Scale (Fourth Revision) was used to diagnose and evaluate speech intelligibility before and after exposure of the participants to the treatment. Therapeutic plans using oral motor therapy and articulation therapy were adopted to rehabilitate the speech intelligibility deficit exhibited by the participants. Data was analysed using the inferential statistics of Analysis of Covariance (ANCOVA) at 0.05 level of significance, while estimated marginal means was used to test the significant deference among the groups. There was a significant main effect of treatments using oral motor and articulation therapies on the speech intelligibility of persons with Down syndrome (F (2, 17) = 123.69, p <.05, η2=0.95). Oral motor therapy had the highest mean (70.77), followed by participants exposed to articulation therapy with a mean score of 65.04, while participants exposed to the control group had the lowest mean score of 40.12. Therefore, it is recommended that speech and language therapists and other relevant professionals in the field of rehabilitation should adopt oral motor and articulation therapies for rehabilitation of speech intelligibility problems among persons with Down syndrome.

Keywords: Down syndrome, oral motor therapy, articulation therapy, speech intelligibility

I. INTRODUCTION

Speech is the natural production of sounds using the tongue, lips, palate, and respiratory system to communicate thoughts, feelings, ideas, and messages, amongst others. One important thing to note is that production of speech sounds begins with the respiratory system. Speech is reliant on the powerful airflow that is supplied through our respiratory system. Impaired speech intelligibility might result from the affected dimensions, creating misperception, difficulties, and communication challenges.(1) When compared to cognitive skills, speech intelligibility in people with Down syndrome (DS) is poor, and this is especially obvious when speaking.(2,3) Most expressive language defects are developmental in nature, for example, consonant sounds deletion and cluster reduction. There are, however, specific exceptions, such as vowel aberrations and discordant phonemes. (3)

Reduced intelligibility could be caused by articulatory anatomical problems, or by the impact of repeated bouts of middle ear infection.(4) Speech apraxia has also been observed in people with DS.(5,6) The degree to which an acoustic signal produced by a speaker may be reliably recovered by a listener has been defined as intelligible speech.(7,8) Intelligibility can be measured in a variety of ways. One way is the naive listeners’ orthographic
transcription of standard speech samples. (9-13) There are similarities and differences in the grammatical profiles of people with DS and people with other developmental language disorders. (1,14,15)

Significant parallels have been found between DS and specific language impairments, particularly with difficulties in tense marking, for example, past tense –ed, and third person singular –s. (1,16) Individuals with DS, on the other hand, appear to have more acute grammatical deficiencies than individuals in other categories of developmental disabilities of known genetic origin. Kumin found that individuals with DS aged 1–21 years had a 4.97 mean speech intelligibility rating on a 10-point scale from their parents, with boys with DS being less intelligible than girls with DS in the same age range. (17) As a result of this, it is logical to argue that DS is a risk factor for decreased speech intelligibility. Poor speech intelligibility in people with DS usually leads to communication challenges and irritation for both speakers and their listeners. (3,18)

Intelligibility in people with DS is likely to be influenced by a variety of factors DS. Examples include voice, vocalization, coherence, fluency, and/or intonation. (3) As a result, no single method can detect all facets of intelligibility in people with DS. A variety of methodologies have been used in DS intelligibility research findings, which can be divided into two categories of global and analytical. Listeners' overall ratings, such as the percentage of words understood or their values on an interval scale, serve as a gauge of the severity of the communication problem, whereas analytical approaches assign a correct or incorrect score to a unit of analysis, such as a word, phoneme, or phonetic feature, and serve to identify the cause of reduced speech intelligibility. (19) According to De Bodt et al., articulation contributes more to speech intelligibility than any other feature of speech. As a result, it may be stated that treating articulation issues is a significant goal in the treatment of motor speech disorder. (20)

