ABSTRACT

A corpus of about 100 meaningful Italian words uttered by 36 normoccluded and maloccluded subjects has been analysed spectrographically. The results show that a direct relationship between different classes of malocclusions and speech errors does not exist.

1. INTRODUCTION

One of the questions which has always been and still is outstanding for orthodontists and speech pathologists is whether there is a relationship between dental malocclusions and speech disorders.

By far the greatest difficulty in this kind of research is to find a cause-effect relationship between a single dental anomaly and a particular speech impairment. In fact if on one hand "articulatory defects of speech may exist even though the dental occlusion is normal" whereas some others, being articulated and, consequently, to notice the presence of possible anomalies of the glottal pulse. Shiftings on the y-axis of the vertical striations, every speech sound has a particular formant pattern: any modification reflects an anomalous posture of articulators involving a change in place and manner of articulation. Nasality is represented on the spectrogram by a loss of energy especially at the level of the second formant as well as in appearance of one or two extraformants in the low region of frequencies. So the spectrographic analysis allows us to say whether an oral articulation has been realized with an incomplete closure of the velopharyngeal port.

2. METHOD

By the foregoing, it seems to us that we should start from the acoustic analysis of the signal, which allows to identify faulty sounds as well as to infer the incorrect articulatory movements that produced them. Many are the possibilities given by this method of analysis. In fact, on a broad-band spectrogram it is possible to deduce the behavior of the vocal folds from the number and periodicity of the vertical striations and, consequently, to notice the presence of possible anomalies of the glottal pulse. Shiftings on the y-axis of the formants reflect the movements of the articulators and the shapes assumed by the supralaryngeal cavities. Formant frequencies are broad bands of energy represented on the spectrogram by clearly marked darkness areas. According to the different contextual situations, every speech sound has a particular formant pattern: any modification reflects an anomalous posture of articulators involving a change in place and manner of articulation. Nasality is represented on the spectrogram by a loss of energy especially at the level of the second formant as well as in appearance of one or two extraformants in the low region of frequencies. So the spectrographic analysis allows us to say whether an oral articulation has been realized with an incomplete closure of the velopharyngeal port.

3. MATERIAL

A list of about one hundred meaningful Italian words has been prepared, where dental articulations [d s z l n] occurred in all phonological contexts. Also bilabials [p b m], labiodental [f v], palatals [s f s j] and velars [k g] have been considered.

The list has been read in a silent room by thirty six speakers differently aged (7-9, 12-14, 17-19 years) selected by a clinical test from a total of 228 subjects. Nine of them were normoccluded subjects and twenty seven represented of the different classes of malocclusion (Class I, Class II, Class III). A structured questionnaire was used to obtain information about age, history of previous speech therapy and orthodontic therapy. All selected subjects had not received any treatment and all of them had normal hearing.

For this research a Nagra IV S recorder, a DSP Sona—Graph 5500 Kay and a computer HP Vectra have been employed. Of each word the broad band spectrogram (from 0 to 8 KHz) and the tracings of F0, intensity and waveform have been obtained.

4. RESULTS

Subjects without any anomaly have been found in all categories. Table I summarizes the speech anomalies of
Among normoccluded and maloccluded subjects.

Glottal pulses have also been noticed.

Most anomalies relative to the voices of normoccluded and maloccluded subjects.

The spectrogram of the word *sodo* (Fig. 1) uttered by a normoccluded subject shows two different anomalies. One relative to [s] having the same characteristics already seen in Fig. 1 and the other concerning the whole word, which is completely nasalized, as the presence of an extra formant at 2.5 KHz shows.

The spectrogram of the word *awiso* (Fig. 3) uttered by a Class II maloccluded subject, shows that [v] has been uttered as a stop (absence of signal followed by burst of noise), bilabial because of the F2 deviations of the adjacent vowels and voiced because of the periodical striations. Furthermore, the signal, a whistled pure tone at about 6 KHz, has awhistled fricative.

The spectrogram of the word *foglia* (Fig. 4) uttered by a Class III maloccluded subject, both the absence of signal and F2 deviations show that [s] is uttered as a voiced palatal stop.

5. CONCLUSIONS

The data gathered in this experimental research point out that a direct relationship between different classes of malarticulations and speech errors does not exist. In fact the same speech sounds can give rise to different kinds of errors, aside from the kind of dental occlusion of the subject.

6. REFERENCES

8. RANDOCH, G. de et al. (1957) "Il problema orofonale, deglutizione, toni sec nel soggetti neurotici", Saggi, IX, 21.