DIADOCHOKINETIC RATE IN THE SPEECH OF THE HEARING IMPAIRED

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Oral diadochokinetic rate in the speech of the in severely hearing handicapped subjects was measured using sound spectrograph. Thirty normally nearing individuals matched for age, sex and education as far as possible, served as controls. The hearing impaired subjects per formed poorly in their oral task when compared to normally hearing subjects. The possible reasons for this poor performance of the hearing impaired subjects have been identified. Therapeutic implications have been drawn.

Introduction:

Speech of the deaf children differs from that of normals in all regards. In all studies of speech of the hearing impaired, attention is drawn to the fact that, to a greater or lesser degree, the hearing impaired individuals do not produce speech as well as those who hear (Monsen, 1974). Considering the information presently available on the speech of the hearing impaired based on acoustical, aerodynamic, phonological and physiological evidences, very little is known of the underlying speech motor coordination skill of the hearing impaired speakers. One of the measures in this direction is oral diadochokinetic rate. Diadochokinesis has been defined as the ability to perform rapid, alternating and repetitive bodily movements such as opening and closing of the jaws on lips, raising or lowering the eyebrows or tapping the fingers (Wood, 1971). Diadochokinetic rate is a number of such movements per minute. Oral diadochokinetic rate refers to such rapid, repetitive and alternating movements of the lips, tongue and other articulators.

So far only Robb, Hughes and Frese (1985) have studied diadochokinetic rate among the hearing impaired individuals. They, by using time-by-count procedure and oscilloscopic tracings, reported that the hearing impaired subjects performed slower on all speech-timing tasks than their normal hearing peers. They also identified within group differences among the hearing impaired subjects with respect to speech intelligibility, degree of hearing loss and gender. In general it was found that for varying degrees of hearing loss severity there are speech-timing coordination deficits commensurate to that level. However we do not know the underlying reason for the slower oral diadochokinetic "ate observed in their speech. It is assumed that the spectrographic method of measuring (Shukla, 1987) diadochokinetic rate, not only throws light on the underlying reason for slower diadochokinetic rate and add to the existing data regarding diadochokinetic rate among the hearing impaired speakers.

Methodology:

Thirty hearing impaired individuals were selected as subjects. The mean age of the subjects was 15.67 years, the age range being 11 to 28 years. The hearing impaired individuals had to satisfy the following conditions. 1) Should have congenital bilateral hearing loss (PTA of greater than 70 dBHL ANSI 1969 in the better ear), 2) Should have no additional handicap other than that directly related to the hearing impairment and 3) should be older than 10 years of age. Thirty normally hearing subjects were selected to match the each hearing impaired subject in terms of age sex and education wherever possible. No hearing

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impaired individual differed from his control by more than 6 months.

Each subject was instructed to utter [pa, ta, ka] syllables as fast as he/she could and recordings of the same were made. A sound spectrograph (Voice Identification 700 Series) was used to make spectrograms of the speech sample recorded. Wide band bar spectrogram of initial segment of 2.5 seconds of [pa, ta, ka] utterances were taken. Then the number of syllables on the spectrogram were counted to calculate the diadochokinetic rate per minute for all the subjects.

Results and discussion:

Table 1 shows mean diadochokinetic rate and standard deviations in the speech of the normally hearing and hearing impaired speakers. From the table it may be observed that the normally hearing subjects have a mean diadochokinetic rate of 155.73 per minute. We may also note that the hearing impaired speakers have performed poorly on diadochokinetic when compared to the normally hearing speakers. On the average, the hearing impaired individuals uttered [pa, ta, ka] 90 times per minutes whereas the normals uttered 155 times per minute. The t-test revealed a statistically significant (0.01 level) difference in the ability to produce rapid and repetitive movements between the two groups. Similar finding was reported by Robb et al., (1985), using time-by-count procedure. This finding implies that exposure to auditory stimulation could very well be a stimulation factor to the development of co-ordination within the speech motor mechanism. An analysis of the spectrograms showed two probable reasons, at least at the acoustic level, for this reduction in the diadochokinetic rate in the speech of the hearing impaired.

1) Hearing impaired speakers have shown a longer time lapse between the syllable of [pa, ta, ka], that is inter syllable gap was longer in the utterances of the hearing impaired than in those of the normally hearing individuals. This observation indicates that the hearing impaired individuals seemd to have difficulty in transiting their articulators of speech rapidly from one position to the other.

2) Hearing impaired individuals while uttering [pa, ta, ka] syllables had prolonged the vowels whereas the normals had not done so.

The spectrographic examples of these characteristics are shown in Figure 1.