II. LITERATURE REVIEW

Oral motor therapy and speech intelligibility

Oral motor therapy is a commonly used technique by speech and language pathologists, which includes non-speech oral exercises. About 67%–85% of speech and language pathologists use such exercises to treat speech sound disorders. (21,22) Oral motor therapy is described generically as any non-speech activity aimed at training and stimulating orofacial structures to improve sensory integration, impulse control, and muscular strength. The application of non-speech oral exercises as a therapy for speech impairments is, however, still debatable (23,24,25) Despite the use of non-speech oral exercises for treating children with speech disorders, various studies have highlighted a lack of statistical data to support this. (23,26,27)

Clinicians employ difference techniques to help people with speech disorders to achieve various objectives, such as improved oral awareness, superior separation, and grading of oral-motor movements to positively impact speech clarity (speech intelligibility), feeding skills, and improved oral-facial muscle tone, to aid in oral structure stability (28,29). Forrest and Iuzzini compared non-speech oral intervention to traditional intervention in children aged 3 to 6 years with speech sound disorders. (30) Warm-up, facial stimulation, and tongue strengthening were included in the non-speech oral exercises, whereas target sound training in words was included in the traditional therapy. The results revealed a significant disparity between the outcomes of the two strategies. Non-speech oral exercises improved sound production accuracy by only 3%, but traditional intervention improved it by 30%.

Polmanteer and Fields investigated the efficacy of NS-OMEs in the treatment of speech sound disorders in preschoolers. (31) Despite the reported positive outcome, this study had significant limitations, including an imbalanced severity distribution in which children who received speech therapy were more severely handicapped than those who did not. Guisti-Braislin and Cascella found that non-speech oral motor therapy resulted in a mild (not significant) improvement in four first-grade children with speech sound disorders who had a normal oral mechanism. (32) In another study, the quality of evidence offered in research was assessed, focusing on the use of non-speech oral intervention from 1981 to 2006. (26) This investigation uncovered 45 studies and reports, 20 of which were published in peer-reviewed journals. Overall, there was no evidence to support the use of non-speech oral exercises to treat children with speech sound disorders, according to the review. Other research that found non-speech oral interventions to be effective focused exclusively on voice quality or non-speech behaviors, rather than on speech sound production. (33)
Articulation therapy and Speech intelligibility

Articulation therapy is a therapeutic intervention programme that focuses on the accurate production of speech sounds to improve speech clarity and intelligibility.(34) Articulation therapy involves significant repetition and targeting of the incorrectly pronounced sounds. The goal of articulation therapy is to help a child produce challenging sounds and achieve age-appropriate speech. Another primary goal of articulation therapy is to create a clear, crisp speech pattern that is easy for listeners to understand (speech intelligibility). Articulation therapy typically involves exercises and drill practice to retrain the speech mechanism for an appropriate positioning and programming.(34).

Hartman et al. conducted a single case study to determine whether segmental articulation therapy would benefit a patient with dysarthria caused by traumatic brain injury.(35) The findings showed that the patient could use appropriate articulation for untrained words, indicating that the trained tasks had improved.

As a result of increased loudness, Sauvageau et al. confirmed improved vowel articulation and consonant distinction.(36) Intensive dysarthria treatment, according to various studies, has a positive carryover effect.(37-42) In a single case study of ataxic dysarthria, Sapir et al. discovered that phonatory and articulatory functions, speech intelligibility, and overall communication improved in both the short and long term.(43) The findings show that therapy aimed at increasing loudness can benefit the speech mechanism while other systems are ignored.(44,45) Cannito et al. found improvements in sentence intelligibility in patients with Parkinson's disease.(46) Marchant et al. investigated the effects of phonetic placement therapy and surface electromyography biofeedback-induced contemplation in a child with severe spastic dysarthria in a single-case study.(47) The phonetic placement therapy resulted in a significant improvement in word intelligibility, but no discernible improvement in perception intelligibility was observed, with dysarthria severity identified as a possible explanation.

