Effects of Maxillary Advancement on the Speech of a Sub-Mucosal Cleft Palate Patient

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A nineteen-year-old patient with a surgically repaired sub-mucosal cleft palate was evaluated following a LeFort I osteotomy to determine the effects of the surgery on his speech. Tape recordings were made of his speech pre- and postoperatively during the administration of an articulation test, during casual conversation, and while repeating standard sentences. Spectrographic analysis of pre- and postoperative segments of a standard sentence were made. Results of the tests indicated that *maxillary advancement had no adverse effect on articulation ability or voice* in this case. Unexpected findings are discussed, and suggestions are given for clinical assessment and evaluation.

Introduction

Surgical intervention for maxillary hypoplasia is performed for functional, esthetic, psychological, and social reasons. Obwegeser (1969) suggests that retrodisplaced maxillae may interfere with the normal functioning of mastication and speech. These abnormalities of function and the unusual appearance of the patient may lead to psychological disturbance and reduced vocational opportunities. If a speech problem exists, the surgeon is concerned with alleviation of the speech problem as well as with improvement in appearance of the patient. If the speech is normal, the surgeon is equally concerned with preventing the development of speech difficulties coincident with maxillary advancement. The speech pathologist member of the cleft palate habilitation team is frequently asked to give an opinion as to whether or not maxillary advancement will change the palatopharyngeal relationship to the point of creating hypernasal speech in the patient. Little information on the effects of maxillary advancement on speech and voice can be found in the literature. Jabaley and Edgerton (1969), reporting on the pre- and postoperative status of an 18-year-old male with no palatal defect and adequate speech prior to surgery, stated that maxillary advancement did not adversely affect speech or voice. DesPrez and Kiehn (1974) also

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found that the speech of cleft palate patients was not adversely affected by maxillary advancement. Basic data on the parameters of speech, however, were not presented. The purpose of this article is to provide an objective description of the effects of maxillary advancement on the speech and voice of a patient with surgically repaired submucosal cleft palate.

Case Presentation

N. B. was a seven-year-old black male who underwent a tonsillectomy and adenoidectomy in July, 1963, following a history of recurrent episodes of otitis media and tonsillitis. He was one of four siblings with Van der Woude's Syndrome. In all four children, bilateral labial pits and submucosal clefts of the palate were evident. In addition, N. B. had maxillary hypoplasia.

In April, 1964, an evaluation of N. B.'s speech was conducted at the University of Virginia Speech and Hearing Center. His speech was characterized by multiple misarticulations and hypernasality. N. B.'s mother stated that, although he was hypernasal prior to the tonsillectomy and adenoidectomy, the condition became worse following surgery. He was enrolled in a public school speech program over the next three years, but the hypernasality persisted. N. B. had a push-back palatoplasty for the submucous cleft palate in January, 1968. Three months later, he was again seen at the University of Virginia Speech and Hearing Center. At this time the presence of a mild to moderate articulation problem was noted, but there was no excess nasality. Hypernasality was also not evident during subsequent hospital visits in December, 1969, and December, 1970. In September, 1975, N. B. had a LeFort I osteotomy and maxillary advancement of 1.5 cm.

Plaster casts were made from dental impressions taken prior to surgery. The maxillary cast was relocated to provide optimal occlusion by indexing the mesial buccal cusp of the maxillary first molar into the buccal groove of the first mandibular molar. This resulted in a maxillary advancement of 1.5 cm. The surgical procedure followed the direction indicated by the model changes. Pre- or postoperative x-ray studies were not made.

Tape recordings were made of his speech pre- and postoperatively. Materials selected for recording included the entire Templin-Darley Tests of Articulation (1969), casual conversation, and the repetition of a list of standard sentences used routinely for evaluation in the University of Virginia Speech and Hearing Center. The results of the pre- and postoperative articulation tests are shown in Table 1. Of the 141 articulation test items, the subject correctly articulated 132 items preoperatively, and 133 items were correctly produced postoperatively. The incorrect responses which are the same for pre- and postoperative evaluations are dialectic in nature and are not associated with cleft palate.

From the list of standard sentences repeated by the subject, the

TABLE 1. Pre- and postoperative misarticulations

consonant error		*preoperative*	*postoperative*
sound	*position*		
t/θ	medial (m)	√	√
f/θ	final (f)	√	√
d/ð	initial (i)	√	√
v/ð	(f)	√	√
-g	(f)	√	√
-v	(f)	√	√
-z	(f)	√	√
k/rk	(as in fork)	√	–
l/lz	(as in nails)	√	√

TABLE 2. Per cent of fundamental amplitude of f_1, f_2, and f_3 based on spectrographic analysis of the vowel æ

formant	*preoperative*	*postoperative*
f_1	.83	.83
f_2	.89	.78
f_3	.89	.69

sentence "Sassy cats raced across the ice," was selected for presentation because it contained consonant sounds that provide discrimination between good and poor palatopharyngeal closure. The "æ" in "sassy" was selected for presentation in this paper because it occurs in a CVC relationship associated with sibilants, which tends to maximize hypernasality when it occurs (Stevens and House, 1955). Analysis of the formant relationship of the sound "æ" was done primarily to observe changes in the amount of energy present in the third formant. This was accomplished by using the amplitude section on the Kay Sonograph Model 6061 A at equivalent points on the vowel taken from pre- and postoperative speech. A representative pattern of the analysis is shown in Table 2.

Tape recordings of the pre- and postoperative segments of the standard sentence used for spectrographic analysis were presented to a panel of five certified speech pathologists to determine the presence of hypernasality. The judges were in one hundred percent agreement that excess nasality was not present in either the pre- or postoperative recorded speech samples.

Discussion

It is recognized that dynamic fluoroscopic studies of the velopharyngeal valving mechanism would have been a valuable addition to this case report. However, the results of pre- and postoperative articulation testing indicated that maxillary advancement had had no significant effect on articulation ability or nasality. Spectrographic analyses of the

selected speech samples confirmed non-existence of hypernasal components in both pre- and postoperative recordings. Therefore palatopharyngeal closure appeared to be sufficient for speech purposes following surgery. However, an unexpected and substantial reduction in the magnitude of the third formant in the postoperative recording was noted. The existence of hypernasality in speech has been shown to be associated with increased magnitude of the third formant (Hattori, Yamoto and Fujimura, 1958). The observed reduction in magnitude of the third formant may have resulted from an increase in the oral cavity size giving added resonance to lower frequencies. The increase of resonance in the lower frequencies may exert a secondary benefit to speech and, therefore, deserves consideration in the evaluation of the patient who is being considered for maxillary advancement. Although prediction of speech and voice changes accompanying maxillary advancement cannot be based on one case study, the results of this report provide additional insight into the possible speech changes accompanying maxillary advancement. Wide-scale studies of the speech characteristics of both cleft and non-cleft patients who undergo maxillary osteotomies should be done.

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