At the physiological level, slower diadochokinetic syllable production by the hearing impaired speakers may be attributed to aberrant respiratory patterns observed in them (Forner and Hixon, 1977; Whitehead, 1982; Itoh and Horii, 1985). Forner and Hixon (1977) reported that the hearing impaired speakers initiate phonation at an inappropriate lung volume range. White head (1982), while confirming the above finding, demonstrated that the hearing impaired speakers with low

Table 1 : The Mean Diadochokinetic Rate and Standard Deviations in the Speech of the Normally Hearing and Hearing Impaired Speakers.

	Normally Hearing	Hearing Impaired
Mean	155.73	90.00
SD	25.11	17.03

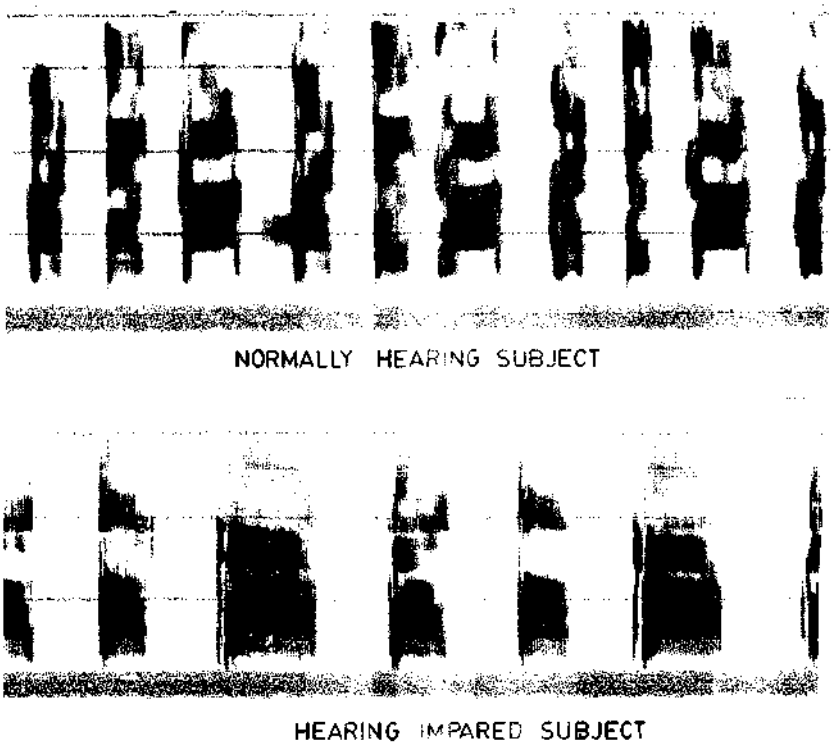

Figure 1 Wide band bar spectrograms of (pa, ta, ka) utterances in the speech of the normally hearing and hearing impaired subject.

speech intelligibility initiated speech at substantially lower lung volumes and continued well below the functional residual capacity. Osberger and McGarr (1982) suggested that speech attempted at such residual lung volumes is exceedingly difficult because the speaker is working against the natural recoil forces of the respiratory mechanism. Most probably, because of this abnormal respiratory patterns hearing impaired speakers produced fewer number of diadochokinetic syllables per minute. Recently, Itoh and Horii (1985) reported that speech respiration of the hearing impaired subject is characterized by high air expenditure per syllable, high average expiratory air flow rates, frequent inspiration at linguistically inappropriate places and short duration of expiration. These observations ndicate that the hearing impaired speaker tended to waste much air vnich explains slower ladochokinetic syliable production rate

Therapeutic implications:

Monsen (1978) states that, knowedge of speech production abilities of hearing impaired individuals is in many ways of potentially greater values to the educators than knowledge of an individual's hearing ability. Results of the present study hint that speecn therapy should aim at improving the diadochokinetic syllable production rate ot the hearing impaired speakers. Articulation drills wnich -facilitate motor co-ordination, speed and transition of art iculators from one position to another may help the hearing impaired speakers to increase their diadocho-

kinetic rate. Further, physiological studies provide mounting evidence of aberrant speech respiratory patterns in the hearing impaired speakers which are probably responsible for the poor diadochokinetic rate. Therefore, speech therapy should also aim at modifying the aberrant physiological patterns in the hearing impaired speakers. Zimmerman and Retaliata (1981) rightly points out that the analysis of physiological parameters of speech produced by the hearing impaired persons are important because they may lead to a better understanding of the speech errors of the hearing impaired persons and may assist in the development of remediation procedures designed to modify aberrant physiological patterns.

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