III. RESEARCH HYPOTHESES

Ho1 There is no significant main effect of treatments oral motor and articulation therapies on speech intelligibility of persons with DS

Ho2 There is no significant main effect of gender on speech intelligibility of persons with DS

Ho3 There is no significant interaction effect of treatments and gender on speech intelligibility of persons with DS

IV. METHODOLOGY

Research design

The study adopted the pretest-posttest control group quasi-experimental research design, with a factorial matrix of three (3) treatment group to assess the speech intelligibility of persons with DS before and after intensive oral motor and articulation therapy on the segmental level. This was adopted to determine the effect of oral motor and articulation therapies on speech.

Participants

Thirty (30) persons with DS were recruited at the Audiology Clinic, Department of Special Education, Faculty of Education, University of Ibadan, Nigeria, using convenience sampling. This sampling technique was employed because of the peculiarity of the respondents and their characteristics. To participate in the study, the patients had to be adults over 18 years of age, who are native speakers of English. Selected participants were randomly assigned to the treatment groups using oral motor therapy, articulation therapy, and the control group.

Instruments

The two instruments that were used for data collection are Arizona Articulation by Janet B. Fudala, and Phonology Scale, Fourth Revision (Arizona-4) by Sheri Stegall. Arizona Articulation and Phonology Scale, Fourth Revision (Arizona-4) was used for speech intelligibility assessment. This scale interpretation of the scores helps clinicians develop treatment or therapeutic plans that are targeted to the individual’s needs. The Arizona-4 is used by speech and language professionals in a variety of settings, such as schools, clinics, hospitals, private practices, and intervention programmes.

Interventions
Two speech therapists from the Department of Special Education served as research assistants in the study. They provided the intervention to selected participants. The research assistants collected pretest data before the intervention was carried out. The pretest instrument was also used as the post-test after eight weeks of intervention, to evaluate the treatment and control groups. The intervention lasted eight (8) weeks, with each session lasting forty-five (45) minutes. The control group received a placebo treatment. The sections were divided into four levels, with varying degrees of difficulty and feedback. Participants began by training on level 1, with the SLP providing feedback after each word or minimal pair. As a result, the treatment is divided into three stages: pre-treatment, treatment, and evaluation post-treatment.

V. RESULTS

**H0₁** There is no significant main effect of treatments using oral motor and articulation therapies on speech intelligibility of persons with DS.

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
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<td>Corrected Model</td>
<td>6234.788</td>
<td>12</td>
<td>519.566</td>
<td>26.614</td>
<td>.000</td>
<td>.949</td>
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<tr>
<td>Intercept</td>
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<td>1</td>
<td>404.032</td>
<td>20.696</td>
<td>.000</td>
<td>.549</td>
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<tr>
<td>Pretest</td>
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<td>1</td>
<td>297.038</td>
<td>15.215</td>
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<td>.472</td>
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<tr>
<td>Treatment group</td>
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<td>2</td>
<td>2414.607</td>
<td>123.685</td>
<td>.000</td>
<td>.936</td>
</tr>
<tr>
<td>Error</td>
<td>331.879</td>
<td>17</td>
<td>19.522</td>
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<td></td>
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</tr>
<tr>
<td>Total</td>
<td>10865.000</td>
<td>30</td>
<td></td>
<td></td>
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<tr>
<td>Corrected Total</td>
<td>6566.667</td>
<td>29</td>
<td></td>
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</tbody>
</table>

a. R Squared = .949 (Adjusted R Squared = .914)

Table 1 reveals a significant main effect of treatments using oral motor and articulation therapies on speech intelligibility of persons with DS (F(2, 17) = 123.69, p < .05, η² = 0.95). Hence, hypothesis one is rejected. This implies that the treatments administered to the study participants were effective. In other words, there is a significant difference in the mean scores of treatments on speech intelligibility of persons with DS who were exposed to oral motor and articulation therapies, and the control group. This simply means that oral motor and articulation therapies are effective as treatment options on the speech intelligibility of persons with DS. To determine the magnitude of the significant main effect across the treatment groups, however, the estimated marginal means of the treatment groups is presented in Table 2.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Mean</th>
<th>Std. Error</th>
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<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
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<tr>
<td>Oral motor therapy</td>
<td>70.769a</td>
<td>1.471</td>
<td>67.665</td>
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<td>Articulation therapy</td>
<td>65.039a</td>
<td>1.563</td>
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<td>Control group</td>
<td>40.121a</td>
<td>1.435</td>
<td>37.094</td>
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</table>

Table 2 reveals that participants exposed to oral motor therapy had the highest mean (70.77), followed by participants exposed to articulation therapy with a mean score of 65.04, and participants exposed to the control group had the lowest mean score of 40.12. Therefore, it can be inferred that oral motor therapy is more effective than articulation therapy on speech intelligibility of persons with DS.

VI. DISCUSSION OF FINDINGS

The result shows that treatment using oral motor and articulation therapies had a significant main effect on the speech intelligibility of persons with DS. This finding corroborates a report that found a significant improvement in the sound production of the participants using articulation therapy.(48) The result also aligns with the submission of GuistiBraislin and Cascella, who noted that non-speech oral motor therapy resulted in a mild (not significant) improvement in four first-grade children with speech sound disorders who had a normal oral mechanism.(32)
Furthermore, the study is in agreement with the assertion of Sapir et al. that phonatory and articulatory functions, speech intelligibility, and overall communication improved in both the short and long term.(43) This shows that intervention aimed at increasing loudness can have positive impact on speech mechanism while ignoring other systems.(44,45)

The significant difference between the two treatments was determined using estimated marginal means. The result revealed that the effect of oral motor therapy on speech intelligibility of persons with DS was higher than that of articulation therapy. This aligns with the submission of Marchant et al. that the use of phonetic placement therapy and surface electromyography biofeedback-induced contemplation resulted in a significant improvement in word intelligibility, with no observable improvement in perception intelligibility due to dysarthria severity.(47) The finding is, however, not consistent with the conclusion of Lass and Pannbacker who, having reviewed 45 studies and reports, 20 of which were published in peer-reviewed journals, reported that there was no evidence to support the use of non-speech oral exercises to treat children with speech sound disorders.(26) On the other hand, McAllister is in agreement with the findings that found non-speech oral interventions to be effective when focused exclusively on voice quality or non-speech behaviors, rather than on speech sound production.(33)

VII. CONCLUSION AND RECOMMENDATIONS

The results of the current study demonstrated that speech intelligibility among persons with DS was significantly improved using oral motor and articulation therapies, although, oral motor therapy proved to be more effective than articulation therapy. The relevance of age as a determinant of speech intelligibility in persons with DS has also been established. Having determined the effects of therapeutic interventions, it is important that speech and language therapists and other professionals in the field of rehabilitation adopt these tools for the rehabilitation of persons with DS who have speech intelligibility deficits, and give preference to oral motor therapy in the course of the rehabilitation. Hence, based on the findings of the study, speech and language pathologists, parents and caregivers should ensure the provision of early intervention for persons with DS to enhance their speech intelligibility. Speech clinics and rehabilitation centers should employ oral motor therapy in their speech therapy plans for persons with DS, together with other interventions.

Limitations

Generalizability of the findings is limited by size of the respondents. The purpose of the study was to investigate the significant main effect of oral motor and articulation therapies on speech intelligibility among persons with DS in Nigeria. Studies that investigated the significant main effect of treatment using oral motor and articulation therapies on speech intelligibility in Nigeria were not available to the researchers, and so these results should be interpreted with caution.

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Conflict of interest

The authors confirm that there is no conflict of interest with respect to the data presented in this paper.

REFERENCES


